



# OpenIMU300RI

Rugged Open-Source IMU with CAN Output



The ACEINNA OpenIMU300RI is an easy-to-use high-performance 9-DOF open inertial platform packaged in a rugged sealed over-molded plastic housing. The OpenIMU300RI features a precision MEMS 3-Axis Accelerometer, low-drift MEMS 3-Axis Rate Gyro, and 3-Axis AMR Magnetometer. The processing power is provided by a 168MHz ARM M4 CPU with a Floating Point Unit. The OpenIMU300RI runs the OpenIMU open-source stack that includes an optimized 16-state Kalman Filter for Attitude and GPS-Aided Position-Velocity-Time (PVT) measurement. A free tool-chain based on VS Code supports PC, MAC, and Ubuntu.





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The ACEINNA OpenIMU300RI is designed for use in 12 V and 24 V vehicle platforms. The plastic over-molded sealed packaging meets the challenging performance, reliability and cost requirements of the automotive, construction and agriculture vehicle markets.

## Applications

- Autonomous Vehicles
- Self-Driving Taxis / Delivery Vehicles
- Construction Vehicles
  - Boom, Bucket and Cab Attitude
- Agriculture Vehicles and Implements
- Forklifts
- Robotics Control / Feedback
- Antenna / Camera Gimbaling and Stabilization



## Features

- Precision 3-axis MEMS Accelerometer
- Low-Drift 3-axis MEMS angular rate sensor
- High Performance 3-axis AMR Magnetometer
- CAN 2.0 and RS232 Interfaces
- 168 MHz ARM M4 processor
- Open Source Tool Chain
- Open Source Algorithms (VG / AHRS / INS)
- Built in 16-State Open Source Extended State Kalman Filter
- Open Community & Support
- Wide Temp Range, -40C to +85C
- Wide Supply Voltage Range, 5 V – 32 V
- IP67 Ampseal Connector
- High Reliability, MTBF > 50k hours

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## Performance Specification

Ta = 25°C, VDC = 12 V, unless otherwise stated

| Angular Rate                           | MIN   | TYP <sup>2</sup> | MAX   |
|----------------------------------------|-------|------------------|-------|
| Range (°/s)                            | -400  |                  | +400  |
| Bias Instability (°/hr) <sup>1</sup>   |       | 6                |       |
| Bias Stability over Temp (°/s)         |       | 0.3              |       |
| Scale Factor Accuracy (%)              |       | 0.03             |       |
| Cross-Axis Error (%FSR)                |       | 0.02             |       |
| Angle Random Walk (°/√hr) <sup>1</sup> |       | 0.3              |       |
| Configurable Bandwidth (Hz)            | 5     |                  | 50    |
| Acceleration                           | MIN   | TYP <sup>2</sup> | MAX   |
| Range (g)                              | -8    |                  | +8    |
| Bias Instability (μg) <sup>1</sup>     |       | 10               |       |
| Bias Stability over Temp (mg)          |       | 3                |       |
| Scale Factor Accuracy (%FSR)           |       | 0.03             |       |
| Non-Linearity (%FSR)                   |       | 0.03             |       |
| VRW (m/s/√hr) <sup>1</sup>             |       | 0.06             |       |
| Configurable Bandwidth (Hz)            | 2     |                  | 50    |
| Magnetic Field                         | MIN   | TYP <sup>2</sup> | MAX   |
| Range (mGauss)                         | -8000 |                  | +8000 |
| Resolution (mGauss)                    |       | 0.3              |       |
| Noise (mGauss/√Hz)                     |       | 0.25             |       |
| Bandwidth (Hz)                         |       | 5                |       |

Note 1: Allan variance curve, constant temperature

Note 2: Typical values are 1-sigma values unless otherwise noted

## Electrical Specifications

| Characteristic       | Specification                   |
|----------------------|---------------------------------|
| Input voltage        | 4.9 – 32 V                      |
| Over voltage         | 36 V                            |
| Reverse voltage      | -36 V                           |
| Current              | < 100 mA                        |
| Power                | < 400 mW                        |
| Reset response       | Automatic after voltage dropout |
| Start-up time        | <2 seconds                      |
| Max Output Data Rate | 100 Hz                          |
| CAN Baud rate        | 250k – 1M                       |
| RS232 Baud Rate      | 38400 – 230400                  |

