iPRENA-II / -III / -IV
iPRENA-M-II / -III / -IV

Family of precise Inertial/GNSS/VMS based Navigation Systems

iPRENA-M-II…IV and iPRENA-II…IV are product families of highly precise Inertial Navigation and Timing systems (iNAT).

It is used for north finding, navigation, surveying and dynamic motion measurements and contains ring laser gyros (RLG). The iPRENA covers applications, which require highest accuracy and reliability, like mining, surveying or gun alignment.

- High performance inertial navigation and surveying systems for military applications in airborne, naval, underwater or surface platforms
- True North Reference, fast and accurate gyro compassing
- Integrated multi-constellation / multi-frequency GNSS receiver (up to RTK / PPP)
- Option: Interface for external mil. grade P/Y code GNSS receivers (M-Code, SAASM)
- Various interfaces: Ethernet TCP/IP, UDP, CAN, RS422/RS232 UART, ARINC825 /429. NTP server capability
- Small size, low weight, low power, high reliability
- Military environment qualified (MIL-STD-810G, MIL-STD-461G, MIL-STD-704F)
- Two versions available: standard COTS version iPRENA-xx and gun-fire approved version iPRENA-**M**-xx within MAPS / DRU compatible enclosure and with integrated gunfire resistant shock isolators.

iPRENA-(M)-II…IV consists of three high precision ring laser gyroscopes (RLG), three accelerometers, a powerful strapdown processor and an open and configurable interface.

The system contains a GNSS receiver for GPS, GLONASS, GALILEO, BEIDOU etc.; it can also be operated with external GNSS receivers. Available COM I/Os are Ethernet (TCP/IP, UDP), RS422/232 UART, CAN, ARINC429, ARINC825, CANaero, NMEA 0183 as well as a large internal data storage on solid-state non-volatile memory.

Data processing (strapdown navigation, gyro compassing / north seeking, north keeping or motion monitoring) is performed inside of the iPRENA as well as data transmission and data storage.

A key feature is its high data rate of up to 400 Hz and its long-term supreme accuracy stability, which is a key factor of RLG technology.

^^iMAR's HMI software iXCOM-CMD allows the user full control of the system, data storage and visualization as well as configuration and maintenance activities (e.g. download of stored data).

iPRENA-xx

iPRENA-M-xx

The iPRENA systems come with the major advantages of ring laser gyros (e.g. no significant aging, i.e. long term performance of gyro bias and scale factor as well as high reliability), and they do not suffer from the typical strong disadvantages of higher performance FOG or CVG based systems (like aging or degraded bias accuracy under vibration or temperature gradients etc.).

Due to the modular system architecture, the iPRENA systems can be delivered with customized data interfaces and connectors, e.g. to replace obsolete navigation systems of any other provider in a form, fit & function manner.

The iPRENA-(M)-II/II/IV systems are only covered by European dual-use export control (no ITAR restrictions).




Technical Data of iPRENA-M-II/-III/-IV and iPRENA-II/-III/-IV (rms values)

