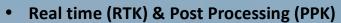


Dual Antenna, GPS-Aided Inertial Navigation Systems

INS-D-OEM
INS-DL-OEM



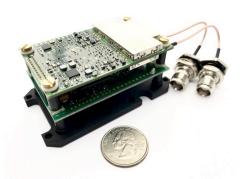
- Position accuracy = 0.5 cm (PPK) / 1 cm (RTK)
- Heading accuracy = 0.03 deg (PPK) / 0.05 deg (RTK)
- Pitch & Roll accuracy = 0.006 deg (PPK) / 0.08 deg (RTK)
- High precision dual antenna GNSS receiver
- Ideal solution for accurate point clouds
- Small Size, light weight
- Affordable price
- Compatible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





GPS-Aided INS-D/DL-OEM Datasheet Rev. 1.5

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 115 gram weight
- 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, 50 Hz GNSS positions, 20 Hz 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
- Full temperature calibration of all sensing elements

INS-D-OEM performance during GNSS outages

Outage duration	Positioning mode		accuracy s, RMS)	Velocity a (meters/se	•	Attitude accuracy (degree, RMS)	
	mode	Horizontal	Vertical	Horizontal	Vertical	Pitch, Roll	Heading*
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

^{* 2} meters baseline



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

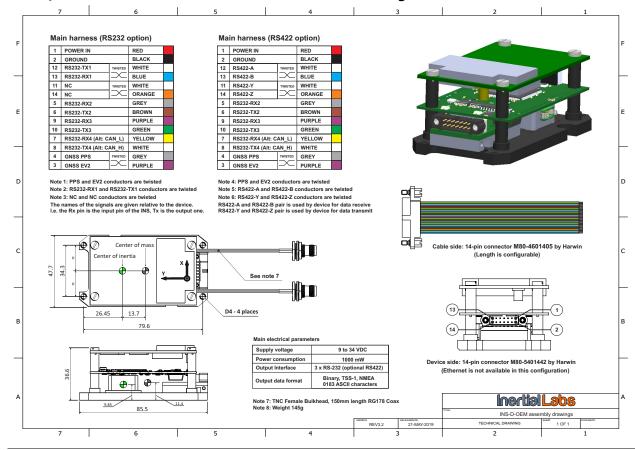
				THE DI OF	M		THE DOEM		
	Parameter	Units		INS-DL-OE ow cost dual ar		High n	INS-D-OEM recision dual a	ntenna	
General	Input signals		Marine application: DVL (Doppler Velocity Log) Land application: Odometer, Wheel sensor, Encoder, DMI Aerial application: Wind sensor, Air Speed Sensor, Doppler shift from locator (for long-term GPS denied)						
	Output signals		All: External Stand Alone Magnetic Compass (SAMC/AHRS) Horizontal and Vertical Positions, Heading, Pitch & Roll, Velocity, Accelerations, Angular rates, Barometric data, PPS Direct AT_TITINS message with Position, Heading, Pitch & Roll to COBHAM AVIATOR UAV 2					3	
Ge	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			
	Positions, Velocity and Timestamps	Units	INS-DL-OEM			INS-D-OEM			
	Horizontal position accuracy (SP, L1), RMS	meters	1.5			1.5			
5	Horizontal position accuracy (SP, L1/L2), RMS Horizontal position accuracy (SBAS), RMS (1)	meters meters	1.2 0.6			1.2 0.6			
	Horizontal position accuracy (DGPS), RMS	meters	0.6				0.4		
<u>\overline{\overline{\sigma}}{}</u>	Horizontal position accuracy (post processing) (2)	meters		0.005			0.005		
. <u>6</u>	Horizontal position accuracy (RTK), RMS	meters		0.01 + 1 ppr	m		0.01 + 1 ppm		
2	Vertical position accuracy (SP), RMS	meters		<2			<1		
Navigation	Vertical position accuracy (RTK), RMS Velocity accuracy, RMS	meters meters/sec		0.02 + 1 ppi 0.03	m		0.02 + 1 ppm 0.03		
_	PPS timestamps accuracy	nano sec		20			20		
	Heading	Units	INS-DL-OEM		ZU INS-D-OEM				
	Range	deg	0 to 360				0 to 360		
Orientation	Static Accuracy (3)	deg RMS	0.15 (1 meter base line)			0.15 (1 meter base line)			
.0	Dynamic accuracy (GNSS) (6)	deg RMS	0.08 (2 meters baseline)			0.08 (2 meters baseline)			
at	Post processing accuracy (2)	deg RMS	0.03			0.03			
= ==	Pitch and Roll Range: Pitch, Roll	Units deg	INS-DL-OEM ±90, ±180				INS-D-OEM ±90, ±180		
<u>a</u>	Angular Resolution	deg	0.01			0.01			
· <u>·</u>	Static Accuracy in whole Temperature Range	deg	0.05		0.03				
0	Dynamic Accuracy (6)	deg RMS			0.08				
	Post processing accuracy (2)	deg RMS		0.01			0.006		
		Units	INS-DL-OEM		INS-D-OEM				
	GNSS receiver	Office			<u> </u>				
	Number of GNSS Antennas Supported GNSS signals & corrections (optional)	Onio		Dual GLONASS L1/L2 LILEO E1/E5, QZ	, BEIDOU B1/B2, SS L1/L5,		Dual .1/L2; GLONASS BeiDou B1/B2;		
S	Number of GNSS Antennas Supported GNSS signals & corrections (optional)	Onics		Dual GLONASS L1/L2 LILEO E1/E5, QZS SBAS, DGPS, F	, BEIDOU B1/B2, SS L1/L5, RTK		Dual 1/L2; GLONASS BeiDou B1/B2; SBAS; DGPS; RT		
SS	Number of GNSS Antennas Supported GNSS signals & corrections (optional) Channel configuration (4)			Dual GLONASS L1/L2 LILEO E1/E5, QZS SBAS, DGPS, F 435 Channe	, BEIDOU B1/B2, SS L1/L5, RTK		Dual 1/L2; GLONASS BeiDou B1/B2; SBAS; DGPS; RT 555 Channels		
NSS	Number of GNSS Antennas Supported GNSS signals & corrections (optional) Channel configuration (4) GNSS Positions data rate (5)	Hz		Dual GLONASS L1/L2 LILEO E1/E5, QZ: SBAS, DGPS, F 435 Channe 20	, BEIDOU B1/B2, SS L1/L5, RTK Is		Dual 1/L2; GLONASS BeiDou B1/B2; SBAS; DGPS; RTI 555 Channels 20, 50	K	
