3DM-GX3® -45

Miniature GPS-Aided Inertial Navigation System (GPS/INS)

The **3DM-GX3®** -45 high-performance, miniature GPS-Aided Inertial Navigation System (GPS/INS) combines MEMS inertial sensors, a highly-sensitive embedded GPS receiver, and a complex Extended Kalman Filter to generate optimal position, velocity, and attitude (PVA) estimates. This combination of technologies creates better short-term GPS-out performance, sustained-G attitude performance, and provides higher rate PVA data than typical GPS and AHRS sensors. Raw GPS data, IMU data, and filtered INS data are time-aligned and available as user-defined packets (either by polling or continuous stream).

Features & Benefits

Best in Class

- precise position, velocity and attitude estimations
- high-speed sample rate & flexible data outputs
- high performance under vibration and high-g

Easiest to Use

- smallest, lightest industrial GPS/INS available
- simple integration supported by SDK and comprehensive API

Cost Effective

- reduced cost and rapid time to market for customer's applications
- aggressive volume discount schedule

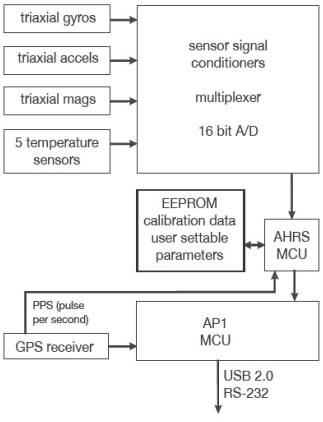
Applications

Accurate navigation and orientation under dynamic conditions such as:

- Primary and/or Secondary GPS-aided Navigation System
- Unmanned Vehicle Navigation
- Platform Stabilization, Artificial Horizon
- Antenna and Camera Pointing
- Health and Usage Monitoring of Vehicles
- Reconnaissance, Surveillance, and Target Acquisition
- Robotic Control
- Personnel Tracking

System Overview

The **3DM-GX3®** -45 offers a range of navigation-related outputquantities, including estimated position, velocity, and attitude (PVA),position, velocity, and attitude uncertainties, bias-compensated angularrate, and linear acceleration. Fully-calibrated inertial measurementsinclude acceleration, angular rate, magnetic field, deltaTheta anddeltaVelocity vectors, Euler angles (pitch, roll, and heading), rotationmatrix and quaternion. Unprocessed GPS data quantities include LLHposition, NED velocity, ECEF position and velocity, DOP data, UTCtime, GPS time, clock info, GPS fix, and SVI. All quantities are fullytemperature compensated and are mathematically aligned to anorthogonal coordinate system. The angular rate quantities are furthercorrected for g-sensitivity and scale factor non-linearity to third order.The 3DM-GX3® -45 architecture has been carefully designed tosubstantially eliminate common sources of error such as hysteresisinduced by temperature changes and sensitivity to supply voltagevariations. Gyro drift is eliminated in AHRS mode by referencingmagnetic North and Earth's gravity and compensating for gyro bias. On-board coning and sculling compensation allows for use of lowerdata output rates while maintaining performance of a fast internalsampling rate. For those users, integrators or OEMs who develop their own orientation and navigation applications, the 3DM-GX3® -45 is shipped with a complete Data Communications Protocol guide that provides access to the powerful LORD **MicroStrain®** Inertial Packet Protocol (MIP). Applications of your own design can readily be developed in any coding language and on any computing platform including microprocessors. The 3DM-GX3® -45 is initially sold as a starter kitconsisting of an INS module, RS-232 or USB communication andpower cable, software CD, user manual, and quick start guide.



LORD MicroStrain®
SENSING SYSTEMS

Specifications

Navigation Specifications

Kalman Filter Performance	
Typical position accuracy †	±2.5 m RMS horizontal, ±5 m RMS vertical
Typical velocity accuracy †	±0.1 m/s to ±0.75 m/s RMS (application and settings dependent)
Typical attitude accuracy †	±0.35 deg RMS roll & pitch ±1.0 deg RMS heading
Update rate	100 Hz
Features	• vehicle dynamics mode selection (portable/ automotive/airborne) • user-defined sensor to vehicle frame transformation • antenna offset specification, bias enable/disable • internal magnetometer enable/disable and external GPS and heading sensor support • full world magnetic model
Data output rate	1 Hz to 100 Hz

