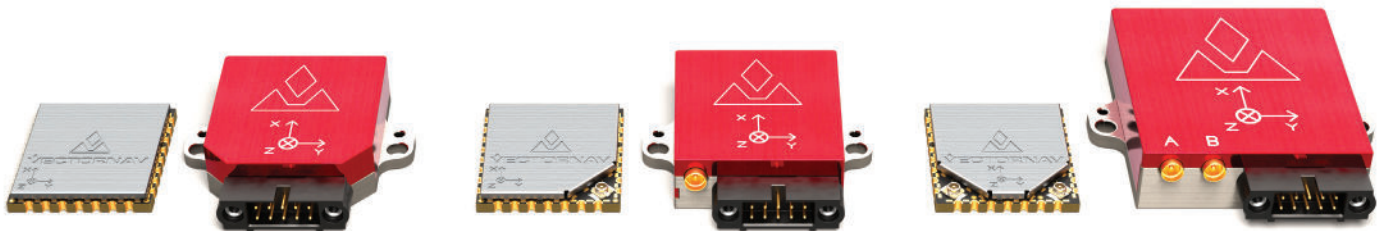


VECTORNAV INDUSTRIAL SERIES



VN-100 IMU/AHRS
VN-200 GPS/INS
VN-300 DUAL GNSS/INS



VectorNav presents the Industrial Series, a complete line of MEMS-based, industrial-grade inertial navigation systems. Available in both surface mount and rugged packaging options and calibrated across temperature, the Industrial Series includes IMU, AHRS, GPS/INS and GPS-Compass solutions optimized for SWaP-C constrained applications.

Key Benefits

- Miniaturized surface mount & Rugged packaging
- 0.3° RMS heading, 0.1° pitch & roll
- 5°/hr typical in-run gyro bias stability
- Calibrated across temperature
- Serial TTL, SPI & USB communication interfaces
- < 30 grams
- ITAR-free
- Made in the USA

NavtechGPS

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 **VECTORNAV**
Embedded Navigation Solutions

THE INDUSTRIAL SERIES

The Industrial Series product line is built on a miniature, high-performance, temperature calibrated IMU core. Each product in the series shares a common protocol and interface, allowing the user to incorporate AHRS, GPS/INS and/or GPS-Compass functionality depending on the target application and performance requirements.



CAPABILITIES

	VN-100 IMU/AHRS	VN-200 GPS/INS	VN-300 Dual GNSS/INS
IMU Measurements	●	●	●
Magnetic Heading	●	●	●
Attitude Filter (VPE ¹)	●	●	●
INS Filter	-	●	●
GPS-Compass Heading	-	-	●

¹ Vector Processing Engine, VectorNav's proprietary suite of attitude estimation algorithms and toolboxes.

INDUSTRY LEADING ALGORITHMS

Each Industrial Series product features a robust Extended Kalman Filter (EKF) along with a 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.



VN-100, VN-200 & VN-300

Magnetic Heading; Pitch & Roll

- Continuous attitude over 360° range
- Real-time gyro bias tracking & compensation
- 3D hard/soft iron calibration
- VPE 2.0 Toolboxes:
 - Real-time magnetic & acceleration disturbance rejection
 - Adaptive signal filtering
 - Dynamic filter tuning toolboxes
- World Magnetic & Gravity Reference Models
- Velocity aiding (airspeed, GPS)



VN-200 & VN-300

GPS-Aided Position, Velocity & Attitude

- Automatic filter initialization & dynamic alignment
- Real-time gyro & accel bias tracking & compensation
- GPS delay compensation
- Synchronized to GPS time
- Automatic transitioning between AHRS & INS modes
- Operates as a True Inertial Navigation System - no mounting restrictions or velocity alignment assumptions



VN-300

GNSS-Based Heading

- Dual antenna GNSS heading
- Magnetic independent
- Automatic transition between AHRS, INS and GPS-Compass
- Adjustable GNSS antenna baseline lengths for shorter start-up times or increased heading accuracy
 - Heading accuracy between 0.15° and 1.2° (RMS)
 - Start-up in under 2 minutes
- Raw pseudorange, Doppler & carrier phase outputs

SPECIFICATIONS

Each individual Industrial Series sensor undergoes a robust calibration and acceptance testing process at VectorNav's manufacturing facility. VectorNav regularly conducts comprehensive testing on all products to verify continued conformance to all performance specifications.

