



Dual Antenna, GPS-Aided Inertial Navigation Systems

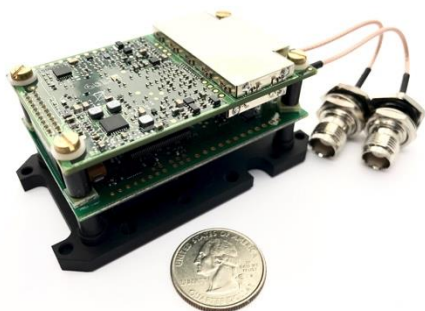
INS-D-OEM

INS-DL-OEM

- Real time (RTK) & Post Processing (PPK)
- Position accuracy = 0.5 cm (PPK) / 1 cm (RTK)
- Heading accuracy = 0.03 deg (PPK) / 0.05 deg (RTK)
- Pitch & Roll accuracy = 0.006 deg (PPK) / 0.08 deg (RTK)
- High precision dual antenna GNSS receiver
- Ideal solution for accurate point clouds
- Small Size, light weight
- Affordable price
- Compatible with LIDAR, Optical camera
- Applications: flight control, remote sensing, photogrammetry



The **Inertial Labs GPS-Aided Inertial Navigation System (INS-D/DL-OEM)** is OEM version of new generation, dual GNSS antenna, fully-integrated, combined GPS, GLONASS, GALILEO 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, Dual Antenna Heading, Pitch & Roll are determined with high accuracy for both motionless and dynamic applications.



The Inertial Labs **INS-D/DL-OEM** utilizes advanced dual antenna GNSS receiver, 3-axes each of calibrated in full operational temperature range Advanced MEMS Accelerometers and new generation of tactical grade MEMS Gyroscopes to provide accurate Position, Velocity, Heading, Pitch and Roll of the device under measure.

INS-D/DL-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 Dual Antenna GPS-Aided Inertial Navigation System
- 85 x 47 x 36 mm size and 150 (or 160) grams in mass. Full temperature calibration of all sensing elements
- Industrial & Tactical-grade IMU (1 – 3 deg/hr gyroscopes Bias in-run stability)
- GPS, GLONASS, BEIDOU, SBAS, DGPS, RTK supported signals
- Up to 0.05 deg Heading and 0.08 deg Pitch & Roll accuracy
- Compatibility with LiDARs and Optical Cameras for remote sensing applications
- Up to 200 Hz INS, up to 2000 Hz IMU, up to 100 Hz GNSS positions and GNSS measurements data rate
- 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, GNSS tracking angle features

INS-D-OEM and INS-DL-OEM performance during GNSS outages

Model	Outage duration	Mode	Position accuracy (meters, RMS)		Velocity accuracy (meters/sec, RMS)		Attitude accuracy (degree, RMS)	
			Horizontal	Vertical	Horizontal	Vertical	Pitch, Roll	Heading*
INS-D-OEM	0 sec	RTK	0.01 + 1ppm	0.02 + 1ppm	0.02	0.01	0.015	0.05
		SP	1.2	1.0	0.03	0.02	0.08	0.08
		PP	0.005	0.01	0.02	0.01	0.006	0.03
	60 sec	RTK	7	2	0.3	0.1	0.05	0.08
		SP	8	3	0.3	0.1	0.1	0.1
		PP	0.3	0.2	0.03	0.05	0.01	0.05
INS-DL-OEM	0 sec	RTK	0.01 + 1ppm	0.02 + 1ppm	0.03	0.02	0.09	0.06
		SP	1.2	1.0	0.04	0.03	0.1	0.09
		PP	0.009	0.015	0.025	0.02	0.009	0.035
	60 sec	RTK	8	3	0.4	0.3	0.06	0.09
		SP	9	4	0.45	0.5	0.15	0.15
		PP	0.45	0.35	0.04	0.065	0.025	0.07

