iNAT-RQH-4003

Inertial Navigation System for Advanced Applications

iNAT-RQH is an INS product family for inertial navigation, timing, gyro compassing, surveying and dynamic motion measurement with ring laser gyros, that covers applications, which require high accuracy, reliability and an flexible interface to the user.

- high performance inertial navigation and surveying system for airborne, naval, underwater, surface and railway applications; self gyro compassing
- RLG technology with low angular random walk and much better bias stability than at FOG based systems
- integrated time sync. and 2 cm accurate GPS/GLONASS/GALILEO engine
- Interfaces: Ethernet TCP/IP, UDP, CAN, RS422/RS232 UART, int./ext. GNSS receiver, ARINC825/429
- Small size, low weight, low power

The iNAT-RQH for advanced airborne, naval, AUV, UAV, ROV, surface and railway applications consists of three high precision ring laser gyroscopes, three servo accelerometers, a powerful strapdown processor and an open and flexible interface, which can be customized.

The system contains an up to L1L2 RTK capable GNSS receiver (GPS, GLONASS, GALILEO, BEIDOU), external triggers, SYNCs and dig. I/Os (e.g., odometer / wheel sensor, laser altimeter, DVL). Possible COM I/Os are Ethernet (TCP/IP, UDP), RS422/232 UART, CAN, ARINC429, ARINC825 and CANaero as well as internal data storage on solid-state memory.

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

A key feature is its high data rate of up to 300 Hz and its unique resolution (0.000'3 degree in roll/pitch/yaw) as well as its superior accuracy (e.g., for stabilization tasks). As an option, special designed algorithms processed in parallel HPST² (High Precision Short Time Tracking) mode allow to output most stable angular and position information during de-

finable time windows also under difficult motion conditions (e.g. for SAR or LIDAR applications).

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

The iNAT-RQH contains a tightly or loosely coupled INS/GNSS based data fusion, using iMAR's highly sophisticated 15+ state Kalman filtering. It includes autonomous gyro compassing capability. The iNAT-RQH-400x family is available in several performance classes, down to 0.001 deg/sqrt(hr) angular random walk.

The system is covered by European dual-use export control and ITAR regulations. With the family of iNAT-RQT a fit-function (FF) compatible system is provided which is not regulated by ITAR. With iNAT-FSSG-1 a compatible system with dual-antenna GNSS technology is provided, which does not require any export license.

Technical Data of iNAT-RQH-4003 (rms)

Data Output:	Heading, Roll, Pitch, Angular Velocity, Velocity (Body and World), Position, Raw Data, Internal Status Information, Odo. and GNSS inf.
True Heading[1]:	< 0.025° sec(lat) free inertial; 0.01° with GNSS/motion, 0.008° post-proc RTK/motion
Attitude Accuracy:	< 0.01° (< 0.005° with GNSS/motion, 0.003° postproc with RTK aiding/motion)
Position Accuracy[1]:	0.8 nm/hr free inertial; < 1 m GNSS (S/A off) and < 10 cm RTK online, < 30 cm GBAS / SBAS / TerraStar and 2 cm RTK/INS < 0.1 % distance travelled (with odometer and GPS, application dependant) < 0.2 % distance travelled on underwater vehicles (incl. RDI DVL interface)
Velocity Accuracy:	5 mm/s (aided with integrated L1/L2 RTK GNSS receiver, < 3 mm/s postproc RTK)
Alignment Time:	< 12 minutes on-shore [typ. < 4 minutes @ 30° lat], < 30 minutes off-shore
Range:	± 800 °/s (no angle limitation) ± 20 g
Drift (unaided) / Offset:	< 0.003 °/hr < 25 µg
Bias Stability:	< 0.002 °/hr (const. temp.) < 10 µg
Random Walk / Q[1]:	< 0.002 °/$\sqrt{h}$ < 8 µg/$\sqrt{Hz}$
Resolution:	0.000'3 ° (1,2"), < 0.001 °/s < 5 µg (depends on data rate)
Scale/Linearity Error:	< 5 ppm / < 5 ppm < 100 ppm / < 20 µg/g²
Axis Misalignment:	< 25 µrad
Data Output Rate:	1…300 Hz, internal data rate 1'800 Hz
Data Latency:	< 3 ms (sampling accuracy better 1 µs, time-stamped according to PPS)
Data storage:	up to 16 GByte on internal flash memory (option)
Output (options):	RS232/422 UART, Ethernet TCP/IP / UDP, PPT (Pulse Per Time), PPS, CAN, ARINC429, ARINC825, , CANaero, MIL-STD1553B
Inputs (options):	internal/external (RTK)GNSS (standard: GPS/GLONASS/GALILEO integrated), marker event trigger, odometer (RS422 level), PPS / SYNC
Connectors:	MIL-C-38999 III, TNC
Temperature (case):	-40...+71°C operating, -55...+85°C storage
Rel. Humidity:	8...100%, IP67
Magnetic. insensitivity:	< 500 µTesla (5 Gauss)
MTBF / MTTR:	> 25,000 hrs (estimated for surveying applications) / < 30 minutes
Shock, Vibration:	25 g, 11 ms ;60 g, 5 ms (operating); 20…2'000 Hz, 3 g rms
Qualification:	MIL-STD-810F, MIL-STD-461E, MIL-STD-704D, DO160E
Power:	10...34 V DC, < 25 W; 50 ms hold up time according to DO160E
Weight / Size:	approx. 8 kg / approx. 187 x 128 x 296 mm³ (without connectors);
Software:	internal 27+ state Kalman filter, iXCOM, INS/RTK-GNSS postproc. (option)

iMAR is manufacturing and developing inertial navigation and guidance systems for all application areas. All systems manufactured by iMAR are maintained at iMAR in Europe / Germany.

iMAR uses latest and highly reliable European ring laser gyro technology in its advanced inertial navigation and guidance systems for industrial and defence applications.

[1] several performance classes available: 0.015…0.1 deg sec(lat), 0.05…2 nm/hr, 0.001…0.01 deg/sqrt(hr)