GNSS	Number of GNSS Antennas Supported GNSS signals & corrections (optional) Channel configuration (4)			Dual GLONASS L1/L2 LILEO E1/E5, QZS SBAS, DGPS, F 435 Channe	, BEIDOU B1/B2, SS L1/L5, RTK Is		Dual 1/L2; GLONASS BeiDou B1/B2; SBAS; DGPS; RT 555 Channels	K	
GNSS	Number of GNSS Antennas Supported GNSS signals & corrections (optional) Channel configuration (4) GNSS Positions data rate (5) RTK corrections	Hz		Dual GLONASS L1/L2 LILEO E1/E5, QZ: SBAS, DGPS, F 435 Channel 20 RTCM 2.3/3.0/	, BEIDOU B1/B2, SS L1/L5, RTK Is		Dual 1/L2; GLONASS BeiDou B1/B2; SBAS; DGPS; RT 555 Channels 20, 50	K	
GNSS	Number of GNSS Antennas Supported GNSS signals & corrections (optional) Channel configuration (4) GNSS Positions data rate (5) RTK corrections GNSS Measurements (raw) data rate	Hz Hz	GA	Dual GLONASS L1/L2 LILEO E1/E5, QZ: SBAS, DGPS, F 435 Channe 20 RTCM 2.3/3.0/ 20	, BEIDOU B1/B2, SS L1/L5, RTK Is	RI	Dual .1/L2; GLONASS BeiDou B1/B2; SBAS; DGPS; RT 555 Channels 20, 50 CM 2.1/2.3/3.0/	3.1	
GNSS	Number of GNSS Antennas Supported GNSS signals & corrections (optional) Channel configuration (4) GNSS Positions data rate (5) RTK corrections GNSS Measurements (raw) data rate Velocity accuracy, RMS	Hz Hz meters/sec	GA	Dual GLONASS L1/L2 L1LEO E1/E5, Q2 SBAS, DGPS, F 435 Channei 20 RTCM 2.3/3.0/ 20 <0.03 (cold start), <30 20	, BEIDOU B1/B2, SS L1/L5, RTK Is /3.2 (hot start)	RI	Dual .1/L2; GLONASS BeiDou B1/B2; SBAS; DGPS; RT 555 Channels 20, 50 'CM 2.1/2.3/3.0/ 20 <0.03 old start), <30 (h	3.1	
GNSS	Number of GNSS Antennas Supported GNSS signals & corrections (optional) Channel configuration (4) GNSS Positions data rate (5) RTK corrections GNSS Measurements (raw) data rate Velocity accuracy, RMS Initialization time Time accuracy (clock drift) (7) Gyroscopes	Hz Hz meters/sec Sec	GA	Dual GLONASS L1/L2 L1LEO E1/E5, QE SBAS, DGPS, F 435 Channel 20 RTCM 2.3/3.0/ 20 <0.03 (cold start), <30 20 INS-DL-OEN	, BEIDOU B1/B2, SS L1/L5, RTK Is Is (3.2	RI	Dual .1/L2; GLONASS BeiDou B1/B2; SBAS; DGPS; RT 555 Channels 20, 50 'CM 2.1/2.3/3.0/ 20 <0.03 old start), <30 (h 20 INS-D-OEM	3.1	
GNSS	Number of GNSS Antennas Supported GNSS signals & corrections (optional) Channel configuration (4) GNSS Positions data rate (5) RTK corrections GNSS Measurements (raw) data rate Velocity accuracy, RMS Initialization time Time accuracy (clock drift) (7) Gyroscopes Type	Hz Hz meters/sec Sec nano sec Units	GA	Dual GLONASS L1/L2 LILEO E1/E5, Q2: SBAS, DGPS, F 435 Channe 20 RTCM 2.3/3.0/ 20 <0.03 (cold start), <30 20 INS-DL-OEN Industrial-gra	r, BEIDOU B1/B2, SS L1/L5, RTK Is Is (3.2	RI	Dual .1/L2; GLONASS BeiDou B1/B2; SBAS; DGPS; RT 555 Channels 20, 50 TCM 2.1/2.3/3.0/ 20 <0.03 old start), <30 (h 20 INS-D-OEM Tactical-grade	3.1	
GNSS	Number of GNSS Antennas Supported GNSS signals & corrections (optional) Channel configuration (4) GNSS Positions data rate (5) RTK corrections GNSS Measurements (raw) data rate Velocity accuracy, RMS Initialization time Time accuracy (clock drift) (7) Gyroscopes Type Measurement range	Hz Hz meters/sec Sec nano sec Units deg/sec	GA	Dual GLONASS L1/L2 SBAS, DGPS, F 435 Channel 20 RTCM 2.3/3.0/ 20 <0.03 (cold start), <30 20 INS-DL-OEN Industrial-gra ±450 / ±95	r, BEIDOU B1/B2, SS L1/L5, RTK Is Is (3.2	RI	Dual 1.1/L2; GLONASS BeiDou B1/B2; SBAS; DGPS; RT 555 Channels 20, 50 CM 2.1/2.3/3.0/ 20 <0.03 old start), <30 (h 20 INS-D-OEM Tactical-grade ±450 / ±950	3.1	
GNSS	Number of GNSS Antennas Supported GNSS signals & corrections (optional) Channel configuration (4) GNSS Positions data rate (5) RTK corrections GNSS Measurements (raw) data rate Velocity accuracy, RMS Initialization time Time accuracy (clock drift) (7) Gyroscopes Type	Hz Hz meters/sec Sec nano sec Units	GA	Dual GLONASS L1/L2 LILEO E1/E5, Q2: SBAS, DGPS, F 435 Channe 20 RTCM 2.3/3.0/ 20 <0.03 (cold start), <30 20 INS-DL-OEN Industrial-gra	r, BEIDOU B1/B2, SS L1/L5, RTK Is Is (3.2	RI	Dual .1/L2; GLONASS BeiDou B1/B2; SBAS; DGPS; RT 555 Channels 20, 50 TCM 2.1/2.3/3.0/ 20 <0.03 old start), <30 (h 20 INS-D-OEM Tactical-grade	3.1	
