LORD **DATASHEET**

3DM-GQ4-45™

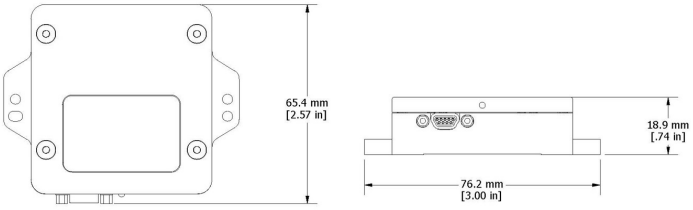
Tactical Grade GNSS-Aided Inertial Navigation System (GNSS/INS)

3DM-GQ4-45™ - *compact, tactical-grade, all-in-one navigation solution with integrated GNSS and magnetometers, high noise immunity, and exceptional performance*

The **LORD MicroStrain®** family of **industrial** and **tactical 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, angular rate, and atmospheric pressure. Sensor measurements are processed through an on-board processor running a sophisticated estimation filter or fusion algorithm to produce high accuracy computed outputs with compensation options for magnetic and linear acceleration anomalies, sensor biases, auto-zero update, and noise offsets. The computed outputs vary between models and can include pitch, roll, yaw, a complete attitude, heading, and reference solution (AHRS) or a complete position, velocity and attitude solution (PVA), as well as integrated GNSS outputs. All sensors 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 MicroStrain® **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 satellite and 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 best combination of measurement qualities
- Dual on-board processors run a sophisticated Extended Kalman Filter (EKF) for excellent PVA estimates
- Improved position outputs with concurrent tracking of up to two GNSS constellations (GPS/QZSS, GLONASS, BeiDou)

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, magnetic, and gravitational field modeling allow for fine tuning to conditions in each application
- High-performance, low-drift gyros with noise density of 0.002°/sec/√Hz and VRE of 0.001°/s/g^2RMS

Ease of Use

- User-defined sensor-to-vehicle frame transformation
- 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

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, temperature sensors, pressure altimeter, and GNSS receiver		
Data outputs	**Inertial Measurement Unit (IMU) outputs:** acceleration, angular rate, ambient pressure, deltaTheta, deltaVelocity **Computed outputs:** **Extended Kalman Filter (EKF):** filter status, GNSS timestamp, LLH position, NED velocity, attitude estimates (in Euler angles, quaternion, orientation matrix), bias compensated angular rate, pressure altitude, gravity-free linear acceleration, 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 gravity 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	±5 *g*	300°/sec (standard) ±75, ±150, ±900 °/sec (options)	±2.5 Gauss
Non-linearity	±0.03 % fs	±0.03 % fs	±0.4% fs
Resolution	<0.04 m*g*	<0.0025°/sec	--
Bias instability	±0.02 m*g*	5°/hr	--
Initial bias error	±0.001 *g*	±0.05°/sec	±0.003 Gauss
Scale factor stability	±0.05 %	±0.05 %	±0.1 %
Noise density	50 µg/√Hz	0.002°/sec/√Hz	100 µGauss/√Hz
Alignment error	±0.05°	±0.05°	±0.05°
Adjustable bandwidth	250 Hz (max)	160 Hz (max)	-
Vibration induced noise	--	0.06°/s RMS/*g* RMS	--
Vibration rectification error (VRE)	0.03%	0.001°/s/g^2 RMS	--
IMU filtering	4 stage filtering: analog bandwidth filter to digital sigma-delta wide band anti-aliasing filter to (user adjustable) digital averaging filter sampled at 8 kHz and scaled into physical units; coning and sculling integrals computed at 1 kHz		
Sampling rate	10 kHz	10 kHz	50 Hz
IMU data output rate	1 Hz to 500 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	
Position accuracy	±2.5 m RMS horizontal, ± 5 m RMS vertical (typ)
Velocity accuracy	±0.1 m/s RMS (typ)
Attitude accuracy	±0.1° RMS roll & pitch, ±0.5° RMS heading (typical)
Attitude heading range	360° about all axes
Attitude resolution	< 0.01°
repeatability	0.1° (typ)
Calculation update rate	500 Hz
Computed data output rate	1 Hz 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-ready 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 (autonomous) SBAS: 2.0 m CEP (stationary, 24 hours, SEP 3.5 m)
Time pulse signal accuracy	30 nsec RMS < 60 nsec 99%
Acceleration limit	≤ 4 *g*
Altitude limit	No limit
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	+ 4.2 to + 28 V dc
Power consumption	2.5 W (typ)
Operating temperature	-40 °C to +85 °C
Vibration limit	6 *g* RMS, 10 Hz to 2 kHz
Mechanical shock limit	750 *g* (half-sine, 2 msec powered, any axis)
Physical Specifications	
Dimensions	76.2 mm x 65.4 mm x 18.9 mm
Weight	105 grams
Enclosure material	Aluminum
Regulatory compliance	ROHS, CE, FCC Class B
Integration	
Connectors	Data/power output: micro-DB9 GNSS antenna: MMCX type
Software	MIP™ Monitor, MIP™ Hard and Soft Iron Calibration, Windows XP/Vista/7/8 compatible
Compatibility	Protocol compatibility across 3DM-GX3, GX4, RQ1, GQ1, and GX5 product families
Software development kit (SDK)	MIP™ data communications protocol with sample code available (OS and platform independent)

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