

VECTORNAV TACTICAL SERIES



VN-110 IMU/AHRS
VN-210 GNSS/INS
VN-310 DUAL GNSS/INS



VectorNav introduces the Tactical Series, a next-generation, MEMS inertial navigation platform that features high-performance IMU, AHRS, GPS/INS and GPS-Compass solutions.

Featuring a tactical-grade IMU core housed in a robust and compact aluminum enclosure, the Tactical Series leverages VectorNav's industry leading navigation algorithms to offer a new class of inertial navigation solutions.

Key Benefits

- < 1°/hr in-run gyro bias stability
- < 2 mrad attitude performance
- IP 68 rated enclosure designed to meet DO-160G
- Software compatible with existing VectorNav products
- Expansion port for connectivity to external sensors
- AS9100 Certified
- Made in the USA and ITAR-free



THE TACTICAL SERIES

The VectorNav Tactical Series sets a new standard for high-performance inertial navigation systems. Built on a tactical grade MEMS IMU core that is housed in a compact and ruggedized aluminum enclosure, the Tactical Series leverages VectorNav's industry leading navigation algorithms and extensive applications experience to deliver a new standard in inertial navigation.



CAPABILITIES	VN-110 IMU/AHRS	VN-210 GNSS/INS	VN-310 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.

RUGGEDIZED PACKAGING

The Tactical Series features a precision milled, anodized aluminum enclosure designed to meet DO-160G standards. With dual I/O connectors the Tactical Series offers maximum flexibility for interfacing with external GNSS receivers and IMUs.

MECHANICAL	VN-110	VN-210	VN-310
Size	56 x 56 x 23 mm	56 x 56 x 31 mm	56 x 56 x 31 mm
Weight	125 g	155 g	160 g
CONNECTOR	Purpose	Voltage	Power
Primary	Input power & primary RS-422 communications	12 - 36 V	Max: 2.5 W (No auxiliary load)
Auxiliary	Optional output power and RS-422 for auxiliary sensors	12 - 36 V	Max: 10 W (with 7.5 W auxiliary load)
GPS	GPS RF input with 5V output to power active antenna	5 V ± 0.1 V	0.5 W (100 mA max)



Key Benefits

- IP 68 rated per IEC 60529
- Designed to meet DO-160G standards
- Protection - MIL-STD-1275E
- Expansion port for connectivity to external sensors
- Circular push-pull 10-pin connectors
- SMA GNSS RF connectors
- < 160 grams

SPECIFICATIONS

Each individual Tactical 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-110	VN-210	VN-310
Heading (Magnetic) ¹	2.0 ° RMS	2.0 ° RMS	2.0 ° RMS
Heading (INS)	-	< 0.1 ° RMS	< 0.1 ° RMS
Heading (GPS-Compass) ²	-	-	0.3 ° RMS
Pitch/Roll (Static)	< 0.05 ° RMS	< 0.05 ° RMS	< 0.05 ° RMS
Pitch/Roll (Dynamic)	-	< 0.03 ° RMS	< 0.03 ° RMS
Horizontal Position Accuracy (w/ SBAS)	-	2.5 m RMS	2.5 m RMS
Vertical Position Accuracy	-	2.5 m RMS	2.5 m RMS
Velocity Accuracy	-	< 0.05 m/s	< 0.05 m/s

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.

IMU	Accelerometers	Gyroscopes	Magnetometers
Range	±15 g	±490 °/s	±2.5 Gauss
In-Run Bias Stability	< 10 µg	< 1 °/hr	-
Noise Density	0.04 mg/√Hz	3.24 °/hr /√Hz	140 µGauss/√Hz
Bandwidth	240 Hz	240 Hz	200 Hz

GNSS (VN-210 and VN-310 Only)

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

ENVIRONMENTAL & ELECTRICAL

Operating Temperature	-40°C to +85°C
Storage Temperature	-40°C to +85°C
IP Rating	IP 68 per IEC 60529
MTBF (VN-110)	> 35,000 hours
MTBF (VN-210 & VN-310)	> 25,000 hours
Power Consumption	< 2.5 watts
Input Voltage	+12 to +36 VDC (MIL-STD-1275E)

INTERFACING

Output Rate (IMU)	Up to 800 Hz
Output Rate (Navigation)	Up to 400 Hz
Primary Interface ³	RS-422 + 3 sync I/O pins
Expansion Interface ³	RS-422
Power & I/O Connectors	Circular Push-Pull Fischer UltiMate (10-pin x 2; Size 7)
GNSS RF Connectors	SMA

³ Contact VectorNav for RS-232 interface options and availability.

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
External Sensors Supported	GNSS, magnetometer
Synchronization	Sync-In, Sync-Out I/O pins GPS PPS, 30 ns RMS, 60 ns 99%

TACTICAL GRADE IMU CORE

The Tactical Series incorporates the most compact, tactical grade MEMS IMU available on the market.

Factory Calibration

Each Tactical Series unit undergoes an extensive individual sensor calibration across the full operating temperature range (-40°C to +85°C) for bias, scale factor, misalignment, temperature dependancies and gyro g-sensitivity.

Tactical Grade Performance

- < 1°/hr in-run gyro bias stability
- < 10 µg in-run accel bias stability
- Ultra low noise accel and gyro (0.04 mg/√Hz and 3.24 °/hr /√Hz)
- High accel and gyro ranges (±15 g and ±490 °/s)

INDUSTRY LEADING ALGORITHMS

Each Tactical 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 up to 800 Hz.



AHRS & VPE

VN-110, VN-210 & VN-310

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)



GPS/INS

VN-210 & VN-310

GNSS-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



GPS-Compass

VN-310

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

APPLICATIONS

The VectorNav Tactical Series has been designed from the ground up to offer robust inertial navigation solutions for a wide range of applications and operating environments. Whether it is an airborne, marine, or ground-based platform, the Tactical Series offers systems integrators versatile hardware and software configuration options to meet the most demanding navigation requirements. The Tactical Series is well suited for Size, Weight, Power and Cost (SWaP-C) constrained systems in the aerospace, military, marine, among other industries.



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 Tactical 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
- Field upgradable firmware
- Common communication protocol across all VectorNav products

PRODUCTION

- 30,000 sq. ft. (2750 sq. meter) manufacturing facility with high-volume production capacity
- AS9100 Certification
- 1-2 day lead time on standard products
- Individual sensor calibration across full temperature range (-40 C to +85 C)
- Standard 1-year warranty
- Calibration reports



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.

VectorNav Technologies is headquartered in Dallas, Texas, USA and is an AS9100 certified company.

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AS9100
CERTIFIED