

STANDARD  
MIL-STD  
810G



# Antenna Inertial Labs singola e doppia con supporto GPS Sistemi di navigazione inerziale INS

**MILANO SYSTEMS**

ADVANCED TECHNOLOGICAL SYSTEMS

Il Sistema di navigazione inerziale assistito da GPS con antenna singola e doppia Inertial Labs - INS è una nuova generazione di navigatori GPS, GLONASS, GALILEO, QZSS, BEIDOU e L-Band completamente integrati, che determinano posizione, velocità e orientamento assoluto (Heading, Pitch and Roll) per qualsiasi dispositivo su cui è montato. Posizione orizzontale e verticale, velocità e orientamento sono determinati con elevata precisione per applicazioni sia dinamiche che immobili.



Inertial Labs INS utilizza un ricevitore GNSS avanzato a singola e doppia antenna, barometro a 3 assi, ciascuno calibrato in precisione di temperatura operativa completa, magnetometri, accelerometri e giroscopi Fluxgate per fornire posizione, velocità, direzione, inclinazione e rollio precisi del dispositivo in misurazione. INS contiene nuovi filtri di fusione dei sensori integrati Inertial Labs, algoritmi di navigazione e guida all'avanguardia supportati da software di calibrazione.

### CARATTERISTICHE PRINCIPALI E FUNZIONALITÀ

- Precisione eccellente in ambienti con negazione GPS (up to 0.05 % DT)
- IMU di livello tattico + bussola Fluxgate + dati aiding
- Supporta: ROS, LabVIEW, Waypoint Inertial Explorer, QINSy
- Segnali supportati: GPS, GLONASS, GALILEO, BEIDOU, SBAS, DGPS, RTK
- IMU di tipo tattico (giroscopi da 1 grado / ora e 5 accelerometri micro g Stabilità in corsa) Fluxgate
- bussola giroscopica per mantenere la rotta libera inerziale (modello INS-P)
- Ricevitori GNSS a antenna singola e doppia
- Compatibilità con LiDAR (Velodyne, RIEGL, FARO) e telecamere ottiche
- Contachilometri, sensore ruota, sensore velocità, sensore vento, spostamento Doppler dai dati di supporto del localizzatore
- Precisione della posizione orizzontale RTK 1 cm + 1 ppm o Precisione della posizione orizzontale
- TerraStar-C PRO 2,5 cm da 0,05 gradi con direzione GNSS e precisione da 0,4 gradi con inerzia libera (3 sigma)
- Algoritmi di fusione del sensore integrati, estensibili e basati su filtro Kalman
- Algoritmi all'avanguardia per diversi movimenti dinamici di navi, elicotteri, UAV, UUV, UGV, AGV, ROV, Gimbals e veicoli terrestri
- Implementate funzionalità ZUPT, angolo di tracciamento GNSS
- Calibrazione a temperatura massima, a tenuta stagna (IP67), design compatto, MIL-STD-810G / DO-160E

WAYPOINT  
PRODUCTS GROUP

ROS



LabVIEW

### Models & features

#### INS-B



Basic

Soluzione ideale per il telerilevamento (UAV, LiDAR, telecamera ottica, nuvole di punti)

