iNAT-FSLG-01

Inertial Measuring System for Navigation and Surveying Applications
with Gyro Compassing Capability

iNAT-FSLG-01 is part of the IMS product family of systems with gyro compassing capability for inertial navigation, surveying, guidance and stabilizationand dynamically motion analysis with fiber optical gyros, that covers applications, which require high accuracy, reliability, a flexible interface and easy integration and usage.

- High performance inertial navigation and surveying system for airborne, naval, underwater, surface and railway applications; self gyro compassing.
- FOG technology with low angular random walk and very high angular resolution.
- Integrated time synchronization module and GPS / RTK-GNSS engine with single or dual antenna. Integrated atomic clock as option. SAASM GNSS as option.
- Internal 32 GByte data storage for black-box operation capability
- High data rate, open interfaces: Ethernet TCP/IP - UDP, CAN, UART RS422/RS232, ARINC429, ARINC825, NMEA 183.
- Integrated VMS / odometer interface.
- Small size, low weight, low power; integrated surveying markers and aiding support points on the enclosure (to support also advanced surveying applications).

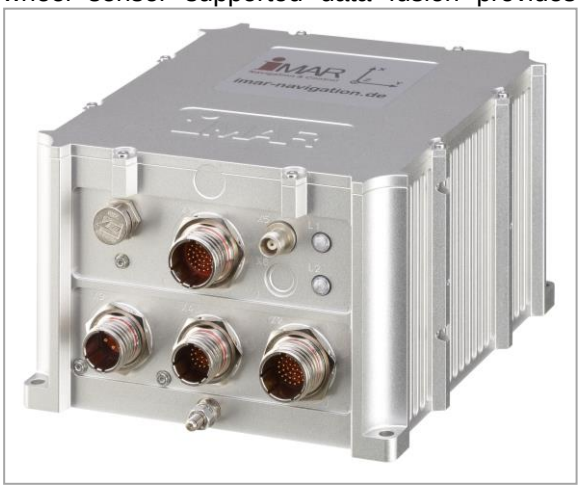
The iNAT-FSLG consists of three high precision fiber optical gyroscopes, three servo accelerometers, a powerful strapdown processor and an open and modular architecture, which allows also adaptations to customer's demands.

The system contains an up to L1L2 RTK capable GNSS receiver (GPS, GLONASS, GALILEO, Beidou) with optional SAASM capability, several Dig-I/Os (e.g. for odometer, laser altimeter, DVL). Communication I/Os are RS422/232 UART, Ethernet (TCP/IP, UDP), ARINC429, CAN, ARINC825 as well as internal data storage on non-volatile memory.

Data processing (strapdown navigation, gyro compassing, north keeping or motion monitoring) is performed inside of the iNAT-FSLG, and also data transmission and storage of pure or corrected raw data is available.

The iNAT-FSLG-01 allows free inertial navigation and autonomous gyro compassing within less than 4 minutes. The optional dual-antenna capability (iNAT-FSLG-01-DA) allows the system additionally to determine true heading within shortest time where required.

For surface applications the most sophisticated, wheel sensor supported data fusion provides



also highest position accuracy even when the system suffers significant GNSS outages (advanced dead-reckoning).

The iNAT-FSLG contains a tightly or loosely coupled INS/GNSS based data fusion, using iMAR's highly sophisticated 42+ state Kalman filtering incl. gyro compassing, free inertial or dead-reckoning navigation etc.

The user software iXCOM allows the user full control of the system as well as data storing and to perform maintenance activities also via network (e.g., download of stored data). Furthermore, a powerful post-processing tool is available for advanced surveying applications.

The measurement results as attitude, heading, position, velocity, rates and acceleration as well as the INS and GNSS raw data are available incl. time stamp with up to 500 Hz.

The system is only covered by dual-use export control and not by any ITAR regulations. Within the EU the simplified EU001 procedure is applicable, which allows a fast delivery from iMAR to the end-user.

Technical Data of iNAT-FSLG-01 and iNAT-FSLG-01-DA (rms values)