GNSS	Number of GNSS Antennas Supported GNSS signals & corrections (optional) Channel configuration (4) GNSS Positions data rate (5) RTK corrections GNSS Measurements (raw) data rate Velocity accuracy, RMS Initialization time Time accuracy (clock drift) (7) Gyroscopes Type Measurement range Bias in-run stability (RMS, Allan Variance)	Hz Hz meters/sec Sec nano sec Units deg/sec deg/hr	GA	Dual GLONASS L1/L2 LILEO E1/E5, Q2: SBAS, DGPS, F 435 Channel 20 RTCM 2.3/3.0/ <0.03 (cold start), <30 20 INS-DL-OEN Industrial-gra ±450 / ±95 3	r, BEIDOU B1/B2, SS L1/L5, RTK Is Is (3.2	RI	Dual .1/L2; GLONASS BeiDou B1/B2; SBAS; DGPS; RT 555 Channels 20, 50 TCM 2.1/2.3/3.0/ 20 <0.03 old start), <30 (h 20 INS-D-OEM Tactical-grade ±450 / ±950	3.1	
0	Number of GNSS Antennas Supported GNSS signals & corrections (optional) Channel configuration (4) GNSS Positions data rate (5) RTK corrections GNSS Measurements (raw) data rate Velocity accuracy, RMS Initialization time Time accuracy (clock drift) (7) Gyroscopes Type Measurement range Bias in-run stability (RMS, Allan Variance) Bias error over temperature range (RMS) Angular Random Walk Accelerometers	Hz Hz meters/sec Sec nano sec Units deg/sec deg/hr deg/hr	GA	Dual GLONASS L1/L2 GLONASS L1/L2 SBAS, DGPS, F 435 Channel 20 RTCM 2.3/3.0/ 20 <0.03 (cold start), <30 20 INS-DL-OEN 3 <50 450 / ±95 3 <50 <0.3 INS-DL-OEN	, BEIDOU B1/B2, SS L1/L5, RTK Is /3.2 (hot start)	RI	Dual 1.1/L2; GLONASS BeiDou B1/B2; SBAS; DGPS; RT 555 Channels 20, 50 TCM 2.1/2.3/3.0/ 20 <0.03 old start), <30 (h 20 INS-D-OEM Tactical-grade ±450 / ±950 1 <30 <0.2 INS-D-OEM	3.1	
0	Number of GNSS Antennas Supported GNSS signals & corrections (optional) Channel configuration (*) GNSS Positions data rate (*) RTK corrections GNSS Measurements (raw) data rate Velocity accuracy, RMS Initialization time Time accuracy (clock drift) (*) Gyroscopes Type Measurement range Bias in-run stability (RMS, Allan Variance) Bias error over temperature range (RMS) Angular Random Walk Accelerometers Type	Hz Hz meters/sec Sec nano sec Units deg/sec deg/hr deg/hr deg/hr Units	<50	Dual GLONASS L1/L2 LILEO E1/E5, Q2: SBAS, DGPS, F 435 Channe 20 RTCM 2.3/3.0/ 20 <0.03 (cold start), <30 20 INS-DL-OEN Industrial-gra ±450 / ±95 <0.03 INS-DL-OEN Industrial-gra Industrial-gra	, BEIDOU B1/B2, SS L1/L5, RTK Is /3.2 (hot start)	<50 (cc	Dual 1/L2; GLONASS BeiDou B1/B2; SBAS; DGPS; RT 555 Channels 20, 50 TCM 2.1/2.3/3.0/ 20 <0.03 old start), <30 (h 20 INS-D-OEM Tactical-grade ±450 / ±950 1 <30 <0.2 INS-D-OEM Tactical-grade	3.1 not start)	
IMU GNSS	Number of GNSS Antennas Supported GNSS signals & corrections (optional) Channel configuration (4) GNSS Positions data rate (5) RTK corrections GNSS Measurements (raw) data rate Velocity accuracy, RMS Initialization time Time accuracy (clock drift) (7) Gyroscopes Type Measurement range Bias in-run stability (RMS, Allan Variance) Bias error over temperature range (RMS) Angular Random Walk Accelerometers Type Measurement range	Hz Hz meters/sec Sec nano sec Units deg/sec deg/hr deg/hr deg/yhr Units	<50 ±8 g	Dual GLONASS L1/L2 LILEO E1/E5, Q2 SBAS, DGPS, F 435 Channel 20 RTCM 2.3/3.0/ 20 <0.03 (cold start), <30 20 INS-DL-OEN Industrial-gra ±450 / ±95 <0.3 INS-DL-OEN Industrial-gra ±15 g	, BEIDOU B1/B2, SS L1/L5, RTK Is //3.2 (hot start) Mode 0	R1 <50 (α ±8 g	Dual .1/L2; GLONASS BeiDou B1/B2; SBAS; DGPS; RT 555 Channels 20, 50 'CM 2.1/2.3/3.0/ 20 <0.03 old start), <30 (h 20 INS-D-OEM Tactical-grade ±450 / ±950 1 <30 <0.2 INS-D-OEM Tactical-grade ±450 / ±950 1 <30 <0.2	3.1 (a) (b) (c) (c) (d) (d) (d) (d) (d) (d) (d) (d) (d) (d	
0	Number of GNSS Antennas Supported GNSS signals & corrections (optional) Channel configuration (*) GNSS Positions data rate (*) RTK corrections GNSS Measurements (raw) data rate Velocity accuracy, RMS Initialization time Time accuracy (clock drift) (*) Gyroscopes Type Measurement range Bias in-run stability (RMS, Allan Variance) Bias error over temperature range (RMS) Angular Random Walk Accelerometers Type	Hz Hz meters/sec Sec nano sec Units deg/sec deg/hr deg/hr deg/hr Units	<50	Dual GLONASS L1/L2 LILEO E1/E5, Q2: SBAS, DGPS, F 435 Channe 20 RTCM 2.3/3.0/ 20 <0.03 (cold start), <30 20 INS-DL-OEN Industrial-gra ±450 / ±95 <0.03 INS-DL-OEN Industrial-gra Industrial-gra	, BEIDOU B1/B2, SS L1/L5, RTK Is /3.2 (hot start)	<50 (cc	Dual 1/L2; GLONASS BeiDou B1/B2; SBAS; DGPS; RT 555 Channels 20, 50 TCM 2.1/2.3/3.0/ 20 <0.03 old start), <30 (h 20 INS-D-OEM Tactical-grade ±450 / ±950 1 <30 <0.2 INS-D-OEM Tactical-grade	3.1 not start)	