#### INS-P



Professional

Alte prestazioni in un ambiente negato GPS a lungo termine

#### INS-D



Dual Antenna

Intestazione di alta precisione  
IMU di grado tattico  
SP / SBAS / DGPS / RTK

#### INS-DL



Dual Antenna

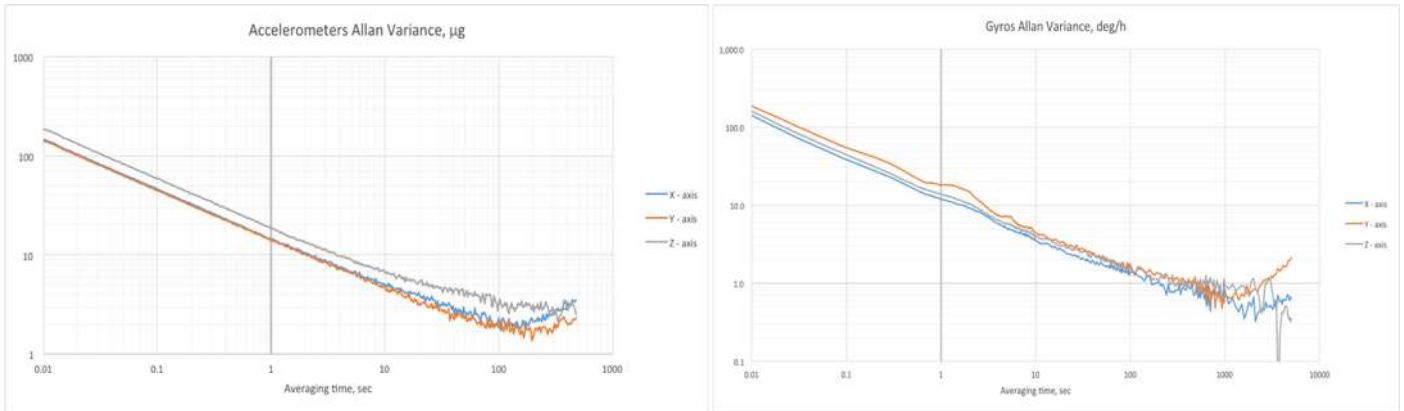
Intestazione di alta precisione  
IMU di livello industriale  
Posizione RTK di 1 cm



