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# iNAT-M300/TLN-2-DA • iNAT-M300/xLN-2

## Precise MEMS Based Inertial Navigation System with integrated INS/GNSS/xxx Sensor Data Fusion

**iNAT-M300/xLN-2**[1] is a member of the advanced iNAT series (iMAR Navigation and Timing) and one of the smallest powerful MEMS based INS/GNSS inertial navigation, measurement, surveying and control systems on the market for applications on the surface (land/sea) and in the air. It provides all kinematic measurements like acceleration, angular rate, attitude, true heading, velocity and position of the target vehicle in real-time with an data update rate of up to 500 Hz.

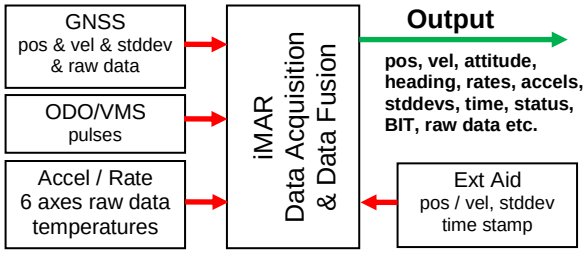
- robust, compact, light weight system, ~850 grams
- based on high grade MEMS gyro & accel technology and up to all frequency GNSS with optional dual-antenna heading and RTK support; gyros highly resistant against vibration impacts
- integrated GNSS engine, up to RTK all frequ./const. (4 types of engines available: /TLN, /SLN, /RLN)
- options for high/low range angular rate (-HRR/-LRR) and high range acceleration (-HRA) available
- odometer / wheel sensor aiding capability
- output of angular rate, acceleration, attitude, true heading, CoG, velocity and position in realtime with up to 1'000 Hz (adjustable) with minimum latency
- several processing modes: Standard mode with 1 m position accuracy and RTK mode with 0.02 m position accuracy
- interfaces: UART RS232 & RS422 / CAN / Ethernet / USB for realtime data output and RS232 for DGPS/RTK correction input; odometer / VMS
- up to 128 GByte internal memory ("black-box")
- several versions with surveying, industrial and economic grade GNSS available
- **iNAT-M300/TLN-2: version with advanced accels**
- high angular rate range (1'200 °/s) as option: -HRR
- easy to use, easy to configure; powerful GUI

Depending on the application, environmental environment and required realtime accuracy, the data fusion includes INS, GNSS, VMS or any other external sensor providing position and/or velocity, standard deviation and time stamp.

The system is available with four different integrated GNSS engines (iNAT-M300/TLN, /RLN, /SLN). The version /TLN is for most difficult envronment and RTK aiding, and the version /RLN for commercial grade applications.

In urban canyons often the number of observable satellites is quite limited and therefore the iNAT-M300/TLN supports an all GNSS constellation / all-frequencies data fusion. The 42+ state extended Kalman filter processsing provides a significant better and more robust position and velocity result compared to standard solutions. For land vehicles additionally an odometer aiding capability is available as an option, the scale factor of the wheel sensor is estimated automatically.

The **iNAT-M300/TLN-2** provides system performance and system reliability which is required in standard tasks of navigation, guidance and control, mapping, vehicle motion dynamics testing, trajectory surveying and platform control tasks for cars, trucks, naval vessels, civil and military aircrafts etc.




The iNAT-M300 is delivered with the MS Windows (or LINUX or MacOS alternatively) based configuration software iXCOM-CMD. This software allows to configure the output interfaces, furthermore all output data can be displayed and stored online on the user's notebook, tablet or process computer. It also allows powerful playback capabilities and provides data export in many formats (csv, xml, GoogleEarth, InertialExplorer, GrafNav). With iREF-GNSS, iMAR also provides a GNSS reference station to provide RTK corrections for centimeter level accuracy on demand.

The iNAT-M300/xLN-2-DA ***"advanced"*** version (this datasheet) contains advanced accelerometers (dual-use items regarding export control). A powerful post-proc software iPosCAL-SURV for batch processing is available to allow post-mission processing including a multi station GNSS correction data solution and a direct visualisation of the results in Google Earth™.