0	Number of GNSS Antennas Supported GNSS signals & corrections (optional) Channel configuration (4) GNSS Positions data rate (5) RTK corrections GNSS Measurements (raw) data rate Velocity accuracy, RMS Initialization time Time accuracy (clock drift) (7) Gyroscopes Type Measurement range Bias in-run stability (RMS, Allan Variance) Bias error over temperature range (RMS) Angular Random Walk Accelerometers Type Measurement range Measurement range Bias in-run stability (RMS, Allan Variance) Measurement range	Hz Hz meters/sec Sec nano sec Units deg/sec deg/hr deg/hr deg/Vhr Units g mq	\$\delta \text{SO}\$\$ \$\leq \frac{\pmatrix}{50}\$ \$\delta \frac{\pmatrix}{9} \text{0.01}\$ \$ 0.01\$ \$ 0.7\$ \$ 1.5\$	Dual GLONASS L1/L2 LILEO E1/E5, Q2: SBAS, DGPS, F 435 Channel 20 RTCM 2.3/3.0/ 20 <0.03 (cold start), <30 INS-DL-OEN Industrial-gra ±450 / ±95 3 <50 <0.3 INS-DL-OEN Industrial-gra ±15 g 0.03 1.1.1 2.0	Medde		Dual 1/L2; GLONASS BeiDou B1/B2; SBAS; DGPS; RT 555 Channels 20, 50 TCM 2.1/2.3/3.0/ 20 <0.03 old start), <30 (h 20 INS-D-OEM Tactical-grade ±450 / ±950 1 <30 <0.2 INS-D-OEM Tactical-grade ±15 g 0.02 0.07 1.3	±40 g 0.03 1.2 1.5	
0	Number of GNSS Antennas Supported GNSS signals & corrections (optional) Channel configuration (4) GNSS Positions data rate (5) RTK corrections GNSS Measurements (raw) data rate Velocity accuracy, RMS Initialization time Time accuracy (clock drift) (7) Gyroscopes Type Measurement range Bias in-run stability (RMS, Allan Variance) Bias error over temperature range (RMS) Angular Random Walk Accelerometers Type Measurement range Bias in-run stability (RMS, Allan Variance) Bias error over temperature range (RMS) Measurement range Bias in-run stability (RMS, Allan Variance) Bias error over temperature range (RMS) Bias one-year repeatability Velocity Random Walk	Hz Hz meters/sec Sec nano sec Units deg/sec deg/hr deg/hr deg/r/hr Units g mg mg mg m/s/v/hr	<50 <8 	Dual GLONASS L1/L2 LILEO E1/E5, Q2 SBAS, DGPS, F 435 Channel 20 RTCM 2.3/3.0/ 20 <0.03 (cold start), <30 20 INS-DL-OEN Industrial-gra ±450 / ±95 3 <50 <0.3 INS-DL-OEN Industrial-gra ±15 g 0.03 1.1 2.0 0.045	Medical Medica	R1 <50 (cc ±8 g 0.005 0.5	Dual .1/L2; GLONASS BeiDou B1/B2; SBAS; DGPS; RT 555 Channels 20, 50 'CM 2.1/2.3/3.0/ 20 <0.03 old start), <30 (h 20 INS-D-OEM Tactical-grade ±450 / ±950 1 <30 <0.2 INS-D-OEM Tactical-grade ±15 g 0.02 0.7 1.3 0.035	±40 g 0.03 1.2	
0	Number of GNSS Antennas Supported GNSS signals & corrections (optional) Channel configuration (4) GNSS Positions data rate (5) RTK corrections GNSS Measurements (raw) data rate Velocity accuracy, RMS Initialization time Time accuracy (clock drift) (7) Gyroscopes Type Measurement range Bias in-run stability (RMS, Allan Variance) Bias error over temperature range (RMS) Angular Random Walk Accelerometers Type Measurement range Bias in-run stability (RMS, Allan Variance) Bias error over temperature range (RMS) Measurement range Bias in-run stability (RMS, Allan Variance) Bias error over temperature range (RMS) Bias one-year repeatability Velocity Random Walk	Hz Hz meters/sec Sec nano sec Units deg/sec deg/hr deg/yhr Units g mg mg mg m/s/v/hr Units	\$\delta \text{SO}\$\$ \$\leq \frac{\pmatrix}{50}\$ \$\delta \frac{\pmatrix}{9} \text{0.01}\$ \$ 0.01\$ \$ 0.7\$ \$ 1.5\$	Dual GLONASS L1/L2 L1LEO E1/E5, QE SBAS, DGPS, F 435 Channel 20 RTCM 2.3/3.0) 20 <0.03 (cold start), <30 INS-DL-OEN Industrial-gra ±450 / ±95 <0.3 INS-DL-OEN Industrial-gra ±15 g 0.03 1.1 2.0 0.045 INS-DL-OEN	M	48 g 0.005 0.5 1.0	Dual .1/L2; GLONASS BeiDou B1/B2; SBAS; DGPS; RT 555 Channels 20, 50 'CM 2.1/2.3/3.0/ 20 <0.03 old start), <30 (h 20 INS-D-OEM Tactical-grade ±450 / ±950 1 <30 <0.2 INS-D-OEM Tactical-grade ±15 g 0.02 0.7 1.3 0.035 INS-D-OEM	±40 g 0.03 1.2 1.5	
