iMAR
NAVIGATION & CONTROL

iATTHEMO-TRIDENT-II

MEMS
FOG
HRG
RLG

Highly reliable INS/GNSS/+ solution for most demanding NAVAL applications

iATTHEMO-TRIDENT is a member of iMAR's iNAT series and one of the smallest yet powerful RLG based INS/GNSS inertial navigation, measurement, surveying and control systems, used for naval & maritime applications. It provides real time kinematic measurements, such as acceleration, angular rate, attitude, true heading, velocity and position with a data update rate of up to 400 Hz. **iATTHEMO-TRIDENT** comes with advanced integrated sensor and data fusion technology.

SWaP
+71° -40° °C
IP 67
ITAR FREE

APPLICATIONS

NAVAL manned & unmanned
Cruiser & Submarine
Surveying & Monitoring
Localization & Navigation

KEY FEATURES

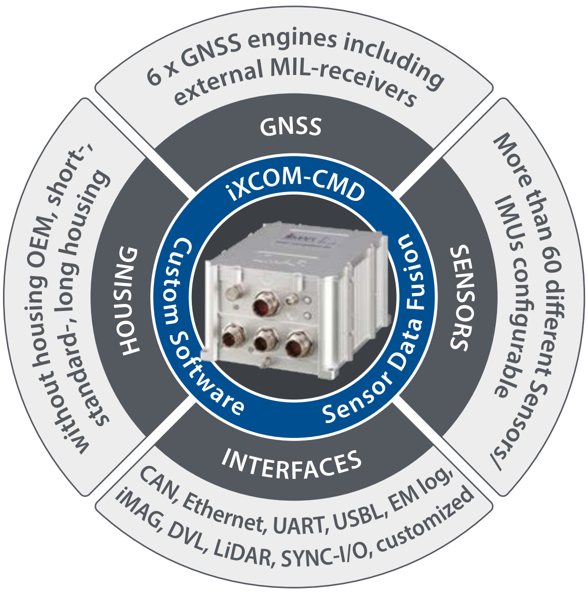
MIL-STD-810H and -1275D qualified
Internal Data Logging (128 GByte)
Single & Dual Antenna GNSS support
Maintenance-free realtime clock

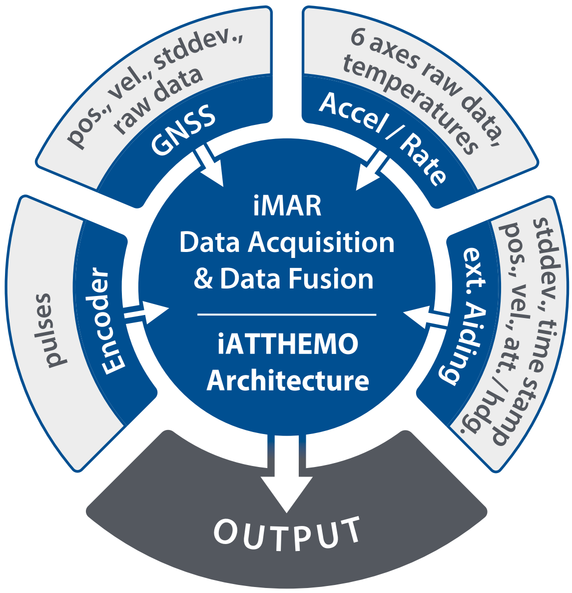
PERFORMANCE

Data Rate	up to 400 Hz
Heading	< 0.3 mil sec lat
Attitude	< 0.01 °
Position	< 0.01 m

iATTHEMO - Family

ONE ARCHITECTURE FOR ALL TECHNOLOGIES





MADE FOR YOUR APPLICATION

iATTHEMO architecture allows application specific software configurations in order to achieve best performance even in most demanding environments.

INTERFACES & PROTOCOLS

NMEA, RTCM 104, TCP/IP, UDP, EtherCat, NTRIP, NTP Time Server, CAN,Ethernet, UART RS422/RS232, GP-I/O, PPS, PPT, USB; iXCOM communication protocol for all processed and raw data.

QUALIFICATION

iATTHEMO is qualified according to MIL-STD-810H, MIL-STD-461G, MIL-STD-704F and partially DO160G,CE, partially EN 50121.

EXTENSIVE AIDING CAPABILITIES

iATTHEMO-TRIDENT is designed to operate with external sensors like, LiDAR, odometer etc. Full performance also achieved w/o any external aiding sources / GNSS.

DATA FUSION

The integrated advanced 42+ state extended Kalman filter allows advanced and predictable data fusion of multiple data sources, e.g. INS, GNSS and additional sensors.