NAVIGATION	VN-100	VN-200	VN-300
Heading (Magnetic) ¹	2.0 ° RMS	2.0 ° RMS	2.0 ° RMS
Heading (INS)	-	0.3 ° RMS	0.3 ° RMS
Heading (GPS-Compass) ²	-	-	0.3 ° RMS
Pitch/Roll (Static)	0.5 ° RMS	0.5 ° RMS	0.5 ° RMS
Pitch/Roll (Dynamic) ³	1.0 ° RMS	0.1 ° RMS	0.1 ° RMS
Horizontal Position Accuracy	-	2.5 m RMS	2.5 m RMS
(w/ SBAS)	-	2.0 m RMS	2.0 m RMS
Vertical Position Accuracy	-	5.0 m RMS	5.0 m RMS
(w/ Barometer)	-	2.5 m RMS	2.5 m RMS
Velocity Accuracy	-	±0.05 m/s	±0.05 m/s
Angular Resolution	< 0.05 °	< 0.05 °	< 0.05 °
Repeatability	< 0.2 °	< 0.1 °	< 0.1 °
Output Rate (IMU Data) ⁴	800 Hz	800 Hz	400 Hz
Output Rate (Navigation Data)	400 Hz	400 Hz	400 Hz

¹ With proper magnetic declination, suitable magnetic environment and valid hard/soft iron calibration.

² With 1 meter baseline, clear view of GNSS satellites and good multipath environment.

³ VN-100: Typical, Velocity Aiding required for applications with sustained linear accelerations.

⁴ VN-100 & VN-200: Contact VectorNav for higher IMU data output rates.

IMU	Accelerometers	Gyroscopes	Magnetometers	Barometer
Range	±16 g	±2000 °/s	±2.5 Gauss	10 to 1200 mbar
In-Run Bias Stability	< 0.04 mg	< 10 °/hr (5 °/hr typ.)	-	-
Linearity	< 0.5 % FS	< 0.1 % FS	< 0.1 %	< 0.5 % FS
Noise Density	0.14 mg/√Hz	0.0035 °/s/√Hz	140 □Gauss/√Hz	-
Bandwidth	260 Hz	256 Hz	200 Hz	200 Hz
Alignment Error	±0.05 °	±0.05 °	±0.05 °	-
Resolution	< 0.5 mg	< 0.02 °/s	1.5 Milligauss	0.042 mbar

GPS/GNSS	VN-200	VN-300
Receiver Type	50 Channel L1 GPS	72 Channel L1 GNSS
Solution Update Rate	5 Hz	5 Hz
Time-to-First-Fix (Cold/Warm Start)	36 s	26 s
Time-to-First-Fix (Hot Start)	< 1 s	< 1 s
Altitude Limit	50,000 m	50,000 m
Velocity Limit	500 m/s	500 m/s

INTERFACES

Interface (SMD)	Serial TTL, SPI
Interface (Rugged)	RS-232, Serial TTL

ENVIRONMENT

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

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, Magnetic Field and Pressure Filtering
Filtering	Extended Kalman Filter; User Configurable Tuning Parameters; Active Disturbance Rejection; Adaptive Filtering
External Sensors Supported	GNSS, magnetometer
Synchronization	Sync-In, Sync-Out I/O pins; GPS PPS, 30 ns RMS, 60 ns 99%

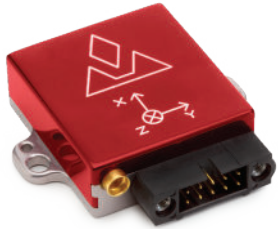
The Industrial Series Rugged packaging option offers a simple, bolt-on, plug-n-play solution that is designed for easy testing and integrations. The Industrial Series surface mount option offers the most compact solution designed to be fully integrated into a host PCB.

RUGGED

Precision aluminum anodized enclosure

Interface
10-pin Harwin

GPS Antenna Connector
MMCX



VN-200 Rugged

MECHANICAL / ELECTRICAL	VN-100	VN-200	VN-300
Size	36 x 33 x 9 mm	36 x 33 x 9.5 mm	45 x 44 x 11 mm
Weight	15 g	16 g	30 g
Input Voltage	4.5 V to 5.5 V	3.3 V to 17 V	3.3 V to 14 V
Current Draw*	40 mA @ 5 V	80 mA @ 5 V	140 mA @ 5 V
Max Power Consumption*	220 mW	500 mW	1.5 W

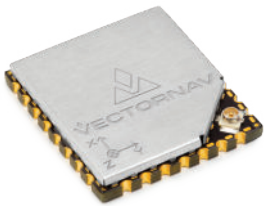
* VN-200/VN-300: Not including active antenna power consumption.

SURFACE MOUNT

Shared footprint across
VN-100, VN-200 & VN-300

Interface
30-pin LGA

GPS Antenna Connector
U.FL



VN-200 SMD

MECHANICAL / ELECTRICAL	VN-100	VN-200	VN-300
Size	24 x 22 x 3 mm	24 x 22 x 3 mm	24 x 22 x 3 mm
Weight	3.5 g	4 g	5 g
Input Voltage	3.2 V to 5.5 V	3.2 V to 5.5 V	3.2 V to 5.5 V
Current Draw*	45 mA @ 3.3 V	105 mA @ 3.3 V	185 mA @ 3.3 V
Max Power Consumption*	185 mW	445 mW	1.2 W

* VN-200/VN-300: Not including active antenna power consumption.

