

## 3DM<sup>®</sup>-CV5-15

### Attitude and Heading Reference System (AHRS)

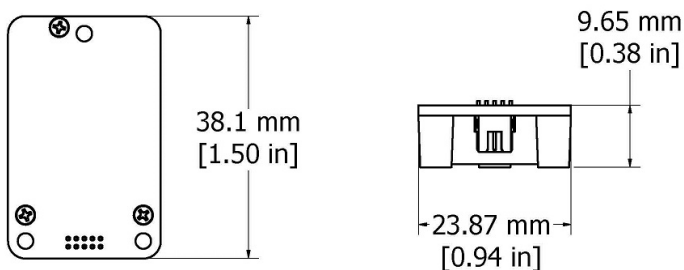


*3DM-CV5-15 – miniature, industrial-grade inertial measurement unit (IMU) and vertical reference unit (VRU)*

The LORD Sensing 3DM-CV5 family of industrial-grade, board-level inertial sensors provides a wide range of triaxial inertial measurements and computed attitude and navigation solutions.

The Inertial Measurement Unit (IMU) includes direct measurement of acceleration, angular rate, Delta-theta, and Delta-velocity. Compensation options include automatic compensation for magnetic anomalies, gyro and accelerometer noise, and noise effects. In models that include computed outputs, sensor measurements are processed through an auto-adaptive estimation filter algorithm to produce high accuracy computed outputs under dynamic conditions. The computed outputs vary between models and can include roll, pitch and yaw. All sensors are fully temperature-compensated and calibrated over the operating temperature. Micro-Electro-Mechanical System (MEMS) technology allows for highly accurate, small, light-weight devices.

The LORD Sensing MIP Monitor software can be used for device configuration, live data monitoring, and recording. Alternatively, the LORD Sensing MIP Data Communications Protocol is available for development of custom interfaces and easy OEM integration.



#### PRODUCT HIGHLIGHTS

- Triaxial accelerometer, gyroscope, and temperature sensors achieve the optimal combination of measurement qualities
- Dual on-board processors run a new Auto-Adaptive Extended Kalman Filter (EKF) for outstanding dynamic pitch and roll
- Smallest, lightest, highest performance VR in its class

#### FEATURES AND BENEFITS

##### BEST IN CLASS PERFORMANCE

- Fully calibrated, temperature-compensated, and mathematically-aligned to an orthogonal coordinate system for highly accurate outputs
- Bias tracking, error estimation, threshold flags, and adaptive noise modeling allow for fine tuning to conditions in each application
- High-performance, low-cost solution
- Direct PCB mount or chassis mount with ribbon cable
- Precision mounting alignment features

##### EASE OF USE

- Easy integration via comprehensive and fully backwards-compatible communication protocol
- Robust, forward compatible MIP packet protocol

##### COST EFFECTIVE

- Out-of-the box solution reduces development time
- Volume discounts

#### APPLICATIONS

- Platform stabilization, artificial horizon
- Health and usage monitoring of vehicles

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## Specifications

General		
<b>Integrated sensors</b>	Triaxial accelerometer, triaxial gyroscope, pressure altimeter, and temperature sensors	
<b>Data outputs</b>	<p><b>Inertial Measurement Unit (IMU) outputs:</b> acceleration, angular rate, magnetic field, ambient pressure, Delta-theta, Delta-velocity</p> <p><b>Computed outputs</b></p> <p><b>Extended Kalman Filter (EKF):</b> filter status, timestamp, attitude estimates (in Euler angles, quaternion, orientation matrix), linear and compensated acceleration, bias compensated angular rate, pressure altitude, gravity-free linear acceleration, gyroscope and accelerometer bias, scale factors and uncertainties, gravity and magnetic models, and more.</p> <p><b>Complementary Filter (CF):</b> attitude estimates (in Euler angles, quaternion, orientation matrix) stabilized, north and up vectors, GNSS correlation timestamp</p>	
Inertial Measurement Unit (IMU) Sensor Outputs		
	Accelerometer	Gyroscope
<b>Measurement range</b>	±8 g (standard) ±2 g, ±4 g, (optional)	±500°/sec (standard) ±250°, ±1000°/sec (optional)
<b>Non-linearity</b>	±0.04% fs	±0.06% fs
<b>Resolution</b>	0.05 mg (+/- 8 g)	<0.003°/sec (500 dps)
<b>Bias instability</b>	±0.08 mg	8°/hr
<b>Initial bias error</b>	±0.004 g	±0.01°/sec
<b>Scale factor stability</b>	±0.05%	±0.05%
<b>Noise density</b>	100 µg/√Hz	0.0075°/sec/√Hz (500°/sec)
<b>Alignment error</b>	±0.05°	±0.08°
<b>Adjustable bandwidth</b>	225 Hz (max)	500 Hz (max)
<b>Offset error over temperature</b>	0.02% (typ)	0.01% (typ)
<b>Gain error over temperature</b>	0.05% (typ) ±0.2% (max)	0.1% (typ) ±0.4% (max)
<b>IMU filtering</b>	First stage sigma delta Analog to Digital Converter sampled at 1 kHz. Second stage user adjustable digital low pass filter.	
<b>Sampling rate</b>	1 kHz	1 kHz
<b>IMU data output rate</b>	1 Hz to 1 kHz (sensor direct mode)	

Pressure Altimeter	
<b>Range</b>	-1800 m to 10,000 m
<b>Resolution</b>	< 0.1 m
<b>Noise density</b>	0.01 hPa RMS
<b>Sampling rate</b>	25 Hz
Computed Outputs	
<b>Attitude accuracy</b>	EKF outputs: ±0.5° RMS roll and pitch (typ) CF outputs: ±0.8° RMS roll and pitch (typ)
<b>Attitude heading range</b>	360° about all axes
<b>Attitude resolution</b>	0.05°
<b>Attitude repeatability</b>	0.5°
<b>Calculation update rate</b>	500 Hz
<b>Computed data output rate</b>	EKF outputs: 1 Hz to 500 Hz CF outputs: 1 Hz to 1000 Hz
Operating Parameters	
<b>Communication</b>	USB 2.0 (full speed) TTL serial (3.0 V dc, 9,600 bps to 921,600 bps, default 115,200)
<b>Power source</b>	+3.2 to + 5.2 V dc
<b>Power consumption</b>	360 mW (typ), 500 mW (max)
<b>Operating temperature</b>	-40°C to +85°C
<b>Mechanical shock limit</b>	500g/1ms survivability
Physical Specifications	
<b>Dimensions</b>	38 mm x 24 mm x 9.7 mm
<b>Weight</b>	11 grams
<b>Enclosure material</b>	Aluminum
<b>Regulatory compliance</b>	ROHS, CE
Integration	
<b>Connectors</b>	Data/power output: micro-DB9 Samtec FTSH Series
<b>Software</b>	MIP Monitor, Windows XP/Vista/7/8/10 compatible
<b>Compatibility</b>	Protocol compatibility across 3DM <sup>®</sup> -GX3, GX4, RQ1, GQ4, GX5 and CV5 product families
<b>Software development kit (SDK)</b>	MIP data communications protocol with sample code available (OS and platform independent)