# VN-310 DUAL GNSS/INS

## Tactical-Grade GNSS/INS with Integrated GNSS-Compass

### Highlights

**0.05°-0.1°**
Dynamic Heading Accuracy (INS)

**0.15°**
Static Heading Accuracy (GNSS-Compass)

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

**MIL-STD VN-310**
MIL-STD-810; MIL-STD-461G; DO-160G; IP 68 Rated

**0.015°**
Dynamic Pitch/Roll Accuracy (INS)

**0.6°/hr**
Gyro In-Run Bias Stability

**RTK/PPK Capable**
External RTCM 3 Inputs; Exportable RINEX

**Low SWaP VN-310E**
31 x 31 x 12 mm; 15 grams; < 1.6 W

### Product Overview

The VN-310 is a tactical-grade, high-performance Dual Antenna GNSS-Aided Inertial Navigation System. Incorporating the latest inertial sensor and GNSS technology, the VN-310 combines 3-axis accelerometers, 3-axis gyros, 3-axis magnetometers and two Multi-band L1/L2/E1/E5b GNSS receivers into a compact embedded module or ruggedized packaging option to deliver a high-accuracy position, velocity and attitude solution under both static and dynamic conditions.

The VN-310 is available in two packaging options: a precision milled, anodized aluminum enclosure (VN-310) and a miniature, board-mount option (VN-310E). Certified to MIL-STD and DO-160G standards, the VN-310 is suitable for the most demanding military and aerospace applications. For SWaP-C constrained applications, the ultra compact VN-310E option delivers unprecedented size and weight advantages while still delivering tactical-grade inertial navigation performance.


VN-310

VN-310E

### Features

**GNSS-Compass for Static Heading**
Two onboard GNSS receivers perform GNSS-Compassing, providing highly accurate heading estimates under static and low dynamic conditions.

**Automatic Heading Transition**
Automatic and seamless transition between magnetic heading, INS operation in dynamics, and GNSS-Compass in static conditions.

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

**Software Compatibility**
The VN-310 and VN-310E 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-310 and VN-310E 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
- GNSS-Compass for static and low dynamic heading accuracy
- 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
- Coning and sculling integrals (ΔV's, Δθ's)
- Data output format: ASCII (VectorNav), NMEA-0183, Binary (VectorNav), ARINC 429[1]
- VN-310:
  - IP 68 per IEC 60529
  - Temperature (DO-160G)
  - Electrical (MIL-STD-1275E)
  - Vibration & Shock (MIL-STD-810G)
  - EMI & Radiation (MIL-STD-461G)
- VN-310E: 24-pin 1mm pitch board-to-board interface connector with (2) 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 |
| Heading (GNSS-Compass)[5] | |
| 0.5 m Baseline | 0.3° to 0.6° RMS |
| 1.0 m Baseline | 0.15° to 0.3° RMS |
| 2.0 m Baseline | 0.08° to 0.15° RMS |
| Pitch/Roll (Static) | 0.05° RMS |
| Pitch/Roll (INS)[4] | 0.015°, 1σ |
| Heading Mounting Misalignment (VN-310)[6] | < 0.05°, 1σ |
| Heading Mounting Misalignment (VN-310E)[6] | 0.15°, 1σ |
| Pitch/Roll Mounting Misalignment[6] | < 0.05°, 1σ |
| Angular Resolution | 0.001° |

### POSITION/VELOCITY

| | |
|---|---|
| Horizontal Position Accuracy[5] | 1.0 m RMS |
| Vertical Position Accuracy[5] | 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 (Optional ±2000°/s)[9] | ±2.5 Gauss |
| In-Run Bias Stability (Allan Variance) | < 10 µg | < 1°/hr (0.6°/hr typ.) | - |
| Noise Density | < 0.04 mg/√Hz | 5°/hr /√Hz | 140 µGauss/√Hz |
| Bandwidth | 200 Hz | 210 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) | 29 s / 2s |
| Altitude Limit | 50,000 m |
| Velocity Limit | 500 m/s |

## Interfacing

| | |
|---|---|
| Output Data Rate (IMU)[11] | up to 800 Hz |
| Output Data Rate (Position, Velocity & Attitude) | up to 400 Hz |
| Primary Interface (VN-310) | RS-422 (Optional RS-232) |
| Auxiliary Interface (VN-310) | RS-422 |
| Interface (VN-310E) | (2) Serial TTL |
| GNSS PPS | 30 ns RMS, 60 ns 99% |
| Input | Sync-in |
| Output | Sync-out |

## Environmental

| | |
|---|---|
| Operating Temperature | -40° to +85° C |
| Storage Temperature | -40° to +85° C |
| MTBF (VN-310) | > 21,000 hours |
| MTBF (VN-310E) | > 22,000 hours |

## Mechanical/Electrical

| | SIZE | WEIGHT | INPUT VOLTAGE | CURRENT DRAW[12] | POWER[12] |
|---|---|---|---|---|---|
| VN-310 | 56 x 56 x 31 mm | 160 g | 12 to 34 V | 135 mA @ 24 V | < 3.3 W |
| VN-310E | 31 x 31 x 12 mm | 15 g | 3.2 to 3.5 V | 480 mA @ 3.3 V | < 1.6 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. Dependant on SBAS, clear view of GNSS satellites, good multipath environment, compatible GNSS antenna, and measurement duration period.
6. Constant on a per part basis. Can be calibrated out during system integration using boresighting or other alignment processes.
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-310 default configuration.
11. Contact VectorNav for higher IMU data output rates.
12. Not including active antenna power consumption.

10501 Markison Road, Dallas, TX 75238, USA | +1 512 772 3615 | sales@vectornav.com | vectornav.com