Parameter		Units	INS-B	INS-P	INS-D	INS-DL
<b>GENERAL</b>	Output signals		<ul style="list-style-type: none"> <li>Positions, Heading, Dual antenna Heading (D/DL), Pitch, Roll, Velocity, Accelerations, Angular rates, Barometer, PPS</li> <li>Direct AT_ITINS message with Position, Heading, Pitch &amp; Roll to COBHAM AVIATOR UAV 200</li> </ul>			
	Input signals		<ul style="list-style-type: none"> <li>Marine application: DVL (Doppler Velocity Log)</li> <li>Land application: Odometer, Wheel sensor, Encoder, DMI</li> <li>Aerial application: Wind sensor, Air Speed Sensor, Doppler shift from locator (for long-term GPS denied)</li> <li>All: External Stand Alone Magnetic Compass (SAMC/AHRS)</li> </ul>			
	Main features		Ideal solution for remote sensing (with LiDAR, Optical Camera)	High performance in long-term GPS-Denied environment	High precision Heading Tactical-grade IMU	Affordable price High precision Heading 1 cm RTK position
	Compatible with		Pixhawk Autopilot; Embention Autopilot; COBHAM AVIATOR UAV 200			
	Data rate	Hz	Up to 200 (INS data); Up to 2000 (IMU data)			
	Internal Data Logger (storage) - optional		8 GB or 64 GB (optional)			
Start-up time	sec		<1		<1	
<b>Navigation</b>	<b>Positions, Velocity and Timestamps</b>	<b>Units</b>	<b>INS-B</b>	<b>INS-P</b>	<b>INS-D</b>	<b>INS-DL</b>
	Horizontal position accuracy (GPS L1)	meters, RMS		1.5		1.5
	Vertical position accuracy (GPS L1)	meters, RMS		<1		<2
	Horizontal position accuracy (GPS L1/L2)	meters, RMS		1.2		1.2
	Horizontal position accuracy (SBAS) <sup>(1)</sup>	meters, RMS		0.6		n/a
	Horizontal position accuracy (DGPS)	meters, RMS		0.4		0.4
	Horizontal position accuracy (TerraStar-L) <sup>(2)</sup>	meters, RMS		0.4		n/a
	Horizontal position accuracy (TerraStar-C PRO) <sup>(2)</sup>	meters, RMS		0.025		n/a
	Horizontal position accuracy (post processing) <sup>(3)</sup>	meters, RMS		0.005		0.005
	Horizontal position accuracy (RTK)	meters, RMS		0.01 + 1 ppm		0.01 + 1 ppm
	Vertical position accuracy (RTK)	meters, RMS		0.02		0.02
	Position accuracy (free inertial, land vehicles)	%, DT		0.2% DT (w/o odometer input) 0.05 % DT (w/ odometer input)		0.5% DT (w/o odometer input) 0.1 % DT (w/ odometer input)
	Velocity accuracy, RMS	meters/sec		0.03		0.03
PPS timestamps accuracy	nano sec		20		20	
<b>Orientation</b>	<b>Heading</b>	<b>Units</b>	<b>INS-B</b>	<b>INS-P</b>	<b>INS-D</b>	<b>INS-DL</b>
	Range	deg	0 to 360	0 to 360	0 to 360	0 to 360
	Static Accuracy <sup>(4)</sup>	deg RMS	1	0.4	0.15 (1 meter base line)	0.2 (1 meter base line)
	Dynamic accuracy (GNSS) <sup>(7)</sup>	deg RMS	0.1	0.1	0.08 (2 meters baseline)	
	Post processing accuracy <sup>(3)</sup>	deg RMS	0.03	0.03	0.03	0.03
	<b>Pitch and Roll</b>	<b>Units</b>	<b>INS-B</b>	<b>INS-P</b>	<b>INS-D</b>	<b>INS-DL</b>
	Range: Pitch, Roll	deg		±90, ±180		±90, ±180
	Angular Resolution	deg		0.01		0.01
	Static Accuracy in whole Temperature Range	deg RMS		0.05		0.05
	Dynamic Accuracy <sup>(7)</sup>	deg RMS		0.08		0.1
Post processing accuracy <sup>(3)</sup>	deg RMS		0.006		0.01	
<b>GNSS</b>	<b>GNSS</b>	<b>Units</b>	<b>INS-B</b>	<b>INS-P</b>	<b>INS-D</b>	<b>INS-DL</b>
	Number of GNSS Antennas		Single	Single	Dual	Dual
	Supported navigation signals		GPS L1 C/A, L1C, L2C, L2P, L5; GLONASS L1 C/A, L2 C/A, L2P, L3, L5; BeiDou B1, B2; Galileo E1, E5 AltBOC, E5a, E5b; NavIC (IRNSS) L5; SBAS L1, L5 QZSS L1 C/A, L1C, L2C, L5; L-Band up to 5 channels; DGPS; RTK			GPS L1/L2; GLO L1/L2; BDS B1/B2, GAL E1/E5, QZSS L1/L2, DGPS, RTK
	Channel configuration <sup>(5)</sup>		555 Channels			432 Channels
	RTK corrections		RTCM 2, RTCM 3			RTCM 2, RTCM 3
	GNSS Positions data rate <sup>(6)</sup>	Hz	20, 50			20
	GNSS Measurements (raw) data rate	Hz	20			5
	Velocity accuracy, RMS	meters/sec	<0.03			<0.03
	Initialization time	Sec	<50 (cold start), <30 (hot start)			<50 (cold start), <30 (hot start)
	Time accuracy (clock drift) <sup>(8)</sup>	nano sec	20			20
<b>IMU</b>	<b>Gyroscopes</b>	<b>Units</b>	<b>INS-B</b>	<b>INS-P</b>	<b>INS-D</b>	<b>INS-DL</b>
	Type		Tactical-grade			Industrial-grade
	Measurement range	deg/sec	±450 / ±950			±450 / ±950
	Bias in-run stability (RMS, Allan Variance)	deg/hr	1			3
	Bias error over temperature range (RMS)	deg/hr	<30			<50
	Angular Random Walk	deg/√hr	<0.2 (0.08 optional)			<0.3
	<b>Accelerometers</b>	<b>Units</b>	<b>INS-B</b>	<b>INS-P</b>	<b>INS-D</b>	<b>INS-DL</b>
	Type		Tactical-grade			Industrial-grade
	Measurement range	g	±8 g / ±15 g / ±40 g			±8 g    ±15 g    ±40 g
	Bias in-run stability (RMS, Allan Variance)	mg	0.005 (±8 g) / 0.02 (±15 g) / 0.03 (±40 g)			0.01    0.03    0.05
	Bias error over temperature range (RMS)	mg	0.5 (±8 g) / 0.7 (±15 g) / 1.2 (±40 g)			0.7    1.1    1.5
	Bias one-year repeatability	mg	1.0 (±8 g) / 1.3 (±15 g) / 1.5 (±40 g)			1.5    2.0    2.5
	Velocity Random Walk	m/s/√hr	0.015 (±8 g) / 0.035 (±15 g) / 0.045 (±40 g)			0.02    0.045    0.06
	<b>Magnetometers</b>	<b>Units</b>	<b>INS-B</b>	<b>INS-P (Fluxgate)</b>	<b>INS-D</b>	<b>INS-DL</b>
	Measurement range	Gauss		±1.6		
Bias in-run stability, RMS	nT	Optional	0.2		Optional	
Noise density, PSD	nT/√Hz		0.3			
<b>Pressure</b>	<b>Units</b>	<b>INS-B</b>	<b>INS-P</b>	<b>INS-D</b>	<b>INS-DL</b>	
Measurement range	hPa	300 – 1100			300 – 1100	
Bias in-run stability (RMS, Allan Variance)	Pa	2			2	
Noise density	Pa/√Hz	0.8			0.8	
<b>General</b>	<b>Environment</b>	<b>Units</b>	<b>INS-B</b>	<b>INS-P</b>	<b>INS-D</b>	<b>INS-DL</b>
	Operating temperature	deg C	-40 to +75			-40 to +70
	Storage temperature	deg C	-50 to +85			-50 to +85
	MTBF (G <sub>M</sub> @ +65degC)	hours	100,000			100,000
	Shock and Vibration		MIL-STD-810G			MIL-STD-810G
	EMC/EMI		MIL-STD-461F			MIL-STD-461F
	<b>Electrical</b>	<b>Units</b>	<b>INS-B</b>	<b>INS-P</b>	<b>INS-D</b>	<b>INS-DL</b>
	Supply voltage	V DC	9 to 36			9 to 36
	Power consumption	Watts	2.5			5
	Output Interface (options)	-	RS-232 / RS-422 / CAN / Ethernet / 2 x RS-232 / 2 x RS-422 + CAN + Ethernet / RS-422 + CAN + Ethernet			
Protection (optional)		MIL-STD-1275				
Output data format		Binary, NMEA 0183 ASCII characters				
<b>Physical</b>	<b>Units</b>	<b>INS-B</b>	<b>INS-P</b>	<b>INS-D</b>	<b>INS-DL</b>	
Size	mm	120 x 50 x 53			120 x 50 x 53	
Weight	gram	220			280	
					320	
					320	

