Low Cost Single Antenna GPS-Aided Inertial Navigation Systems

INS-BU

InertialLabs
Attitude is Everything

VALUABLE 20 YEARS EXPERIENCE

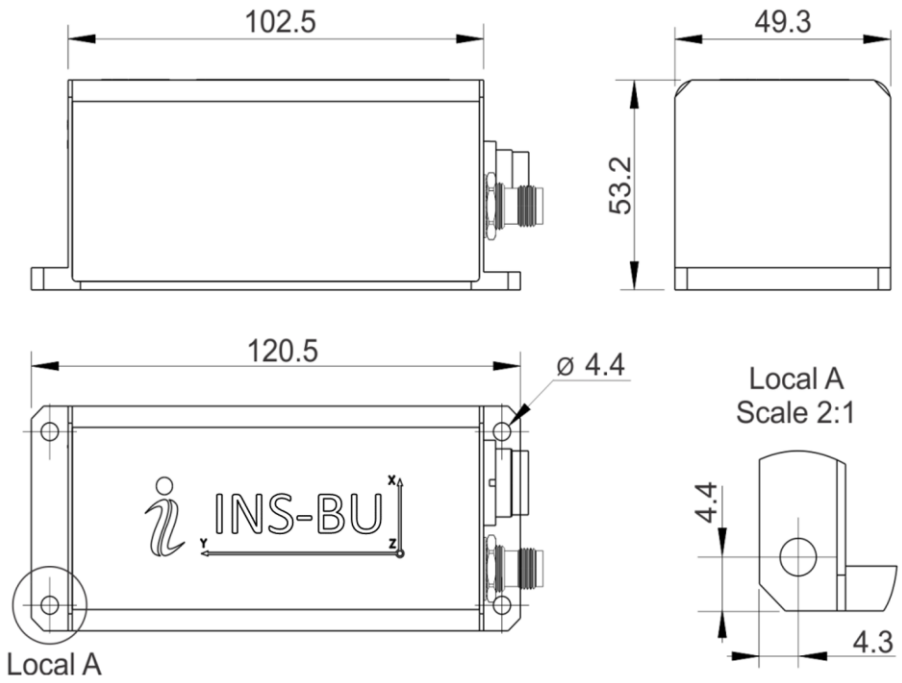
CERTIFIED ISO 9001:2015 COMPANY

MADE IN THE USA

INS-BU Specifications

	Parameter	Units	INS-BU		
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) • 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, 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-BU		
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) [1]	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		
	Position Accuracy (Free Inertial Land Vehicle) [2]	%, DT	1 (Tunnel Guide positional aiding references)		
	Velocity accuracy, RMS	meters/sec	0.05		
	PPS timestamps accuracy	nano sec	20		
	Heading	Units	INS-BU		
Orientation	Range	deg	0 to 360		
	Static Accuracy [3]	deg RMS	0.6		
	Dynamic accuracy (GNSS) [6]	deg RMS	0.3		
	Post processing accuracy [1]	deg RMS	0.1		
	Pitch and Roll	Units	INS-BU		
	Range: Pitch, Roll	deg	±90, ±180		
	Angular Resolution	deg	0.01		
	Static Accuracy in whole Temperature Range	deg	0.08		
	Dynamic Accuracy [6]	deg RMS	0.05		
	Post processing accuracy [1]	deg RMS	0.03		
	GNSS receiver	Units	INS-BU		
GNSS	Number of GNSS Antennas		Single GNSS Antenna		
	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	10, 20 [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-BU		
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-BU		
	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-BU		
	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-BU		
	Measurement Rate	hPa	300 – 1100		
	Bias in-run stability (RMS, Allan Variance)	Pa	2		
	Noise Density	Pa/√Hz	0.8		
	Environment	Units	INS-BU		
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-BU		
	Supply voltage	V DC	9 - 34		
	Power consumption	Watts	5 (6 with data logger)		
	Output Interface (options)	-	RS-232 or RS-422, CAN, Ethernet		
	Output data format	-	Binary, NMEA 0183 ASCII		
	Physical	Units	INS-BU		
	Size	mm	120 x 50 x 53		
	Weight	gram	320		

[1] RMS, incremental error growth from steady state accuracy. Post-processing results using third party software; [2] Under ideal conditions that include proper static alignment and in-field dynamic motions during loss of GNSS signal; [3] Heading accuracy in static environment is gyro-magnetic dependent; [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] If tracking GPS only.