## Physical Specifications

| Characteristic      | Specification                |
|---------------------|------------------------------|
| Dimensions          | 65 x 66 x 27 mm              |
| Weight              | < 75 g                       |
| Interface Connector | Ampseal 16 – 6 Position IP67 |
| Mating Connector    | TE Connectivity 776531-1     |

## Environmental Specifications

| Characteristic        | Specification |
|-----------------------|---------------|
| Operating Temperature | -40 – 85 °C   |
| Storage Temperature   | -40 – 85 °C   |
| Ingress Protection    | IP67, IP69K   |

## Qualification Summary (Not inclusive of all tests)

| Electrical Loads               | DUTs | Op Mode <sup>3</sup> | Function Class <sup>3</sup> | Summary                                                                                                                   |
|--------------------------------|------|----------------------|-----------------------------|---------------------------------------------------------------------------------------------------------------------------|
| Over Voltage (V)               | 3    | 3.2                  | A                           | SAE J1455 4.13.1: 36 V, 1 hour                                                                                            |
| Reverse Voltage (V)            | 3    | 1.1                  | C                           | SAE J1455 4.13.1: -36 V, 5 minutes                                                                                        |
| Short Circuit                  | 3    | 3.2                  | C                           | SAE J1455, 4.13.1: 32V                                                                                                    |
| Starting Profile               | 3    | 3.2                  | A                           | 10 cycles, 12 V System, Class IV                                                                                          |
| Load dump                      | 3    | 3.2                  | A                           | 5 pulses, 64V, 60 s pulse rate; 95 pulses 56V 120 s pulse rate                                                            |
| Reset Behavior at Voltage Drop | 1    | 3.2                  | B                           | ISO 16750-2: 4.6.2                                                                                                        |
| Mechanical Loads               |      |                      |                             |                                                                                                                           |
| Vibration Swept Sine           | 3    | 3.2                  | A                           | 5 – 500 Hz; <10 Hz Displacement = ± 12 mm; >10 Hz = 5 g Pk                                                                |
| Vibration Random               | 3    | 3.2                  | C                           | 10 – 2000 Hz; 13.9 g RMS                                                                                                  |
| Mechanical Bump                | 4    | 3.2                  | C                           | 100 bumps x 3 axis/DUT (600 Total/DUT) 400m/s <sup>2</sup> , ½ sine, 6 ms pulse                                           |
| Mechanical Shock               | 4    | 3.2                  | C                           | 3 Shocks x 3 axis x 2 directions (18 total) 500m/s <sup>2</sup> , ½ sine, 11 ms pulse                                     |
| Mechanical Drop                | 2    | 1.1                  | C                           | 1 m to steel plate, 1 drop x 3 axis x 2 directions (6 total)                                                              |
| Climatic Loads                 |      |                      |                             |                                                                                                                           |
| Hot Soak                       | 10   | 3.2                  | A                           | 96 Hours 85 °C                                                                                                            |
| Cold Soak                      | 10   | 3.2                  | A                           | 96 Hours -40 °C                                                                                                           |
| Temperature Cycle              | 10   | 3.2                  | A                           | 2 cycles, -40 – 85 °C                                                                                                     |
| Temperature Shock              | 10   | 1.1                  | C                           | 10 Cycles; -40 - 85 °C, <30s Transition, 3 hour dwell                                                                     |
| Chemical Loads                 |      |                      |                             |                                                                                                                           |
| Salt Spray                     | 2    | 1.1                  | C                           | EN 60068-2-52 Kb. Salt mist Cyclic (NaCl Solution) 35 °C                                                                  |
| General                        | 2    | 3.2                  | A                           | Engine oil, Diesel, Hydraulic Oil, Ethylene Glycol, Urea Nitrogen, Liquid Lime, NPK Fertilizer, Ammonia, Calcium Chloride |

Note 3: ISO 16750-1 Operation Mode and Function Class definition



## EMC Specifications

| Characteristic               | Standard        | Test Level / Frequency                          |                               |
|------------------------------|-----------------|-------------------------------------------------|-------------------------------|
| ESD direct contact discharge | ISO 13766       | 8 kV - Function Class A, Reference Limits IV    |                               |
| ESD air discharge            | ISO 13766       | 15 kV - Function Class A, Reference Limits IV   |                               |
| Radiated Immunity            | ISO 11452-2     | 100 V/m, 200 – 2000 MHz                         |                               |
| Bulk current injection       | ISO 11452-2     | 100 mA, 20 – 400 MHz                            |                               |
| EMC Transient Emissions      | ISO 13766       | 30 – 75 MHz                                     | 51 Bb uV/m                    |
|                              |                 | 75-400 MHz                                      | 51+15.13 log (freq in MHz/75) |
|                              |                 | 400 – 1000 MHz                                  | 62 dB uV/m                    |
| EMC Conducted Transmission   | ISO 13766; 7637 | 24V Parameters, Pulse 1, 2a, 2b, 3a, 3b,, 4, 5b |                               |

