3DM™-GX5™-15
Vertical Reference Unit (VRU)


3DM-GX5-15 - *miniature, high-performance, industrial-grade inertial measurement unit (IMU) and vertical reference unit (VRU)*

The **LORD Sensing 3DM-GX5** family of high-performance, industrial-grade 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, and are fully temperature-compensated and calibrated over the operating temperature. The use of Micro-Electro-Mechanical System (MEMS) technology allows for highly accurate, small, lightweight 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.
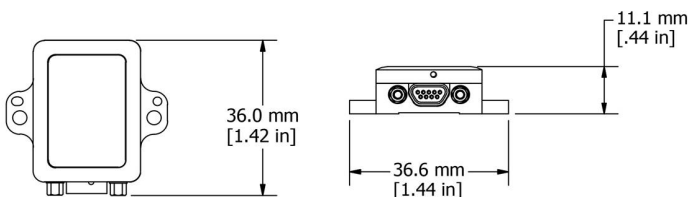
Product Highlights

- Triaxial accelerometer, gyroscope, 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-drift gyros with noise density of $0.005°/sec/\sqrt{Hz}$ and VRE of $0.001°/s/g^2$ RMS
- Accelerometer noise as low as 25 u$g/\sqrt{Hz}$

Ease of Use
- User-defined sensor-to-vehicle frame transformation
- 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

Best in Class Inertial Measurement

Specifications

General	
Integrated sensors	Triaxial accelerometer, triaxial gyroscope, temperature sensors, and pressure altimeter
Data outputs	**Inertial Measurement Unit (IMU) outputs:** acceleration, angular rate, ambient pressure, delta theta, delta velocity **Computed outputs:** **Extended Kalman Filter (EKF):** 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**
Measurement range	±8 g (standard) ±2 g, ±4 g, ±20 g, ±40 g (optional)	300°/sec (standard) ±75, ±150, ±900° /sec (optional)
Non-linearity	±0.02% fs	±0.02% fs
Bias instability	±0.04 mg	8°/hr
Initial bias error	±0.002 g	±0.04°/sec
Scale factor stability	±0.03%	±0.05%
Noise density	25 µg/√Hz (2 g)	0.005°/sec/√Hz 0.005°/sec/√Hz (300°/sec)
Alignment error	±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)
Vibration induced noise	--	0.072°/s RMS/g RMS
Vibration rectification error (VRE)	0.03%	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; coning and sculling integrals computed at 1 kHz	
Sampling rate	1 kHz	4 kHz
IMU data output rate	1 Hz to 1000 Hz	

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 (typ) CF outputs: ±0.5° roll and pitch (static, typ) and ±2.0° roll and pitch (dynamic, 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 500 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
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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