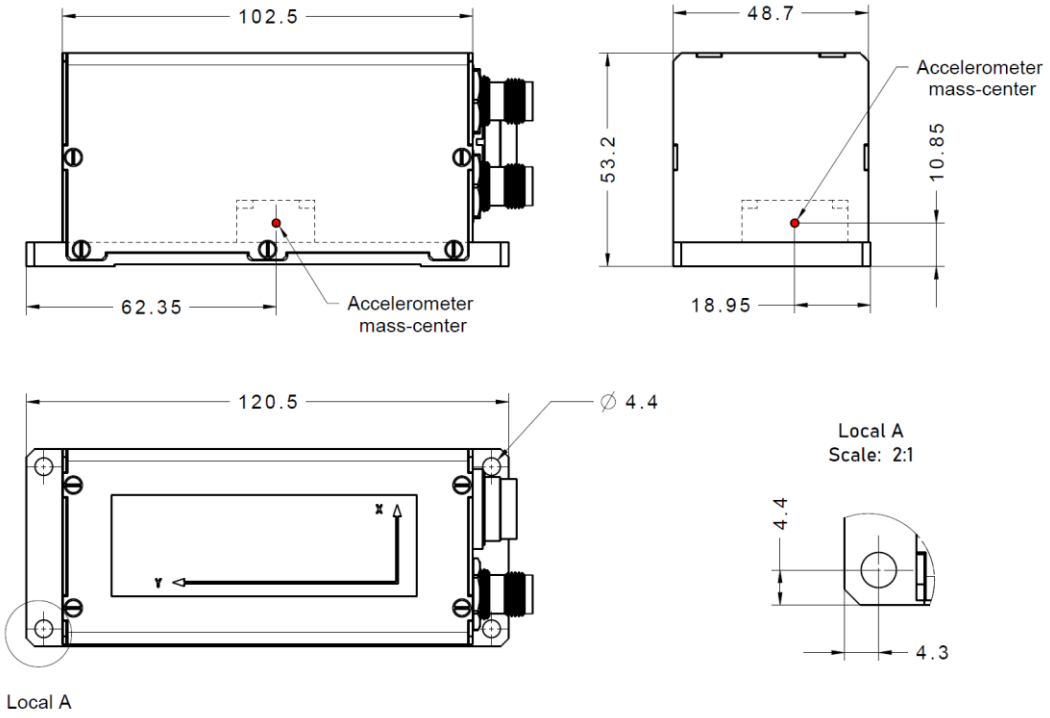
Product Code Structure:

Model	Gyroscope	Accel	Calibration	Connector	Encoder	Color	Datalogger	GNSS receiver	Version	Interface
INS-BU	G2000	A8	TGA	C3	E (option)	B (default)	S64 (default)	ZF9P	V9	1245
		A15	TMGA			D				124
		A40				G				145
						W				

Example: INS-BU-G2000-A15-TMGA-C3E-B-ZF9P-VD9.1245

- INS-BU: Low Cost Ublox Based GPS-Aided Inertial Navigation System Utilizing MiniAHRS
- 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 vibration
- TGA: Gyroscopes and Accelerometers (Temperature Calibrated)
- TMGA: Magnetometers, Gyroscopes and Accelerometers (Temperature Calibrated)
- 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)
- ZF9P: Single Antenna UBlox ZED-F9P GNSS Receivers
- V9: GPS L1/L2, GLO L1/L2, BDS B1/B2, GAL E1/E5, QZSS L1/L5, SBAS, RTK, Single GNSS Heading, GNSS measurements, GNSS positions (Single Antenna GNSS Receiver only)
- VX.1245: RS-232, RS-422, CAN and Ethernet interface (default)
- VX.124: RS-232, RS-422, and CAN interfaces (Ethernet to Support Encoder Input)
- VX.145: RS-232, CAN and Ethernet interfaces (RS-422 to Support Encoder Input)

IMU Center Diagram



DIMENSIONS ARE IN MILLIMETERS

All dimensions within this drawing are subject to change without notice. Customers should obtain final drawings before designing any interface hardware.