* 2 meters baseline

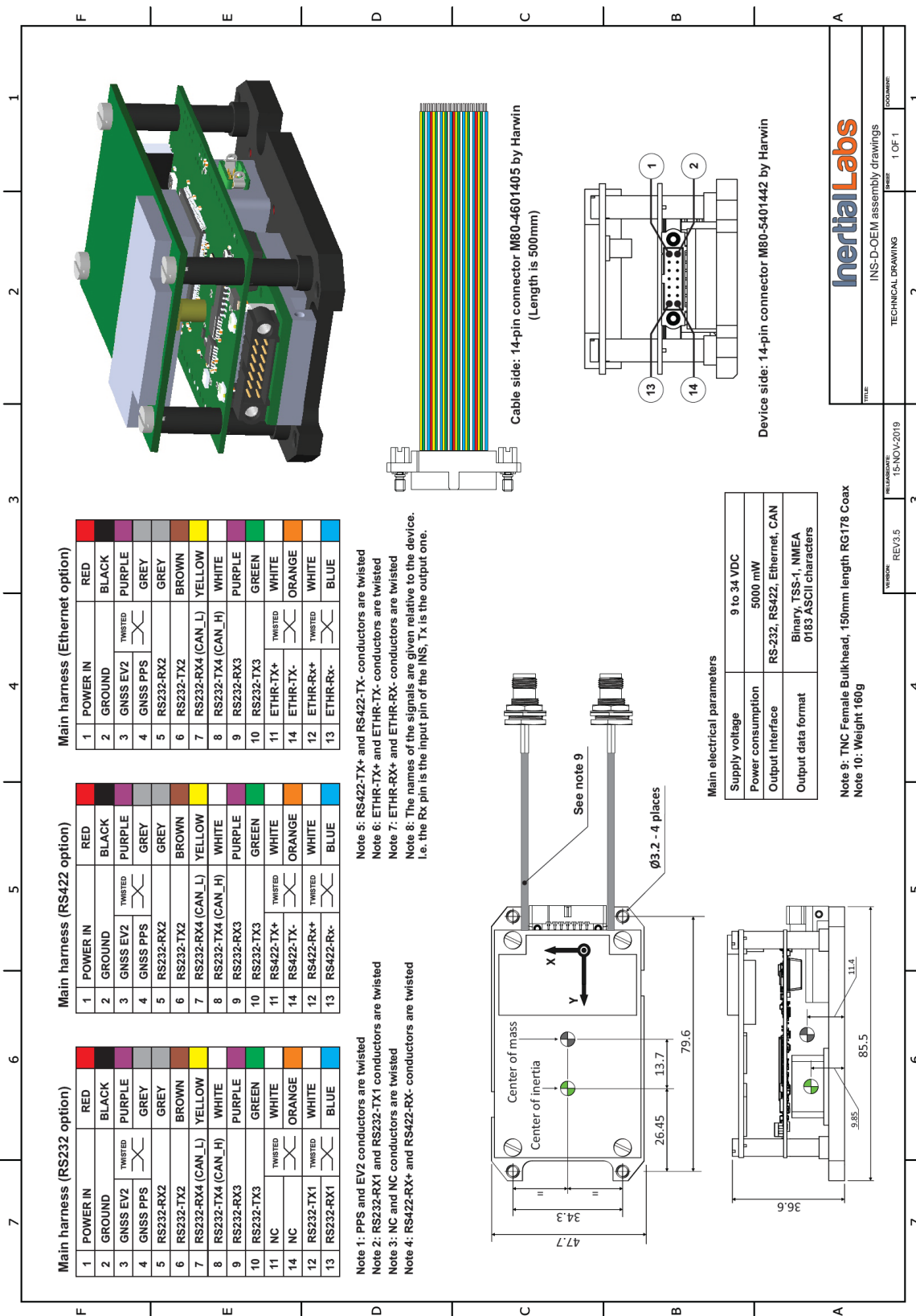
INS-D-OEM & INS-DL-OEM Specifications

	Parameter	Units	INS-DL-OEM Low cost dual antenna	INS-D-OEM High precision dual antenna
General	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) - All: External Stand Alone Magnetic Compass (SAMC/AHRS)	
	Output signals		- Horizontal and Vertical Positions, Heading, Pitch & Roll, Velocity, Accelerations, Angular rates, Barometric data, PPS - 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 features		Affordable price Dual antenna Heading 1 cm RTK position	High precision dual antenna Heading, 1 cm RTK position, Tactical-grade IMU
	Data rate (INS)	Hz	Up to 200 (user settable)	Up to 200 (user settable)
	Data rate (IMU)	Hz	Up to 2000 (user settable)	Up to 2000 (user settable)
	Start-up time	sec	<1	<1
Navigation	Positions, Velocity and Timestamps	Units	INS-DL-OEM	INS-D-OEM
	Horizontal position accuracy (SP, L1), RMS	meters	1.5	1.5
	Horizontal position accuracy (SP, L1/L2), RMS	meters	1.2	1.2
	Horizontal position accuracy (SBAS), RMS ⁽¹⁾	meters	0.6	0.6
	Horizontal position accuracy (DGPS), RMS	meters	0.4	0.4
	Horizontal position accuracy (post processing) ⁽²⁾	meters	0.005	0.005
	Horizontal position accuracy (RTK), RMS	meters	0.01 + 1 ppm	0.01 + 1 ppm
	Vertical position accuracy (SP), RMS	meters	<2	<1
	Vertical position accuracy (RTK), RMS	meters	0.02 + 1 ppm	0.02 + 1 ppm
	Velocity accuracy, RMS	meters/sec	0.03	0.02
	PPS timestamps accuracy	nano sec	20	20
Orientation	Heading	Units	INS-DL-OEM	INS-D-OEM
	Range	deg	0 to 360	0 to 360
	Static Accuracy ⁽³⁾	deg RMS	0.15 (1 meter base line)	0.15 (1 meter base line)
	Dynamic accuracy (GNSS) ⁽⁶⁾	deg RMS	0.08 (2 meters baseline)	0.08 (2 meters baseline)
	Post processing accuracy ⁽²⁾	deg RMS	0.03	0.03
	Pitch and Roll	Units	INS-DL-OEM	INS-D-OEM
	Range: Pitch, Roll	deg	±90, ±180	±90, ±180
	Angular Resolution	deg	0.01	0.01
	Static Accuracy in whole Temperature Range	deg	0.05	0.03
	Dynamic Accuracy ⁽⁶⁾	deg RMS	0.1	0.08
	Post processing accuracy ⁽²⁾	deg RMS	0.01	0.006
