

iNAT-RQH-400x

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, 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.
- RLG technology with low angular random walk and much better bias stability than at FOG based systems.
- Integrated time synchronization module and GPS / RTK-GNSS engine with single or dual antenna. Integrated atomic clock as option. SAASM GNSS as option.
- High data rate, open interfaces: UART RS422 / RS232, Ethernet TCP/IP - UDP, CAN, ARINC429, ARINC825, NMEA 183.
- Integrated VMS / odometer interface.
- Internal 32 GByte non-volatile memory ("black-box")
- Small size, low weight, low power; integrated surveying markers and aiding support points on the enclosure (to support also advanced surveying applications).

The iNAT-RQH consists of three high precision ring laser 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). Optional communication I/Os are Ethernet (TCP/IP, UDP), RS422/232 UART, CAN, ARINC429, 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-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 definable time windows also under difficult motion conditions (e.g. for SAR or LIDAR applications).

The iNAT-RQH 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 iNAT-RQH-400x family is available in several performance classes, down to 0.001 deg/sqrt(hr) angular random walk.

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 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-400x (rms values)

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|-------------------------------|--|--|-------------------------|--|-------|-------|-------|-------|-------|--------|-------------------------------|-----------|--------|
| Data Output: | Heading, Roll, Pitch, Angular Velocity, Velocity (Body and World), Position, Raw Data of INS / GNSS / VMS incl. time-stamp, Internal Status Information | | | | | | | | | | | | |
| True Heading: | | | | | | | | | | | | | |
| iNAT-RQH-4001: | < 0.015° [0.26 mils] sec(lat) free inertial; 0.01° with GNSS/motion, 0.008° post-proc RTK/motion | | | | | | | | | | | | |
| iNAT-RQH-4002: | < 0.020° [0.35 mils] sec(lat) free inertial; 0.01° with GNSS/motion, 0.008° post-proc RTK/motion | | | | | | | | | | | | |
| iNAT-RQH-4003: | < 0.028° [0.50 mils] sec(lat) free inertial; 0.01° with GNSS/motion, 0.008° post-proc RTK/motion | | | | | | | | | | | | |
| iNAT-RQH-4004: | < 0.057° [1.00 mils] sec(lat) free inertial; 0.01° with GNSS/motion, 0.008° post-proc RTK/motion | | | | | | | | | | | | |
| Attitude Accuracy: | | | | | | | | | | | | | |
| iNAT-RQH-4001: | < 0.012° (< 0.005° with GNSS/motion, 0.002° postproc with RTK aiding/motion) | | | | | | | | | | | | |
| iNAT-RQH-4002: | < 0.016° (< 0.005° with GNSS/motion, 0.003° postproc with RTK aiding/motion) | | | | | | | | | | | | |
| iNAT-RQH-4003: | < 0.023° (< 0.005° with GNSS/motion, 0.003° postproc with RTK aiding/motion) | | | | | | | | | | | | |
| iNAT-RQH-4004: | < 0.050° (< 0.008° with GNSS/motion, 0.003° postproc with RTK aiding/motion) | | | | | | | | | | | | |
| Position Accuracy: | free inertial: -4001: < 0.2 nm/hr; -4002: < 0.5 nm/hr; -4003: < 0.8 nm/hr; < 1 m GNSS (S/A off) and < 10 cm RTK online, < 0.5 m with ground based ref station / SBAS / TerraStar and 2 cm with 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 Duration: | On-shore Alignment Duration (static): | | | | | | | | | | | | |
| Class of System | Gyroscopes | | Accelerometer | | 0.25° | | | | | 0.1° | 0.05° | 0.028° | 0.012° |
| iNAT-RQH-4001: | < 0.0010 °/√h | | 0.0020 °/hr < 8 µg/√Hz | | 25 µg | 2 min | 2 min | 3 min | 6 min | 20 min | @ lat 0° | @ lat 50° | |
| iNAT-RQH-4002: | < 0.0015 °/√h | | 0.0027 °/hr < 10 µg/√Hz | | 25 µg | 2 min | 2 min | 4 min | 7 min | 13 min | @ lat 0° | @ lat 50° | |
| iNAT-RQH-4003: | < 0.0020 °/√h | | 0.0036 °/hr < 12 µg/√Hz | | 50 µg | 2 min | 3 min | 5 min | 7 min | 9 min | @ lat 0° | @ lat 50° | |
| iNAT-RQH-4004: | < 0.0030 °/√h | | 0.0050 °/hr < 12 µg/√Hz | | 50 µg | 2 min | 4 min | 7 min | 7 min | 3 min | @ lat 0° | @ lat 50° | |
| | Off-shore Alignment Duration = On-shore Alignment Duration + 15 minutes | | | | | | | | | | | | |
| 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 | | | | | | | | | | < 25 µrad | | |
| Sensor Range: | ± 800 °/s (no angle limitation) | | | | | | | | | | ± 20 g | | |
| Bias Instability (AllanVar): | < 0.002 °/hr (const. temp.) | | | | | | | | | | < 10 µg | | |
| GNSS Receiver (integrated): | up to L1L2 GPS+GLONASS+GALILEO+BEIDOU, RTK/PPP, L-Band; SAASM capability as hardware option | | | | | | | | | | | | |
| 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 on Ethernet as option; NTRIP caster as option | | | | | | | | | | | | |
| Data Output Rate: | 1...300 Hz, internal data rate 1'800 Hz | | | | | | | | | | | | |
| Data Latency: | < 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.): | Integrated 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...+71°C operating (case), -55...+85°C storage; 8...100%; IP67 | | | | | | | | | | | | |
| Magnetic. insensitivity: | < 500 µTesla (5 Gauss) | | | | | | | | | | | | |
| MTBF / MTTR: | > 25,000 hrs (estimated for surveying applications) / < 30 minutes | | | | | | | | | | | | |
| Shock, Vibration, Altitude: | 25 g / 11 ms, 60 g / 5 ms (operating); 20...2'000 Hz, 3 g rms; 60'000 ft | | | | | | | | | | | | |
| 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. 7.9 kg / approx. 187 x 128 x 296 mm³ (w/o connectors); | | | | | | | | | | | | |
| Installation: | Installation in all arbitrary orientations allowed | | | | | | | | | | | | |
| 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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