VN-210 GNSS/INS

Tactical-Grade GNSS-Aided Inertial Navigation System

Highlights

0.05°-0.1°
Dynamic Heading Accuracy (INS)

< 1°/hr
Gyro In-Run Bias Stability

Multi-band GNSS
Integrated L1/L2/E1/E5b GNSS Receiver

MIL-STD VN-210
MIL-STD-810; MIL-STD-461G; DO-160G; IP 68

0.015°
Dynamic Pitch/Roll Accuracy (INS)

External GNSS
Support for external RTK/PPK & SAASM/M-Code GPS

RTK/PPK Capable
External RTCM 3 Inputs; Exportable RINEX

Low SWaP VN-210E
31 x 31 x 12 mm; 14 grams; < 1.5 W

Product Overview

The VN-210 is a tactical-grade, high performance GNSS-Aided Inertial Navigation System (GNSS/INS) that combines 3-axis gyros, accelerometers and magnetometers, a Multi-band L1/L2/E1/E5b GNSS receiver, and advanced Kalman filtering algorithms to provide optimal estimates of position, velocity, and attitude. The VN-210 utilizes VectorNav's proprietary onboard Extended Kalman Filter (EKF) to optimally combine high bandwidth inertial sensor measurements with high-accuracy, low bandwidth GNSS measurements to provide high-accuracy, low latency position, velocity, and attitude measurements.

The VN-210 is available in two packaging options: a precision milled, anodized aluminum enclosure (VN-210) and a miniature, board-mount option (VN-210E). With dual I/O connectors the VN-210 offers maximum flexibility for interfacing with external GNSS receivers and IMUs. For SWaP-C constrained applications, the ultra compact VN-210E option delivers unprecedented size and weight advantages while still delivering tactical-grade inertial navigation performance.

VN-210

VN-210E

Features

Industry-Leading INS
The VN-210 features VectorNav's proprietary Extended Kalman Filter INS algorithm, which is proven to excel under the most challenging dynamic conditions.

Robust Positioning
With support for RTK, PPK & SAASM/M-Code GPS, the VN-210 can be configured to meet the positioning requirements of a wide variety of applications.

True Inertial Navigation System
No mounting orientation restrictions or configuration modes; Automatic filter initialization and dynamic alignment.

Software Compatibility
The VN-210 and VN-210E share a common communication protocol with the entire VectorNav product line.

Ease of Availibility
ITAR-free and Made in the USA; short lead times.

User Configurable Messages
ASCII and VectorNav Binary messages.

VECTORNAV

Each individual VN-210 and VN-210E undergoes a robust calibration and acceptance testing process at VectorNav's AS9100 certified manufacturing facility. 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.

Sensor Summary

- VectorNav proprietary Extended Kalman Filter INS delivers coupled position, velocity, and a continuous attitude solution over the complete 360° range of operation
- Hard/Soft Iron Compensation (Real-time and Manual 2D & 3D)
- Individually calibrated for bias, scale factor, misalignment, and temperature over full operating range (-40°C to +85 °C)
- RTK Capable: Support for External RTCM 3 Inputs
- Raw GNSS Data: Exportable RINEX Data for PPK; Raw Pseudorange, Doppler and Carrier Phase outputs
- Support for external RTK GNSS receivers (NovAtel, Septentrio) & SAASM/ M-Code GPS receivers (ICD-GPS-153)
- Coning and sculling integrals (ΔV's, Δθ's)
- Data output format: ASCII (VectorNav), NMEA-0183, Binary (VectorNav), ARINC 429[1]
- VN-210:
  - IP 68 per IEC 60529
  - Temperature (DO-160G)
  - Electrical (MIL-STD-1275E)
  - Vibration & Shock (MIL-STD-810G)
  - EMI & Radiation (MIL-STD-461G)
- VN-210E: 24-pin 1mm pitch board-to-board interface connector with U.FL for GNSS antenna connection