OMI	Number of GNSS Antennas Supported GNSS signals & corrections (optional) Channel configuration (4) GNSS Positions data rate (5) RTK corrections GNSS Measurements (raw) data rate Velocity accuracy, RMS Initialization time Time accuracy (clock drift) (7) Gyroscopes Type Measurement range Bias in-run stability (RMS, Allan Variance) Bias error over temperature range (RMS) Angular Random Walk Accelerometers Type Measurement range Bias in-run stability (RMS, Allan Variance) Bias error over temperature range (RMS) Bias one-year repeatability Velocity Random Walk Environment Operating temperature	Hz Hz meters/sec Sec nano sec Units deg/sec deg/hr deg/hr Units g mg mg mg mg m/s/\hr Units deg C	\$\delta \text{SO}\$\$ \$\leq \frac{\pmatrix}{50}\$ \$\delta \frac{\pmatrix}{9} \text{0.01}\$ \$ 0.01\$ \$ 0.7\$ \$ 1.5\$	Dual GLONASS L1/L2 GLONASS L1/L2 SBAS, DGPS, F 435 Channel 20 RTCM 2.3/3.0/ 20 <0.03 (cold start), <30 20 INS-DL-OEN Industrial-gra ±450 / ±95 3 <50 <0.3 INS-DL-OEN Industrial-gra ±15 9 0.03 1.1 2.0 0.045 INS-DL-OEN -40 to +75	M start) M start) M start) M start) M start) M start M start	48 g 0.005 0.5 1.0	Dual 1.1/L2; GLONASS BeiDou B1/B2; SBAS; DGPS; RT 555 Channels 20, 50 CM 2.1/2.3/3.0/ 20 <0.03 old start), <30 (h 20 INS-D-OEM Tactical-grade ±450 / ±950 1 <30 <0.2 INS-D-OEM Tactical-grade ±15 g 0.02 0.7 1.3 0.035 INS-D-OEM -40 to +75	±40 g 0.03 1.2 1.5	
OMI	Number of GNSS Antennas Supported GNSS signals & corrections (optional) Channel configuration (*) GNSS Positions data rate (*) RTK corrections GNSS Measurements (raw) data rate Velocity accuracy, RMS Initialization time Time accuracy (clock drift) (*) Gyroscopes Type Measurement range Bias in-run stability (RMS, Allan Variance) Bias error over temperature range (RMS) Angular Random Walk Accelerometers Type Measurement range Bias in-run stability (RMS, Allan Variance) Bias error over temperature range (RMS) Bias one-year repeatability Velocity Random Walk Environment Operating temperature Storage temperature	Hz Hz meters/sec Sec nano sec Units deg/sec deg/hr deg/hr deg/vhr Units g mg mg mg mg mg deg/column mg mg mg deg/column mg mg mg mg mg mg mg mg mg	\$\delta \text{SO}\$\$ \$\leq \frac{\pmatrix}{50}\$ \$\delta \frac{\pmatrix}{9} \text{0.01}\$ \$ 0.01\$ \$ 0.7\$ \$ 1.5\$	Dual GLONASS L1/L2 LILEO E1/E5, Q2: SBAS, DGPS, F 435 Channe 20 RTCM 2.3/3.0/ 20 <0.03 (cold start), <30 20 INS-DL-OEN Industrial-gra ±450 / ±95 3 <50 <0.3 INS-DL-OEN Industrial-gra ±15 g 0.03 1.1 2.0 0.045 INS-DL-OEN -40 to +75 -50 to +85	M start) M start) M start) M start) M start) M start M start	48 g 0.005 0.5 1.0	Dual .1/L2; GLONASS BeiDou B1/B2; SBAS; DGPS; RT 555 Channels 20, 50 CM 2.1/2.3/3.0/ 20 <0.03 old start), <30 (h 20 INS-D-OEM Tactical-grade ±450 / ±950 1 <30 <0.2 INS-D-OEM Tactical-grade ±15 g 0.02 0.7 1.3 0.035 INS-D-OEM -0.04 -0.07 -1.3 -0.035 INS-D-OEM -0.04 -0.05 -0.07 -0.07 -0.07 -0.08 -0.095 -0.07 -0.095 -0.07 -0.095 -0.0	±40 g 0.03 1.2 1.5	
OMI	Number of GNSS Antennas Supported GNSS signals & corrections (optional) Channel configuration (4) GNSS Positions data rate (5) RTK corrections GNSS Measurements (raw) data rate Velocity accuracy, RMS Initialization time Time accuracy (clock drift) (7) Gyroscopes Type Measurement range Bias in-run stability (RMS, Allan Variance) Bias error over temperature range (RMS) Angular Random Walk Accelerometers Type Measurement range Bias in-run stability (RMS, Allan Variance) Bias error over temperature range (RMS) Seasurement range Bias in-run stability (RMS, Allan Variance) Bias error over temperature range (RMS) Welsozity Random Walk Environment Operating temperature Storage temperature MTBF	Hz Hz meters/sec Sec nano sec Units deg/sec deg/hr deg/hr Units g mg mg mg mg m/s/\hr Units deg C	\$\delta \text{SO}\$\$ \$\leq \frac{\pmatrix}{50}\$ \$\delta \frac{\pmatrix}{9} \text{0.01}\$ \$ 0.01\$ \$ 0.7\$ \$ 1.5\$	Dual GLONASS L1/L2 GLONASS L1/L2 SBAS, DGPS, F 435 Channel 20 RTCM 2.3/3.0/ 20 <0.03 (cold start), <30 20 INS-DL-OEN Industrial-gra ±450 / ±95 3 <50 <0.3 INS-DL-OEN Industrial-gra ±15 9 0.03 1.1 2.0 0.045 INS-DL-OEN -40 to +75	Mede ±40 g 0.05 1.5 2.5 1.006 Medical control of the control of th	48 g 0.005 0.5 1.0	Dual 1.1/L2; GLONASS BeiDou B1/B2; SBAS; DGPS; RT 555 Channels 20, 50 CM 2.1/2.3/3.0/ 20 <0.03 old start), <30 (h 20 INS-D-OEM Tactical-grade ±450 / ±950 1 <30 <0.2 INS-D-OEM Tactical-grade ±15 g 0.02 0.7 1.3 0.035 INS-D-OEM -40 to +75	±40 g 0.03 1.2 1.5	