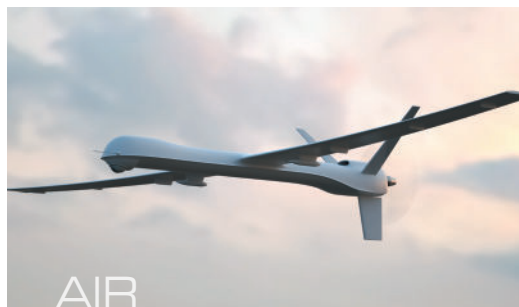
APPLICATIONS

The Industrial Series has been designed from the ground up to offer robust inertial navigation solutions for a wide range of applications and operating environments. The Industrial Series is well suited for Size, Weight, Power and Cost (SWaP-C) constrained systems in the aerospace, military, marine, and robotics industries among others.



LAND

- Ground Vehicle Navigation
- Camera/Antenna/Platform Stabilization & Pointing
- Geo-Referencing & Mapping
- Robotics Control & Navigation
- Body Motion Capture



AIR

- UAV & Manned Aircraft Navigation
- Autopilots
- Camera/Antenna/Platform Stabilization & Pointing
- Geo-Referencing & Mapping
- Smart Weapons



SEA

- ASV and ROV Navigation
- Marine Antenna Stabilization
- Hydrography
- Ocean Buoys
- Weather Monitoring
- Platform Monitoring

VECTORNAV SUPPORT ECOSYSTEM

The Industrial Series is backed by the industry's most customer-focused, robust and responsive support ecosystem. With VectorNav as your inertial navigation partner, you receive full access to our support ecosystem throughout the entire development cycle and product lifetime of your system. Our mission is to ensure the successful evaluation, development, testing, and integration of VectorNav sensors into your application.

SUPPORT

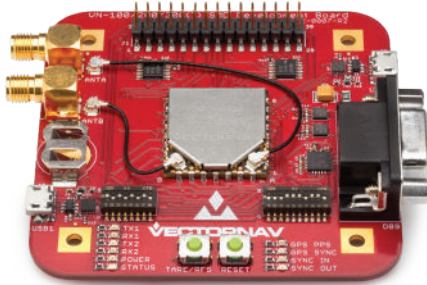
- < 24-hour sales and support response time
- Direct access to VectorNav's hardware, software and applications engineers
- Detailed and comprehensive documentation
- Online collection of inertial navigation knowledge, FAQ's and application notes
- Common communication protocol across all VectorNav products
- Field upgradable firmware

PRODUCTION

- 30,000 sq. ft. (2750 sq. meter) manufacturing facility with high-volume production capacity
- 1-2 day lead time on Development Kits
- Individual sensor calibration across full temperature range (-40 C to +85 C)
- Standard 1-year warranty
- Calibration reports

DEVELOPMENT TOOLS

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

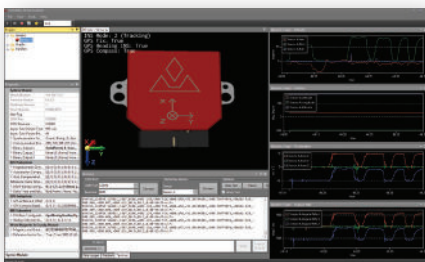


VN-300 SMD Development Board



VN-300 Rugged Development Kit

Sensor Explorer GUI & Software Development Kit: Powerful and user-friendly GUI and programming libraries with C/C++, .NET, MATLAB & LabVIEW support for both Windows and Linux.



VectorNav Sensor Explorer GUI

QNX
Unity Cygwin
Embedded
Windows Linux
OSX
C/C++/C#
x64 ARM x86
.NET
LabVIEW MATLAB
Python

Custom Solutions Available: Application-specific modeling & algorithm development; controls & closed-loop navigation solutions; custom form-factors & packaging; integration with other external sensors; displays, GUIs & other software packages; tailored calibrations; custom communication protocols.



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Your Partner in Embedded Navigation.

VectorNav Technologies is a leading developer and manufacturer of high performance inertial navigation systems using the latest in MEMS sensor and GPS/GNSS technology. Since its founding in 2008, VectorNav has provided systems integrators in the Military, Aerospace, Marine, and Robotics industries with embedded navigation solutions optimized for SWaP-C constraints. VectorNav has unique expertise in applying the digital filtering and sensor calibration techniques that have multiple decades of heritage in Aerospace applications to the state-of-the-art in MEMS inertial and GPS/GNSS technology.

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