Low Cost Dual Antenna GPS-Aided Inertial Navigation Systems

INS-DU

Inertial Labs
Attitude is Everything

VALUABLE 20 YEARS EXPERIENCE

CERTIFIED ISO 9001:2015 COMPANY

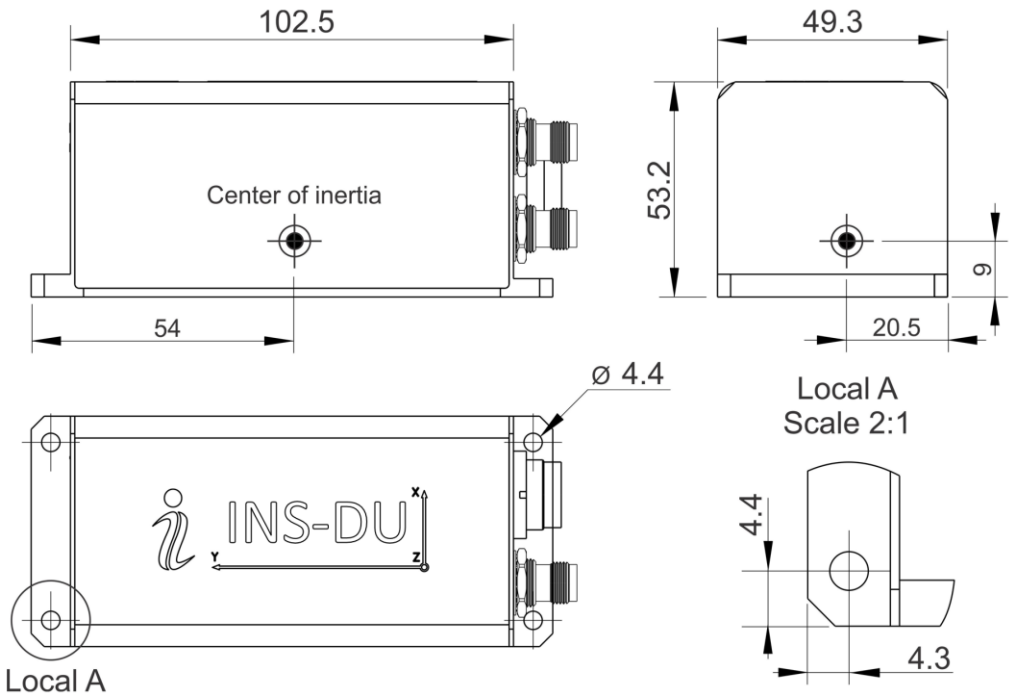
MADE IN THE USA

INS-DU Specifications

	Parameter	Units	INS-DU		
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		Low Cost, Dual antenna Heading, 1 cm RTK position		
	Data rate (INS)	Hz	Up to 200 (user settable)		
	Data rate (IMU)	Hz	Up to 2000 (user settable)		
	Start-up time	sec	<1		
	Positions, Velocity and Timestamps	Units	INS-DU		
Navigation	Horizontal position accuracy (SP, L1), RMS	meters	1.5		
	Horizontal position accuracy (SP, L1/L2), RMS	meters	1.2		
	Horizontal position accuracy (post processing) [2]	meters	0.005		
	Horizontal position accuracy (RTK), RMS	meters	0.01 + 1 ppm CEP		
	Vertical position accuracy (SP), RMS	meters	<2		
	Vertical position accuracy (RTK), RMS	meters	0.02 + 1 ppm CEP		
	Velocity accuracy, RMS	meters/sec	0.05		
	PPS timestamps accuracy	nano sec	20		
	Heading	Units	INS-DU		
Orientation	Range	deg	0 to 360		
	Static Accuracy [3]	deg RMS	0.2 (2m baseline); 0.4 (1m baseline)		
	Dynamic accuracy (GNSS) [6]	deg RMS	0.2 (2m baseline); 0.4 (1m baseline)		
	Post processing accuracy [2]	deg RMS	0.1		
	Pitch and Roll	Units	INS-DU		
	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	0.01		
	GNSS receiver	Units	INS-DU		
GNSS	Number of GNSS Antennas		Dual		
	Supported GNSS signals & corrections (optional)		GPS L1C/A L2C, GLO L1OF L2OF, GAL E1B/C E5b, BDS B1I B2I, QZSS L1C/A L2C SBAS L1C/A: WAAS, EGNOS, MSAS, GAGAN		
	Channel configuration [4]		184 Channels – F9 Engine		
	GNSS Positions data rate [5]	Hz	20, 25[8]		
	RTK corrections		RTCM 3		
	GNSS Measurements (raw) data rate	Hz	20		
	Velocity accuracy, RMS	meters/sec	0.05		
	Initialization time	Sec	<29 (cold start), <1 (hot start)		
	Time accuracy (clock drift) [7]	nano sec	30		
	Gyroscopes	Units	INS-DU		
IMU	Type		Industrial-grade		
	Measurement range	deg/sec	±2000		
	Bias in-run stability (RMS, Allan Variance)	deg/hr	2		
	Bias instability after INS initialization (RMS)	deg/hr	10		
	Bias instability over temperature range (RMS)	deg/hr	72		
	Angular Random Walk	deg/√hr	0.38		
	Accelerometers	Units	INS-DU		
	Type		Tactical-grade		
	Measurement range	g	±8 g	±15 g	±40 g
	Bias in-run stability (RMS, Allan Variance)	mg	0.01	0.03	0.05
	Bias instability over temperature range (RMS)	mg	0.7	1.1	1.5
	Bias one-year repeatability	mg	1.5	2	2.5
	Velocity Random Walk	m/s/√hr	0.02	0.045	0.06
	Magnetometers	Units	INS-DU		
