

## 3DM<sup>®</sup>-CX5-25

### Attitude and Heading Reference System (AHRS)

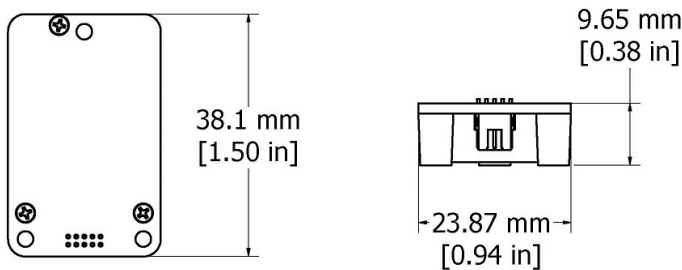


*3DM-CX5-25 – high-performance, industrial-grade attitude and heading reference system (AHRS) with integrated magnetometers, high noise immunity, and exceptional performance*

The **LORD Sensing 3DM-CX5** family of high-performance, industrial-grade, board-level inertial sensors provide a wide range of triaxial inertial measurements and computed attitude and navigation solutions.

The 3DM-CX5-25 is the smallest and lightest industrial AHRS with an Adaptive Kalman Filter available. It features a triaxial accelerometer, gyroscope, magnetometer, and temperature sensors to achieve the optimum combination of measurement qualities. The dual on-board processors run a new Auto-Adaptive Extended Kalman Filter (EKF) for outstanding dynamic attitude estimates, making it ideal for a wide range of applications, including platform stabilization and vehicle health and usage monitoring.

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, 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

#### FEATURES AND BENEFITS

##### BEST IN CLASS PERFORMANCE

- Bias tracking, error estimation, threshold flags, and adaptive noise modeling allow for fine tuning to conditions in each application
- Accelerometer noise as low as 25  $\mu\text{g}/\sqrt{\text{Hz}}$
- Smallest and lightest industrial AHRS with Adaptive Kalman Filter available

##### EASE OF USE

- Automatic magnetometer calibration and anomaly rejection eliminates the need for field calibration
- Automatically compensates for vehicle noise and vibration
- Easy integration via comprehensive and fully backwards-compatible communication protocol
- Common protocol between 3DM-GX3, GX4, RQ1, GQ4, and GX5 inertial sensor families for easy migration

##### COST EFFECTIVE

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

##### APPLICATIONS

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

# 3DM<sup>®</sup>-CX5-25 Attitude and Heading Reference System (AHRS)

## Specifications

General			
<b>Integrated sensors</b>	Triaxial accelerometer, triaxial gyroscope, and temperature sensors		
<b>Data outputs</b>	<b>Inertial Measurement Unit (IMU) outputs:</b> acceleration, angular rate, magnetic field, ambient pressure, Delta-theta, Delta-velocity  <b>Computed outputs</b> <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.		
Inertial Measurement Unit (IMU) Sensor Outputs			
	Accelerometer	Gyroscope	Magnetometer
<b>Measurement range</b>	±8 g (standard) ±2 g, ±4 g, ±20 g, ±40 g (optional)	300°/sec (standard) ±75, ±150, ±900 (optional)	±8 Gauss
<b>Non-linearity</b>	±0.02% fs	±0.02% fs	±0.3% fs
<b>Resolution</b>	<0.1 mg	<0.003°/sec	--
<b>Bias instability</b>	±0.04 mg	8°/hr	--
<b>Initial bias error</b>	±0.002 g	±0.04°/sec	±0.003 Gauss
<b>Scale factor stability</b>	±0.03%	±0.05%	±0.1%
<b>Noise density</b>	25 µg/√Hz (2 g)	0.005°/sec/√Hz (300°/sec)	400 µGauss/√Hz
<b>Alignment error</b>	±0.05°	±0.05°	±0.05°
<b>Adjustable bandwidth</b>	225 Hz (max)	250 Hz (max)	--
<b>Offset error over temperature</b>	0.06% (typ)	0.04% (typ)	--
<b>Gain error over temperature</b>	0.03% (typ)	0.03% (typ)	--
<b>Scale factor non-linearity (@ 25°C)</b>	0.02% (typ) 0.06% (max)	0.02% (typ) 0.06% (max)	±0.0015 Gauss
<b>Vibration induced noise</b>	--	0.072°/s RMS/g RMS	--
<b>Vibration rectification error (VRE)</b>	0.03%	0.001°/s/g <sup>2</sup> RMS	--
<b>IMU filtering</b>	Digital sigma-delta wide band anti-aliasing filter to digital averaging filter (user adjustable) scaled into physical units.		
<b>Sampling rate</b>	1 kHz	4 kHz	100 Hz
<b>IMU data output rate</b>	1 Hz to 1 kHz		

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: ±0.25° RMS roll and pitch, ±0.8° RMS heading (typ) CF outputs: ±0.5° RMS roll and pitch, ±1.5° RMS heading (typ)
<b>Attitude heading range</b>	360° about all axes
<b>Attitude resolution</b>	< 0.01°
<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 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>	+4 to + 36 V dc
<b>Power consumption</b>	500 mW (typ)
<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>	8 grams
<b>Enclosure material</b>	Aluminum
<b>Regulatory compliance</b>	ROHS, CE
Integration	
<b>Connectors</b>	Data/power output: micro-DB9Samtec 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)