

# VN-100 IMU/AHRS

Miniature, lightweight and high-performance IMU & AHRS

## Highlights

<b>2.0°</b> Magnetic Heading Accuracy	<b>5-7°/hr (typ.)</b> Gyro In-Run Bias Stability	<b>400 Hz</b> Onboard Extended Kalman Filter Update Rate	<b>Rugged</b> 36 x 33 x 9 mm; 15 grams; 220 mW
<b>0.5°</b> Pitch/Roll Accuracy	<b>&lt; 0.04 mg</b> Accel In-Run Bias Stability	<b>800 Hz</b> IMU Data	<b>Surface Mount (SMD)</b> 24 x 22 x 3 mm; 3.5 grams; 185 mW

## Product Overview

The VN-100 is a miniature, high-performance Inertial Measurement Unit (IMU) and Attitude Heading Reference System (AHRS). Combining 3-axis accelerometers, gyros, and magnetometers, a barometric pressure sensor and a 32-bit processor, the VN-100 provides high-rate, calibrated IMU data and a real-time 3D attitude solution that is continuous over the complete 360 degrees of motion.

Introduced in 2009, the VN-100 is the world's first IMU/AHRS in a single surface mount package (SMD). At the size of a postage stamp, the VN-100 SMD requires only a single 3.2-5.5V power supply and can be directly embedded into a user's electronics for unprecedented SWAP advantages.

The VN-100 Rugged is the "plug and play" version of the VN-100 SMD. Enclosed in a clamshell precision anodized aluminum enclosure, the VN-100 Rugged offers additional protection of the internal inertial sensors and electronics.

## Features

### Vector Processing Engine (VPE) 2.0 Toolboxes

Real-time magnetic & acceleration disturbance rejection, adaptive signal filtering and dynamic filter tuning.

### Onboard Hard & Soft Iron Compensation

World Magnetic Model: WMM2016  
World Gravity Model: EGM96

### Onboard Gyro Drift Compensation

AHRS Kalman Filter tracks real-time estimation of the gyro bias and compensates for small perturbations.

### Software Compatibility

The VN-100 Rugged and SMD share a common communication protocol with the entire VectorNav product line.

### Ease of Availability

ITAR-free and Made in the USA; ships in 1-2 days.

### User Configurable Messages

ASCII and VectorNav Binary messages.



VN-100 Rugged

VN-100 SMD

Each individual VN-100 sensor 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 AHRS delivers a continuous attitude solution over the complete 360° range of operation
- ▶ VectorNav Processing Engine (VPE) for disturbance rejection, adaptive filtering, dynamic filter tuning
- ▶ Real-time gyro bias tracking and compensation
- ▶ Hard/Soft Iron Compensation (Real-time and Manual 2D & 3D)
- ▶ Real-time and delayed heave estimation
- ▶ Individually calibrated for bias, scale factor, misalignment, and temperature over full operating range (-40°C to +85°C)
- ▶ Available with standard (@ 25°C) or full temperature compensation (-40°C to +85°C)
- ▶ Coning and sculling integrals ( $\Delta V$ 's,  $\Delta \theta$ 's)
- ▶ Data output format: ASCII (VectorNav), Binary (VectorNav)
- ▶ World Magnetic & Gravity Reference Models
- ▶ VectorNav Control Center GUI (available for free download at [www.vectornav.com](http://www.vectornav.com)) provides a practical tool for easy sensor setup, configuration and data viewing/logging
- ▶ ITAR-Free

## Performance Specifications

### ATTITUDE / HEAVE

Range (Heading/Yaw, Roll) .....	± 180°
Range (Pitch) .....	± 90°
Heading (Magnetic) <sup>1</sup> .....	2.0° RMS
Pitch/Roll (Static) .....	0.5° RMS
Pitch/Roll (Dynamic) <sup>2</sup> .....	1.0° RMS
Heave Accuracy .....	.5 % or 5 cm
Delayed Heave Accuracy .....	.2 % or 2 cm
Angular Resolution .....	0.001°

## Environmental

Operating Temperature .....	-40° to +85° C
Storage Temperature .....	-40° to +85° C
MTBF (Rugged) .....	> 240,000 hours
MTBF (SMD) .....	> 280,000 hours

## Interfacing

Output Data Rate (IMU) <sup>3</sup> .....	up to 800 Hz
Output Data Rate (Attitude) .....	up to 400 Hz
Interface (VN-100 Rugged) .....	RS-232, Serial TTL
Interface (VN-100 SMD) .....	Serial TTL, SPI
Input .....	Sync-in
Output .....	Sync-out

## IMU Specifications

	ACCELEROMETER	GYROSCOPE	MAGNETOMETER	BAROMETER
Range	±16 g	±2,000°/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/√Hz	0.0035 °/s /√Hz	140 μGauss/√Hz	-
Bandwidth	260 Hz	256 Hz	200 Hz	200 Hz
Cross-Axis Sensitivity	±0.05 °	< 0.05 °	±0.05 °	-

## Mechanical

	SIZE	WEIGHT	INTERFACE
Rugged	36 x 33 x 9 mm	15 g	10-pin Harwin
SMD	24 x 22 x 3 mm	3.5 g	30-pin LGA

## Electrical

	INPUT VOLTAGE	CURRENT DRAW	POWER
Rugged	4.5 to 5.5 V	40 mA @ 5 V	220 mW
SMD	3.2 to 5.5 V	45 mA @ 3.3 V	185 mW

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

2. Typical; Velocity Aiding required for applications with sustained linear accelerations.

3. Contact VectorNav for higher IMU data output rates.