

# VN-110 IMU/AHRS

## Rugged and Miniature Tactical-Grade IMU and AHRS

### Highlights

<b>&lt; 1°/hr</b> Gyro In-Run Bias Stability	<b>&lt; 10 µg</b> Accel In-Run Bias Stability	<b>0.05°</b> Pitch/Roll Accuracy	<b>MIL-STD VN-110</b> MIL-STD-810; MIL-STD-461G; DO-160G; IP 68 Rated
<b>5°/hr /√Hz</b> Gyro Noise Density (ARW)	<b>&lt; 0.04 mg/√Hz</b> Accelerometer Noise Density (VRW)	<b>800 Hz</b> IMU Data	<b>Low SWaP VN-110E</b> 31 x 31 x 12 mm; 12 grams; < 1 W

### Product Overview

The VN-110 is a Tactical Grade Inertial Measurement Unit (IMU) and Attitude Heading Reference System (AHRS). The VN-110 incorporates the latest inertial sensor technology, combining 3-axis accelerometers, 3-axis gyroscopes and 3-axis magnetometers into a compact and rugged package. Along with providing calibrated sensor measurements, the VN-110 also computes and outputs a real-time 3D orientation solution that is continuous over the complete 360 degrees of motion.

The VN-110 is available in two packaging options: a precision milled, anodized aluminum enclosure (VN-110) and a miniature, board-mount option (VN-110E). Certified to MIL-STD and DO-160G standards, the VN-110 is suitable for the most demanding military and aerospace applications. For SWaP-C constrained applications, the ultra compact VN-110E option delivers unprecedented size and weight advantages while still delivering tactical-grade inertial navigation performance.



### 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-110 and VN-110E share a common communication protocol with the entire VectorNav product line.

#### Ease of Availability

ITAR-free and Made in the USA; Short lead times.

#### User Configurable Messages

ASCII and VectorNav Binary messages.

Each individual VN-110 and VN-110E 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

- ▶ 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)
- ▶ Inputs for external magnetometers or velocity measurements (Airspeed, GPS)
- ▶ Individually calibrated for bias, scale factor, misalignment, and temperature over full operating range (-40°C to +85 °C)
- ▶ VN-110:
  - IP 68 per IEC 60529
  - Temperature (DO-160G)
  - Electrical (MIL-STD-1275E)
  - Vibration & Shock (MIL-STD-810G)
  - EMI & Radiation (MIL-STD-461G)
- ▶ VN-110E: 24-pin 1mm pitch board-to-board interface connector
- ▶ Coning and sculling integrals ( $\Delta V$ 's,  $\Delta \theta$ 's)
- ▶ World Magnetic & Gravity Reference Models
- ▶ Data output format: ASCII (VectorNav), Binary (VectorNav)
- ▶ 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

## Environmental

Operating Temperature.....	-40° to +85° C
Storage Temperature.....	-40° to +85° C
MTBF (VN-110).....	> 35,000 hours
MTBF (VN-110E).....	> 45,000 hours

## Interfacing

Output Data Rate (IMU) <sup>2</sup> .....	up to 800 Hz
Output Data Rate (Attitude).....	up to 400 Hz
Primary Interface (VN-110).....	RS-422 (Optional RS-232)
Auxiliary Interface (VN-110).....	RS-422
Interface (VN-110E).....	(2) Serial TTL
Input.....	Sync-in
Output.....	Sync-out

## Performance Specifications

### ATTITUDE

Range (Heading/Yaw, Roll).....	± 180°
Range (Pitch).....	± 90°
Heading (Magnetic) <sup>1</sup> .....	2.0° RMS
Pitch/Roll (Static).....	0.05° RMS
Angular Resolution.....	0.001°

## IMU Specifications

	ACCELEROMETER	GYROSCOPE	MAGNETOMETER
Range <sup>3</sup>	±15 g	±490°/s	±2.5 Gauss
In-Run Bias Stability (Allan Variance)	< 10 µg	< 1°/hr (0.4-0.7°/hr typ.)	-
Noise Density	< 0.04 mg/√Hz	5 °/hr /√Hz	140 µGauss/√Hz
Bandwidth	240 Hz	240 Hz	200 Hz
Cross-Axis Sensitivity	±0.05 °	< 0.05 °	±0.05 °

## Mechanical

	SIZE	WEIGHT	INTERFACE
VN-110	56 x 56 x 23 mm	125 g	10-pin Circular push-pull
VN-110E	31 x 31 x 12 mm	12 g	24-pin Board-to-Board

## Electrical

	INPUT VOLTAGE	CURRENT DRAW	POWER
VN-110	12 to 34 V	80 mA @ 24 V	< 2 W
VN-110E	3.2 to 3.5 V	280 mA @ 3.3 V	< 1 W

1. With proper magnetic declination, suitable magnetic environment and valid hard/soft iron calibration.  
 2. Contact VectorNav for higher IMU data output rates.  
 3. Contact VectorNav for Extended Range Gyro Option.