and IMU	Number of GNSS Antennas Supported GNSS signals & corrections (optional) Channel configuration (4) GNSS Positions data rate (5) RTK corrections GNSS Measurements (raw) data rate Velocity accuracy, RMS Initialization time Time accuracy (clock drift) (7) Gyroscopes Type Measurement range Bias in-run stability (RMS, Allan Variance) Bias error over temperature range (RMS) Angular Random Walk Accelerometers Type Measurement range Bias in-run stability (RMS, Allan Variance) Bias error over temperature range (RMS) Seasurement range Bias in-run stability (RMS, Allan Variance) Bias error over temperature range (RMS) Welsozity Random Walk Environment Operating temperature Storage temperature MTBF	Hz Hz meters/sec Sec nano sec Units deg/sec deg/hr deg/yhr Units g mg mg mg mg company mg deg C deg C hours	\$\delta \text{SO}\$\$ \$\leq \frac{\pmatrix}{50}\$ \$\delta \frac{\pmatrix}{9} \text{0.01}\$ \$ 0.01\$ \$ 0.7\$ \$ 1.5\$	Dual GLONASS L1/L2 LILEO E1/E5, Q2: SBAS, DGPS, F 435 Channel 20 RTCM 2.3/3.0/ 20 <0.03 (cold start), <30 20 INS-DL-OEN Industrial-gra ±450 / ±95 3 <50 <0.3 INS-DL-OEN Industrial-gra ±1.5 g 0.03 1.1 2.0 0.045 INS-DL-OEN -40 to +75 -50 to +85 55,500 INS-DL-OEN 9 - 36	Mede ±40 g 0.05 1.5 2.5 1.006 Medical control of the control of th	48 g 0.005 0.5 1.0	Dual 1.1/L2; GLONASS BeiDou B1/B2; SBAS; DGPS; RT 555 Channels 20, 50 CM 2.1/2.3/3.0/ 20 <0.03 old start), <30 (h 20 INS-D-OEM Tactical-grade ±450 / ±950 1 <30 <0.2 INS-D-OEM Tactical-grade ±15 g 0.02 0.7 1.3 0.035 INS-D-OEM -40 to +75 -50 to +85 55,500 INS-D-OEM 9 - 36	±40 g 0.03 1.2 1.5	
and IMU	Number of GNSS Antennas Supported GNSS signals & corrections (optional) Channel configuration (4) GNSS Positions data rate (5) RTK corrections GNSS Measurements (raw) data rate Velocity accuracy, RMS Initialization time Time accuracy (clock drift) (7) Gyroscopes Type Measurement range Bias in-run stability (RMS, Allan Variance) Bias error over temperature range (RMS) Angular Random Walk Accelerometers Type Measurement range Bias in-run stability (RMS, Allan Variance) Bias error over temperature range (RMS) Seasurement range Bias in-run stability (RMS, Allan Variance) Bias error over temperature range (RMS) Welsozity Random Walk Environment Operating temperature Storage temperature MTBF	Hz Hz meters/sec Sec nano sec Units deg/sec deg/hr deg/hr deg/hr Units g mg mg mg mg ms ms units deg C deg C hours Units	±8 g 0.01 0.7 1.5 0.02	Dual GLONASS L1/L2 LILEO E1/E5, Q2: SBAS, DGPS, F 435 Channe 20 RTCM 2.3/3.0/ 20 <0.03 (cold start), <30 20 INS-DL-OEN Industrial-gra ±450 / ±95 3 <50 <0.3 INS-DL-OEN Industrial-gra ±15 g 0.03 1.1 2.0 0.045 INS-DL-OEN -40 to +75 -50 to +85 55,500 INS-DL-OEN 55,500 INS-DL-OEN 3	M start) M start) M start) M start) M start) M start M start	±8 g 0.005 0.5 1.0 0.015	Dual .1/L2; GLONASS BeiDou B1/B2; SBAS; DGPS; RT 555 Channels 20, 50 CM 2.1/2.3/3.0/ 20 <0.03 old start), <30 (h 20 INS-D-OEM Tactical-grade ±450 / ±950 .0.2 INS-D-OEM Tactical-grade ±15 g 0.02 0.7 1.3 0.035 INS-D-OEM -40 to +75 -50 to +85 55,500 INS-D-OEM 9 - 36 3	±40 g 0.03 1.2 1.5 0.045	
and IMU	Number of GNSS Antennas Supported GNSS signals & corrections (optional) Channel configuration (4) GNSS Positions data rate (5) RTK corrections GNSS Measurements (raw) data rate Velocity accuracy, RMS Initialization time Time accuracy (clock drift) (7) Gyroscopes Type Measurement range Bias in-run stability (RMS, Allan Variance) Bias error over temperature range (RMS) Angular Random Walk Accelerometers Type Measurement range Bias in-run stability (RMS, Allan Variance) Bias error over temperature range (RMS) Seasurement range Bias in-run stability (RMS, Allan Variance) Bias error over temperature range (RMS) Welsozity Random Walk Environment Operating temperature Storage temperature MTBF	Hz Hz meters/sec Sec nano sec Units deg/sec deg/hr deg/yhr Units g mg mg mg mg company mg deg C deg C hours	±8 g 0.01 0.7 1.5 0.02	Dual GLONASS L1/L2 LILEO E1/E5, Z2 SBAS, DGPS, F 435 Channe 20 RTCM 2.3/3.0/ <0.03 (cold start), <30 INS-DL-OEN Industrial-gra ±450 / ±95 <50 <0.3 INS-DL-OEN Industrial-gra ±15 g 0.03 1.1 2.0 0.045 INS-DL-OEN -40 to +85 555,500 INS-DL-OEN 9 - 36 3 RS-232 or RS-422	M BEIDOU B1/B2, SS L1/L5, RTK Is S L1/L5, RTK	±8 g 0.005 0.5 1.0 0.015	Dual .1/L2; GLONASS BeiDou B1/B2; SLONASS BeiDou B1/B2; SBAS; DGPS; RT 555 Channels 20, 50 [CM 2.1/2.3/3.0/ 20 <0.03 old start), <30 (h 20 INS-D-OEM Tactical-grade ±450 / ±950 1 <30 <0.2 INS-D-OEM Tactical-grade ±15 g 0.02 0.7 1.3 0.035 INS-D-OEM -40 to +75 -50 to +85 55,500 INS-D-OEM 9 - 36 3 -232 or RS-422,	±40 g 0.03 1.2 1.5 0.045	
