

GPS-Aided Inertial Navigation Systems

INS-FI









The **Inertial Labs GPS-Aided Inertial Navigation System (INS-FI)** is the newest Inertial Navigation System (INS) developed by Inertial Labs using Tactical-grade Fiber Optic Gyroscope technology. The INS-FI is the result of over 20 years of experience in developing and supplying INS solutions to land, marine and aerial platforms around the world.

The fully integrated INS-FI contains an Inertial Measurement Unit (IMU) combining Fiber Optic Gyroscopes and MEMS Accelerometers, along with all constellations (GPS, GLONASS, GALILEO, QZSS, BEIDOU and NAVIC) and multiple bands GNSS receiver. It determines horizontal and vertical positions, velocity, and absolute orientation (Heading, Pitch and Roll) for any device on which it is mounted. Horizontal and vertical Position, velocity, and orientation are determined with high accuracy for both motionless and dynamic applications.



Due to its high-performing FOG IMU, the **INS-FI** can measure GNSS-free Heading (True North) with less than 0.5 deg error, Horizontal & Vertical Positions with approximately 0.1% error of Distance Traveled for land applications, and 5 nautical miles per hour drift for aerospace (Unmanned Aerial Vehicles) applications without GNSS signal.

INS-FI is fully compatible with the Inertial Labs developed VINS (Visual Inertial Navigation Systems) and SAMC (Stand-Alone Magnetic Compass).

The **INS-FI** contains Inertial Labs' latest version of the on-board sensor fusion filter, state of the art navigation and guidance algorithms, and calibration software.

KEY FEATURES, BENEFITS & FUNCTIONALITY

- Commercially exportable GPS-Aided Inertial Navigation System (ECCN 7A994)
- 3-in-1 strapdown system: IMU + AHRS + INS
- Fiber Optic Gyroscopes (FOG) & MEMS accelerometers Inertial Measurement Unit (IMU)
- NovAtel OEM7, u-blox ZED-F9P, or Septentrio mosaic-H High Precision GNSS receiver
- Embedded Anti-Jamming and Spoofing mitigation features
- L1/L2/L5 GPS, GLONASS, GALILEO, BEIDOU, QZSS, IRNSS
- SP, SBAS, DGPS, RTK and PPP for real time operation
- Sensor fusion algorithms with advanced extended Kalman Filter
- State-of-the-art algorithms for Land, Aerospace and Maritime applications
- Full temperature calibration of all sensing elements according to MIL-STD-810 standard
- MIL-STD-461 standard based EMC, EMI, and ERD protection
- Aiding data: Wind sensor, Air Speed Sensor, Doppler shift from locator (for long-term GPS denied), External position and External Heading
- Internal/External Air Data Computer (ADC) and External Stand-Alone Magnetic Compass (SAMC)
- Full integration with ArduPilot platform



