

VN-200 GNSS/INS

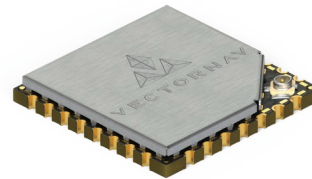
GNSS-Aided Inertial Navigation System

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INTRODUCTION

The VN-200 is a miniature, high performance GNSS-Aided Inertial Navigation System (GNSS/INS) that combines 3-axis gyros, accelerometers and magnetometers, a high-sensitivity GNSS receiver, and advanced Kalman filtering algorithms to provide optimal estimates of position, velocity, and attitude.



VN-200 SMD



VN-200 Rugged

PRODUCT HIGHLIGHTS

0.2° Dynamic Heading Accuracy (INS)	5-7°/hr (typ.) Gyro In-Run Bias Stability	400 Hz Position, Velocity and Attitude Data	800 Hz IMU Data
0.03° Dynamic Pitch/Roll Accuracy (INS)	< 0.04 mg Accel In-Run Bias Stability	1.0 m / 1.5 m Horizontal / Vertical Position Accuracy	Surface Mount (SMD) 24 x 22 x 3 mm; 4 grams; 445 mW

VECTORNAV INS FILTER

Each VectorNav product features a robust Kalman Filter (EKF) along with proprietary suite of high performance algorithms that run completely onboard the sensors. VectorNav's industry leading algorithms provide high-accuracy position, velocity and attitude estimates along with compensated inertial measurements at rates between 400 and 800 Hz.

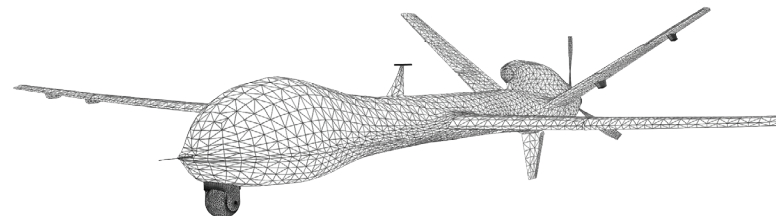
DEVELOPMENT KIT OPTIONS



VN-200 Rugged



VN-200 Surface Mount



Kit Contents

Complete hardware Development Kits include VectorNav sensor, applicable cabling, GNSS antenna, documentation, hardware tools and rugged carrying case.

Sensor Summary

- ▶ VectorNav proprietary Extended Kalman Filter INS delivers coupled position, velocity, and a continuous attitude solution over the complete 360° range of operation
- ▶ True INS Filter, no mounting restrictions, modes of operation or constraints required
- ▶ Real-time gyro & accel bias tracking & compensation
- ▶ VectorNav Processing Engine (VPE) for disturbance rejection, adaptive filtering, dynamic filter tuning
- ▶ 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)
- ▶ Raw Pseudorange, Doppler and Carrier Phase outputs
- ▶ Real-time and delayed heave estimation
- ▶ Coning and sculling integrals (ΔV 's, $\Delta \theta$'s)
- ▶ Data output format: ASCII (VectorNav), NMEA-0183, Binary (VectorNav)
- ▶ VectorNav Control Center GUI (available for free download at www.vectornav.com) provides a practical tool for easy sensor setup, configuration and data viewing/logging
- ▶ ITAR-Free

Performance Specifications

ATTITUDE

Range (Heading/Yaw, Roll)	$\pm 180^\circ$
Range (Pitch)	$\pm 90^\circ$
Heading (Magnetic) ¹	2.0° RMS
Heading (INS) ²	0.2°, 1 σ
Pitch/Roll (Static)	0.5° RMS
Pitch/Roll (INS) ²	0.03°, 1 σ
Heading Mounting Misalignment (Rugged) ³	0.15°, 1 σ
Pitch/Roll Mounting Misalignment ³	0.1°, 1 σ
Angular Resolution	0.001°

POSITION/VELOCITY

Horizontal Position Accuracy ⁴	1.0 m RMS
Vertical Position Accuracy ⁴	1.5 m RMS
Free Inertial Position Drift ⁵	3.0 cm/s ²
Velocity Accuracy	< 0.05 m/s
Heave Accuracy	5 % or 5 cm
Delayed Heave Accuracy	2 % or 2 cm

IMU Specifications

	ACCELEROMETER	GYROSCOPE	MAGNETOMETER	BAROMETER
Range	± 16 g	$\pm 2,000^\circ/\text{s}$	± 2.5 Gauss	10 to 1200 mbar
In-Run Bias Stability (Allan Variance)	< 0.04 mg	< 10°/hr (5-7°/hr typ.)	-	-
Noise Density	0.14 mg/ $\sqrt{\text{Hz}}$	0.0035 °/s / $\sqrt{\text{Hz}}$	140 $\mu\text{Gauss}/\sqrt{\text{Hz}}$	-
Bandwidth	260 Hz	256 Hz	200 Hz	200 Hz
Cross-Axis Sensitivity	$\pm 0.05^\circ$	< 0.05 °	$\pm 0.05^\circ$	-

GNSS Receiver

Receiver Type	72 Channel, L1C/A, L10F, E1, B1I GNSS
Constellations ⁶	GPS, GLONASS, Galileo, BeiDou, QZSS, SBAS
Time-To-First-Fix (Cold)	29 s
Time-To-First-Fix (Hot)	1 s
Altitude Limit	50,000 m
Velocity Limit	500 m/s

Interfacing

Output Data Rate (IMU) ⁷	up to 800 Hz
Output Data Rate (Position, Velocity & Attitude)	up to 400 Hz
Interface (VN-200 Rugged)	RS-232, Serial TTL
Interface (VN-200 SMD)	Serial TTL, SPI
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 (Rugged)	> 150,000 hours
MTBF (SMD)	> 240,000 hours

Mechanical/Electrical

	SIZE	WEIGHT	INPUT VOLTAGE	CURRENT DRAW ⁸	POWER ⁸
Rugged	36 x 33 x 9.5 mm	16 g	3.3 to 17 V	80 mA @ 5 V	500 mW
SMD	24 x 22 x 3 mm	4 g	3.2 to 5.5 V	105 mA @ 3.3 V	445 mW

1. With proper magnetic declination, suitable magnetic environment and valid hard/soft iron calibration.
2. With sufficient motion for dynamic alignment.
3. Constant on a per part basis. Can be calibrated out during system integration using boresighting or other alignment processes.
4. Dependant on SBAS, clear view of GNSS satellites, good multipath environment, compatible GNSS antenna, and measurement duration period.

5. Typical rate of growth in error of position estimates after loss of GNSS signal, provided INS full alignment prior to loss.
6. Only GPS, Galileo and SBAS constellations used in VN-200 default configuration.
7. Contact VectorNav for higher IMU data output rates.
8. Not including active antenna power consumption.