

## 3DM-CV5™-15

### Vertical Reference Unit (VRU)

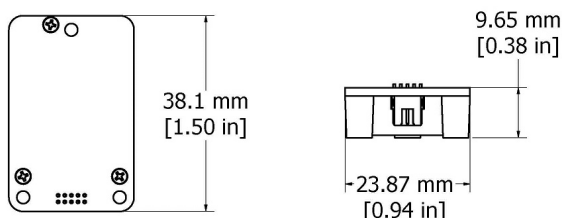


3DM-CV5™-15- miniature, industrial-grade inertial measurement unit (IMU) and vertical reference unit (VRU)

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.

In all models, the Inertial Measurement Unit (IMU) includes direct measurement of acceleration and angular rate. 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. Compensation options include automatic compensation for magnetic anomalies, gyro and accelerometer noise, and noise effects. The computed outputs vary between models and can include pitch, roll, yaw, a complete attitude and heading reference solution (AHRS), or a complete position, velocity and attitude solution (PVA), as well as integrated GNSS outputs. All sensors are fully temperature-compensated and calibrated over the operating temperature. The use of 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 **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

## Specifications

General		
<b>Integrated sensors</b>	Triaxial accelerometer, triaxial gyroscope, temperature sensors, and pressure altimeter	
<b>Data outputs</b>	<b>Inertial Measurement Unit (IMU) outputs:</b> acceleration, angular rate, ambient pressure, delta theta, delta velocity  <b>Computed outputs:</b> <b>Extended Kalman Filter (EKF):</b> filter status, attitude estimates (Euler angles, quaternion, orientation matrix), bias compensated angular rate, pressure altitude, gravity-free linear acceleration, attitude uncertainties, gyroscope and accelerometer bias, scale factors and uncertainties, gravity models, and more.	
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>Bias instability</b>	±0.04 mg	8°/hr
<b>Initial bias error</b>	±0.004 g	0.1°/sec
<b>Scale factor stability</b>	±0.05%	±0.05%
<b>Noise density</b>	100 µg/√Hz	0.0075°/sec/√Hz (300°/sec)
<b>Alignment error</b>	±0.05°	±0.05°
<b>Adjustable bandwidth</b>	500 Hz (max)	500 Hz (max)
<b>Offset error over temperature</b>	0.2% (typ)	0.1% (typ)
<b>Gain error over temperature</b>	0.05% (typ)	0.06% (typ)
<b>Scale factor non-linearity (@ 25° C)</b>	0.04% (typ) 0.2% (max)	0.04% (typ) 0.15% (max)
<b>IMU filtering</b>	Digital averaging filter (user adjustable) sampled at 2 kHz and scaled into physical units; coning and sculling integrals computed at 1 kHz	
<b>Sampling rate</b>	2 kHz	2 kHz
<b>IMU data output rate</b>	1 Hz to 1000 Hz	
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 & pitch (typ)
<b>Attitude heading range</b>	360° about all axes
<b>Attitude resolution</b>	0.05°
<b>Attitude repeatability</b>	0.2° (typ)
<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 500 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>	200 mW (typ)
<b>Operating temperature</b>	-40 °C to +85 °C
<b>Mechanical shock limit</b>	500 g (calibration unaffected) 1000 g (bias may change), 5000 g (survivability)
Physical Specifications	
<b>Dimensions</b>	38 mm x 24 mm x 9.7 mm
<b>Weight</b>	8 grams
<b>Enclosure material</b>	Aluminum
<b>Regulatory compliance</b>	ROHS, CE
Integration	
<b>Connectors</b>	Data/power output: Samtec FTSH Series (FTSH-105-01-F-D-K)
<b>Software</b>	MIP Monitor, Windows XP/Vista/7/8/10 compatible
<b>Compatibility</b>	Protocol compatibility across 3DM-GX3, GX4, RQ1, GQ4, and GX5 product families
<b>Software development kit (SDK)</b>	MIP data communications protocol with sample code available (OS and platform independent)

**LORD SENSING**  
MicroStrain

LORD Corporation  
MicroStrain® Sensing Systems  
459 Hurricane Lane, Suite 102  
Williston, VT 05495 USA

ph: 802-862-6629  
[sensing\\_sales@LORD.com](mailto:sensing_sales@LORD.com)  
[sensing\\_support@LORD.com](mailto:sensing_support@LORD.com)