

3DM-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. Additionally, 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

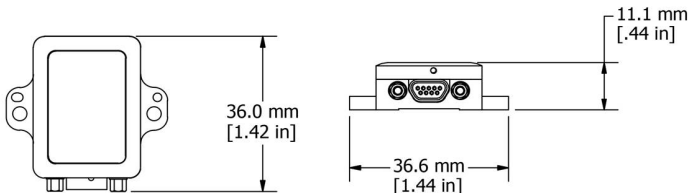
- Automatic magnetometer calibration and anomaly rejection eliminates the need for field calibration
- Automatically compensates for vehicle noise and vibration
- Easy integration via comprehensive and fully backwards-compatible communication protocol
- Common protocol between 3DM-GX3, GX4, RQ1, GQ4,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



Specifications

General			
Integrated sensors	Triaxial accelerometer, triaxial gyroscope, triaxial magnetometer, pressure altimeter, and temperature sensors		
Data outputs	Inertial Measurement Unit (IMU) outputs: acceleration, angular rate, magnetic field , ambient pressure, Delta-theta, Delta-velocity Computed outputs: Extended Kalman Filter (EKF): 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
Measurement range	±8 g (standard) ±2 g, ±4 g, ±20 g, ±40 g (optional)	300°/sec (standard) ±75, ±150, ±900 (optional)	±2.5 Gauss
Non-linearity	±0.02 fs	±0.02% fs	±0.3% fs
Resolution	<0.1 mg	<0.003°/sec	--
Bias instability	±0.04 mg	8°/hr	--
Initial bias error	±0.002 g	±0.04°/sec	±0.003 Gauss
Scale factor stability	0.03%	±0.05%	±0.1%
Noise density	25 µg/√Hz (2 g)	0.005°/sec/√Hz (300°/sec)	100 µGauss/√Hz
Alignment error	±0.05°	±0.05°	±0.05°
Adjustable bandwidth	225 Hz (max)	250 Hz (max)	-
Offset error over temperature	0.06% (typ)	0.04% (typ)	--
Gain error over temperature	0.03% (typ)	0.03% (typ)	--
Scale factor non-linearity (@ 25° C)	0.02% (typ) 0.06% (max)	0.02% (typ) 0.06% (max)	±0.0015 Gauss
Vibration induced noise	--	0.072°/s RMS/g RMS	--
Vibration rectification error (VRE)	--	0.001°/s/g ² RMS	--
IMU filtering	Digital sigma-delta wide band anti-aliasing filter to digital averaging filter (user adjustable) scaled into physical units.		
Sampling rate	1 kHz	4 kHz	50 Hz
IMU data output rate	1 Hz to 1 kHz		
Pressure Altimeter			
Range	-1800 m to 10,000 m		
Resolution	<0.1 m		
Noise density	0.01 hPa RMS		
Sampling rate	25 Hz		

Computed Outputs	
Attitude accuracy	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)
Attitude heading range	360° about all axes
Attitude resolution	<0.01°
Attitude repeatability	0.2° (typ)
Calculation update rate	500 Hz
Computed data output rate	EKF outputs: 1 Hz to 500 Hz CF outputs: 1 Hz to 1000 Hz
Operating Parameters	
Communication	USB 2.0 (full speed) RS232 (9,600 bps to 921,600 bps, default 115,200)
Power source	+4 to +36 V dc V dc
Power consumption	500 mW (typ)
Operating temperature	-40 °C to +85 °C
Mechanical shock limit	500 g (calibration unaffected) 1000 g (bias may change), 5000 g (survivability)
MTBF	(TBD)
Physical Specifications	
Dimensions	36.0 mm x 36.6 mm x 11.1 mm
Weight	16.5 grams
Enclosure material	Aluminum
Regulatory compliance	ROHS, CE
Integration	
Connectors	Data/power output: micro-DB9
Software	MIP Monitor, Windows XP/Vista/7/8/10 compatible
Compatibility	Protocol compatibility across 3DM-GX3, GX4, RQ1, GQ4, and GX5 product families
Software development kit (SDK)	MIP data communications protocol with sample code available (OS and platform independent)

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