Isnav

NAVIGATOR AND TIME SERVER

ISNAV NAVIGATION SYSTEM

Modular Land Vehicle Military Navigation System for Resilient Position, Speed and Time Distribution

The **Isnav** vehicular navigation system is the **advanced navigation and time reference solution of GMV** for military vehicles. **Isnav** incorporates **multiconstellation** (GPS, Galileo and GLONASS) and **multifrequency** satellite navigation technology for accurate positioning. The system integrates use of **SBAS services and integrity monitoring** algorithms in order to provide a reliable GNSS solution. **Isnav** is **ready to operate with two internal GNSS receivers** that can be processed separately or in a mixed fusion solution. One of the internal GNSS slots of **Isnav** is **ready to operate with GPS M-Code receivers** for providing a robust military solution. **Isnav** is also **ready to include the PRESENCE 2 Public Regulated Service Galileo receiver.**

For a resilient navigation solution in contested environments **Isnav can incorporate various inertial data sources.** It offers compatibility with external high grade Inertial Navigation Systems (INS) for a robust navigation in covered areas or operation theatres under satellite navigation denial (strong jamming). Additionally, **Isnav can integrate a small industrial grade IMU** sensor inside its enclosure in order to maintain the functionalities in case the external INS is not used. This functionalities provided by the internal IMU include **attitude calculation and enhanced spoofing detection even if only Open Service GNSS is used. Isnav** can also integrate a high-grade internal IMU in order to provide a robust navigation solution up to navigation grade without the use of external INS.

Isnav also provides the **time source for the vehicle network**. **Isnav** implements an **NTP** time server for the synchronization of the vehicle systems and provides a **1PPS** output paired with NMEA messages, for those equipment requiring a higher timing accuracy. Additionally it also offers a **raw GNSS signal output** for aided initialization of the vehicle internal systems.

The **modular design** of **Isnav** allows the adaptation to diverse external inertial units and sensors as well as different receivers to best meet the customer needs.

FEATURES

- Multiconstellation and multifrecuency GNSS solution.

- Dual GNSS receiver slot with capacity to integrate Open Service and Military GPS receivers.

- Compatible with Galileo PRS receiver.

- Spoofing detection and anti-spoofing algorithms.

- Capability for integration of internal IMU for fully integrated attitude calculation and enhanced spoofing detection.

- Capability to optionally integrate a high-grade internal IMU for navigation grade PVT and attitude solution.

- NTP time distribution server and high accuracy PPS output.

- Dual redundant Ethernet output.

- RF output for external GNSS signal distribution.

- CAN input for vehicle odometer data.

- Compatible with external INS.

- Fast and easy configuration and monitoring over SNMP.

gmv
INNOVATING SOLUTIONS

DATA SPECIFICATIONS

The *Isnav* systems provide a full navigation solution and a complete monitoring capability of all the internal elements and crosschecking of the sensor data. The data is provided through the Mission system interface and internally recorded up to the last 72 hours of operation, for mission post processing. These data logs can be downloaded directly from the maintenance interface. The data interface provided by *Isnav* is compatible for every configuration, so the customer can freely exchange *Isnav* units with different configurations or add external INS or upgrade the *Isnav* configuration without the need of undergoing a new system integration.

Output Data	**Position:** 3D referred to WGS84 or UTM. **Speed:** Horizontal, drift angle and vertical. **Attitude[1]:** Pitch, roll and yaw. **Inertial data:** 3D rotation and acceleration. **Alerts:** GNSS denial, internal system monitoring, spoofing[1], sensor data mismatch[2]. **Navigation output data rate:** Up to 10 Hz.
Mission Configuration	**BITE:** Internal system and sensor monitoring for data coherence and failure detection. **Integrity:** GNSS FDE and outlier detection by comparison with inertial data (if available) for spoofing detection. **Constellation use:** User selectable set of GNSS constellations and use of OS or encrypted signals only. **Manual mode:** Manual fix available for operator position correction.

GNSS SPECIFICATIONS

OS-GNSS Characteristics	**Channels:** 448. **GPS Signals:** L1/L2/L5. Galileo Signals: E1/E5a/E5b. GLONASS Signals: L1/L2/L3. **SBAS:** EGNOS/WAAS per DO-229. **Time to first fix:** 45 s. **Integrity:** FDE and satellite crosscheck if other sensors are available
Default Receiver Accuracy	**Horizontal position accuracy** [3] : • Standalone: 2 m (1-α). • SBAS: 1 m (1-α). **Vertical position accuracy** [3] : • Standalone: 2.5 m (1-α). • SBAS: 1.5 m (1-α). **Speed accuracy[2]: 5 cm/s.**

The above listed characteristics are for the GNSS precision are for the default GNSS receiver mounted along all possible configurations of Isnav. If a secondary GNSS receiver is used or a military internal or external receiver is selected, these figures might change accordingly to the characteristics of the customer selected receiver.