<sup>(1)</sup> GPS only; <sup>(2)</sup> Requires a subscription to a TerraStar data service <sup>(3)</sup> RMS, incremental error growth from steady state accuracy. Post-processing results using third party software; <sup>(4)</sup> calibrated in whole operational temperature range, in homogeneous magnetic environment, for latitude

## Prestazioni dei sensori INS (GPS-Aided INS) di Inertial Labs



## Inertial Labs GPS-Aided INS applicazioni chiave



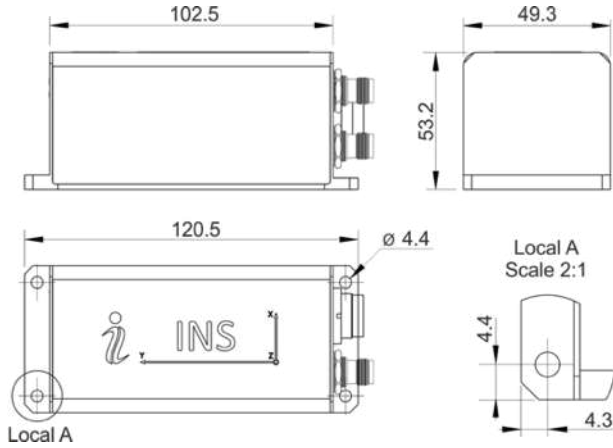
### INS struttura part number

Model	Gyro	Accel	Calibration	Connector & Enclosure	Encoder support	Color	Data Logger	GNSS receiver	Version	Interface
INS-B	G450	A8	TGA	C1 (obsolete)	E (option)	B (default)	S64 (default)	O615 - obsolete	V0	1
INS-P	G950	A15	TMGA	C3 (default)		D	S8 (option)	O617D - obsolete	V1	2
INS-D	G2000	A40		C31		G		O718D (China only)	V2	3
INS-DL				C32		W		O719	V3	4
				C5				O7720	V4	5
				C7				P327	VR43	11
				C71				B482	VR5	22
									V8	145
									VD4	245
									VD42	
									VD43	
									VD9	