SPECIFICATIONS

	Parameter	Units									
	Input signals		External Magnetometer, Embedded/External Air External position and External Heading aiding da		C), Wind sensor, Air Speed Sensor, Doppler shift from locator (for long-term GPS denied),						
യ് ഗ്ര			IMU data: Accelerations, Angular rates, Magneti								
Inputs & Outputs			AHRS data: Heading, Pitch & Roll	c new,							
# 2	Output signals		MRU data: Heave, Surge, Sway	" " ONGO 1 - T							
<u> </u>	,,		INS data: Positions, Velocity, Delta Theta and D	elta Velocity, GNSS data, Time	! ssure (calibrated) Baro-Corre	cted Pressure Altitude Pr	essure Altitude				
Inputs Outpu			External Air Data Computer data: Static Pressure (calibrated), Dynamic Pressure (calibrated), Baro-Corrected Pressure Altitude, Pressure Calibrated Airspeed, True Airspeed, Mach-Number, Static Pressure Over Total Pressure, True Angle of Attack, Rate of Climb								
	Update rate	Hz		1 200 (INS & AHRS da	ta); up to 1000 (IMU data)						
	Start-up time	sec		•	:1						
	Positions, Velocity, and Timestamps				•						
_	Horizontal position accuracy (SP) Horizontal position accuracy (SBAS) (1)	m m			.2						
<u> </u>	Horizontal position accuracy (DGPS)	m		0.6 0.4							
至	Horizontal position accuracy (PPP TerraStar-C PRO) (2)	m									
Navigation	Horizontal position accuracy (RTK)	m									
- 5	Vertical position accuracy (RTK)	m									
Ō	Velocity accuracy (OEM7720, Mosaic H), RMS Velocity accuracy (uBlox F9P), RMS	m/sec m/sec									
Z	Horizontal Position accuracy (free inertial, land vehicles)	% DT									
	Horizontal Position accuracy (free inertial, aerial)	NMPH	0.1								
	Heading										
	Range	deg	0 to 360 0.01								
	Angular Resolution Static & Dynamic Accuracy (4) (Dual antenna, 1 meter baseline)	deg deg									
Ç	Static & Dynamic Accuracy (4) (Dual antenna, 1 meter baseline) Static & Dynamic Accuracy (4) (Dual antenna, 2 meters baseline)	deg									
<u>.</u>	Dynamic Accuracy (4) (Single antenna)	deg			08 15						
늞	Post processing accuracy (3)	deg		0	01						
뀰	Free inertial	deg			.5						
Orientation	With External Stand-Alone Magnetic Compass (after calibration) Pitch and Roll	deg			1						
Ë	Range	deg		±90.	±180						
0	Angular Resolution	deg		0	01						
	Static Accuracy	deg			01	·					
	Dynamic Accuracy Post processing accuracy (3)	deg deg			.01 .005						
	Gyroscopes	deg		0.	003						
	Technology	-		Closed-	oop FOG						
	Measurement range	deg/sec			190						
	Bandwidth (-3dB)	Hz			00						
	Data update rate	Hz			000 .5						
	Bias repeatability (over temperature range) SF accuracy (over temperature range)	deg/hr ppm			00						
	Noise. Angular Random Walk (ARW) ⁽⁸⁾	deg/√hr			025						
	Non-linearity	ppm			50						
IMU	Accelerometers				***						
H	Technology Measurement range	- q	±8	MI	MS T	±40					
	Bandwidth (-3dB)	Hz	±0	2	260						
	Data update rate	Hz		10	.000						
	Bias in-run stability (RMS, Allan Variance)	mg	0.005		0.02						
	Bias repeatability (over temperature range) SF accuracy (over temperature range)	mg ppm	0.5 150		1.2 500						
	Noise. Velocity Random Walk (VRW) ⁽⁸⁾	m/sec/√hr	0.015		0.045						
	Non-linearity	ppm		1	150						
	Receiver		NovAtel OEM7720 NovAtel OEM719	Septentrio mosaic-H	Septentrio mosaic-X5	u-blox ZED-F9P	u-blox ZED-F9P L5				
							Single				
	Number of GNSS Antennas	-	Dual Single	Dual	Single	Dual Single					
	Number of GNSS Antennas	-	Dual Single GPS L1 C/A, L1C, L2C, L2P, L5; GLONASS L1	Dual GPS L1C/A, L1C, L1PY, L2C	, L2P, L5; GLONASS L1CA,	Dual Single GPS L1C/A, L2C; GLONASS L1OF,	GPS L1C/A, L5; GLONASS L1OF;				
		-	Dual Single GPS L1 C/A, L1C, L2C, L2P, L5; GLONASS L1 C/A, L2 C/A, L2P, L3, L5; BeiDou B1I, B1C,	Dual GPS L1C/A, L1C, L1PY, L2C L2CA, L2P, L3 CDMA; Beidd	, L2P, L5; GLONASS L1CA, bu B1I, B1C, B2a, B2I, B3;	Dual Single GPS L1C/A, L2C; GLONASS L1OF, L2OF;	GPS L1C/A, L5; GLONASS L1OF; Galileo E1B/C, E5a;				
	Number of GNSS Antennas GNSS Constellations		Dual Single GPS L1 C/A, L1C, L2C, L2P, L5; GLONASS L1 C/A, L2 C/A, L2P, L3, L5; BelDou B1I, B1C, B2I, B2a, B3I; Galileo E1, E5 AltBOC, E5a, E5b, E6; NavIC (IRNSS) L5; QZSS L1 C/A,	Dual GPS L1C/A, L1C, L1PY, L2C L2CA, L2P, L3 CDMA; Beidd Galileo E1, E5a, E5b, E5	, L2P, L5; GLONASS L1CA, bu B1I, B1C, B2a, B2I, B3; AltBoc, E6; QZSS L1C/A,	Dual Single GPS L1C/A, L2C; GLONASS L1OF, L2OF; Galileo E1B/C, E5b;	GPS L1C/A, L5; GLONASS L1OF; Galileo E1B/C, E5a; BeiDou B1I, B2a;				
Ŋ			Dual Single GPS L1 C/A, L1C, L2C, L2P, L5; GLONASS L1 C/A, L2 C/A, L2P, L3, L5; BelDou B1I, B1C, B2I, B2a, B3I; Galileo E1, E5 AltBOC, E5a, E5b, E6; NavIC (IRNSS) L5; QZSS L1 C/A, L1C, L2C, L5, L6; L-Band	Dual GPS L1C/A, L1C, L1PY, L2C L2CA, L2P, L3 CDMA; Beidc Galileo E1, E5a, E5b, E5 L1C, L2C, L5, L6;	, L2P, L5; GLONASS L1CA, Du B11, B1C, B2a, B2I, B3; AltBoc, E6; QZSS L1C/A, Navic L5; L-band	Dual Single GPS L1C/A, L2C; GLONASS L1OF, L2OF; Galileo E1B/C, E5b; BeiDou B1I, B2I; QZSS L1C/A, L2C	GPS L1C/A, L5; GLONASS L1OF; Galileo E1B/C, E5a; BeiDou B1I, B2a; QZSS L1C/A L1S L5; NavIC L5				
SS			Dual Single GPS L1 C/A, L1C, L2C, L2P, L5; GLONASS L1 C/A, L2 C/A, L2P, L3, L5; BelDou B1I, B1C, B2I, B2A, B3I; Gailleo E1, E5 AltBOC, E5A, E5b, E6; NavIC (IRNSS) L5; Q2SS L1 C/A, L1C, L2C, L5, L6; L-Band WAAS; EGNOS; MSAS; GAGAN; SBAS L1, L5;	Dual GPS L1C/A, L1C, L1PY, L2C L2CA, L2P, L3 CDMA; Beidd Galileo E1, E5a, E5b, E5	, L2P, L5; GLONASS L1CA, Du B11, B1C, B2a, B2I, B3; AltBoc, E6; QZSS L1C/A, Navic L5; L-band	Dual Single GPS L1C/A, L2C; GLONASS L1OF, L2OF; Galileo E1B/C, E5b; BeiDou B11, B21; QZSS L1C/A, L2C WAAS; EGNOS; MSAS	GPS L1C/A, L5; GLONASS L10F; Galileo E1B/C, E5a; BeiDou B1I, B2a; QZSS L1C/A L1S L5; NavIC L5 GAGAN; SBAS L1C/A;				
SSNE	GNSS Constellations GNSS Corrections	-	Dual Single GPS L1 C/A, L1C, L2C, L2P, L5; GLONASS L1 C/A, L2 C/A, L2P, L3, L5; BelDou B1I, B1C, B2I, B2A, B3I; Galliee G1, E5 AltBoC, E5a, E5b, E6; NavIC (IRNSS) L5; Q2SS L1 C/A, L1C, L2C, L5, L6; L-Band WAAS; EGNOS; MSAS; GAGAN; SBAS L1, L5; DGPS; RTK; PPP Terrastar	Dual GPS L1C/A, L1C, L1PY, L2C L2CA, L2P, L3 CDMA; Beide Gallieo E1, E5a, E5b, E5. L1C, L2C, L5, L6; WAAS; EGNOS; MSAS; G.	, L2P, L5; GLONASS L1CA, bu B1I, B1C, B2a, B2I, B3; AltBoc, E6; QZSS L1C/A, Navic L5; L-band	Dual Single GPS L1C/A, L2C; GLONASS L1OF, L2OF; Galileo E1B/C, E5b; BelDou B11, B21; QZSS L1C/A, L2C WAAS; EGNOS; MSAS DGPS	GPS L1C/A, L5; GLONASS L10F; Galileo E1B/C, E5a; BeiDou B1I, B2a; QZSS L1C/A L1S L5; NavIC L5 GAGAN; SBAS L1C/A; ; RTK				