Data Output:	Heading, Roll, Pitch, Angular Velocity, Velocity (Body and World), Position, Raw Data of INS / GNSS / VMS incl. time-stamp, internal status information		
Performance:	True Heading [2]:	< 0.02° [RMS]	with at least single antenna GNSS (data fusion) and under sufficient motion dynamics (no dual antenna required)
		< 0.01° [RMS]	post-proc with RTK corrections
		< 0.28° sec lat [RMS]	gyro compassing (no GNSS support required)
		< 0.1° [RMS] [1]	with 2 m baseline between the two GNSS antennas (-DA)
		< 0.05° [RMS] [1]	with 4 m baseline between the two GNSS antennas (-DA)
	Position accuracy:	1…2 m [RMS]	with GPS, S/A off
		0.6 m [RMS]	with SBAS
		0.02 m [RMS]	with RTK corrections online or with RTK post-proc
		5 nm/hr [CEP]	free inertial navigation (w/o any GNSS or other aiding)
		3 nm/hr [CEP]	free inertial navigation after sufficient GNSS aiding
	Dead-Reckoning:	< 0.1 % [CEP] of distance travelled in lon/lat and altitude (with wheel sensor)	
	Velocity:	0.02 m/s [RMS]	with GNSS; < 0.005 m/s with RTK post-proc
	Altitude:	1…4 m RMS	with GPS, S/A off
		0.06 m RMS	with RTK corrections online or with RTK post-proc
	Roll/Pitch Accuracy:	0.01° RMS	with GPS, S/A off; < 0.005° with RTK post-proc
	Heave accuracy:	< 5 cm or 5 % (RMS)	whichever is highest
Alignment Time:	< 2 min. GNSS cold start, < 1 min. GNSS warm start; < 30 sec with stored heading < 6 min. to achieve 0.25° sec lat, < 2 min. to achieve 0.5° sec lat (rms) with Gyro Compassing		

Inertial Sensor Performance:	Gyroscopes	Accelerometers
Range:	± 600 °/s (no angle limitation)	± 20 g
Gyro ARW, Accel. Noise:	< 0.0045 deg/√h	< 40 µg/√Hz
Linearity / Scalefactor:	0.01 % / 0.015 %	50 µg/g² / 0.03 %
Drift (unaided), Accel. Offset:	< 0.05 °/hr	< 300 µg
Bias Stability (AV):	< 0.01 °/hr	< 15 µg
Resolution of Raw Data:	< 0.05 µrad / LSB	< 0.1 µg / LSB
Axis Misalignment:	< 0.15 mrad	< 0.25 mrad

GNSS Receiver (integrated):	up to L1L2 GPS+GLONASS+GALILEO+BEIDOU, RTK/PPP, L-Band; SAASM capability as hardware option high speed range version (< 515 m/s) available as option (iNAT-FSLG-HRS, requires export license)
Input Interfaces (options):	external GNSS receiver (standard: integrated GNSS receiver); event trigger (PPS / SYNC, RS422 level), odometer (opto-coupler input up to 32 V, A/B quadrature or counts & direction, RS422 level compliant)
Output Interfaces (options):	UART RS232/422, Ethernet TCP/IP / UDP, CAN, ARINC429, ARINC825, HDLC/SDLC, PPT (Pulse Per Time), PPS, SYNC; PTP / NTP Server (since HW rev. 4); NTRIP caster; PPD (Pulse-per Distance)
Data Output Rate:	1…500 Hz, internal data rate 1'000 Hz
Data Latency and Jitter:	1.2 ms (sampling accuracy better 1 µs, time-stamped according to PPS; jitter < 1 ms)
Data storage:	32 GByte on internal non-volatile memory
Atomic Clock TimeRef. (opt.):	external high precision clock, drift < 100 ps/s (= 90 µs / 10 days) for -15…+55 °C ambient temperature
Connectors:	MIL-C-38999 Series III for signals and power, TNC for antenna
Temperature, rel. Humidity:	-40...+65°C operating (case), -55...+85°C storage; 8...100%; IP67
Magnetic. insensitivity:	< 200 µTesla (2 Gauss) for operation within spec.
MTBF / MTTR:	> 35,000 hrs (estimated for surveying applications) / < 30 minutes
Shock, Vibration, Altitude:	6 g / 20 ms operational and 40 g / 15 ms non-operational; 60'000 ft 4 g rms (operating) and 6 g rms (endurance) [10…2'000 Hz]
Qualification:	MIL-STD-810G, MIL-STD-461G, MIL-STD-704F, DO160G
Power:	10...35 V DC, < 25 W (incl. GNSS); 50 ms hold up time according to DO160; continuous overvoltage protection up to 60 V
Weight / Size:	approx. 5.46 kg / approx. 187 x 130 x 261 mm³ (WxHxL), w/o connectors;
Installation:	Installation in all arbitrary orientationss allowed
Part-Number:	00190-00103-0Y0Z (Y = GNSS engine, Z = single/dual-antenna GNSS)
Software:	iXCOM communication protocol; iXCOM-CMD GUI software under MS Windows and Linux available; INS/GNSS post-proc iWP+ / iIP+; integrated real-time Kalman filter (42+ states); on request customized applications can be integrated

iMAR Navigation manufactures and designs inertial navigation, surveying, guidance, control and stabilization systems for defence, airborne, industrial, automotive, agriculture, mining, drilling, surveying and many other applications. All systems are manufactured and maintained by iMAR Navigation in Europe / Germany.

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[1] initial heading accuracy obtained from dual-antenna setup only; will be automatically improved as soon as certain motion is observed; accuracy rule of thumb: 0.2 °/[m baseline]
[2] values with GNSS or RTK aiding are given under the condition of sufficient GNSS availability and sufficient motion

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