SPOOFING SPECIFICATIONS

The *Isnav* systems provide spoofing detection algorithms and anti-spoofing protection algorithms to assure a reliable source of GNSS position and timing even in an electronic warfare environment for military vehicles. There will be enhanced spoofing capabilities if raw inertial and odometer data is provided:

Spoofing protection	Three-layered defense against synchronous, asynchronous and meaconing spoofing attacks: 1. Signal processing level: Power, C/N0 and signal monitoring at the receiver. 2. Measurement processing level: Receiver observables and navigation messages monitoring. 3. PNT processing level: cross-checking with vehicle dynamics and odometer (if available). Statistical monitoring of hybridization solution if IMU data is available. Capability to manually disable constellations or even fully disable GNSS.

TIMING SPECIFICATIONS

The *Isnav* systems provide two timing interfaces: an NTPv4 stratum 1 network timing interface and a 1PPS discrete signal synchronized to GPS time (or Galileo when operating exclusively with Galileo PRS signal). The stability of the discrete timing PPS signal is as follows, depending on the selected clock option:

Time Characteristics with GNSS	**PPS accuracy:** < 20 ns.
Denied GNSS Time Propagation	**Stability (standard time Isnav):**~1 ppm " . **Stability (robust time Isnav):**~5 ppb.

INTERFACES

Mission System Ports

- 2 x Ethernet 10/100 I/O (redundant failover configuration).
- 1 x CAN (J1939) input.
- 1 x RF GNSS input for GNSS antenna.
- 2 x RF GNSS output (GNSS raw signal distribution).
- 1 x RS-422 NMEA serial port output.
- 1 x 1PPS output.
- 3 x State indication discrete outputs.
- 2 x Configurable discrete outputs.
- 3 x Configurable discrete inputs.

Mission System Data Protocols

INM protocol: Network distributed advanced data and command interface[5] .
NMEA: Alternative navigation data source over network and serial interface according to NMEA 0183 (v. 4.1).
J1939: CAN odometer data integration using J1939 standard protocol.
NTPv4: Network time distribution server.
SNMPv3: Configuration and management of the system by means of a SNMP parameter tree.

[1] Enhanced spoofing detection if given access to odometer and internal or external inertial sensor is present.
[2] Only for configurations with internal or external inertial sensors.
[3] Conditions with all active constellations in clear open sky with no interferences.
[4] Approximate value, time propagation stability highly dependent on operation conditions, temperature and temperature variations.
[5] Interoperable with the Spanish VCR 8x8 mission system.

MECHANICAL ENCLOSURE

Isnav is supplied in a single mechanical enclosure painted to the customer specification. The mechanics main characteristics are:

- Dimensions (without connectors):
  - ISNAV: 121 x 177 x 258 mm
  - ISNAV-Mini: 121 x 177 x 166 mm
- Standard MIL-DTL-38999 connectors.
- MIL-STD-1472G ergonomic requirements compliant.
- Liquid protection as per STANAG 4360.
- Anti-corrosion per MIL- STD-889.
- Earthing thread at back panel.

POWER SUPPLY

Power Input Characteristics

Input voltage: 28 V DC.
Qualification: MIL-STD-1275E.
Nominal power consumption: < 12 W (without external INS, without internal high grade IMU and without external PRS receiver).
Maximum power capability: 60 W (maximum power capacity to drive internal IMUs, external INS, internal dual receivers and external PRS receiver).

Power Output for External Systems

INS: 28 V DC (filtered and stabilized).
External PRS receiver: 12 V DC (filtered and stabilized).
GNSS antenna: 5 V DC (filtered and stabilized).

SYSTEM QUALIFICATION

Environmental

Low pressure: MIL-STD-810G Ch1 (M. 500 P. I for transport and P. II for Operation).
Operation temperature: MIL-STD-810G Ch1 (M. 501.6 and 502.6 P. II for areas C1 and A1 of AECTP-200-4).
Humidity: MIL-STD-810G Ch1 (M. 501 and 502 P. I for C1, A1, M1 and M3 of AECTP-200-4).
Fluids: MIL-STD-810G (M. 504 P. I).
Fungus: MIL-STD-810G.
Salt fog: ISO9227:2012 (240h).
Vibration: MIL-STD-810G Ch1 (M. 514 Ground Vehicle).
Shock: MIL-STD-810G Ch1 (M. 516 P. I and P. V Crash Hazard Shock Test).
Rain: MIL-STD-810G Ch1 (M. 506 P. III).
Environment impact: REACH and RoHS.