Data Output:	Azimuth (True Heading) and elevation, position and velocity (including standard deviations), roll, pitch, angular rates, acceleration, system status (BIT) etc.
Azimuth / True Heading	[all values: sec Lat, free inertial / gyro compassing]:
iPRENA-II and iPRENA-M-II:	< 0.3 mil gyro compassing within 10 min.; 0.2 mil with GNSS on the move[1] < 0.8 mil gyro compassing within 5 min.; 0.2 mil with GNSS on the move[1]
iPRENA-III and iPRENA-M-III:	< 1.0 mil gyro compassing within 6 min.; 0.2 mil with GNSS on the move[1] < 3.0 mil gyro compassing within 3 min.; 0.2 mil with GNSS on the move[1]
iPRENA-IV andiPRENA-M-IV:	< 1.5 mil gyro compassing within 7 min.; 0.2 mil with GNSS on the move[1] < 3.0 mil gyro compassing within 4 min.; 0.2 mil with GNSS on the move[1]
Elevation (Pitch), Roll:	< 0.18 mil (< 0.1 mil dynamically[1] with GNSS aiding)
Position and Velocity Accuracy:	< 2 m [CEP50] and < 0.05 m/s with GNSS aiding (S/A off, sufficient visibility); < 0.5 nm/hr [CEP50] and < 1 m/s free inertial drift (iPRENA-(M)-II)[2] < 1.0 nm/hr [CEP50] and < 1.3 m/s free inertial drift (iPRENA-(M)-III) [2] < 1.5 nm/hr [CEP50] and < 1.5 m/s free inertial drift (iPRENA-(M)-IV) [2] < 0.1 % distance travelled [CEP50] (with odometer / VMS aiding, during GNSS outages) < 18 m horizontal [CEP50] / 10 m vertical [PE50] without GNSS and each 10 minutes ZUPT (given accuracy for up to 10 ZUPTs or 20 km distance)
Altitude Accuracy (all versions):	< 5 m [PE50] under sufficient GNSS constellation and visibility, S/A off < 0.04…0.1 % distance travelled [PE50] (with odometer/VMS aiding during GNSS outages)
Alignment Methods:	Static and Dynamic Alignment, Stored Heading/ Stored Position Alignment
Aiding Methods:	GNSS and/or VMS and/or ZUPT and/or waypoint aiding
Data storage:	up to 128 GByte on internal non-volatile memory; processed data and sensor raw data
Software:	iXCOM communication protocol; iXCOM-CMD HMI software under MS Windows and Linux available; integrated real-time Kalman filter (42+ states)
Inertial Sensor Ranges:	± 395 °/s and ± 20 g (option: ± 40 g); GNSS altitude unlimited
Data Output Rate:	1…400 Hz; internal data rate 3'200 Hz
GNSS Receiver (integrated):	up to all-frequencies / all constellations GPS+GLONASS+GALILEO+BEIDOU, RTK/PPP, L-Band; option: independent heading determination with GNSS dual-antenna support, providing 4 mil / L [m] with L = antenna baseline (according to SIL demands)[3]
GNSS external receiver support:	Rockwell-Collins ERGR™ with SAASM / PPS (Precision Positioning Service) capability, other on request
Output Interfaces (options):	RS232/422 UART, Ethernet TCP/IP / UDP, PPT (Pulse Per Time), PPS, CAN, ARINC429, ARINC825, CANaero, NMEA 0183, USB; PTP / NTP Time Server
Input Interfaces (options):	internal/external GNSS (standard: integrated GNSS engine), marker event, PPS, trigger, odometer (opto-coupler input up to 32 V, RS422 level compliant)
Qualification:	MIL-STD-810G, MIL-STD-461G, MIL-STD-704F, DO160G
Temperature (case); rel humid.:	-40...+65 °C operating, -55...+85 °C storage; 8...100 %, IP67
Shock, Vibration, Altitude:	iPRENA-II/III/IV: 6 g, 20 ms (operating); 5…2'000 Hz, 6.3 g rms (operating); 60'000 ft iPRENA-**M**-II/III/IV: Gunfire shock resistant (MIL-STD-810G)
MTBF / MTTR:	> 25,000 hrs (estimated for surveying applications) / < 30 minutes
Power Supply & Consumption:	10...35 V DC, < 28 W (incl. internal GNSS receiver); 50 ms hold up time according to DO160G
Weight / Size:	iPRENA-II/III/IV: approx. 6.9 kg / approx. 187 x 128 x 296 mm³ (without connectors) iPRENA-M-II/III/IV: approx. 16 kg / 383 x 276 x 221 mm³ (LxWxH; without connectors)
Connectors:	MIL-C-38999 Series III TNC (opt. Series I, if compatibility to MAPS/DRU cabling required)
Export license:	Standard Dual-Use equipment, not covered by ITAR (COTS design)

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.

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[1] with sufficient GNSS aiding and sufficient dynamics
[2] can be improved if sufficient GNSS aiding and motion is available before switching to free inertial mode
[3] under sufficient GNSS conditions