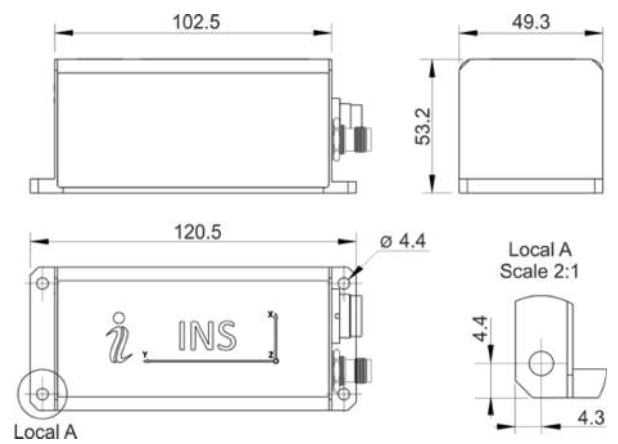
Example: INS-B-G450-A8-TGA-C3EB-S64-O719-V0.1

- INS-B: Basic Model of GPS-Aided Inertial Navigation System
- INS-P: Professional Model of GPS-Aided Inertial Navigation System
- INS-D: Dual Antenna GPS-Aided Inertial Navigation System
- INS-DL: Dual Antenna GPS-Aided Inertial Navigation System
- G450: Gyroscopes measurement range =  $\pm 450$  deg/sec
- G950: Gyroscopes measurement range =  $\pm 950$  deg/sec
- G2000: Gyroscopes measurement range =  $\pm 2000$  deg/sec
- A8: Accelerometers measurement range =  $\pm 8$  g
- A15: Accelerometers measurement range  $\pm 15$  g
- A40: Accelerometers measurement range  $\pm 40$  g
- TGA: Gyroscopes and Accelerometers
- TMGA: Magnetometers, Gyroscopes and Accelerometers (INS-P and INS-D only)
- C1: 12 pins connector (RS-232) - OBSOLETE
- C3: 24 pins connector (RS-232, RS-422, CAN, Ethernet interfaces)
- C31: 24 pins connector (RS-232, 2 x RS-422, CAN interfaces)
- C32: 24 pins connector (RS-232, RS-422, CAN, Ethernet interfaces) with modified PPS (preserve PPS configurable polarity): Active high – 5v (1'). Active low – 0v (0')
- C5: 24 pins connector, flanges and alignment pins
- C7: two 19 pins connectors
- C71: two 19 pins connectors, MIL-STD1275 protection
- E: encoder support
- B - Black Color (default)
- D - Desert Color (Desert tan, color code 33446 (tan 686A) per FED-STD-595, Change Notice 1.)
- G - Green
- W - White
- S8: 8GB embedded Data Logger (optional)
- S64: 64GB embedded Data Logger (optional)
- O615: Novatel OEM615 single antenna GNSS receiver (INS-B and INS-P only) - OBSOLETE
- O617D: Novatel OEM617D dual antenna GNSS receiver (INS-D only) - OBSOLETE
- O718: Novatel OEM718D dual antenna GNSS receiver (INS-D, for China only)
- O719: Novatel OEM719 single antenna GNSS receiver (INS-B and INS-P only)
- O7720: Novatel OEM7720 dual antenna GNSS receiver (INS-D only)
- P327: Hemisphere P327 single antenna GNSS receiver (INS-B and INS-P only)
- B482: Inertial Labs B482 dual antenna GNSS receiver (INS-DL only)
- V0: GPS L1, SBAS, DGPS, 20 Hz positions (INS-B and INS-P only)
- V1: GPS L1, SBAS, DGPS, 50 Hz positions (INS-B and INS-P only)
- V2: GPS L1, GLONASS, SBAS, DGPS, 20 Hz positions (INS-B and INS-P only)
- V3: GPS L1/L2, SBAS, DGPS, 20 Hz positions (INS-B and INS-P only)
- V4: GPS L1/L2, GLONASS L1/L2, SBAS, DGPS, 20 Hz positions (INS-B and INS-P only)
- VR43: GPS L1/L2, GLONASS L1/L2, SBAS, DGPS, 20 Hz positions, 20 Hz measurements (INS-B and INS-P only)
- VR5: GPS L1/L2, GLONASS L1/L2, SBAS, DGPS, RTK, 20 Hz positions, 20 Hz measurements (INS-B and INS-P only)
- V8: GPS L1/L2/L5; GLONASS L1/L2; BeiDou B1/B2/B3; GALILEO E1/E5; SBAS; DGPS; 20 Hz measurements; 20 Hz positions RTK (INS-B and INS-P 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 only)
- VD43: GPS L1/L2, GLONASS L1/L2, Dual antenna Heading, SBAS, DGPS, 20 Hz positions (INS-D 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 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 (w/o Encoder support)

