

3DM[®]-GX5-15 Vertical Reference Unit (VRU)

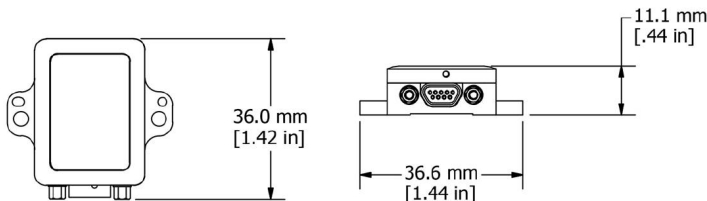


3DM-GX5-15 – miniature, high-performance, industrial-grade inertial measurement unit (IMU) and vertical reference unit (VRU)

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. 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, 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
- 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 $0.005^\circ/\text{sec}/\sqrt{\text{Hz}}$ and VRE of $0.001^\circ/\text{s}/\text{g}^2\text{RMS}$
- Accelerometer noise as low as $25 \mu\text{g}/\sqrt{\text{Hz}}$

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

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

Specifications

General		
Integrated Sensors	Triaxial accelerometer, triaxial gyroscope, pressure altimeter, and temperature sensors	
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 (in 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. Complementary Filter (CF): attitude estimates (in Euler angles, quaternion, orientation matrix) stabilized, north and up vectors, GPS correlation timestamp	
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 (optional)
Non-linearity	±0.02 % fs	±0.02% fs
Resolution	0.02 mg (+/- 8 g)	<0.003°/sec (300 dps)
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 (300°/sec)
Alignment error	±0.05°	±0.05°
Bandwidth	225 Hz	250 Hz
Offset error over temperature	0.06% (typ)	0.04% (typ)
Gain error over temperature	0.03% (typ)	0.03% (typ)
Vibration induced noise	--	0.072°/s RMS/g RMS
Vibration rectification error (VRE)	--	0.001°/s/g² RMS
IMU filtering	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.	
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 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
Power consumption	500 mW (typ)
Operating temperature	-40°C to +85°C
Mechanical shock limit	500g/1ms survivability
MTBF	557,280 hours (Telcordia method, GM/35C)
Physical Specifications	
Dimensions	36.0 mm x 36.6 mm x 11 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, GX5 and CV5 product families
Software development kit (SDK)	MIP data communications protocol with sample code available (OS and platform independent)

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