MODULARITY

The modular nature of iATTHEMO-Family allows iMAR to configure the systems with a wide range of best in class inertial sensors and GNSS receivers, expandable at any time and best fitted to customer's needs.

iATTHEMO-TRIDENT-II

TECHNICAL DATA

NAVIGATION PERFORMANCE

Position & Velocity Accuracy (CEP50 / PE50)

Position (GNSS RTK post-proc.) **)	± 0.01 m
Position (GNSS RTK) **)	± 0.05 m
Position (GNSS with / w/o SBAS)	± 0.6 m / 0.5 - 2 m
Position (GNSS denied w/o odometer)*) ***)	0.02... 0.12 % DT or 10 m
Position, VMS aided, w/o GNSS *) ***)	0.01...0.13 % DT
Altitude, w/o VMS, w/o GNSS *) ***)	0.1 % DT or 10 m
Velocity (RTK)	0.01 m/s

Angles (rms)

Range (Heading/Yaw, Roll, Pitch)	unlimited
True Heading (free inertial)	1.5 mil secLat
Heading/Yaw (after 600 s GNSS denied)	1.5 mil secLat
Roll/Pitch	0.35 mil
Roll/Pitch (ISA, initial, w/o any aiding)	0.18 mil
Dual-Antenna initial Heading, with 1 m baseline	4 mil
with 2 m baseline	2 mil
Alignment duration	3 mil secLat @ 4 min.
	1.5 mil secLat @ 7 min.

MECHANICAL

Size (W x H x D)	approx. 187 x 128 x 296 mm
Weight	approx. 6.9 kg
Connectors	MIL-C-38999 Series III (Data, Power)
	TNC (Antenna)

GNSS

Constellations	GPS, GAL, GLO, BDS, IRNSS
Frequencies	up to all frequencies
Features	SBAS, RTK, PPP, Basestation, etc.
High speed version (> 515 m/s)	on request
Other external engines	several setups available

ELECTRICAL

Operating voltage	9/16 (MIL-STD-1275D) ... 34 V DC
Power consumption	approx. 17 W
Power inputs	2 x insulated

IMU SPECIFICATION

	ACCELEROMETERS	GYROSCOPES
Range	40 g	± 400 °/s
Resolution	< 2 µg	< 0.000'000'33 °/s
Bias instability (AV)	< 12 µg	< 0.001 °/h
Initial Bias	< 100 µg	< 0.01 °/h
Noise (AV)	12 µg/√Hz	< 0.005 °/√h
Non-orthonality	< 50 µrad	< 30 µrad
Scale factor error	< 100 ppm	< 15 ppm
Non-linearity	< 30 µg/g^2	< 10 ppm
Bandwidth	250 Hz	250 Hz

DATA OUTPUT, DATA INPUT

Data Output

Data Rate	up to 400 Hz
Latency / Jitter / Time stamp	< 7 ms / < 1 ms / < 1 µs

Input / Output Interfaces

PPS, PPT, GP Trigger/Sync I/O, 3 x encoder / VMS input (wide range opto-coupler; RS422 level compatible)

Communication Interfaces and Protocols (excerpt)

Ethernet (TCP/IP, UDP), 4 x UART (RS232/422), 2 x CAN, USB, NMEA183, ARINC 825, NTRIP caster with RTCM 104, NTP, PTP, iXCOM, ROS-2, Python, SDK C++, MQTT

ENVIRONMENTAL

Temperature (operational / storage)	-40 . . +71 °C / -55 . . +85 °C
Shock (operational)	20 g, 11 ms (half-sine)
Shock (endurance)	50 g, 11 ms (half-sine)
Vibration (operational)	10 ... 2'000 Hz, 6.3 g RMS
Maximum altitude (operational)	60'000 ft
Environmental protection	IP67
Magnetic sensitivity	typ 0.000'3 °/h/Gauss
MTBF	> 50'000 h (inertial core > 120'000 h)

)** for road and rail applications *)** after sufficient availibility of GNSS aiding and motion dynamics *****)** without VMS/odometer, during 1 hr GNSS denied environment (can be improved by sufficient GNSS aiding and motion dynamics before GNSS denied scenario)

*Each individual **iATTHEMO-TRIDENT** undergoes a calibration and verification testing process at iMAR's calibration laboratory. Performance specifications are based on comprehensive field testing and results from real-world applications, and are regularly tested to ensure continued conformance to such specifications.*

iATTHEMO - Family

SYSTEM FEATURES AND SENSOR PERFORMANCES

iATTHEMO-TRIDENT	PERFORMANCE		HDG	GYROSCOPES				ACCELEROMETERS			COST
	Accuracy	[g] Vibration immunity	[mil secLat] Heading	[°/s] Range	[°/√h] ARW (AV)	AV [°/h] Bias instability	ppm Scale factor error	[g] Range	µg Bias day-to-day	[µg/√Hz] VRW	
-II	★★★★★	★★★★★	< 0.3	± 400	0.0016	< 0.001	< 15	40 1)	50	< 12	€€€€€
-IIIA	★★★★⯪	★★★★★	< 0.6	± 400	0.0025	< 0.001	< 15	40 1)	75	< 12	€€€€€
-III	★★★★☆	★★★★★	< 1	± 400	0.0028	< 0.001	< 15	40 1)	75	< 12	€€€€€
-IV	★★★⯪☆	★★★★★	< 1.5	± 400	0.0050	< 0.001	< 15	40 1)	100	< 12	€€€€€
-R0											
-R1											
-R2											
Custom	Option: integration of other inertial and GNSS sensors										

Table Notes: all values1σ, except ranges   1) other ranges available

iATTHEMO-TRIDENT-II /-IIIA /-III /-IV

iATTHEMO-TRIDENT-R0 /-R1 /-R2

MIL-STD 810H/461G/704F   SWaP   OEM   ITAR FREE

General information about iMAR's INS/GNSS solutions for all applications

iATTHEMO-Family

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