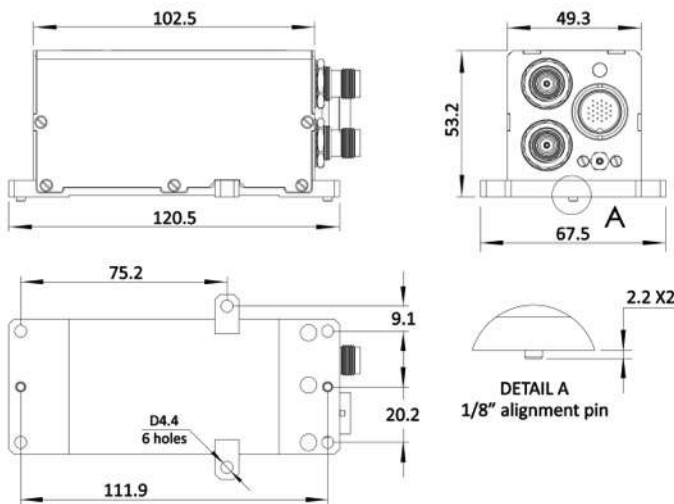
**Default: INS-D / INS-DL disegni meccanici interni**



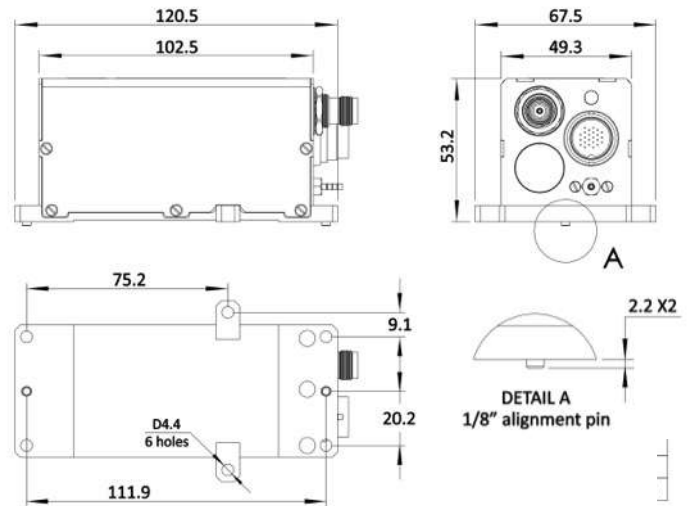
**Default: INS-B / INS-P disegni meccanici interni**



**Opzionale: INS-D / INS-DL disegni meccanici interni**



**Opzione: INS-B / INS-P con allineamento pin**



- Notes:
1. All dimensions are in millimeters.
  2. All dimensions within this drawing are subject to change without notice. Customers should obtain final drawings before designing any interface hardware.
  3. Interface connector type: Binder. Male receptacle, shielded, rear-mounting
  4. GNSS antenna connector type: TNC - Female