and IMU	Number of GNSS Antennas Supported GNSS signals & corrections (optional) Channel configuration (4) GNSS Positions data rate (5) RTK corrections GNSS Measurements (raw) data rate Velocity accuracy, RMS Initialization time Time accuracy (clock drift) (7) Gyroscopes Type Measurement range Bias in-run stability (RMS, Allan Variance) Bias error over temperature range (RMS) Angular Random Walk Accelerometers Type Measurement range Bias in-run stability (RMS, Allan Variance) Bias error over temperature range (RMS) Seasurement range Bias in-run stability (RMS, Allan Variance) Bias error over temperature range (RMS) Welsozity Random Walk Environment Operating temperature Storage temperature MTBF	Hz Hz meters/sec Sec nano sec Units deg/sec deg/hr deg/yhr Units g mg mg mg mg company mg deg C deg C hours	*8 g 0.01 0.7 1.5 0.02	Dual GLONASS L1/L2 LILEO E1/E5, Q2: SBAS, DGPS, F 435 Channe 20 RTCM 2.3/3.0/ 20 <0.03 (cold start), <30 20 INS-DL-OEN Industrial-gra ±450 / ±95 3 <50 <0.3 INS-DL-OEN Industrial-gra ±15 g 0.03 1.1 2.0 0.045 INS-DL-OEN -40 to +75 -50 to +85 55,500 INS-DL-OEN 55,500 INS-DL-OEN 3	Medical Medica	±8 g 0.005 0.5 1.0 0.015	Dual 1.1/L2; GLONASS BeiDou B1/B2; SBAS; DGPS; RT 555 Channels 20, 50 (CM 2.1/2.3/3.0/ 20 <0.03 old start), <30 (h 20 INS-D-OEM Tactical-grade ±450 / ±950 1 <30 <0.2 INS-D-OEM Tactical-grade ±15 g 0.02 0.7 1.3 0.035 INS-D-OEM -40 to +75 -50 to +85 55,500 INS-D-OEM 9 - 36 3 223 or RS-422, /	±40 g 0.03 1.2 1.5 0.045	
and IMU	Number of GNSS Antennas Supported GNSS signals & corrections (optional) Channel configuration (4) GNSS Positions data rate (5) RTK corrections GNSS Measurements (raw) data rate Velocity accuracy, RMS Initialization time Time accuracy (clock drift) (7) Gyroscopes Type Measurement range Bias in-run stability (RMS, Allan Variance) Bias error over temperature range (RMS) Angular Random Walk Accelerometers Type Measurement range Bias in-run stability (RMS, Allan Variance) Bias error over temperature range (RMS) Seasurement range Bias in-run stability (RMS, Allan Variance) Bias error over temperature range (RMS) Welsozity Random Walk Environment Operating temperature Storage temperature MTBF	Hz Hz meters/sec Sec nano sec Units deg/sec deg/hr deg/hr Units g mg mg mg mg check deg C deg C	*8 g 0.01 0.7 1.5 0.02	Dual GLONASS L1/L2 LILEO E1/E5, Q2: SBAS, DGPS, F 435 Channe 20 RTCM 2.3/3.0/ 20 <0.03 (cold start), <30 20 INS-DL-OEN Industrial-gra ±450 / ±95 3 <50 <0.3 INS-DL-OEN Industrial-gra ±15 g 0.03 1.1 2.0 0.045 INS-DL-OEN INS-DL-OEN SS,500 INS-DL-OEN GRS-232 or RS-42: Ethernet (opticiarry, NMEA 018 INS-DL-OEN INS-DL-OEN GRS-232 or RS-42: Ethernet (opticiarry, NMEA 018 INS-DL-OEN	M BEIDOU B1/B2, SS L1/L5, RTK Is	±8 g 0.005 0.5 1.0 0.015	Dual .1/L2; GLONASS BeiDou B1/B2; SBAS; DGPS; RT 555 Channels 20, 50 CM 2.1/2.3/3.0/ 20 <0.03 old start), <30 (h 20 INS-D-OEM Tactical-grade ±450 / ±950 .0.2 INS-D-OEM Tactical-grade ±15 g 0.02 0.7 1.3 0.035 INS-D-OEM -40 to +75 -50 to +85 55,500 INS-D-OEM 9 - 36 3 -232 or RS-422, tethernet (options) INS-D-OEM	±40 g 0.03 1.2 1.5 0.045	
OMI	Number of GNSS Antennas Supported GNSS signals & corrections (optional) Channel configuration (4) GNSS Positions data rate (5) RTK corrections GNSS Measurements (raw) data rate Velocity accuracy, RMS Initialization time Time accuracy (clock drift) (7) Gyroscopes Type Measurement range Bias in-run stability (RMS, Allan Variance) Bias error over temperature range (RMS) Angular Random Walk Accelerometers Type Measurement range Bias in-run stability (RMS, Allan Variance) Bias error over temperature range (RMS) Bias one-year repeatability Velocity Random Walk Environment Operating temperature Storage temperature MTBF Electrical Supply voltage Power consumption Output data format	Hz Hz meters/sec Sec nano sec Units deg/sec deg/hr deg/yhr Units g mg mg mg mg chours deg C hours V DC Watts	*8 g 0.01 0.7 1.5 0.02	Dual GLONASS L1/L2 GLONASS L1/L2 SBAS, DGPS, F 435 Channel 20 RTCM 2.3/3.0/ 20 <0.03 (cold start), <30 20 INS-DL-OEN Industrial-gra ±450 / ±95 3 <50 <0.3 INS-DL-OEN Industrial-gra ±15 g 0.03 1.1 2.0 0.045 INS-DL-OEN INS-DL-OEN INS-DL-OEN S55,500 INS-DL-OEN 555,500 INS-DL-OEN 557,500	M BEIDOU B1/B2, SS L1/L5, RTK Is	±8 g 0.005 0.5 1.0 0.015	Dual 1.1/L2; GLONASS BeiDou B1/B2; SBAS; DGPS; RT 555 Channels 20, 50 CM 2.1/2.3/3.0/ 20 <0.03 old start), <30 (h 20 INS-D-OEM Tactical-grade ±450 / ±950 1 <30 <0.2 INS-D-OEM Tactical-grade ±15 g 0.02 0.7 1.3 0.035 INS-D-OEM -40 to +75 -50 to +85 55,500 INS-D-OEM 9 - 36 3 -232 or RS-422, cthernet (optional ray, NMEA 0183 A	±40 g 0.03 1.2 1.5 0.045	

