

VectorNav Introduces the Tactical Embedded

Delivering tactical-grade performance in an unprecedented footprint



Products

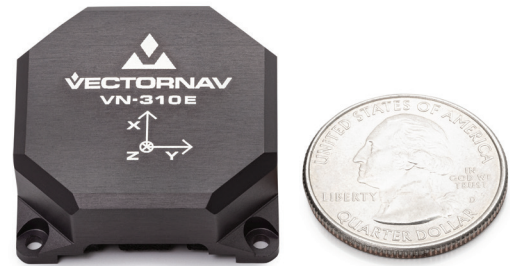
- **VN-110E** IMU/AHRS
- **VN-210E** GNSS-Aided INS
- **VN-310E** Dual GNSS-Aided INS

Availability

- Production units: **July 2020**

Overview

VectorNav introduces the Tactical Embedded, a miniature, board-mount version of the VectorNav Tactical Series line of IMU/AHRS, GNSS/INS and Dual GNSS-Aided INS products. Delivering tactical-grade IMU performance, $< 0.1^\circ$ attitude accuracy and a Multi-band GNSS receiver in an ultra compact package, the Tactical Embedded brings unprecedented capability to SWaP-C constrained applications.



Key Features

- 0.05-0.1° heading; $< 0.015^\circ$ pitch & roll
- $< 1^\circ/\text{hr}$ gyroscope in-run bias
- $< 10 \mu\text{g}$ accelerometer in-run bias
- $\pm 15 \text{ g}$ accelerometer range; $\pm 490^\circ/\text{s}$ gyroscope range
- 184 channel, L1/L2/E5b GNSS receivers
- External RTCM v3 inputs for RTK
- Exportable RINEX data for PPK
- Raw Psuedorange, Doppler and Carrier Phase Outputs
- High update rates (800 Hz IMU; 400 Hz Nav)
- Miniature footprint: ($< 15 \text{ grams}$; 31 x 31 x 11 mm)
- Low power: $< 480 \text{ mA @ } 3.3 \text{ V}$
- 24-pin 1mm pitch board-to-board interface connector
- Software compatible with VectorNav's full product line
- Manufactured in VectorNav's AS9100 certified facilities
- Made in the USA and ITAR-free

CAPABILITIES	VN-110E IMU/AHRS	VN-210E GNSS/INS	VN-310E Dual GNSS/INS
IMU Measurements	●	●	●
Magnetic Heading	●	●	●
Attitude Filter (AHRS)	●	●	●
INS Position, Velocity & Attitude	-	●	●
GPS-Compass Heading	-	-	●

Specifications

Each individual VN-110E, VN-210E and VN-310E sensor undergoes a robust calibration and acceptance testing process at VectorNav's AS9100 certified manufacturing facility. Performance specifications are based on regular and comprehensive field testing and results from real-world applications.

Attitude	VN-110E	VN-210E	VN-310E
Heading (Magnetic) ¹	2.0 ° RMS	2.0 ° RMS	2.0 ° RMS
Heading (INS) ^{2,3}	-	0.05-0.1°, 1σ	0.05-0.1°, 1σ
Heading (GNSS-Compass, 1 m Baseline)	-	-	0.3° RMS
Typical ⁴	-	-	0.15° RMS
Pitch & Roll (Static)	0.05 ° RMS	0.05 ° RMS	0.05 ° RMS
Pitch & Roll (INS) ³	-	0.015°, 1σ	0.015°, 1σ
Heading Mounting Misalignment ⁵	-	0.15°, 1σ	0.15°, 1σ
Pitch & Roll Mounting Misalignment ⁵	-	< 0.05°, 1σ	< 0.05°, 1σ
Angular Resolution	-	0.001°	0.001°

Position & Velocity (VN-210E & VN-310E)

Horizontal Position Accuracy	2.5 m RMS
Typical ⁴	1.0 m RMS
Vertical Position Accuracy	2.5 m RMS
Typical ⁴	1.5 m RMS
RTK Position Accuracy ⁶	0.01 m + 1 ppm CEP
Free Inertial Position Drift ⁷	0.5 cm/s ²
Velocity Accuracy	< 0.02 m/s

GNSS Receiver (VN-210E & VN-310E)

Receiver Type	184 Channel, L1/L2/E5b GNSS
Time-to-First-Fix (Cold)	24 s
Time-to-First-Fix (Hot)	2 s
Altitude Limit	50,000 m
Velocity Limit	500 m/s

IMU	Accelerometers	Gyroscopes	Magnetometers
Range	±15 g	±490°/s	±2.5 Gauss
In-Run Bias Stability (Allan Variance)	< 10 µg	< 1°/hr (0.4-0.7°/hr. typ.)	-
Non-Linearity	< 150 ppm	100 ppm	< 0.1% FS
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°

Interfacing

Output Rate (IMU) ⁸	Up to 800 Hz
Output Rate (Navigation)	Up to 400 Hz
Primary Interface	(2) Serial TTL
Power & I/O Connectors	24-pin 1mm pitch board-to-board
GNSS RF Connector(s)	U.FL

Environmental

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

Mechanical / Electrical	VN-110E	VN-210E	VN-310E
Size	31 x 31 x 11 mm	31 x 31 x 11 mm	31 x 31 x 11 mm
Weight	12 g	14 g	15 g
Input Voltage	3.2 to 3.5 V	3.2 to 3.5 V	3.2 to 3.5 V
Current Draw ⁹	280 mA @ 3.3 V	420 mA @ 3.3 V	480 mA @ 3.3 V
Power ⁹	< 1 W	< 1.5 W	< 1.6 W

Input / Output

Serial Protocols	VectorNav Binary, VectorNav ASCII, NMEA
Data Outputs	Euler Angles (Yaw, Pitch, Roll); Quaternion; Position; Velocity; Coning & Sculling Integrals (ΔV's, ΔΘ's); Direction Cosine Matrix; Acceleration, Angular Rate and Magnetic Field
Filtering	Extended Kalman Filter; User Configurable Tuning Parameters; Active Disturbance Rejection; Adaptive Filtering
Synchronization	Sync-In, Sync-Out I/O pins GPS PPS, 30 ns RMS, 60 ns 99%

1. With proper magnetic declination, suitable magnetic environment and valid hard/soft iron calibration.
2. Dependant on a number of factors, contact VectorNav to discuss expected performance in your application.
3. With sufficient motion for dynamic alignment.
4. With SBAS, clear view of GNSS satellites, good multipath environment, compatible GNSS antenna, and as measured over a 24 hour period.
5. Constant on a per part basis. Can be calibrated out during system integration using boresighting or other alignment processes.

6. Dependant on atmospheric conditions, baseline length, GNSS antenna, multipath conditions, satellite visibility and geometry.
7. Typical rate of growth in error of position estimates after loss of GNSS signal, provided INS full alignment prior to loss.
8. Contact VectorNav for higher IMU data output rates.
9. Not including active antenna power consumption.