[1] Meaning „x": the iNAT-M300/**x**LN can be delivered with 3 classes of integrated GNSS engines. Standard device is iNAT-M300/**T**LN (multi-freqency GPS/GALILEO/GLONASS/BEIDOU)

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# Technical Data iNAT-M300/TLN-2-DA and iNAT-M300/xLN-2 (typical, rms):

| | Rate | Acceleration | Attit./Heading | Position | Velocity | Height |
|---|---|---|---|---|---|---|
| Range[1]: | ± 400 °/s | ± 10 g (opt. 30/80 g) | unlimited | unlimited | 515 m/s (without export control) | unlimited |
| Bias Stability (AV): | < 0.5 °/h | < 0.005 mg | | | | |
| Bias (filtered[4]): | < 2 °/h | < 0.3 mg | | | | |
| Bias day-to-day: | < 0.07 °/s | < 1 mg | | | | |
| Angles (Attitude, Hdg.): | | | **0.02°** / 0.07° RP/Y (INS/GNSS) [under best conditions 0.01° / 0.03° RP/Y] [5]<br>0.03° / 0.1° RP/Y (after 60 s GNSS outage) [best cond. 0.02° / 0.04° RP/Y] [5]<br>0.1 deg heading for 2 m baseline in dual-antenna setup (/SLN-DA) [2]<br>**0.06°** Roll/Pitch without any initial ading after power-on at standstill | | | |
| Position (horizontal plane) [2]: | *for **iNAT-M300/TLN-2:*** | | +/- 0.03 m CEP (INS/GNSS RTK real-time) [3]<br>+/- 0.02 m CEP (INS/GNSS RTK post-proc) [5]<br>+/- 0.4 m CEP (INS/GNSS with SBAS)<br>+/- 1.8 m CEP (INS/GNSS)<br>0.15 % of DT CEP (with VMS, during GNSS outages)[4] | | | |
| | | | +/- 1.8 m CEP (INS/GNSS) | | | |
| Velocity: | | | | | 0.02 m/s (INS / RTK GNSS) | |
| Noise: | 0.15 °/ √hr | **25** µg/√Hz | 0.03 ° | < 0.01 m | < 0.01 m/s | |
| Resolution: | < 0.000'1 °/s | < 2 µg | 0.001 ° | < 0.001 m | < 0.001 m/s | |
| Linearity error: | < 0.005 % | < 0.005 % | | | | |
| Scale factor error: | < 0.05 % | < 0.02 % | | | | |
| Non-Orthogonality: | < 0.3 mrad | < 0.3 mrad | | | | |

