

## 3DM<sup>®</sup>-GX5-25

### Attitude and Heading Reference System (AHRS)



**3DM-GX5-25** – miniature, high-performance, industrial-grade attitude and heading reference system (AHRS) with integrated magnetometers, high noise immunity, and exceptional performance

The LORD Sensing 3DM-GX5 family of high-performing, industrial-grade inertial sensors provides a wide range of triaxial inertial measurements and computed attitude and navigation solutions.

The 3DM-GX5-25 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, magnetometer, 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 attitude estimates

#### 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

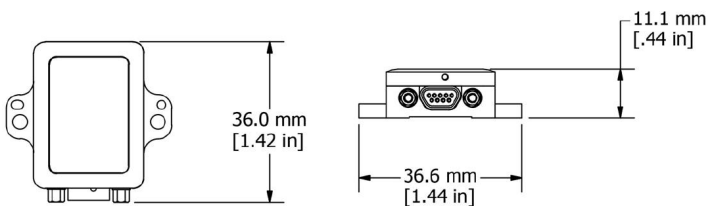
- Automatic magnetometer calibration and anomaly rejection eliminates the need for field calibration
- Automatically compensates for vehicle noise and vibration
- Easy integration via comprehensive and fully backwards-compatible communication protocol
- Common protocol between 3DM-GX3, GX4, RQ1, GQ4,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



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## Specifications

General			
<b>Integrated Sensors</b>	Triaxial accelerometer, triaxial gyroscope, triaxial magnetometer, 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, GPS correlation timestamp</p>		
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>	0.02 mg (+/- 8 g)	<0.003°/sec (300 dps)	--
<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°	±0.08°	±0.05°
<b>Bandwidth</b>	225 Hz	250 Hz	--
<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>Vibration induced noise</b>	--	0.072°/s RMS/g RMS	--
<b>Vibration rectification error (VRE)</b>	--	0.001°/s/g <sup>2</sup> RMS	--
<b>IMU filtering</b>	Digital sigma-delta ADC sampled at 1kHz and 4kHz. 4kHz data averaged to 1kHz nominal sampling rate. Scaled into physical units at 1kHz. User adjustable IIR filter available for 1kHz data. Coning and sculling integrals computed at 1kHz.		
<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) RS232 (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>	36.0 mm x 36.6 mm x 11 mm
<b>Weight</b>	16.5 grams
<b>Enclosure material</b>	Aluminum
<b>Regulatory compliance</b>	ROHS, CE
Integration	
<b>Connectors</b>	Data/power output: micro-DB9
<b>Software</b>	MIP Monitor, MIP Hard and Soft Iron Calibration, 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)

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