SSNS	GNSS Constellations		Dual Single GPS L1 C/A, L1C, L2C, L2P, L5; GLONASS L1 C/A, L2 C/A, L2P, L3, L5; BelDou B1I, B1C, B2I, B2A, B3I; Gailleo E1, E5 AltBOC, E5A, E5b, E6; NavIC (IRNSS) L5; Q2SS L1 C/A, L1C, L2C, L5, L6; L-Band WAAS; EGNOS; MSAS; GAGAN; SBAS L1, L5;	Dual GPS L1C/A, L1C, L1PY, L2C L2CA, L2P, L3 CDMA; Beidc Galileo E1, E5a, E5b, E5 L1C, L2C, L5, L6;	, L2P, L5; GLONASS L1CA, bu B1I, B1C, B2a, B2I, B3; AltBoc, E6; QZSS L1C/A, Navic L5; L-band AGAN; SBAS; DGPS; RTK	Dual Single GPS L1C/A, L2c; GLONASS L1OF, L2OF; Galileo E1B/C, E5b; BelDou B11, B21; QZSS L1C/A, L2C WAAS; EGNOS; MSAS DGPS	GPS L1C/A, L5; GLONASS L10F; Galileo E1B/C, E5a; BeiDou B1I, B2a; QZSS L1C/A L1S L5; NavIC L5 GAGAN; SBAS L1C/A;				
GNSS	GNSS Constellations GNSS Corrections Channel Configuration (5) GNSS Data Rate (6) RTK Corrections	- channels Hz -	Dual Single GPS L1 C/A, L1C, L2C, L2P, L5; GLONASS L1 C/A, L2 C/A, L2P, L5; BelDou B1I, B1C, B2I, B2A, B3I; Gailleo E1, E5 AltBOC, E5A, E5b, E6; NavIC (IRNSS) L5; Q2SS L1 C/A, L1C, L2C, L5, L6; L-Band WAAS; EGNOS; MSAS; GAGAN; SBAS L1, L5; DGPS; RTK; PPP Terrastar 555 5 / 20 / 100	Dual GPS L1C/A, L1C, L1PY, L2C L2CA, L2P, L3 CDMA; Beide Gallieo E1, E5a, E5b, E5: L1C, L2C, L5, L6; WAAS; EGNOS; MSAS; G, 44 100 (M 2, RTCM 3	, L2P, L5; GLONASS L1CA, bu B1I, B1C, B2a, B2I, B3; AltBoc, E6; QZSS L1C/A, Navic L5; L-band AGAN; SBAS; DGPS; RTK	Dual Single GPS L1C/A, L2C; GLONASS L1OF, L2OF; Galileo E18/C, E5b; BelDou B11, B21; QZSS L1C/A, L2C WAAS; EGNOS; MSS 10, RTC	GPS L1C/A, L5; GLONASS L1OF; Galileo E1B/C, E5a; BeiDou B1I, B2a; QZSS L1C/A L1S L5; NavIC L5 GAGAN; SBAS L1C/A; ; RTK 34 20 				
GNSS	GNSS Constellations GNSS Corrections Channel Configuration (5) GNSS Data Rate (6) RTK Corrections Velocity Accuracy	- channels Hz - m/sec	Dual Single GPS L1 C/A, L1C, L2C, L2P, L5; GLONASS L1 C/A, L2 C/A, L2P, L3, L5; BeDou B1I, B1C, B2I, B2A, B3I; Gallleo E1, E5 Alt80C, E5A, E5b, E6; NavIc (IRNSS) L5; QZSS L1 C/A, L1C, L2C, L5, L6; L-Band WAAS; EGNOS; MSAS; GAGAN; SBAS L1, L5; DGPS; RTK; PPP Terrastar 555 5720 / 100 RTC	Dual GPS L1C/A, L1C, L1PY, L2C L2CA, L2P, L3 CDM2; Beid Galileo E1, E5a, E5b, E5 L1C, L2C, L5, L6; WAAS; EGNOS; MSAS; G 44 100 (M 2, RTCM 3 0.03	, L2P, L5; GLONASS L1CA, bu B1I, B1C, B2a, B2I, B3; AlfBoc, E6; QZSS L1C/A, Navic L5; L-band AGAN; SBAS; DGPS; RTK 8 max)	Dual Single GPS L1C/A, L2C; GLONASS L10F, L2OF; Gallieo E1B/C, E5b; BelDou B1J, B2J; QZSS L1C/A, L2C; WAAS; EGNOS; MSAS GPS 1: 10, RTC	GPS L1C/A, L5; GLONASS L1C/A, E5; Gallieo E1B/C, E5a; BeiDou B1I, B2a; QZSS L1C/A L1S L5; Nav1C L5 GAGAN; SBAS L1C/A; ; RTK 34 20 M3				
GNSS	GNSS Constellations GNSS Corrections Channel Configuration ⁽⁵⁾ GNSS Data Rate ⁽⁶⁾ RTK Corrections Velocity Accuracy Initialization Time	- channels Hz - m/sec S	Dual Single GPS L1 C/A, L1C, L2C, L2P, L5; GLONASS L1 C/A, L2 C/A, L2P, L5; BelDou B1I, B1C, B2I, B2A, B3I; Gailleo E1, E5 AltBOC, E5A, E5b, E6; NavIC (IRNSS) L5; Q2SS L1 C/A, L1C, L2C, L5, L6; L-Band WAAS; EGNOS; MSAS; GAGAN; SBAS L1, L5; DGPS; RTK; PPP Terrastar 555 5 / 20 / 100	Dual GPS L1C/A, L1C, L1PY, L2C L2CA, L2P, L3 CDMA; Beidd Galileo E1, E5a, E5b, E5 L1C, L2C, L5, L6; WAAS; EGNOS; MSAS; G 44 100 (M 2, RTCM 3 0.03 <45 (cold start);	, L2P, L5; GLONASS L1CA, bu B1I, B1C, B2a, B2I, B3; AlfBoc, E6; QZSS L1C/A, Navic L5; L-band AGAN; SBAS; DGPS; RTK 8 max)	Dual Single GPS LLC/A, L2C; GLONASS L10F, L2OF; Gallleo E1B/C, E5b; BelDou B1I, B2I; QZSS L1C/A, L2C WAAS; EGNOS; MSAS DGPS 11 10,0 RTC 0.	GPS L1C/A, L5; GLONASS L1OF; Gallieo E1B/C, E5a; BeiDou B11, B2a; QZSS L1C/A L1S L5; NavIC L5 GAGAN; SBAS L1C/A; ; RTK 34 20 M 3 05 < 10 (hot start)				
GNSS	GNSS Constellations GNSS Corrections Channel Configuration (5) GNSS Data Rate (6) RTK Corrections Velocity Accuracy Initialization Time Time Accuracy (clock drift) (7)	- channels Hz - m/sec	Dual Single GPS L1 C/A, L1C, L2C, L2P, L5; GLONASS L1 C/A, L2 C/A, L2P, L3, L5; BeDou B1I, B1C, B2I, B2A, B3I; Gallleo E1, E5 Alt80C, E5A, E5b, E6; NavIc (IRNSS) L5; QZSS L1 C/A, L1C, L2C, L5, L6; L-Band WAAS; EGNOS; MSAS; GAGAN; SBAS L1, L5; DGPS; RTK; PPP Terrastar 555 5720 / 100 RTC	Dual GPS L1C/A, L1C, L1PY, L2C L2CA, L2P, L3 CDM2; Beid Galileo E1, E5a, E5b, E5 L1C, L2C, L5, L6; WAAS; EGNOS; MSAS; G 44 100 (M 2, RTCM 3 0.03	, L2P, L5; GLONASS L1CA, bu B11, B1C, B2a, B21, B3; AltBoc, E6; QZSS L1C/A, Navic L5; L-band AGAN; SBAS; DGPS; RTK 8 max)	Dual Single GPS L1C/A, L2C; GLONASS L1OF, L2OF; Galileo E1B/C, E5b; BelDou B11, B21; QZSS L1C/A, L2C WAAS; EGNOS; MSAS 10, RTC C0, <30 (cold start)	GPS L1C/A, L5; GLONASS L1OF; Gallieo E1B/C, E5a; BeiDou B1I, B2a; QZSS L1C/A L1S L5; NavIC L5 GAGAN; SBAS L1C/A; ;RTK 34 20 M 3 05 < <10 (hot start) 0				
SSNS	GNSS Constellations GNSS Corrections Channel Configuration ⁽⁵⁾ GNSS Data Rate ⁽⁶⁾ RTK Corrections Velocity Accuracy Initialization Time	- channels Hz - m/sec S	Dual Single GPS L1 C/A, L1C, L2C, L2P, L5; GLONASS L1 C/A, L2 C/A, L2P, L3, L5; BelDou B1I, B1C, B2I, B2A, B3I; Galline G1, E5 AltBoC, E5a, E5b, E6; NavIC (IRNSS) L5; Q2SS L1 C/A, L1C, L2C, L6; L-Band WAS; EGNOS; MSAS; GAGAN; SBAS L1, L5; DGPS; RTK; PPP Terrastar 555 5 / 20 / 100 RTC <39 (cold start), <20 (hot start)	Dual GPS L1C/A, L1C, L1PY, L2C L2CA, L2P, L3 CMA; Beide Gallieo E1, E5a, E5b, E5 L1C, L2C, L5, L6; WAAS; EGNOS; MSAS; G 44 100 (M 2, RTCM 3 0.03 <45 (cold start);	, L2P, L5; GLONASS L1CA, bu B1I, B1C, B2a, B2I, B3; AltBoc, E6; QZSS L1C/A, Navic L5; L-band AGAN; SBAS; DGPS; RTK 8 max) <20 (hot start)	Dual Single GPS L1C/A, L2C; GLONASS L10F, L2OF; Gallieo E1B/C, E5b; BeiDou B1J, B2J; QZSS L1C/A, L2C WAAS; EGNOS; MSAS UAAS; EGNOS; MSAS III 10, RTC 0. <30 (cold start)	GPS L1C/A, L5; GLONASS L1OF; Gallieo E1B/C, E5a; BeiDou B11, B2a; QZSS L1C/A L1S L5; NavIC L5 GAGAN; SBAS L1C/A; ; RTK 34 20 M 3 05 < 10 (hot start)				
SSNB	GNSS Constellations GNSS Corrections Channel Configuration (5) GNSS Data Rate (6) RTK Corrections Velocity Accuracy Initialization Time Time Accuracy (clock drift) (7) Air Data Computer Pressure Sensor Range Static Pressure Range	channels Hz m/sec s nano sec mbar hPa, % FS	Dual Single GPS L1 C/A, L1C, L2C, L2P, L5; GLONASS L1 C/A, L2 C/A, L2P, L3, L5; BeDou BII, BIC, B2I, B2A, B3I; Gallleo E1, E5 Alt80C, E5A, E5b, E6; NavIc (IRNSS) L5; QZSS L1 C/A, L1C, L2C, L5, L6; L-Band WAAS; EGNOS; MSAS; GAGAN; SBAS L1, L5; DGPS; RTK; PPP Terrastar 555 5 / 20 / 100 RTC <39 (cold start), <20 (hot start)	Dual GPS L1C/A, L1C, L1PY, L2C L2CA, L2P, L3 CDMA; Beldd Galileo E1, E5a, E5b, E5 L1C, L2C, L5, L6; WAAS; EGNOS; MSAS; G, 44 100 (M 2, RTCM 3 0.03 <45 (cold start); 20 2PE ±66 300 t	, L2P, L5; GLONASS L1CA, bu B11, B1C, B2a, B21, B3; AltBoc, E6; QZSS L1C/A, Navic L5; L-band AGAN; SBAS; DGPS; RTK 8 max) <20 (hot start) XT 00 0 1100	Dual Single GPS L1C/A, L2C; GLONASS L10F, L2OF; Gallieo E1B/C, E5b; BeiDou B1J, B2J; QZSS L1C/A, L2C WAAS; EGNOS; MSAS UAAS; EGNOS; MSAS III 10, RTC 0. <30 (cold start)	GPS L1C/A, L5; GLONASS L1OF; Gallieo E1B/C, E5a; BeiDou B1I, B2a; QZSS L1C/A L1S L5; NavIC L5 GAGAN; SBAS L1C/A; ;; RTK 34 20 M3 05 <10 (hot start) 0				