	Measurement Rate	Gauss	±8.0		
	Bias in-run stability (Allan Variance)	μGauss	8		
	Power Spectral Density	μGauss/√Hz	15		
	SF Accuracy	%	0.05		
	Pressure	Units	INS-DU		
	Measurement Rate	hPa	300 – 1100		
	Bias in-run stability (RMS, Allan Variance)	Pa	2		
	Noise Density	Pa/√Hz	0.8		
	Environment	Units	INS-DU		
Electrical and Physical	Operating temperature	deg C	-40 to +85		
	Storage temperature	deg C	-50 to +90		
	Type of Sealing		IP-67		
	MTBF	hours	55,500		
	Electrical	Units	INS-DU		
	Supply voltage	V DC	9 - 34		
	Power consumption	Watts	5 (6 with data logger)		
	Output Interface (options)	-	RS-232 or RS-422, CAN Ethernet (optional)		
	Output data format	-	Binary, NMEA 0183 ASCII		
	Physical	Units	INS-DU		
	Size	mm	120 x 50 x 53		
	Weight	gram	320		

[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, [8] 20 (GPS+GLO+GAL+BDS or GPS+GLO+GAL) and 25 (GPS only or GPS+GAL/GLO/BDS)



Product Code Structure:

Model	Gyroscope	Accel	Calibration	Connector	Encoder	Color	Datalogger	GNSS receiver	Version	Interface
INS-DU	G450	A8	TMGA	C3	E (option)	B (default)	S64 (default)	ZD9P	VD9	1
	G950	A15				D				2
	G1864	A40				G				4
						W				5
										11
										22
										145
										245
										135
										235

Example: INS-DU-G450-A15-TMGA-C3E-B-ZD9P-VD9.1

- INS-DU-OEM: Low Cost Ublox Based GPS-Aided Inertial Navigation System Utilizing MiniAHRS
- G450: Gyroscopes measurement range = ±450 deg/sec
- G950: Gyroscopes measurement range = ±950 deg/sec
- G1864: Gyroscopes measurement range = ±1864 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 vibration
- TMGA: Magnetometers, Gyroscopes and Accelerometers
- C3: 24 pins connector (RS-232, RS-422, CAN, Ethernet interfaces)
- 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
- S64: 64GB embedded Data Logger (optional)
- ZD9P: Dual UBlox ZED-F9P GNSS Receivers
- VD9: GPS L1/L2, GLO L1/L2, BDS B1/B2, GAL E1/E5, QZSS L1/L5, SBAS, RTK, Dual GNSS Heading, 20 Hz measurements, 20 Hz positions
- VX.1: RS-232 interface
- VX.2: RS-422 interface
- VX.3: RS-485 interface (to be used when connecting to a Stand-alone Magnetic Compass)
- 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)
- VX.135: RS-232, RS-485 (to be used when connecting to a Stand-alone Magnetic Compass), and Ethernet interfaces (unit will not be able to communicate with the receiver)
- VX.235: RS-422 (RS-485 interface (to be used when connecting to a Stand-alone Magnetic Compass) and Ethernet interfaces (unit will not be able to communicate with the receiver)