3DM-GX5-45

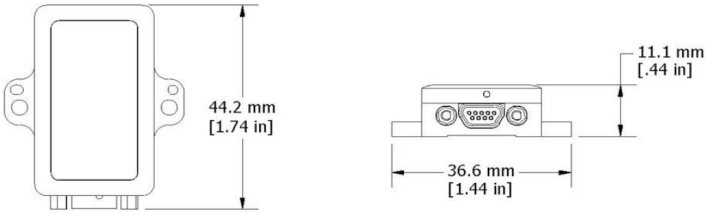
GNSS-Aided Inertial Navigation System (GNSS/INS)

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.

The 3DM-GX5-45 all-in-one navigation solution features a high-performance, integrated multi-constellation GNSS receiver utilizing the GPS, GLONASS, BeiDou, and Galileo satellite constellations. Sensor measurements are fully calibrated, temperature-compensated, and mathematically-aligned to an orthogonal coordinate system for highly accurate outputs. The auto-adaptive estimation filter algorithm produces highly accurate computed outputs under dynamic conditions.

Compensation options include automatic compensation for magnetic anomalies, gyro and accelerometer noise, and noise effects. The computed outputs include pitch, roll, yaw, heading, position, velocity, and GNSS, making it a complete GNSS/INS (GNSS Aided Inertial Navigation System) solution. Micro-Electro-Mechanical System (MEMS) technology provides a highly accurate, small, light-weight device.

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

- High-performance integrated multi-constellation GNSS receiver and advanced MEMS sensor technology provide direct inertial measurements, and computed position, velocity, and attitude outputs in a small package
- Triaxial accelerometer, gyroscope, magnetometer, temperature sensors, and a pressure altimeter achieve the optimal combination of measurement qualities
- Dual on-board processors run a new Auto-Adaptive Extended Kalman Filter (EKF) for outstanding dynamic position, velocity, and attitude estimates

FEATURES AND BENEFITS

BEST IN CLASS PERFORMANCE

- Fully calibrated, temperature-compensated, and mathematically-aligned to an orthogonal coordinate system for highly accurate outputs
- High-performance, low-drift gyros with low noise density and Vibrational Rectification Error
- Accelerometer noise as low as 25 ug/√Hz

EASE OF USE

- The MSCL API allows easy integration with C++, Python, .NET, C#, Visual Basic, LabVIEW and MATLAB environments.Robust, forward compatible MIP packet protocol
- MIP open byte level communication protocol
- SensorConnect enables simple device configuration, live data monitoring, and recording
- Automatic magnetometer calibration and anomaly rejection eliminates the need for field calibration
- Automatically compensates for vehicle noise and vibration

COST EFFECTIVE

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

APPLICATIONS

- GNSS-aided navigation system
- Platform stabilization, artificial horizon
- Satellite dish, radar, and antenna pointing

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Specifications

General			
Integrated Sensors	Triaxial accelerometer, triaxial gyroscope, triaxial magnetometer, pressure altimeter, temperature sensors, and GNSS receiver		
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, GNSS timestamp, LLH position, NED velocity, attitude estimates (in Euler angles, quaternion, orientation matrix), linear and compensated acceleration, bias compensated angular rate, pressure altitude, gyroscope and accelerometer bias, scale factors and uncertainties, gravity and magnetic models, and more. **Complementary Filter (CF):** attitude estimates (in Euler angles, quaternion, orientation matrix) stabilized, north and up vectors, GNSS correlation timestamp **Global Navigation Satellite System outputs (GNSS):** LLH position, ECEF position and velocity, NED velocity, UTC time, GNSS time, SV. GNSS protocol access mode available.		
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)	±8 Gauss
Non-linearity	±0.02 % fs	±0.02% fs	±0.3% 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	±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)	400 µGauss/√Hz
Alignment error	±0.05°	±0.08°	±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	100 Hz
IMU data output rate	1 Hz to 500 Hz (standard mode) 1 Hz to 1000 Hz (sensor direct mode)		
Pressure Altimeter			
Altitude Range	1260-260 mB (hPa) (-1400 to 10,000m)		
Resolution	0.01 hPa RMS		
Relative Accuracy	±0.1 hPa, over the range 800-1000 hPa @ T=25°C		
Sampling rate	25 Hz		
Computed Outputs			

Position accuracy	±2 m RMS horizontal, ± 5 m RMS vertical (typ)
Velocity accuracy	±0.1 m/s RMS (typ)
Attitude accuracy	EKF outputs: ±0.25° RMS roll and pitch, ±0.8° RMS heading (typ) CF outputs: ±0.5° roll, pitch, and heading (static, typ), ±2.0° roll, pitch, and heading (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: up to 500 Hz, CF outputs: up to 500 Hz
Global Navigation Satellite System (GNSS) Outputs	
Receiver type	72-channel GPS/QZSS L1 C/A, GLONASS L10F, BeiDou B1, SBAS L1 C/A:WAAS, EGNOS, MSAS Galileo E1B/C
GNSS data output rate	1 Hz to 4 Hz
Time-to-first-fix	Cold start: 27 second, reacquisition: 1 second hot start: <1 second
Sensitivity	Tracking: -164 dBm, cold start: -147 dBm hot start: - 156 dBm
Velocity accuracy	0.1 m/sec
Heading accuracy	0.5°
Horizontal position accuracy	GNSS: 2.5 m CEP SBAS: 2.0 m CEP
Time pulse signal accuracy	30 nsec RMS < 60 nsec 99%
Acceleration limit	≤ 4 g
Altitude limit	50,000 meters
Velocity limit	500 m /sec (972 knots)
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	700 mW (typ), 800 mW (max)
Operating temperature	-40°C to +85°C
Mechanical shock limit	500*g*/1ms
MTBF	396,193 hours (Telcordia method, GM/35C)
Physical Specifications	
Dimensions	44.2 mm x 36.6 mm x 11.1 mm
Weight	20 grams
Enclosure material	Aluminum
Regulatory compliance	ROHS, CE
Integration	
Connectors	Data/power output: micro-DB9 GNSS antenna: MMCX type
Software	SensorConnect;, 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)	MSCL code examples available. MIP open byte level protocol, with sample code available (OS and platform independent)

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