N _D	GNSS Constellations GNSS Corrections Channel Configuration (5) GNSS Data Rate (6) RTK Corrections Velocity Accuracy Initialization Time Time Accuracy (clock drift) (7) Air Data Computer Pressure Sensor Range Static Pressure Range Static Pressure Accuracy	channels Hz - m/sec s nano sec mbar hPa, % FS % FSS	Dual Single GPS L1 C/A, L1C, L2C, L2P, L5; GLONASS L1 C/A, L2 C/A, L2P, L3, L5; BelDou B1I, B1C, B2I, B2A, B3I; Gallleo E1, E5 Alt80C, E5A, E5b, E6; NavIC (IRNSS) L5; Q2SS L1 C/A, L1C, L2C, L5, L6; L-Band WAAS; EGNOS; MSAS; GAGAN; SBAS L1, L5; DGPS; RTK; PPP Terrastar 555 5 / 20 / 100 RTC <39 (cold start), <20 (hot start) 2P ±25	Dual GPS L1C/A, L1C, L1PY, L2C L2CA, L2P, L3 CDM2; Beids Galileo E1, E5a, E5b, E5 L1C, L2C, L5, L6; WAAS; EGNOS; MSAS; G 44 100 (M 2, RTCM 3 0.03 <45 (cold start); 20 20 26 26 300 t ±6 300 t ±	, L2P, L5; GLONASS L1CA, bu B1I, B1C, B2a, B2I, B3; AltBoc, E6; QZSS L1C/A, Navic L5; L-band AGAN; SBAS; DGPS; RTK 8 max) <20 (hot start) XT 00 0 1100 0.1	Dual Single	GPS L1C/A, L5; GLONASS L1C/G, E5; Galileo E1B/C, E5a; BeiDou B1I, B2a; QZSS L1C/A L1S L5; Nav1C L5 GAGAN; SBAS L1C/A; ;; RTK 34 20 M3 05 , <10 (hot start) 0 MAX				
N _D	GNSS Constellations GNSS Corrections Channel Configuration (5) GNSS Data Rate (6) RTK Corrections Velocity Accuracy Initialization Time Time Accuracy (clock drift) (7) Air Data Computer Pressure Sensor Range Static Pressure Accuracy Dynamic Pressure Accuracy Dynamic Pressure Range	channels Hz m/sec s nano sec mbar hPa, % FS hPa	Dual Single GPS L1 C/A, L1C, L2C, L2P, L5; GLONASS L1 C/A, L2 C/A, L2P, L3, L5; BeDou BII, BIC, B2I, B2A, B3I; Gallleo E1, E5 Alt80C, E5A, E5b, E6; NavIc (IRNSS) L5; QZSS L1 C/A, L1C, L2C, L5, L6; L-Band WAAS; EGNOS; MSAS; GAGAN; SBAS L1, L5; DGPS; RTK; PPP Terrastar 555 5 / 20 / 100 RTC <39 (cold start), <20 (hot start)	Dual GPS L1C/A, L1C, L1PY, L2C L2CA, L2P, L3 CDMA; Beids Galileo E1, E5a, E5b, E5 L1C, L2C, L5, L6; WAAS; EGNOS; MSAS; G 44 100 (M 2, RTCM 3 0.03 <45 (cold start); 20 2PE ±6 300 t ± 0.15 te 0.15 te	, L2P, L5; GLONASS L1CA, DJ B1I, B1C, B2a, B2I, B3; AtBoc, E6; Q2SS L1C/A, Navic L5; L-band AGAN; SBAS; DGPS; RTK 8 max) <20 (hot start) XT 00 0 1100 0.11	Dual Single	GPS L1C/A, L5; GLONASS L1OF; Gallieo E1B/C, E5a; BeiDou B1I, B2a; QZSS L1C/A L1S L5; NavIC L5 GAGAN; SBAS L1C/A; ;; RTK 34 20 M3 05 <10 (hot start) 0				
N _D	GNSS Constellations GNSS Corrections Channel Configuration (5) GNSS Data Rate (6) RTK Corrections Velocity Accuracy Initialization Time Time Accuracy (clock drift) (7) Air Data Computer Pressure Sensor Range Static Pressure Range Static Pressure Accuracy Dynamic Pressure Ange Dynamic Pressure Accuracy Dynamic Pressure Accuracy	channels Hz m/sec s nano sec mbar hPa, % FS hPa % FSS	Dual Single GPS L1 C/A, L1C, L2C, L2P, L5; GLONASS L1 C/A, L2 C/A, L2P, L3, L5; BelDou B1I, B1C, B2I, B2A, B3I; Gallleo E1, E5 Alt80C, E5A, E5b, E6; NavIC (IRNSS) L5; Q2SS L1 C/A, L1C, L2C, L5, L6; L-Band WAAS; EGNOS; MSAS; GAGAN; SBAS L1, L5; DGPS; RTK; PPP Terrastar 555 5 / 20 / 100 RTC <39 (cold start), <20 (hot start) 2P ±25	Dual GPS L1C/A, L1C, L1PY, L2C L2CA, L2P, L3 CDMA; Beldd Galileo E1, E5a, E5b, E5 L1C, L2C, L5, L6; WAAS; EGNOS; MSAS; G, 44 100 (M 2, RTCM 3 0.03 <45 (cold start); 20 2PE ±66 300 t ± 0.15 tb £10 0.15 tb	, L2P, L5; GLONASS L1CA, bu B11, B1C, B2a, B21, B3; AltBoc, E6; QZSS L1C/A, Navic L5; L-band AGAN; SBAS; DGPS; RTK 8 max) <20 (hot start) XT 00 0 1100 0.1 0 6000 0.125	Dual Single	GPS L1C/A, L5; GLONASS L1C/G, E5; Galileo E1B/C, E5a; BeiDou B1I, B2a; QZSS L1C/A L1S L5; Nav1C L5 GAGAN; SBAS L1C/A; ;; RTK 34 20 M3 05 , <10 (hot start) 0 MAX				
N _D	GNSS Constellations GNSS Corrections Channel Configuration (5) GNSS Data Rate (6) RTK Corrections Velocity Accuracy Initialization Time Time Accuracy (clock drift) (7) Air Data Computer Pressure Sensor Range Static Pressure Accuracy Dynamic Pressure Accuracy Dynamic Pressure Accuracy Pressure Altitude Range Pressure Altitude Range Pressure Altitude Accuracy	channels Hz m/sec s nano sec mbar hPa, % FS hPa	Dual Single GPS L1 C/A, L1C, L2C, L2P, L5; GLONASS L1 C/A, L2 C/A, L2P, L5, L5; BEDDO B1I, B1.C B2I, B2A, B3I; Galileo E1, E5 AltBOC, E5a, E5b, E6; NavIC (IRNSS) L5; Q2SS L1 C/A, L1C, L2C, L5, L6; L-Band WAAS; EGNOS; MSAS; GAGAN; SBAS L1, L5; DGPS; RTK; PPP Terrastar 555 5 / 20 / 100 RTC <39 (cold start), <20 (hot start) 2P ±25 0.15 to 25	Dual GPS L1C/A, L1C, L1PY, L2C L2CA, L2P, L3 CDMA; Beidd Galileo E1, E5a, E5b, E5 L1C, L2C, L5, L6; WAAS; EGNOS; MSAS; G 44 100 (M 2, RTCM 3 0.03 <45 (cold start); 20 2PE	, L2P, L5; GLONASS L1CA, bu B1I, B1C, B2a, B2I, B3; AtBoc, E6; QZSS L1C/A, Navic L5; L-band AGAN; SBAS; DGPS; RTK 8 max) <20 (hot start) XT 00 0 1100 0.1 0 600 0.25 0 9000 1	Dual Single GPS L1C/A, L2C; GLONASS L1OF, L2OF; Gailleo E1B/C, E5b; BelDou B1I, B21; QZSS L1C/A, L2C WAAS; EGNOS; MSAS DGPS 11 10, RTC 0. <30 (cold start) ±4 0.15 t	GPS L1C/A, L5; GLONASS L1OF; Galileo E1B/C, E5a; BeiDou B1I, B2a; QZSS L1C/A L1S L5; Nav1C L5 GAGAN; SBAS L1C/A; ; RTK 34 20 M 3 05 5 5 C10 (hot start) 0 MAX				
N _D	GNSS Constellations GNSS Corrections Channel Configuration (5) GNSS Data Rate (8) RTK Corrections Velocity Accuracy Initialization Time Time Accuracy (clock drift) (7) Air Data Computer Pressure Sensor Range Static Pressure Accuracy Dynamic Pressure Accuracy Dynamic Pressure Accuracy Pressure Altitude Range Pressure Altitude Accuracy Airspeed Range	channels Hz - m/sec s nano sec mbar hPa, % FS % FSS hPa % FSS m m/sec	Dual Single GPS L1 C/A, L1C, L2C, L2P, L5; GLONASS L1 C/A, L2 C/A, L2P, L3, L5; BelDou B1I, B1C, B2I, B2A, B3I; Gallleo E1, E5 Alt80C, E5A, E5b, E6; NavIC (IRNSS) L5; Q2SS L1 C/A, L1C, L2C, L5, L6; L-Band WAAS; EGNOS; MSAS; GAGAN; SBAS L1, L5; DGPS; RTK; PPP Terrastar 555 5 / 20 / 100 RTC <39 (cold start), <20 (hot start) 2P ±25	Dual GPS L1C/A, L1C, L1PY, L2C L2CA, L2P, L3 CDM2; Beid Galileo E1, E5a, E5b, E5 L1C, L2C, L5, L6; WAAS; EGNOS; MSAS; G, 44 100 (M 2, RTCM 3 0.03 <45 (cold start); 20 2PE	, L2P, L5; GLONASS L1CA, bu B11, B1C, B2a, B21, B3; AltBoc, E6; QZSS L1C/A, Navic L5; L-band AGAN; SBAS; DGPS; RTK 8 max) <20 (hot start) XT 00 0 1100 0.1 0.1 0.5600 0.25 0.9000 1 1 1.1	Dual Single GPS L1C/A, L2C; GLONASS L1OF, L2OF; Gailleo E1B/C, E5b; BelDou B1I, B21; QZSS L1C/A, L2C WAAS; EGNOS; MSAS DGPS 11 10, RTC 0. <30 (cold start) ±4 0.15 t	GPS L1C/A, L5; GLONASS L1C/G, E5; Galileo E1B/C, E5a; BeiDou B1I, B2a; QZSS L1C/A L1S L5; Nav1C L5 GAGAN; SBAS L1C/A; ;; RTK 34 20 M3 05 , <10 (hot start) 0 MAX				