Performance Specifications

ATTITUDE

Range (Heading/Yaw, Roll)	± 180°
Range (Pitch)	± 90°
Heading (Magnetic)[2]	2.0° RMS
Heading (INS)[3,4]	0.05° to 0.1°, 1σ
Pitch/Roll (Static)	0.05° RMS
Pitch/Roll (INS)[4]	0.015°, 1σ
Heading Mounting Misalignment (VN-210)[5]	< 0.05°, 1σ
Heading Mounting Misalignment (VN-210E)[5]	0.15°, 1σ
Pitch/Roll Mounting Misalignment[5]	< 0.05°, 1σ
Angular Resolution	0.001°

POSITION/VELOCITY

Horizontal Position Accuracy[6]	1.0 m RMS
Vertical Position Accuracy[6]	1.5 m RMS
RTK Position Accuracy[7]	0.01 m + 1 ppm CEP
Free Inertial Position Drift[8]	0.5 cm/s²
Velocity Accuracy	< 0.02 m/s

IMU Specifications

	ACCELEROMETER	GYROSCOPE	MAGNETOMETER
Range[9]	±15 g	±490°/s	±2.5 Gauss
In-Run Bias Stability (Allan Variance)	< 10 µg	< 1°/hr (0.4-0.7°/hr typ.)	-
Noise Density	< 0.04 mg/√Hz	5 °/hr /√Hz	140 µGauss/√Hz
Bandwidth	240 Hz	240 Hz	200 Hz
Cross-Axis Sensitivity	±0.05 °	< 0.05 °	±0.05 °

GNSS Receivers

Receiver Type	184 Channel, L1C/A, L1OF, E1, B1I, L2C, L2OF, E5b, B2I GNSS
Constellations[10]	GPS, GLONASS, Galileo, BeiDou, QZSS, SBAS
Time-To-First-Fix (Cold / Hot)	24 s / 2s
Altitude Limit	50,000 m
Velocity Limit	500 m/s

Environmental

Operating Temperature	-40° to +85° C
Storage Temperature	-40° to +85° C
MTBF (VN-210)	> 25,000 hours
MTBF (VN-210E)	> 45,000 hours

Interfacing

Output Data Rate (IMU)[11]	up to 800 Hz
Output Data Rate (Position, Velocity & Attitude)	up to 400 Hz
Primary Interface (VN-210)	RS-422 (Optional RS-232)
Auxiliary Interface (VN-210)	RS-422
Interface (VN-210E)	(2) Serial TTL
GNSS PPS	30 ns RMS, 60 ns 99%
Input	Sync-in
Output	Sync-out

Mechanical/Electrical

	SIZE	WEIGHT	INPUT VOLTAGE	CURRENT DRAW[12]	POWER[12]
VN-210	56 x 56 x 31 mm	155 g	12 to 34 V	110 mA @ 24 V	< 2.7 W
VN-210E	31 x 31 x 12 mm	14 g	3.2 to 3.5 V	420 mA @ 3.3 V	< 1.5 W

1. Contact VectorNav for ARINC 429 option.
2. With proper magnetic declination, suitable magnetic environment and valid hard/soft iron calibration.
3. Dependant on a number of factors, contact VectorNav to discuss expected performance in your application.
4. With sufficient motion for dynamic alignment.
5. Constant on a per part basis. Can be calibrated out during system integration using boresighting or other alignment processes.
6. Dependant on SBAS, clear view of GNSS satellites, good multipath environment, compatible GNSS antenna, and measurement duration period.
7. Dependant on atmospheric conditions, baseline length, GNSS antenna, multipath conditions, satellite visibility and geometry.
8. Typical rate of growth in error of position estimates after loss of GNSS signal, provided INS full alignment prior to loss.
9. Contact VectorNav for Extended Range Gyro Option.
10. Only GPS, Galileo and SBAS constellations used in VN-210 default configuration.
11. Contact VectorNav for higher IMU data output rates.
12. Not including active antenna power consumption.

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