EME/Electrical

Conducted emissions: MIL-STD-461F CE-102.
Conducted susceptibility: MIL-STD-461F CS-101; MIL-STD-461G CS-114, CS-115, CS-116.
Radiated emissions: MIL-STD-461G RE-102.
Radiated susceptibility: MIL-STD-461G RS-103.
Bonding: MIL-STD-464C S.5.11.
Grounding: MIL-STD-464C S.5.12.
ESD: EN/IEC 61000-4-2 (± 8kV contact and ± 15 kV air).
Lightning: AECTP-250 ED CV.1

VEHICLE INTEGRATION DIAGRAM
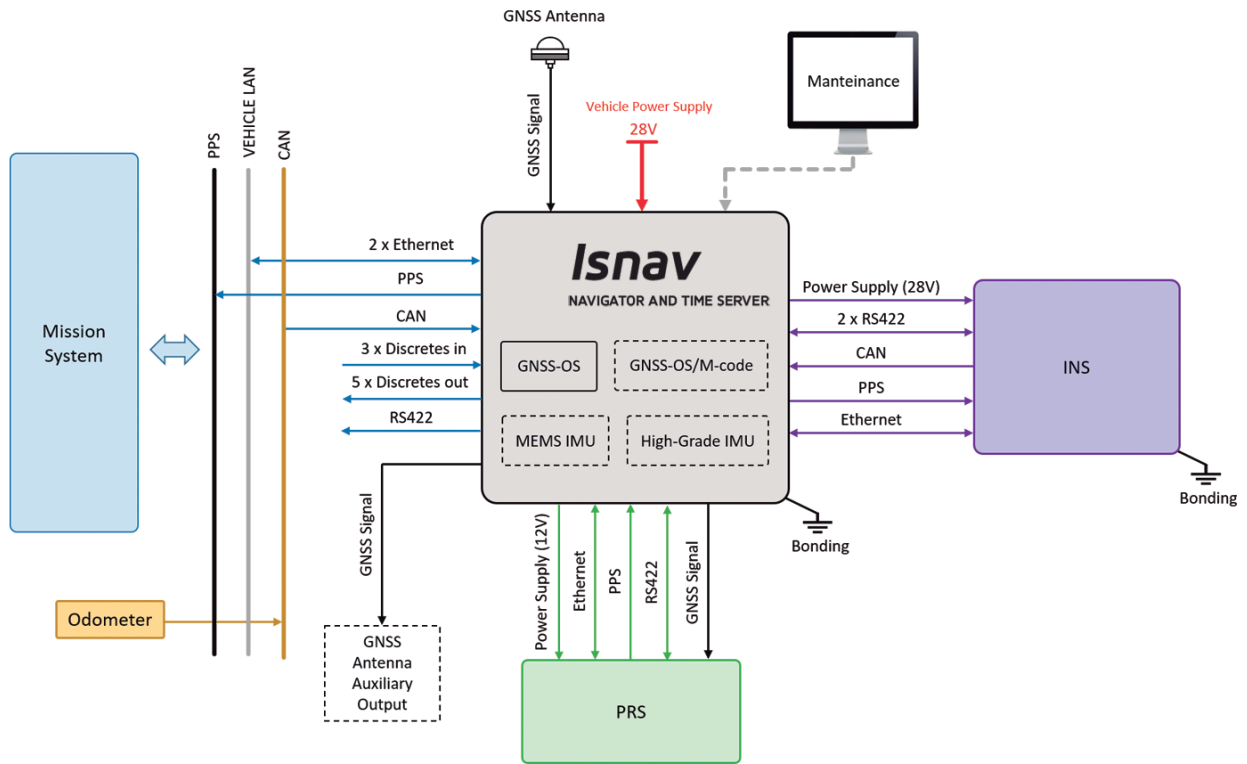
ISNAV PRODUCT FAMILY

Isnav	Isnav mini
P/N GU2100081	**P/N GU2100138**

Each one of the above Isnav Family Part Numbers include a series of configuration parameters which allow to customize the product. These parameters include the usage of internal or external IMU, M-Code GPS, Isnav color, etc....