

# VN-210-S GNSS/INS

## Tactical-Grade GNSS-Aided Inertial Navigation System

### Highlights

<b>0.05°-0.1°</b> Dynamic Heading Accuracy (INS)	<b>&lt; 1°/hr</b> Gyro In-Run Bias Stability	<b>Tri-band GNSS</b> Integrated L1/L2/L5/E1/E5a/b GNSS Receiver	<b>Designed to MIL-STD</b> MIL-STD-810; MIL-STD-461G; DO-160G; IP 68
<b>0.015°</b> Dynamic Pitch/Roll Accuracy (INS)	<b>±490°/s</b> Gyroscope Range ±2000°/s Optional	<b>RTK/PPK Capable</b> External RTCM 3 Inputs; Exportable RINEX	<b>Low SWaP</b> 56 x 56 x 31 mm; 170 grams; < 3.3 W

### Product Overview

The VN-210-S is a tactical-grade, high performance GNSS-Aided Inertial Navigation System (GNSS/INS) that combines 3-axis accelerometers, gyros, and magnetometers, a tri-band L1/L2/L5/E1/E5b GNSS receiver with anti-jamming/anti-spoofing technology, and advanced Kalman filtering algorithms to provide optimal estimates of position, velocity, and attitude. The VN-210-S uses VectorNav's proprietary onboard Extended Kalman Filter (EKF) to combine high-bandwidth inertial sensors and high-accuracy, low-bandwidth GNSS measurements, to deliver best-in-class low-latency performance.

The VN-210-S is available in a precision milled, anodized aluminum enclosure. In SWaP-constrained applications, VN-210E (Embedded) provides native support to integrate the GNSS receiver used in VN-210-S as an external module, offering identical performance and features at a fraction of the size.



**VN-210-S**

### Features

#### Industry-Leading INS

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

#### RTK and PPK Positioning

The VN-210-S integrated GNSS receiver supports RTK and PPK positioning to achieve centimeter-level position accuracy. Support for Moving Baseline RTK operations coming Q1 2024.

#### High Dynamic Operations

The VN-210-S is available in an "Extended Range Velocity" option, enabling operation beyond the specified Altitude (50,000 m) and Velocity (500 m/s) limits.

#### Robust Positioning

With industry leading interference mitigation capabilities and message authentication, the VN-210-S delivers improved GNSS performance and integrity across 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-S shares communication protocol with the entire VectorNav product line.

#### Ease of Availability

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

Each VN-210-S 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 gyro g-sensitivity over full operating temperature range (-40°C to +85°C)
- ▶ RTK Capable: Support for External RTCM v3 Inputs
- ▶ Raw GNSS Data: Exportable RINEX Data for PPK; Raw Pseudorange, Doppler and Carrier Phase outputs; Ephemeris Data (Coming Q1 2024)
- ▶ Coning and sculling integrals ( $\Delta V$ 's,  $\Delta \theta$ 's)
- ▶ Data output format: ASCII (VectorNav), NMEA-0183, Binary (VectorNav), ARINC 429<sup>1</sup>
- ▶ Designed to the following Environmental Standards:
  - Vibration & Shock (MIL-STD-810G)
  - Temperature (DO-160G)
  - EMI & Radiation (MIL-STD-461G)
  - Electrical (MIL-STD-1275E)
- ▶ IP 68 per IEC 60529

### Performance Specifications

**PRELIMINARY**

#### ATTITUDE

Range (Heading/Yaw, Roll).....	± 180°
Range (Pitch).....	± 90°
Heading (Magnetic) <sup>2</sup> .....	2.0° RMS
Heading (INS) <sup>3,4</sup> .....	0.05° to 0.1°, 1σ
Pitch/Roll (Static).....	0.05° RMS
Pitch/Roll (INS) <sup>4</sup> .....	0.015°, 1σ
Heading Mounting Misalignment <sup>5</sup> .....	< 0.05°, 1σ
Pitch/Roll Mounting Misalignment <sup>5</sup> .....	< 0.05°, 1σ
Angular Resolution.....	0.001°

#### POSITION/VELOCITY

Horizontal Position Accuracy <sup>6</sup> .....	0.6 m RMS
Vertical Position Accuracy <sup>6</sup> .....	0.8 m RMS
RTK Position Accuracy <sup>7</sup> .....	1 cm + 1 ppm CEP
Free Inertial Position Drift <sup>8</sup> .....	0.5 cm/s <sup>2</sup>
Velocity Accuracy.....	3 cm/s

### IMU Specifications

	ACCELEROMETER	GYROSCOPE	MAGNETOMETER
Range	±15 g	±490°/s (Optional ±2000°/s) <sup>9</sup>	±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.....	448 Channel
GPS.....	L1C/A, L1PY, L2C, L2P, L5
Galileo.....	E1, E5a, E5b, E5 AltBoc, E6
GLONASS.....	L1CA, L2CA, L2P, L3 CDMA
Beidou.....	B1I, B1C, B2a, B2b, B2I, B3
QZSS.....	L1C/A, L1 C/B, L2C, L5
Navic.....	L5
SBAS.....	Egnos, WAAS, GAGAN, MSAS, SDCM (L1, L5)
Time-To-First-Fix (Cold / Hot).....	< 45 s / < 20 s
Altitude Limit <sup>10</sup> .....	50,000 m
Velocity Limit <sup>10</sup> .....	500 m/s

### Interfacing

Output Data Rate (IMU) <sup>11</sup> .....	up to 800 Hz
Output Data Rate (Position, Velocity & Attitude).....	up to 400 Hz
Primary Interface.....	RS-422 (Optional RS-232)
Auxiliary Interface.....	RS-422
GNSS PPS.....	<10 ns RMS, 25 ns 99%
Input.....	Sync-in
Output.....	Sync-out

### Environmental

Operating Temperature.....	-40° to +85° C
Storage Temperature.....	-40° to +85° C

### Mechanical/Electrical

	SIZE	WEIGHT	INPUT VOLTAGE	CURRENT DRAW <sup>12</sup>	POWER <sup>12</sup>
VN-210-S	56 x 56 x 31 mm	170 g	12 to 34 V	135 mA @ 24 V	< 3.3 W

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