AHRS Specifications

Attitude and Heading	
Attitude heading range	360° about all 3 axes
Accelerometer range	±5*g* standard
Gyroscope range	±300°/sec standard
Static accuracy	±0.5° pitch, roll, heading typical for static test conditions
Dynamic accuracy	±2.0° pitch, roll, heading for dynamic (cyclic) test conditions and for arbitrary angles
Long term drift	eliminated by complimentary filter architecture
Repeatability	0.2°
Resolution	<0.1°
Data output rate	up to 1000 Hz
Filtering	sensors sampled at 30 kHz, digitally filtered (user adjustable) and scaled into physical units; coning and sculling integrals computed at 1 kHz
Output modes	acceleration, angular rate, magnetic field, deltaTheta, deltaVelocity, Euler angles, orientation matrix, quaternion, LLH position, NED velocity, GPS time, filter status, PVA estimate, PVA uncertainties, attitude as: quaternion, matrix, or Euler angles, gravity-free linear acceleration, bias-compensated angular rate
General	
A/D resolution	16 bits SAR oversampled to 17 bits
Interface options	USB 2.0 or RS232
Baud rate	9,600 bps to 921,600 bps
Power supply voltage	+3.2 to +16 volts DC
Power consumption	at full performance with GPS lock: 200 mA typ (250 mA max) when powered by Vpri (3.2V-5.5V); 850 mW typ (1.0W max) when powered by Vaux (5.2V-16V)
Connector	micro-DB9
Operating temperature	-40 °C to +65 °C
Dimensions	44 mm x 24 mm x 14 mm - excluding mounting tabs, width across tabs 37 mm
Weight	23 grams
ROHS	compliant
Shock limit	500 *g*
Software utility	CD in starter kit (XP/Vista/Win7/Win 8 compatible)
Software development kit (SDK)	complete data communications protocol and sample code
CE	compliant

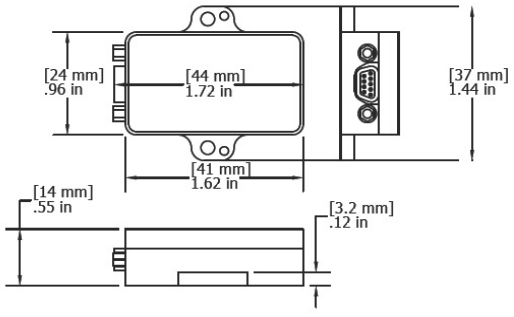
Sensor Specifications

	Accels	Gyros	Mags
Measurement range	±5 *g*	±300°/sec	±2.5 Gauss
Non-linearity	±0.1 % fs	±0.03 % fs	±0.4 % fs
In-run bias stability	±0.04 m*g*	18°/hr	—
Initial bias error	±0.002 *g*	±0.25°/sec	±0.003 Gauss
Scale factor stability	±0.05 %	±0.05 %	±0.1 %
Noise density	80 µ*g*/√Hz	0.03°/sec/√Hz	100 µGauss/√Hz
Alignment error	±0.05°	±0.05°	±0.05°
User adjustable bandwidth	225 Hz max	440 Hz max	230 Hz max
Sampling rate	30 kHz	30 kHz	7.5 kHz max

GPS Specifications

GPS Receiver	
GPS receiver type	50-channel u-blox 6 engine GPS L1 C/A code SBAS: WAAS, EGNOS, MSAS
Data output rate	1 Hz to 4 Hz
Time-to-First-Fix	Cold starts: 27 sec Aided starts: 4 sec Hot starts: 1 sec
GPS tracking and navigation sensitivity	-159 dBm
Sensitivity	Tracking: -159 dBm Cold starts: -147 dBm Hot starts: -158 dBm
GPS velocity accuracy	0.1 m/sec
GPS heading accuracy	0.5°
GPS horizontal position accuracy	position: 2.5 m CEP SBAS: 2.0 m CEP
GPS timepulse signal accuracy	30 nsec RMS < 60 nsec 99%
GPS acceleration limit	≤ 4 g
GPS altitude limit	no limit
GPS velocity limit	500 m/sec (972 knots)
GPS antenna connector	MMCX type
Options	
Accelerometer range	±1.7 *g*, ±16 *g*, ±50 *g*
Gyroscope range	±50°/sec, ±600°/sec, ±1200°/sec

† RMS values generated from actual vehicle testing (airborne & land) when compared to a reference navigation unit



Version 8400-0035 rev. 003

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