Computer GN	GNSS Constellations GNSS Corrections Channel Configuration (5) GNSS Data Rate (6) RTK Corrections Velocity Accuracy Initialization Time Time Accuracy (clock drift) (7) Air Data Computer Pressure Sensor Range Static Pressure Accuracy Dynamic Pressure Accuracy Dynamic Pressure Accuracy Dynamic Pressure Accuracy Pressure Accuracy Pressure Activated Pressure Altitude Range Pressure Altitude Accuracy Airspeed Range Airspeed Accuracy Airspeed Accuracy Airspeed Accuracy Airspeed Accuracy	channels Hz - m/sec s nano sec mbar hPa, % FS hPa % FSS hPa m m m/sec m/sec	Dual Single GPS L1 C/A, L1C, L2C, L2P, L5; GLONASS L1 C/A, L2 C/A, L2P, L3, L5; BelDou B1I, B1C, B2I, B2A, B31; Gallieo E1, E5 AltBOC, E5A, E5b, E6; Nav1C (IRNSS) L5; Q2SS L1 C/A, L1C, L2C, L5, L6; L-Band WAAS; EGNOS; MSAS; GAGAN; SBAS L1, L5; DGPS; RTK; PPP Terrastar 555 5 / 20 / 100 RTC <39 (cold start), <20 (hot start) 2P ±25 0.15 to 25	Dual GPS L1C/A, L1C, L1PY, L2C L2CA, L2P, L3 CDMA; Beids Galileo E1, E5a, E5b, E5 L1C, L2C, L5, L6; WAAS; EGNOS; MSAS; G 44 100 (M 2, RTCM 3 0.03	, L2P, L5; GLONASS L1CA, DJ B1I, B1C, B2A, B2I, B3; AttBoc, E6; QZSS L1C/A, Navic L5; L-band AGAN; SBAS; DGPS; RTK B B MAX BAS BAS; DGPS; RTK B B MAX BAS	Dual Single	GPS L1C/A, L5; GLONASS L1OF; Galileo E1B/C, E5a; BeiDou B11, B2a; QZSS L1C/A L1S L5; NavIC L5 GAGAN; SBAS L1C/A; ; RTK 34 20 M 3 05 , <10 (hot start) 0 4AAX 0000				
Computer GN	GNSS Constellations GNSS Corrections Channel Configuration (5) GNSS Data Rate (6) RTK Corrections Velocity Accuracy Initialization Time Time Accuracy (clock drift) (7) Air Data Computer Pressure Sensor Range Static Pressure Accuracy Static Pressure Accuracy Dynamic Pressure Anguracy Dynamic Pressure Accuracy Pressure Altitude Range Pressure Altitude Range Pressure Altitude Accuracy Airspeed Range Airspeed Accuracy Mach Number Range Mach Number Range	channels Hz m/sec s nano sec mbar hPa, % FS % FSS hPa % FSS m m/sec m/sec M	Dual Single GPS L1 C/A, L1C, L2C, L2P, L5; GLONASS L1 C/A, L2 C/A, L2P, L5, L5; BEDOU B1I, B1C, B2I, B2A, B3I; Galileo E1, E5 AltBOC, E5a, E5b, E6; NavIC (IRNSS) L5; Q2SS L1 C/A, L1C, L2C, L5, L6; L-Band WAAS; EGNOS; MSAS; GAGAN; SBAS L1, L5; DGPS; RTK; PPP Terrastar 555 5 / 20 / 100 RTC <39 (cold start), <20 (hot start) 2P ±25 0.15 to 25 5 to 64	Dual GPS L1C/A, L1C, L1PY, L2C L2CA, L2P, L3 CDMA; Beidd Galileo E1, E5a, E5b, E5 L1C, L2C, L5, L6; WAAS; EGNOS; MSAS; G 44 100 (M 2, RTCM 3 0.03 <45 (cold start); 20 2PE	, L2P, L5; GLONASS L1CA, bu B1I, B1C, B2a, B2I, B3; AttBoc, E6; QZSS L1C/A, Navic L5; L-band AGAN; SBAS; DGPS; RTK 8 max) <20 (hot start) XT 00 0 1100 0.1 0 600 0.25 0 99000 1 310 .55	Dual Single	GPS L1C/A, L5; GLONASS L1OF; Galileo E1B/C, E5a; BeiDou B1I, B2a; QZSS L1C/A L1S L5; Nav1C L5 GAGAN; SBAS L1C/A; ; RTK 34 20 M 3 05 5 5 C10 (hot start) 0 MAX				
Computer GN	GNSS Constellations GNSS Corrections Channel Configuration (5) GNSS Data Rate (6) RTK Corrections Velocity Accuracy Initialization Time Time Accuracy (clock drift) (7) Air Data Computer Pressure Sensor Range Static Pressure Accuracy Dynamic Pressure Accuracy Dynamic Pressure Accuracy Dynamic Pressure Accuracy Pressure Accuracy Pressure Activated Pressure Altitude Range Pressure Altitude Accuracy Airspeed Range Airspeed Accuracy Airspeed Accuracy Airspeed Accuracy Airspeed Accuracy	channels Hz - m/sec s nano sec mbar hPa, % FS hPa % FSS hPa m m m/sec m/sec	Dual Single GPS L1 C/A, L1C, L2C, L2P, L5; GLONASS L1 C/A, L2 C/A, L2P, L3, L5; BelDou B1I, B1C, B2I, B2A, B31; Gallieo E1, E5 AltBOC, E5A, E5b, E6; Nav1C (IRNSS) L5; Q2SS L1 C/A, L1C, L2C, L5, L6; L-Band WAAS; EGNOS; MSAS; GAGAN; SBAS L1, L5; DGPS; RTK; PPP Terrastar 555 5 / 20 / 100 RTC <39 (cold start), <20 (hot start) 2P ±25 0.15 to 25	Dual GPS L1C/A, L1C, L1PY, L2C L2CA, L2P, L3 CDMA; Beids Galileo E1, E5a, E5b, E5 L1C, L2C, L5, L6; WAAS; EGNOS; MSAS; G 44 100 (M 2, RTCM 3 0.03	, L2P, L5; GLONASS L1CA, bu B11, B1C, B2a, B21, B3; AltBoc, E6; QZSS L1C/A, Navic L5; L-band AGAN; SBAS; DGPS; RTK 8 max) <20 (hot start) XT 00 0 1100 0.1 0.1 0.5 0.9000 1 1 1.0 0.0 0.1 0.0 0.0 0.1 0.0 0.0	Dual Single	GPS L1C/A, L5; GLONASS L1OF; Gallieo E1B/C, E5a; BeiDou B1I, B2a; QZSS L1C/A L1S L5; Nav1C L5 GAGAN; SBAS L1C/A; ;; RTK 34 20 M3 05 , <10 (hot start) 0 04000				
Data Computer GN	GNSS Constellations GNSS Corrections Channel Configuration ⁽⁵⁾ GNSS Data Rate ⁽⁶⁾ RTK Corrections Velocity Accuracy Initialization Time Time Accuracy (clock drift) ⁽⁷⁾ Air Data Computer Pressure Sensor Range Static Pressure Accuracy Static Pressure Accuracy Dynamic Pressure Accuracy Dynamic Pressure Accuracy Pressure Altitude Range Pressure Altitude Range Pressure Altitude Range Airspeed Accuracy Airspeed Accuracy Mach Number Range Mach Number Range Mach Number Range Static Pressure Over Total Pressure Range Static Pressure Over Total Pressure Range	channels Hz m/sec s nano sec mbar hPa, % FS % FSS hPa % FSS m m/sec m/sec m/sec M M - ppm	Dual Single GPS L1 C/A, L1C, L2C, L2P, L5; GLONASS L1 C/A, L2 C/A, L2P, L3, L5; BelDou B1I, B1C, B2I, B2A, B3I; Gallleo E1, E5 Alt80C, E5A, E5b, E6; NavIc (IRNSS) L5; Q2SS L1 C/A, L1C, L2C, L5, L6; L-Band WAAS; EGNOS; MSAS; GAGAN; SBAS L1, L5; DGPS; RTK; PPP Terrastar 5555 5 / 20 / 100 RTC <39 (cold start), <20 (hot start) 2P ±25 0.15 to 25 5 to 64 0.01 to 0.2 0.001	Dual GPS L1C/A, L1C, L1PY, L2C L2CA, L2P, L3 CDMA; Beidd Galileo E1, E5a, E5b, E5 L1C, L2C, L5, L6; WAAS; EGNOS; MSAS; G 44 100 (M 2, RTCM 3 0.03 <45 (cold start); 20 2PE	, L2P, L5; GLONASS L1CA, bu B1I, B1C, B2a, B2I, B3; AltBoc, E6; QZSS L1C/A, Navic L5; L-band AGAN; SBAS; DGPS; RTK 8 max) <20 (hot start) XT 00 0 100 0.1 0.600 0.25 0.9000 1 310 0.10 0.099 0.25 0.9900 1 1 0.099 0.2 0.1	Dual Single	GPS L1C/A, L5; GLONASS L1OF; Gallieo E1B/C, E5a; BeiDou B1I, B2a; QZSS L1C/A L1S L5; NavIC L5 GAGAN; SBAS L1C/A; ;RTK 34 20 M3 05 , <10 (hot start) 0 04000				
