

VN-110 IMU/AHRS

Inertial Measurement Unit /
Attitude Heading Reference System

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INTRODUCTION

The VN-110 is a miniature, light weight, low power, high-performance Inertial Measurement Unit (IMU) and Attitude and Heading Reference System (AHRS) available in a embedded module package for mounting to Printed Circuit Boards or aluminum encased rugged module.

The VN-110 computes and outputs a real-time, drift-free attitude solution (i.e. 3D orientation) that is continuous over a complete range of 360° motion.



VN-110E

VN-110

PRODUCT HIGHLIGHTS

< 1°/hr

Gyro In-Run Bias Stability

< 10 µg

Accel In-Run Bias Stability

0.05°

Pitch/Roll Accuracy

MIL-STD VN-110

MIL-STD-810; MIL-STD-461G;
DO-160G; IP 68

5°/hr /√Hz

Gyro Noise Density
(ARW)

< 0.04 mg/√Hz

Accelerometer Noise Density
(VRW)

800 Hz

IMU Data

Low SWaP VN-110E

31 x 31 x 12 mm;
12 grams; < 1 W

INDUSTRY LEADING ALGORITHMS - VPE

The VN-110 features a robust Kalman Filter (EKF) along with a proprietary suite of high performance algorithms that run completely onboard the sensors. VectorNav's industry leading Vector Processing Engine (VPE) algorithms provide real-time magnetic and acceleration disturbance rejection, adaptive signal filtering, dynamic filter tuning and onboard Hard & Soft Iron compensation.

PACKAGING OPTIONS

Embedded

The VN-110E brings unprecedented capability and performance to SWaP-C constrained applications.

- ▶ Miniature footprint:
31 x 31 x 12 mm
- ▶ Lightweight:
12 grams
- ▶ Low Power:
< 1 W
- ▶ 24-pin 1mm pitch
board-to-board interface
connector
- ▶ Software compatible with
VectorNav's full product line



Tactical

The VN-110 is designed to meet the demands of the most demanding military and aerospace applications.

- ▶ IP 68 per IEC 60529
- ▶ Temperature (DO-160G)
- ▶ Electrical (MIL-STD-1275E)
- ▶ Vibration & Shock (MIL-STD-810G)
- ▶ EMI & Radiation (MIL-STD-461G)
- ▶ Circular push-pull 10-pin connectors
- ▶ Wide input voltage range (12 to 34 V)



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)
- ▶ Data output format: ASCII (VectorNav), Binary (VectorNav)

- ▶ Coning and sculling integrals (ΔV 's, $\Delta \theta$'s)
- ▶ World Magnetic & Gravity Reference Models
- ▶ 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)..... | ± 180° |
| Range (Pitch)..... | ± 90° |
| Heading (Magnetic) ¹ | 2.0° RMS |
| Pitch/Roll (Static)..... | 0.05° RMS |
| Angular Resolution..... | 0.001° |

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) ² | 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 |

IMU Specifications

| | ACCELEROMETER | GYROSCOPE | MAGNETOMETER |
|--|---------------|----------------------------|----------------|
| Range ³ | ±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. Contact VectorNav for higher IMU data output rates.

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

3. Contact VectorNav for Extended Range Gyro Option.