GNSS	GNSS receiver	Units	INS-DL-OEM	INS-D-OEM
	Number of GNSS Antennas		Dual	Dual
	Supported GNSS signals & corrections (optional)		GPS L1/L2, GLONASS L1/L2, BEIDOU B1/B2, GALILEO E1/E5, QZSS L1/L5, SBAS, DGPS, RTK	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; SBAS L1, L5; QZSS L1 C/A, L1C, L2C, L5, L6; L-Band up to 5 channels; DGPS;
	Channel configuration ⁽⁴⁾		435 Channels	555 Channels
	GNSS Positions data rate ⁽⁵⁾	Hz	20	Up to 100
	RTK corrections		RTCM 2.3/3.0/3.2	RTCM 2.1/2.3/3.0/3.1
	GNSS Measurements (raw) data rate	Hz	20	Up to 100
	Velocity accuracy, RMS	meters/sec	<0.04	<0.03
	Initialization time	Sec	<50 (cold start), <30 (hot start)	39 (cold start), 20 (hot start)
	Time accuracy (clock drift) ⁽⁷⁾	nano sec	20	20
IMU	Gyroscopes	Units	INS-DL-OEM	INS-D-OEM
	Type		Industrial-grade	Tactical-grade
	Measurement range	deg/sec	±450 / ±950 / ±2000	±450 / ±950 / ±2000
	Bias in-run stability (RMS, Allan Variance)	deg/hr	3	1
	Bias error over temperature range (RMS)	deg/hr	<50	<30
	Angular Random Walk	deg/√hr	<0.3	<0.2
	Accelerometers	Units	INS-DL-OEM	INS-D-OEM
	Type		Industrial-grade	Tactical-grade
	Measurement range	g	±8 g ±15 g ±40 g	±8 g ±15 g ±40 g
	Bias in-run stability (RMS, Allan Variance)	mg	0.01 0.03 0.05	0.005 0.02 0.03
	Bias error over temperature range (RMS)	mg	0.7 1.1 1.5	0.5 0.7 1.2
	Bias one-year repeatability	mg	1.5 2.0 2.5	1.0 1.3 1.5
	Velocity Random Walk	m/s/√hr	0.02 0.045 0.06	0.015 0.035 0.045
Electrical and Physical	Environment	Units	INS-DL-OEM	INS-D-OEM
	Operating temperature	deg C	-40 to +75	-40 to +75
	Storage temperature	deg C	-50 to +85	-50 to +85
	MTBF	hours	55,500	55,500
	Electrical	Units	INS-DL-OEM	INS-D-OEM
	Supply voltage	V DC	9 - 36	9 - 36
	Power consumption	Watts	5	5
	Output Interface (options)		RS-232 or RS-422, CAN Ethernet (optional)	RS-232 or RS-422, CAN Ethernet (optional)
	Output data format		Binary, NMEA 0183 ASCII	Binary, NMEA 0183 ASCII
	Physical	Units	INS-DL-OEM	INS-D-OEM
	Size	mm	85 x 47 x 36	85 x 47 x 36
	Weight	gram	150 - 160	150 - 160

