

# iPRENA-V

## Precision Inertial/GNSS/VMS based Navigation System

iPRENA-V is part of an INS product family for inertial navigation, gyro compassing, surveying and dynamic motion measurement with ring laser gyros (RLG), that covers applications, which require highest accuracy, reliability and easy usage.

- High performance inertial navigation and surveying system for defence, airborne, naval, underwater, surface and railway applications
- True North Reference, gyro compassing
- Azimuth, elevation, position and more
- Various Interfaces: UART RS422, CAN, Ethernet TCP/IP & UDP; options: ARINC429, ARINC825, HDLC or customized
- Integrated L1/L2 GNSS, SAASM capability as option
- High bandwidth, fast response, low latency
- Option: integrated time sync. and 2 cm accurate GPS/GLONASS/GALILEO / RTK
- RLG technology with very low gyro drift and long time performance
- No ITAR, dual-use

iPRENA-V consists of three high precision ring laser gyroscopes, three servo accelerometers, a powerful strapdown processor and an universal interface.

The system contains an internal RTK capable GNSS receiver and can also be operated with external GNSS receivers. Available output interfaces are Ethernet (TCP/IP, UDP), RS232/422 UART, CAN, ARINC429, ARINC825, CANaero, HDLC as well as internal data storage on solid-state non-volatile memory (“black-box”). Application specific interfaces can be provided on request.

Data processing (strapdown algorithms, global or local navigation, gyro compassing, AHRS support, INS/GNSS/VMS data fusion with supported periodical ZUPT and way-

point aiding etc.) is performed inside of the iPRENA-V.

The iPRENA supports “plug & play” operation incl. automatic estimation of the wheel sensors scale factor and misalignment. It operates a tightly or loosely coupled INS/GNSS/VMS based data fusion, using



iMAR’s highly sophisticated 42+ state extended Kalman filtering. The user software iXCOM-CMD incl. moving map (under Linux and MS Windows) supports operation, visualization and maintenance (also remote via network).

A data rate of up to 300 Hz, a unique resolution (0.001 degree in roll/pitch/yaw) as well as the outstanding accuracy are further unique selling points of iPRENA-V.

iPRENA-V is export controlled and covered by ITAR control.

The system is available in three classes of performance:

- MP Medium Precision
- HP High Precision
- UP Ultra Precision

Due to the modular system architecture, the iPRENA-V can be delivered with customized data interfaces, e.g. to operate as fit & function replacement for e.g. obsolete navigation systems of other providers.



## Technical Data of iPRENA-V-MP/-HP/-UP (rms values)

Performance:	True Heading:	MP: < 0.50° (0.028°) sec(lat) free inertial; 0.008° with GNSS HP: < 0.35° (0.020°) sec(lat) free inertial; 0.008° with GNSS UP: < 0.26° (0.015°) sec(lat) free inertial; 0.008° with GNSS
	Attitude Accuracy:	MP: < 0.35° (0.020°) free inertial RMS (< 0.005° with GNSS) HP: < 0.26° (0.015°) free inertial RMS (< 0.005° with GNSS) UP: < 0.18° (0.010°) free inertial RMS (< 0.005° with GNSS)
	Position accuracy:	< 2 m [CEP] (under sufficient GNSS visibility, S/A off) < 0.1 m [CEP] RTK-GNSS (option) < 0.1 % DT [CEP] during GNSS outages, with VMS < 0.2 nm/hr (-UP), < 0.5 nm/hr (-HP), < 0.8 nm/hr (-MP) free inertial <sup>1</sup>
	Velocity accuracy:	< 1 cm/s (GNSS aided); < 1 m/s free inertial <sup>1</sup>
	Altitude:	< 5 m [rms] (under sufficient GNSS conditions, with VMS) < 0.1 % DT [rms] during GNSS outages, with VMS
Heading Drift (unaided): < 0.06 °/hr (0.003 °/hr) [bounded by gyro compassing]		

ARW / Q and bias:			Land Vehicle Alignment Duration:							
			0.25°	0.1°	0.05°	0.025°	0.015°			
iiPRENA-V-UP:	< 0.0011 °/√h	0.002 °/hr	< 8 µg/√Hz	25 µg	2 min	2 min	3 min	6 min	22 min	@ lat 0°
iPRENA-V-HP:	< 0.0015 °/√h	0.003 °/hr	< 10 µg/√Hz	25 µg	2 min	2 min	4 min	12 min		@ lat 0°
iPRENA-V-MP:	< 0.0020 °/√h	0.003 °/hr	< 12 µg/√Hz	50 µg	2 min	3 min	7 min	120 min		@ lat 50°
all devices:					2 min	4 min	10 min			@ lat 50°
					1 min	<2 min	< 3 min	<4 min		under motion+GNSS <sup>2</sup>

Sensor Range:	Angular Rate: ± 400 °/s (no angle limitation)   Acceleration: ±20 g
Angular Resolution:	1.13 arcsec (< 0.000°31 °)
Output Interfaces:	RS232/422 UART, Ethernet TCP/IP / UDP, CAN, ARINC429, ARINC825, PPS / SYNC (RS422 level); MIL-STD-1553B and HDLC/SDLC optional; NTP/PTP on Ethernet as option
Data Output Rate:	1...300 Hz, internal data rate 1'800 Hz, bandwidth 300 Hz
Input Interfaces:	external GNSS receiver (option, e.g. ERGR); event marker / GPIO (opto-coupler), SYNC, VMS / odometer / wheel sensor (A/B, opto-coupler input up to 32 V, also operable with RS422 level)
GNSS Receiver:	internal GNSS receiver (L1 or L1L2, GPS / GLONASS / Beidou, SBAS; SAASM etc.); dual-antenna setup as option
Connectors:	MIL-C-38999 Series III, TNC for GNSS antenna; earthing screw
Temperature, humid.:	-46 to +71°C operating (case), -55 to +85°C not operating; 8...100% rel. Humidity; IP67
Magnetic insensitivity:	< 500 µTesla (5 Gauss)
MTBF / MTTR:	> 25,000 hrs (estimated for surveying applications) / < 30 minutes
Shock, Vibration:	20 g, 11 ms operational; 40 g, 6 ms (endurance); 20...2'000 Hz, 6.3 g rms
Qualification:	MIL-STD-810G, MIL-STD-461G, MIL-STD-704F, partially DO160G
Power:	10...34 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 mm <sup>3</sup> (WxHxL; without connectors)
Software:	iXCOM & NMEA183 commun. protocol, iXCOM-CMD GUI; iXCOM-CMD supports easy system configuration and moving map (Linux and Windows)
Data storage:	up to 32 GByte on internal non-volatile memory on board (as data logger, "black-box")
Alignment Methods:	Static Alignment, Dynamic Alignment, Stored & Forced Heading/Position Alignment
Aiding Methods:	GNSS aided, VMS aided, ZUPT aided, Waypoint aided

iMAR uses latest and high reliable ring laser gyro technology inside the iPRENA-V advanced inertial navigation and guidance systems for industrial and defence applications.

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<sup>1</sup> Can be improved if sufficient GNSS aiding and motion is available before switching to free inertial mode

<sup>2</sup> with sufficient GNSS observations and sufficient trajectory (i.e. with several significant heading changes under motion)