| | |
|---|---|
| INS / GNSS / ODO proc.: | integrated advanced 42+ state INS/GNSS/+ extended Kalman filter data fusion (GPS, GALILEO, GLONASS, BEIDOU) |
| Internal GNSS Engine: | version /TLN: high performance all frequencies / all constellation RTK GNSS engine (single & dual antenna available)<br>version /SLN: performance up to all frequency / constellation geodedic class RTK GNSS engine (single or dual antenna)<br>version /RLN: commercial multi frequencies / multi constellation RTK GNSS engine (single & dual antenna available) |
| Data Processing Rate: | up to 500 Hz; PPS timing accuracy better 10 ns |
| Data Output Rate: | integer divisor of 500 Hz; all data available in real time, latency < 6 ms, jitter < 1 ms |
| Synchronisation: | PPS_OUT (RS422 level, latency < 1 µs); 2x EVENT_IN (RS422 or TTL level, latency < 2 ms) |
| Output (options): | USB, 2 x CAN, 4 x UART RS232/422, Ethernet 100 Mbit/s, NMEA183, ARINC825, TCP/IP, UDP, NTRIP caster with RTCM104 rev 3 (can serve as a GNSS reference station); NTP Time Server (since HW rev. 5) |
| Inputs: | DGPS/RTK correction data from base station, if available (RS232);<br>odometer / VMS (A or A/B at RS422 level) as an option |
| Data Latency and Jitter: | < 6 ms (sampling accuracy better 1 µs, time-stamped according to PPS; jitter < 1 ms) |
| Connectors: | MIL-C-38999 III (data), SMA (antenna), M12 (Ethernet); option: LEMO connectors |
| Integrated Data Storage: | 32 GByte non-vlatime memory, option 128 GByte (lasts for several days continuous data sampling as "black-box") |
| Graphical User Interface: | MS Windows or LINUX or MacOS based software iXCOM-CMD for configuration,<br>visualization, data recording, data converting and playback operation |
| Power Supply: | 9...34 V DC, two independent and isolated inputs available; reverse an overvoltage protection;<br>approx. 8.5 …11 W (dep. on options); < 14 W for < 1 sec after power-on |
| Qualification: | designed to meet MIL-STD-810H, MIL-STD-461G, MIL-STD-704F and partially DO160G |
| Temperature; MTBF: | -40...+71 °C (outer case temperature) operating, -40…85 °C storage; 49'000 hrs (AUC, Airborne Uninhabited Cargo, 25 °C) |
| Shock, Vibration, Altitude: | 1'200 g, 0.5 ms, 10…2'000 Hz 20 g rms (endurance); 10...2'000 Hz 10 g rms (operational); 60'000 ft |
| g / g² depenent bias: | < 1 °/h/g / 0.06 °/h/g² [at 20 g rms / 1'000 Hz] / **0.3** mg/g² [at 10 g rms / 1'000 Hz] |
| Mass, size; IP: | approx. 780 grams , approx. 102 x 65 x 122 mm; IP67 environmental protection |
| Operational Support: | Airborne, Ground (with and without odometer), Sea, Subsea; ZUPT (auto or on demand), open interface to feed in application specific aiding information (position, velocity, attitude, heading, standard deviations, time stamp) |
| Deliverables: | - MEMS based INS with integrated GNSS receiver, GNSS antenna, cable set<br>- Python scripts, ROS 2 node and SDK in C++ available for easy interfacing<br>- iXCOM-CMD MS Windows or LINUX or MacOS based GUI / HMI software (if ordered) |
| PartNumber: | advanced version: P/N 00193-000E1-0y2x [this datasheet] x = 6: single atenna setup<br>standard version: P/N 00193-00001-0y2x [see separate datasheet] x = 7: dual antenna setup<br>y = T,R,S – type of GNSS engine |
| Options: | - ROS-2 driver, Python-driver and SW-Development Kit with DLL (with SDK under Qt / C) available<br>- up to all-frequency / all-constellations RTK / PPP accuracy of the integrated GNSS receiver<br>- dual-antenna GNSS based true heading (**iNAT-M300/xLN-2-DA**, iATTHEMO/xLN-2-DA) allows heading determination even at standstill conditions -> typ. 0.2° at 1 m baseline<br>- odometer (VMS) interface for velocity aiding during longer GNSS outages (position error is then correlated to wheel sensor performance, typically 0.1 % longitudinal error of distance travelled)<br>- iPosCAL-SURV advanced INS/GNSS post-processing software<br>- interface to iMAR's iDMN Dynamic Mesh Network for Swarm Communication & Control |

[1] Option: **iNAT-M300/xLN-2-HRR** for high rate range tasks: up to 1'200 deg/s (requires export license)
Option: **iNAT-M300/xLN-2-HRA** for high range acceleration tasks: up to 80 g (requires an export license)
Option: **iNAT-M300/xLN-2-HRS** for high range speed tasks: > 515 m/s (requires an export license)
[2] GNSS based altitude deviation is abut 1.5 times of GNSS based horizontal error
[3] after algorithm converging under sufficient motion / trajectory and multiple heading changes with GNSS aiding
[4] Position error in relation to distance travelled (DT) during GNSS outages (requires a vehicle motion sensor / wheel sensor), after suffic. GNSS

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