⁽¹⁾ GPS only; ⁽²⁾ RMS, incremental error growth from steady state accuracy. Post-processing results using third party software; ⁽³⁾ 2 meters base line between two GNSS antennas; ⁽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

INS-D/DL-OEM electrical and mechanical interface drawing



Part number structure:

Model	Gyroscope	Accel	Calibration	Connector	Encoder	GNSS receiver	Version	Interface
INS-D-OEM	G450	A8	TGA	C4	E (option)	O7720 WOR	VD4	1
	G950	A15	TMGA (Optional)	C6			VD42	2
	G2000	A40		C8			VD43	3
								4
								5
								11
								22
								145
								245

Model	Gyroscope	Accel	Calibration	Connector	Encoder	GNSS receiver	Version	Interface
INS-DL-OEM	G450	A8	TGA	C4	E (Option)	B482 WOR	VD9	1
	G950	A15	TMGA (Optional)	C6				2
	G2000	A40		C8				3
								4
								5
								11
								22
								145
								245

Example: INS-DL-OEM-G450-A15-TGA-C6E-B482-VD9.1

- INS-D-OEM: Dual Antenna GPS-Aided Inertial Navigation System
- INS-DL-OEM: Low cost Dual Antenna 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 $\rightarrow$ recommended for applications with low level of operational vibrations
- A15: Accelerometers measurement range ± 15 g $\rightarrow$ recommended for applications with medium level of operational vibrations
- A40: Accelerometers measurement range ± 40 g $\rightarrow$ recommended for high dynamic applications or/and with high level of vibration
- TGA: Gyroscopes and Accelerometers
- TMGA: Magnetometers, Gyroscopes and Accelerometers
- C4: Aluminum Base Plate - 26 pin header and ribbon cable (20021121-00026T4LF by Amphenol)
- C6: Aluminum Base Plate - 14 pin screw-lock connector (M80-5401442 by Harwin)
- C8: Aluminum Base Plate - 25 pin enclosed cable with screw lock connector (CCA-025-I36R152 by NorComp)
- E: Encoder support
- O7720: Novatel OEM7720 dual antenna GNSS receiver (INS-D only)
- B482: Inertial Labs B482 dual antenna GNSS receiver (INS-DL only)
- WOR: without GNSS receiver
- VD4: GPS L1/L2, Dual antenna Heading, SBAS, DGPS, 20 Hz positions (INS-D only)
- VD42: GPS L1/L2, GLONASS L1/L2, Dual GNSS Heading, SBAS, DGPS, RTK, 20 Hz measurements, 20 Hz positions (INS-D-OEM only)
- VD43: GPS L1/L2, GLONASS L1/L2, Dual antenna Heading, SBAS, DGPS, 20 Hz positions (INS-D-OEM only)
- VD9: GPS L1/L2, GLONASS L1/L2, BEIDOU B1/B2, GALILEO E1/E5, QZSS L1/L5, DGPS, RTK, Dual GNSS Heading, 20 Hz measurements, 20 Hz positions (INS-DL-OEM only)
- VX.1: RS-232 interface
- VX.2: RS-422 interface
- VX.3: RS-485 interface (temporary is not available)
- 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 interfaces (with optional Encoder support)
- VX.245: RS-422, CAN and Ethernet interfaces (without Encoder support)