iNAT-MSLG-5/T

Inertial Measuring System for Navigation, Stabilization and Surveying Applications with optional Dual-Antenna True Heading Capability

iNAT-MSLG-5 is part of the IMS product family of systems with true heading capability for inertial navigation, surveying, guidance and stabilization and dynamically motion analysis with advanced MEMS 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; supports dual-antenna GNSS based true north seeking also at standstill condition.
- MEMS technology with low angular random walk and high angular and accel. resolution.
- Integrated multi-consteallation / multi-frequencies GNSS engine (GPS / GLO / GAL / BDS etc., RTK / PPP capability; dual antenna as option.
- Internal 32 GByte data storage for black-box operation capability (option: 128 GByte)
- High data rate up to 500 Hz, open interfaces: Ethernet TCP/IP - UDP, CAN, UART RS422/ RS232, ARINC429, ARINC825, NMEA 183.
- Integrated VMS / odometer interface.
- Available in two versions: Industrial (standard temperature range) and Extended Temperature range
- Small size, low weight, low power; integrated surveying markers and aiding support points on the enclosure (to support also advanced surveying applications).

The iNAT-MSLG consists of three high accurate MEMS based 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 all frequency all constellation RTK capable GNSS receiver (GPS, GLONASS, GALILEO, Beidou), 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-MSLG, and also data transmission and storage of pure or corrected raw data is available.

The iNAT-MSLG-5/T allows true heading determination in-motion and with dual-antenna setup iNAT-MSLG-5/T-DA also during standstill within significant less than 3 minutes (at warm-start < 90 seconds).

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

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

The iNAT-MSLG contains a robust INS/GNSS based data fusion, using iMAR's highly sophisticated 42+ state Kalman filtering incl. free inertial and dead-reckoning navigation support. Beside of robustness and superior accuracy the very small data latency and and jitter makes the iNAT-MSLG the convincing choice also for advanced vehicle and antenna control applications.

The GUI / HMI software iXCOM as well as direct access allow 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 iNAT-MSLG is fully interface compatible to all other systems of the iNAT family, e.g. iNAT-FSLG, iNAT-FSSG (FOG based) or iNAT-RQT, iNAT-RQH (RLG based).

The system is not covered by any ITAR regulations or any other export control.




Technical Data of iNAT-MSLG/T-5 and iNAT-MSLG-5/T-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:	< 0.05°	with at least single antenna GNSS (data fusion) [2] (no dual antenna required)
		< 0.04°	with RTK corrections [2]; < 0.02° with RTK post-proc [2]
		< 0.2° [1]	with > 1 m baseline between the two GNSS antennas (-DA) [3]
		< 0.1° [1]	with > 2 m baseline between the two GNSS antennas (-DA) [3]
	Roll/Pitch Accuracy:	< 0.05°	with GNSS, 0.02° with RTK [2]; S/A off; < 0.005° RTK post-proc [2]
	Position accuracy:	1…2 m	with GPS, S/A off
		0.6 m	with SBAS
		0.02 m	with RTK corrections online or with RTK post-proc
	Dead-Reckoning:	< 0.2 % [CEP]	of distance travelled in lon/lat and altitude (with wheel sensor)
	Velocity:	< 0.05 m/s	with GNSS; < 0.01 m/s with RTK
	Altitude:	1…4 m	with GNSS, S/A off
		0.06 m	with RTK corrections online or with RTK post-proc
Alignment Time:	< 3 min. GNSS cold start, < 90 sec GNSS warm start; < 30 sec with stored heading		

Inertial Sensor Performance:	Gyroscopes	Accelerometers
Range:	± 490 °/s (no angle limitation)	± 15 g
Gyro ARW, Accel. Noise:	< 0.15 deg/√h	< 100 µg/√Hz
Linearity / Scalefactor:	0.05 % / 0.075 %	50 µg/g² / 0.1 %
Drift (unaided), Accel. Offset:	< 4 °/hr	< 1.5 mg
Bias Stability (AV):	< 0.3 °/hr	< 50 µg
Bias (filtered [2]):	< 1 °/h	< 0.5 mg
Resolution of Raw Data:	< 0.5 µrad / LSB	< 0.1 µg / LSB
Axis Misalignment:	< 0.5 mrad	< 0.5 mrad

GNSS Receiver (integrated):	up to all frequency GPS+GLONASS+GALILEO+BEIDOU, RTK/PPP, optional L-Band; high speed range version (< 515 m/s) available as option (iNAT-MSLG-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; NTP Server; NTRIP caster;
Data Output Rate:	integer divisor of 500 Hz, internal data rate 1'000 Hz
Data Latency and Jitter:	1.3 ms (sampling accuracy better 1 µs, time-stamped according to PPS; jitter < 1 ms)
Data storage:	32 GByte on internal non-volatile memory (option: 128 GByte)
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:	Extended Temp. Version: -55...+70 °C operating (case), +85 °C short term operation (30 min.); not RoHS; (P/N 00190-00301-050x)
	Standard Temp. Version: -40…+63 °C operating (case) and fully RoHS (P/N 00190-00300-050x)
	all versions: -55...+85°C storage; 8...100% rel. humidity; IP67 protection level
Acoustic Noise Level Prot.:	up to 140 dB (< 5 deg/h rms acoustic rectification at 140 dB ref to 20 µPa)
Vibration Rectification Error:	< 0.3 deg/h/g² (rms), < 2.5 mg
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; 40 g / 20 ms crash safety; 4.1 g rms (operating) and 6 g rms (endurance) [10…2'000 Hz]; 60'000 ft
Qualification:	designed to meet MIL-STD-810G, MIL-STD-461G, MIL-STD-704F, DO160G (qualification on request)
Power:	11...34 V DC, < 20 W (incl. GNSS); 50 ms hold up time according to DO160; available in Stadard Overvoltage Protection (SOVP) or Extended Transient Protection (ETP) setup – see ICD
Weight / Size (WxHxL):	~4.0 kg / ~ 187 x 138 x 210 mm [standard temp.]; ~5.1 kg / 187 x 130 x 213 mm [ext. temp.], w/o connectors;
Installation:	Installation in all arbitrary orientationss allowed; both antennas in –DA setup to see the same satellites
Software:	iXCOM communication protocol; iXCOM-CMD GUI software under MS Windows and Linux available; INS/GNSS software post-proc iPosCAL; 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 sufficient motion is observed (given values valid for sufficient GNSS availability and environment and motion dynamics)
[2] after algorithm converging under sufficient motion dynamics with suffic. GNSS aiding (no strong temperature gradients)
[3] assumes sufficient GNSS visibility of both antennas to the same GNSS satellites

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