## Development Kit

- OpenIMU300RI EVK
- Special Housing with JTAG connection for development / debugging
- ST-Link debugger for in-system development of application code
- Fixture and Interface JTAG board
- Development Cable with Ampseal 16-6 Position to Dual DB9
  - CAN 2.0 Connection DB9
  - RS232 Connection DB9
  - Flying Lead for power connection

## Open Navigation Platform

Embedded navigation applications quickly developed on PC, MAC, and Ubuntu and deployed to run on OpenIMU hardware.

- Code / Compile / Debug
- Simulate / Analyze

Aceinna Navigation Studio developer tools and GUI are found on our developer site: [developers.aceinna.com](http://developers.aceinna.com)

Full manual, API and Algorithm documentation are found at: [openimu.readthedocs.io](http://openimu.readthedocs.io)

IDE and Compilation tools, download VS Code and Add Aceinna Extension: [code.visualstudio.com](http://code.visualstudio.com)

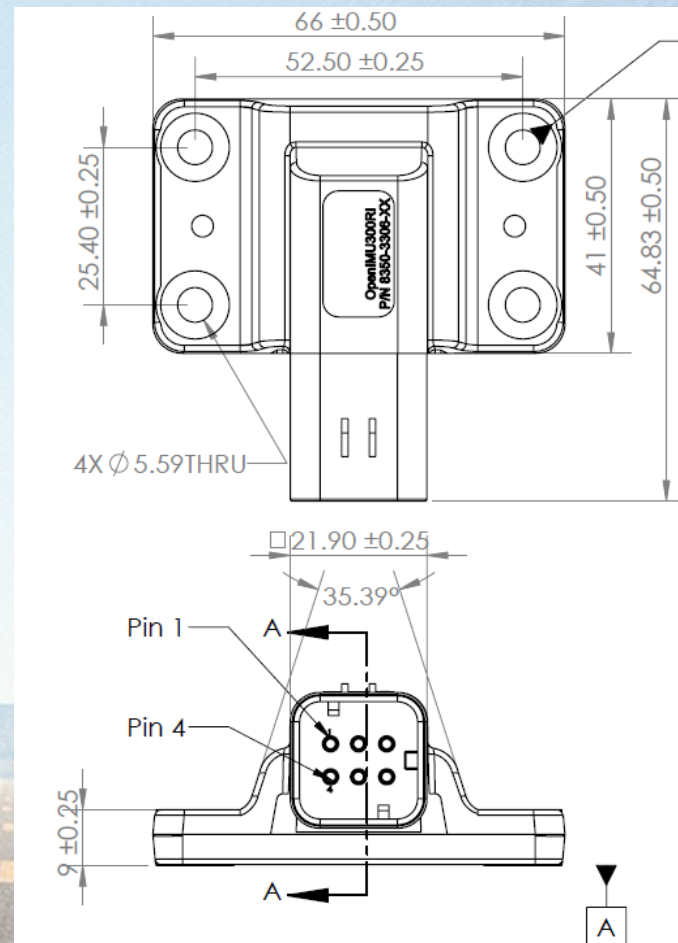
## Ready to Use Open Source Algorithms

- Calibrated IMU, 3D Acceleration, 3D Rate, 3D Mag
- VG / AHRS, Dynamic Roll, Pitch and Heading
- INS, Position, Velocity, Attitude and Heading

## Development System Requirements

- PC or MAC
- USB Port (2.0)
- Internet Connection

## Dimensioned Drawing



## Ordering Information

| Part Ordering Information                |                                                                                |
|------------------------------------------|--------------------------------------------------------------------------------|
| Rugged High-Performance OpenIMU Platform |                                                                                |
| OpenIMU300RI                             | Industrial Grade:<br>9 DOF IMU, FSR = 400dps / ±8g                             |
| OpenIMU300RI EVK                         | Developer Kit with OpenIMU300RI<br>with JTAG, STLink/v2 and developer<br>cable |



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- Защита от снятия компонента с производства.



#### Как с нами связаться

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