Data Computer GN	GNSS Constellations GNSS Corrections Channel Configuration (5) GNSS Data Rate (6) RTK Corrections Velocity Accuracy Initialization Time Time Accuracy (clock drift) (7) Air Data Computer Pressure Sensor Range Static Pressure Range Static Pressure Accuracy Dynamic Pressure Range Static Pressure Accuracy Dynamic Pressure Accuracy Pressure Altitude Angue Pressure Altitude Accuracy Airspeed Accuracy Airspeed Accuracy Mach Number Range Mach Number Range Static Pressure Over Total Pressure Resolution Air Density Range Airspeafy Range Airspeafy Range	channels Hz - m/sec 5 nano sec mbar hPa, % FS hPa % FSS nFS m m m m/sec M/sec M/sec M/sec M/sec M/sec M/sec M/sec	Dual Single GPS L1 C/A, L1C, L2C, L2P, L5; GLONASS L1 C/A, L2 C/A, L2P, L3, L5; BelDou B1I, B1C, B2I, B2A, B3I; Gallleo E1, E5 Alt80C, E5A, E5b, E6; NavIc (IRNSS) L5; Q2SS L1 C/A, L1C, L2C, L5, L6; L-Band WAAS; EGNOS; MSAS; GAGAN; SBAS L1, L5; DGPS; RTK; PPP Terrastar 5555 5 / 20 / 100 RTC <39 (cold start), <20 (hot start) 2P ±25 0.15 to 25 5 to 64 0.01 to 0.2 0.001	Dual GPS L1C/A, L1C, L1PY, L2C L2CA, L2P, L3 CDM2; Beide Galileo E1, E5a, E5b, E5 L1C, L2C, L5, L6; WAAS; EGNOS; MSAS; G 44 100 (M 2, RTCM 3 0.03 <45 (cold start); 20 2pe ±6 300 t ± 6 -500 t 5 to 0.01 t 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.063	, L2P, L5; GLONASS L1CA, DI BII, B1C, B2A, B2I, B3; AltBoc, E6; QZSS L1C/A, Navic L5; L-band AGAN; SBAS; DGPS; RTK 8 max) <20 (hot start) XT 00 0 1100 0.1 0 600 0.25 0 9900 1 310 0.5 10.99 02 to 1 1 to 1.6	Dual Single	GPS L1C/A, L5; GLONASS L1OF; Gallieo E1B/C, E5a; BeiDou B1I, B2a; QZSS L1C/A L1S L5; NavIC L5 GAGAN; SBAS L1C/A; ;RTK 34 20 M3 05 , <10 (hot start) 0 04000				
Computer GN	GNSS Constellations GNSS Corrections Channel Configuration (5) GNSS Data Rate (6) RTK Corrections Velocity Accuracy Initialization Time Time Accuracy (clock drift) (7) Air Data Computer Pressure Sensor Range Static Pressure Accuracy Static Pressure Accuracy Dynamic Pressure Accuracy Dynamic Pressure Accuracy Pressure Altitude Range Pressure Altitude Accuracy Airspeed Range Airspeed Accuracy Mach Number Range Mach Number Range Static Pressure Over Total Pressure Rasolution Air Density Range Static Pressure Over Total Pressure Rasolution Air Density Range	channels Hz - m/sec s nano sec mbar hPa, % FS hPa % FSS m m/sec m/sec M M - ppm kg/m3 kg/m3	Dual Single GPS L1 C/A, L1C, L2C, L2P, L5; GLONASS L1 C/A, L2 C/A, L2P, L3, L5; BelDou B1I, B1C, B2I, B2A, B3I; Gallleo E1, E5 Alt80C, E5A, E5b, E6; NavIc (IRNSS) L5; Q2SS L1 C/A, L1C, L2C, L5, L6; L-Band WAAS; EGNOS; MSAS; GAGAN; SBAS L1, L5; DGPS; RTK; PPP Terrastar 5555 5 / 20 / 100 RTC <39 (cold start), <20 (hot start) 2P ±25 0.15 to 25 5 to 64 0.01 to 0.2 0.001	Dual GPS L1C/A, L1C, L1PY, L2C L2CA, L2P, L3 CDMA; Beids Galileo E1, E5a, E5b, E5 L1C, L2C, L5, L6; WAAS; EGNOS; MSAS; G. 44 100 (M 2, RTCM 3 0.03	, L2P, L5; GLONASS L1CA, pu B1I, B1C, B2a, B2I, B3; AtBoc, E6; Q2SS L1C/A, Navic L5; L-band AGAN; SBAS; DGPS; RTK 8 max) <20 (hot start) XT 00 0 1100 0.11 0 600 0.25 0 9000 1 310 0.55 0 0.99 02 10 10 10 10 10 10 10 10 10 10 10 10 10 1	Dual Single	GPS L1C/A, L5; GLONASS L1OF; Gallieo E1B/C, E5a; BeiDou B1I, B2a; QZSS L1C/A L1S L5; NavIC L5 GAGAN; SBAS L1C/A; ;RTK 34 20 M3 05 , <10 (hot start) 0 04000				
Data Computer GN	GNSS Constellations GNSS Corrections Channel Configuration (5) GNSS Data Rate (6) RTIK Corrections Velocity Accuracy Initialization Time Time Accuracy (clock drift) (7) Air Data Computer Pressure Sensor Range Static Pressure Accuracy Dynamic Pressure Range Static Pressure Accuracy Dynamic Pressure Accuracy Dynamic Pressure Accuracy Pressure Altitude Range Pressure Altitude Range Pressure Altitude Accuracy Airspeed Range Airspeed Accuracy Mach Number Range Mach Number Range Static Pressure Over Total Pressure Range Static Pressure Over Total Pressure Resolution Static Pressure Over Total Pressure Resolution Air Density Range Air Density Accuracy Air Density Accuracy Outside Air Temperature (OAT) Range	channels Hz m/sec s nano sec mbar hPa, % FSS hPa % FSS m m/sec	Dual Single GPS L1 C/A, L1C, L2C, L2P, L5; GLONASS L1 C/A, L2 C/A, L2P, L3, L5; BelDou B1I, B1C, B2I, B2A, B3I; Gallleo E1, E5 Alt80C, E5A, E5b, E6; NavIc (IRNSS) L5; Q2SS L1 C/A, L1C, L2C, L5, L6; L-Band WAAS; EGNOS; MSAS; GAGAN; SBAS L1, L5; DGPS; RTK; PPP Terrastar 5555 5 / 20 / 100 RTC <39 (cold start), <20 (hot start) 2P ±25 0.15 to 25 5 to 64 0.01 to 0.2 0.001	Dual GPS L1C/A, L1C, L1PY, L2C L2CA, L2P, L3 CDM2; Beide Gallieo E1, E5a, E5b, E5 L1C, L2C, L5, L6; WAAS; EGNOS; MSAS; G, 44 100 (M 2, RTCM 3 0.03 <45 (cold start); 20 2PE	, L2P, L5; GLONASS L1CA, bu B11, B1C, B2a, B21, B3; AltBoc, E6; QZSS L1C/A, Navic L5; L-band AGAN; SBAS; DGPS; RTK 8 max) <20 (hot start) XT 00 0 1 0 000 0.1 0 000 0.25 0 9000 1 1 310 0.1 0 0.99 0.2 0 0.90 0.1 0 0.90 0.0 0.90 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	Dual Single	GPS L1C/A, L5; GLONASS L1OF; Gallieo E1B/C, E5a; BeiDou B1I, B2a; QZSS L1C/A L1S L5; Nav1C L5 GAGAN; SBAS L1C/A; ;; RTK 34 20 M3 05 , <10 (hot start) 0 04000				
Data Computer GN	GNSS Constellations GNSS Corrections Channel Configuration (5) GNSS Data Rate (6) RTK Corrections Velocity Accuracy Initialization Time Time Accuracy (clock drift) (7) Air Data Computer Pressure Sensor Range Static Pressure Accuracy Static Pressure Accuracy Dynamic Pressure Accuracy Dynamic Pressure Accuracy Pressure Altitude Range Pressure Altitude Accuracy Airspeed Range Airspeed Accuracy Mach Number Range Mach Number Range Static Pressure Over Total Pressure Rasolution Air Density Range Static Pressure Over Total Pressure Rasolution Air Density Range	channels Hz - m/sec s nano sec mbar hPa, % FS hPa % FSS m m/sec m/sec M M - ppm kg/m3 kg/m3	Dual Single GPS L1 C/A, L1C, L2C, L2P, L5; GLONASS L1 C/A, L2 C/A, L2P, L3, L5; BelDou B1I, B1C, B2I, B2A, B3I; Gallleo E1, E5 Alt80C, E5A, E5b, E6; NavIc (IRNSS) L5; Q2SS L1 C/A, L1C, L2C, L5, L6; L-Band WAAS; EGNOS; MSAS; GAGAN; SBAS L1, L5; DGPS; RTK; PPP Terrastar 5555 5 / 20 / 100 RTC <39 (cold start), <20 (hot start) 2P ±25 0.15 to 25 5 to 64 0.01 to 0.2 0.001	Dual GPS L1C/A, L1C, L1PY, L2C L2CA, L2P, L3 CDM2; Beide Gallieo E1, E5a, E5b, E5 L1C, L2C, L5, L6; WAAS; EGNOS; MSAS; G, 44 100 (M 2, RTCM 3 0.03 <45 (cold start); 20 2PE	, L2P, L5; GLONASS L1CA, pu B1I, B1C, B2a, B2I, B3; AtBoc, E6; Q2SS L1C/A, Navic L5; L-band AGAN; SBAS; DGPS; RTK 8 max) <20 (hot start) XT 00 0 1100 0.11 0 600 0.25 0 9000 1 310 0.55 0 0.99 02 10 10 10 10 10 10 10 10 10 10 10 10 10 1	Dual Single	GPS L1C/A, L5; GLONASS L1OF; Gallieo E1B/C, E5a; BeiDou B1I, B2a; QZSS L1C/A L1S L5; Nav1C L5 GAGAN; SBAS L1C/A; ;; RTK 34 20 M3 05 , <10 (hot start) 0 04000				