⁽¹⁾ GPS only; (2) RMS, incremental error growth from steady state accuracy. Post-processing results using third party software; (2) 2 meters base line between two GNSS antennas; (4) tracks up to 60 L1/L2 satellites;

^{(9) 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



INS-D-OEM part numbers structure (Example: INS-D-OEM-G450-A15-TGA-C6-O7720-VD4.1)

Model	Gyroscope	Accel	Calibration	Connector	GNSS receiver	Version	Interface
INS-D-OEM	G450	A8	TGA	C4	07720	VD4	1
	G950	A15		C6		VD42	2
		A40			•	VD43	11
							22

INS-DL-OEM part numbers structure (Example: INS-DL-OEM-G450-A15-TGA-C6-B482-VD9.1

Model	Gyroscope	Accel	Calibration	Connector	GNSS receiver	Version	Interface
INS-DL-OEM	G450	A8	TGA	C4	B482	VD9	1
	G950	A15		C6			2
		A40					11
Part number structure:							22

- INS-D-OEM: Dual Antenna GPS-Aided Inertial Navigation System
- INS-DL-OEM: Low cost Dual Antenna GPS-Aided Inertial Navigation System G450: Gyroscopes measurment range $= \pm 450$ deg/sec
- G950: Gyroscopes measurment range = \pm 950 deg/sec
- A8: Accelerometers measurement range = ±8 g -> 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 operational vibration
- TGA: Gyroscopes and Accelerometers
- C4: 14 pins M80-4601405 (Harwin)
- C6: Aluminum base plate with screw lock connector
 O7720: Novatel OEM7720 dual antenna GNSS receiver (INS-D only)
- B482: Inertial Labs B482 dual antenna GNSS receiver (INS-DL only)
- VD4: GPS L1/L2, Dual antenna Heading, SBAS, DGPS, 20 Hz positions (INS-D only)

- VD42: GPS L1/L2, GLONASS L1/L2, Dual antenna 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 antenna Heading, DGPS, RTK, 20 Hz measurements, 20 Hz positions (INS-DL-OEM only)
- VX.1: RS-232, CAN, Ethernet interface
- VX.2: RS-422, CAN, Ethernet interface
- VX.1: two RS-232 interfaces
- VX.2: two RS-422 interfaces