Data Computer GN	GNSS Constellations GNSS Corrections Channel Configuration (5) GNSS Data Rate (6) RTK Corrections Velocity Accuracy Initialization Time Time Accuracy (clock drift) (7) Air Data Computer Pressure Sensor Range Static Pressure Accuracy Static Pressure Accuracy Dynamic Pressure Accuracy Dynamic Pressure Accuracy Pressure Altitude Range Pressure Altitude Range Pressure Altitude Range Airspeed Accuracy Mach Number Accuracy Mach Number Range Mach Number Range Static Pressure Over Total Pressure Range Static Pressure Over Total Pressure Range Outside Air Temperature (OAT) Range Outside Air Temperature (OAT) Resolution Environment Operational and Storage Temperature	channels Hz m/sec s nano sec mbar hPa, % FSS hPa % FSS m m/sec	Dual Single GPS L1 C/A, L1C, L2C, L2P, L5; GLONASS L1 C/A, L2 C/A, L2P, L3, L5; BelDou B1I, B1C, B2I, B2A, B3I; Gallleo E1, E5 Alt80C, E5A, E5b, E6; NavIc (IRNSS) L5; Q2SS L1 C/A, L1C, L2C, L5, L6; L-Band WAAS; EGNOS; MSAS; GAGAN; SBAS L1, L5; DGPS; RTK; PPP Terrastar 5555 5 / 20 / 100 RTC <39 (cold start), <20 (hot start) 2P ±25 0.15 to 25 5 to 64 0.01 to 0.2 0.001	Dual GPS L1C/A, L1C, L1PY, L2C L2CA, L2P, L3 CDM2; Beid Gallieo E1, E5a, E5b, E5 L1C, L2C, L5, L6; WAAS; EGNOS; MSAS; G, 44 100 (M 2, RTCM 3 0.03 <45 (cold start); 20 2PE	, L2P, L5; GLONASS L1CA, bu B1I, B1C, B2a, B2I, B3; AttBoc, E6; QZSS L1C/A, Navic L5; L-band AGAN; SBAS; DGPS; RTK 8 max) <20 (hot start) XT 00 0 100 0.1 0 600 0.25 0 9000 1 1 310 0.1 0 100 0.1 0 600 0.25 0 9000 1 1 0 100 0.1 0 0.99 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Dual Single	GPS L1C/A, L5; GLONASS L1OF; Gallieo E1B/C, E5a; BeiDou B1I, B2a; QZSS L1C/A L1S L5; Nav1C L5 GAGAN; SBAS L1C/A; ;; RTK 34 20 M3 05 , <10 (hot start) 0 04000				
Data Computer GN	GNSS Constellations GNSS Corrections Channel Configuration (5) GNSS Data Rate (6) GNSS Data Rate (7) GNSS Data Rate (8) RTK Corrections Velocity Accuracy Initialization Time Time Accuracy (clock drift) (7) Air Data Computer Pressure Sensor Range Static Pressure Range Static Pressure Accuracy Dynamic Pressure Range Dynamic Pressure Accuracy Pressure Altitude Range Pressure Altitude Accuracy Airspeed Ange Airspeed Accuracy Mach Number Range Mach Number Range Mach Number Range Static Pressure Over Total Pressure Range Static Pressure Over Total Pressure Range Static Pressure Over Total Pressure Range Outside Air Temperature (OAT) Range Outside Operational and Storage Temperature EMC/EMI	channels Hz - m/se s nano sec mbar hPa, % FS % FSS hPa % FSS mm m/sec m/sec M M - pp/m kg/m3 kg/m3 deg C deg C	Dual Single GPS L1 C/A, L1C, L2C, L2P, L5; GLONASS L1 C/A, L2 C/A, L2P, L3, L5; BelDou B1I, B1C, B2I, B2A, B3I; Gallleo E1, E5 Alt80C, E5A, E5b, E6; NavIc (IRNSS) L5; Q2SS L1 C/A, L1C, L2C, L5, L6; L-Band WAAS; EGNOS; MSAS; GAGAN; SBAS L1, L5; DGPS; RTK; PPP Terrastar 5555 5 / 20 / 100 RTC <39 (cold start), <20 (hot start) 2P ±25 0.15 to 25 5 to 64 0.01 to 0.2 0.001	Dual GPS L1C/A, L1C, L1PY, L2C L2CA, L2P, L3 CDMA; Beidd Galileo E1, E5a, E5b, E5 L1C, L2C, L5, L6; WAAS; EGNOS; MSAS; G 44 100 (M 2, RTCM 3 0.03 <45 (cold start); 20 20 20 26 26 300 t ± 6 300 t 5 5 to 0.15 t 0.01 t 0.03 0.03 0.03 0.03 0.04 0.04 0.05 0.05 0.06 0.06 0.07 0.07 0.07 0.08 0.09 0.09 0.09 0.09 0.09 0.09 0.09	, L2P, L5; GLONASS L1CA, DI B11, B1C, B2a, B21, B3; AttBoc, E6; QZSS L1C/A, Navic L5; L-band AGAN; SBAS; DGPS; RTK B B B B B B B B B B B B B B B B B B B	Dual Single	GPS L1C/A, L5; GLONASS L1OF; Gallieo E1B/C, E5a; BeiDou B1I, B2a; QZSS L1C/A L1S L5; Nav1C L5 GAGAN; SBAS L1C/A; ;; RTK 34 20 M3 05 , <10 (hot start) 0 04000				
Data Computer GN	GNSS Constellations GNSS Corrections Channel Configuration (5) GNSS Data Rate (6) RTK Corrections Velocity Accuracy Initialization Time Time Accuracy (clock drift) (7) Air Data Computer Pressure Sensor Range Static Pressure Accuracy Static Pressure Accuracy Dynamic Pressure Accuracy Dynamic Pressure Accuracy Pressure Altitude Range Pressure Altitude Range Pressure Altitude Range Airspeed Range Airspeed Range Airspeed Accuracy Mach Number Range Mach Number Range Static Pressure Over Total Pressure Resolution Air Density Range Static Pressure Over Total Pressure Range Unstide Air Temperature (OAT) Range Outside Air Temperature (OAT) Range Outside Air Temperature (OAT) Range Environment Operational and Storage Temperature Envicent	channels Hz - m/sec s nano sec mbar hPa, % FSS hPa % FSS m m/sec	Dual Single GPS L1 C/A, L1C, L2C, L2P, L5; GLONASS L1 C/A, L2 C/A, L2P, L3, L5; BelDou B1I, B1C, B2I, B2A, B3I; Gallleo E1, E5 Alt80C, E5A, E5b, E6; NavIc (IRNSS) L5; Q2SS L1 C/A, L1C, L2C, L5, L6; L-Band WAAS; EGNOS; MSAS; GAGAN; SBAS L1, L5; DGPS; RTK; PPP Terrastar 5555 5 / 20 / 100 RTC <39 (cold start), <20 (hot start) 2P ±25 0.15 to 25 5 to 64 0.01 to 0.2 0.001	Dual GPS L1C/A, L1C, L1PY, L2C L2CA, L2P, L3 CDMA; Beids Galileo E1, E5a, E5b, E5 L1C, L2C, L5, L6; WAAS; EGNOS; MSAS; G. 44 100 (M 2, RTCM 3 0.03 <45 (cold start); 20 2PE	, L2P, L5; GLONASS L1CA, DI B11, B1C, B2a, B21, B3; AttBoc, E6; Q2SS L1C/A, Navic L5; L-band AGAN; SBAS; DGPS; RTK 88 max) <20 (hot start) XT 000 0 1100 0.11 0.600 0.25 0.0900 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0	Dual Single	GPS L1C/A, L5; GLONASS L1OF; Gallieo E1B/C, E5a; BeiDou B1I, B2a; QZSS L1C/A L1S L5; Nav1C L5 GAGAN; SBAS L1C/A; ;; RTK 34 20 M3 05 , <10 (hot start) 0 04000				
Data Computer GN	GNSS Constellations GNSS Corrections Channel Configuration (5) GNSS Data Rate (6) GNSS Data Rate (7) GNSS Data Rate (8) RTK Corrections Velocity Accuracy Initialization Time Time Accuracy (clock drift) (7) Air Data Computer Pressure Sensor Range Static Pressure Range Static Pressure Accuracy Dynamic Pressure Range Dynamic Pressure Accuracy Pressure Altitude Range Pressure Altitude Accuracy Airspeed Ange Airspeed Accuracy Mach Number Range Mach Number Range Mach Number Range Static Pressure Over Total Pressure Range Static Pressure Over Total Pressure Range Static Pressure Over Total Pressure Range Outside Air Temperature (OAT) Range Outside Operational and Storage Temperature EMC/EMI	channels Hz - m/se s nano sec mbar hPa, % FS % FSS hPa % FSS mm m/sec m/sec M M - pp/m kg/m3 kg/m3 deg C deg C	Dual Single GPS L1 C/A, L1C, L2C, L2P, L5; GLONASS L1 C/A, L2 C/A, L2P, L3, L5; BelDou B1I, B1C, B2I, B2A, B3I; Gallleo E1, E5 Alt80C, E5A, E5b, E6; NavIc (IRNSS) L5; Q2SS L1 C/A, L1C, L2C, L5, L6; L-Band WAAS; EGNOS; MSAS; GAGAN; SBAS L1, L5; DGPS; RTK; PPP Terrastar 5555 5 / 20 / 100 RTC <39 (cold start), <20 (hot start) 2P ±25 0.15 to 25 5 to 64 0.01 to 0.2 0.001	Dual GPS L1C/A, L1C, L1PY, L2C L2CA, L2P, L3 CDM2; Beide Galileo E1, E5a, E5b, E5b, L1C, L2C, L5, L6; WAAS; EGNOS; MSAS; G. 44 100 (M 2, RTCM 3 0.03 <45 (cold start); 20 2PE	, L2P, L5; GLONASS L1CA, DI B11, B1C, B2a, B21, B3; AttBoc, E6; QZSS L1C/A, Navic L5; L-band AGAN; SBAS; DGPS; RTK B B B B B B B B B B B B B B B B B B B	Dual Single	GPS L1C/A, L5; GLONASS L1OF; Gallieo E1B/C, E5a; BeiDou B1I, B2a; QZSS L1C/A L1S L5; Nav1C L5 GAGAN; SBAS L1C/A; ;; RTK 34 20 M3 05 , <10 (hot start) 0 04000				



_	Electrical			
		Input power protection	-	Standard
<u>io</u>		Supply voltage	V DC	9 to 36 (27±10 for MIL-STD-1275 protection)
<u>a</u>		Output data format	-	Binary, NMEA 0183 ASCII characters
Gen		1 PPS level	V DC TTL	3.3 / 5 / differential
	Physical			
		Size	mm	D88.9 x H129
		Weight	gram	950

Specifications subject to change without notice

(1) GPS only. (2) For Novatel OEM7720 GNSS receiver only. Requires a subscription to a TerraStar data service. (3) RMS, incremental error growth from steady state accuracy. Post-processing results using third party software. (4) Dynamic accuracy may depend on the type of motion. (5) Tracks up to 60 L1/L2 satellites. (6) If tracking GPS Only. (7) Time accuracy does not include biases due to RF or antenna delay. (8) Typical result value.

Product Code Structure

Model	Gyro	Accel	Calibration	Connector	Encoder	Pressure Ports	Color	External Compass	Data Logger	GNSS receiver	Version	Interface
INS-FI	G490	A8	TGA	C18	E	0P	S	SAMC	S64	0719	V9	124
		A40				2P				07720	VD9	145
			=			2PEXT				DMH		1234
						2PMAX				SMX5		1245
							-			ZF9P		
										ZD9P		
										ZF9P-L5		

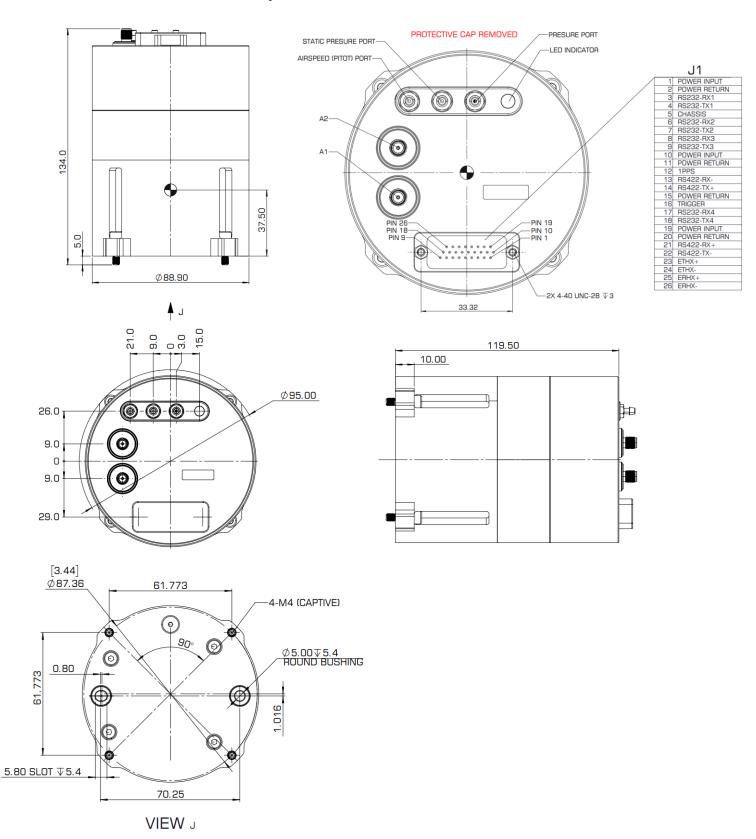
Example: INS-FI-G490-A40-TGA-C18-2P-S-SAMC-S64-ZD9P-VD9.12345

Product code details:

- INS-FI: Dual Antenna GPS-Aided Inertial Navigation System
- FI: FOG IMU-FI-200T
- G490: Gyroscopes measurement range = ±490 deg/sec
- A8: Accelerometers measurement range ±8 g
- A40: Accelerometers measurement range ±40 g
- TGA: Calibration of IMU (Gyroscopes and Accelerometers) in operational temperature range
- C18: 26-pin male, D-sub connector
- E: Encoder support (optional)
- OP: Zero Airspeed Pressure Ports (Total/Static)
- 2P: Two Airspeed Pressure Ports with Standard Range (Total/Static, Honeywell 025MD)
- 2PEXT: Two Airspeed Pressure Ports with Extended Range (Total/Static, Honeywell 600MD)
- 2PMAX: Two Airspeed Pressure Ports with Extended Range (Total/Static, Honeywell 004BD)
- S: Silver Color of enclosure (default)
- SAMC: External Stand-Alone Magnetic Compass (optional)
- S64: 64GB embedded Data Logger (optional)
- O719: NovAtel OEM719: GPS+GLO+GAL+BDS+QZSS, L1/L2/L5/L6/E1/E5a/E5b/AltBOC/E6/B1/B2I/B2b/B2a/B3, NavIC L5, SBAS L1/L5, RTK+PPP+Single Point+DGPS PNT, 20 Hz Data Output Rate, Base Station Corrections + Measurements, GRIT Interference Mitigation and Spoofing Detection Includes GLIDE & RAIM
- O7720: NovAtel OEM7720: GPS+GAL+BDS+QZSS, L1/L2/L5/E1/E5a/E5b/AltBOC/B1/B2I/B2a/B2b, NavIC L5, SBAS L1/L5 Dual Antenna Activation, RTK+PPP+Single Point+DGPS PNT, ALIGN Heading, 20 Hz Data Output Rate, Base Station Corrections + Measurements, GRIT Interference Mitigation and Spoofing Detection Includes GLIDE & RAIM
- SMX5: Septentrio mosaic-X5: GPS+GLO+BDS+GAL+QZSS, L1C/A/L1PY/L2C/L2P(Y)/L5/L1CA/L2CA/L2P/L3 CDMA/B1I/B1C/B2a/B2I/B2b/B3I/E1/E5a/E5b/ E5 AltBoc/E6, SBAS, L-band, RTK, AIM+ anti-jamming, anti-spoofing Advanced Interference Monitoring and Mitigation
- DMH: Septentrio mosaic-H: GPS+GLO+BDS+GAL+QZSS, L1C/A/L2P(Y)/L2C/L1CA/L2CA/B1I/B2I/B3I/E1/E5b/L1C/A/L1C/B/L2C, SBAS, RTK, Dual Antenna GNSS Heading, AIM+ anti-jamming, anti-spoofing Advanced Interference Monitoring and Mitigation
- ZF9P: u-blox ZED-F9P-02B: GPS+GLO+GAL+BDS+QZSS, L1C/A/L2C/L10F/L2OF/E1B/C/E5b/B1I/B2I/L1C/A/L1S/L2C/L5, SBAS, RTK, Active CW detection and removal, Onboard bandpass filter, Advanced anti-spoofing algorithms
- ZF9P-L5: u-blox ZED-F9P-15B: GPS+GLO+GAL+BDS+QZSS, L1C/A/L5/L10F/E1B/C/E5a/B1I/B2a/L1C/A/L1S/L5/, NavIC L5, SBAS, RTK, Active CW detection and removal, Onboard bandpass filter, Advanced anti-spoofing algorithms
- ZD9P: Dual u-blox ZED-F9P-02B: GPS+GLO+GAL+BDS+QZSS, L1C/A/L2C/L10F/L2OF/E1B/C/E5b/B1I/B2I/L1C/A/L1S/L2C/L5, SBAS, RTK, Dual Antenna GNSS Heading, Active CW detection and removal, Onboard bandpass filter, Advanced anti-spoofing algorithms
- V9: Single Antenna GNSS Receiver
- VD9: Dual Antenna GNSS Receiver
- .124: RS-232, RS-422 and CAN interface
- .145: RS-232, CAN and Ethernet interface (w/ Encoder support)
- .1234: RS-232, RS-422, RS-485 (to be used when connecting to a Stand-alone Magnetic Compass), and CAN interface
- .1245: RS-232, RS-422, CAN and Ethernet interface



INS-FI Mechanical Interfaces Description



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