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

The 3DM-GX3® -45 offers a range of navigation-related output quantities, including estimated position, velocity, and attitude (PVA), position, velocity, and attitude uncertainties, bias-compensated angular rate, and linear acceleration. Fully-calibrated inertial measurements include acceleration, angular rate, magnetic field, deltaTheta and deltaVelocity vectors, Euler angles (pitch, roll, and heading), rotation matrix and quaternion. Unprocessed GPS data quantities include LLH position, NED velocity, ECEF position and velocity, DOP data, UTC time, GPS time, clock info, GPS fix, and SVI. All quantities are fully temperature compensated and are mathematically aligned to an orthogonal coordinate system. The angular rate quantities are further corrected for g-sensitivity and scale factor non-linearity to third order. The 3DM-GX3® -45 architecture has been carefully designed to substantially eliminate common sources of error such as hysteresis induced by temperature changes and sensitivity to supply voltage variations. Gyro drift is eliminated in AHRS mode by referencing magnetic North and Earth’s gravity and compensating for gyro bias. On-board coning and sculling compensation allows for use of lower data output rates while maintaining performance of a fast internal sampling 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 kit consisting of an INS module, RS-232 or USB communication and power cable, software CD, user manual, and quick start guide.
### Specifications

#### 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
- **GPS velocity accuracy**: ±0.1 m/sec
- **GPS heading accuracy**: ±0.5°
- **GPS horizontal position accuracy**: 2.5 m CEP (SBAS: 2.0 m CEP)
- **GPS timepulse signal accuracy**: 30 nsec RMS
- **GPS acceleration limit**: ≤4 g
- **GPS altitude limit**: no limit
- **GPS velocity limit**: 500 m/sec (972 knots)
- **GPS antenna connector**: MMCX type

#### Sensor Specifications

<table>
<thead>
<tr>
<th>Accels</th>
<th>Gyros</th>
<th>Mags</th>
</tr>
</thead>
<tbody>
<tr>
<td>±5 g</td>
<td>±300°/sec</td>
<td>±2.5 Gauss</td>
</tr>
<tr>
<td>±0.1 % fs</td>
<td>±0.03 % fs</td>
<td>±0.4 % fs</td>
</tr>
<tr>
<td>±0.04 mg</td>
<td>18°/hr</td>
<td>—</td>
</tr>
<tr>
<td>±0.002 g</td>
<td>±0.25°/sec</td>
<td>±0.003 Gauss</td>
</tr>
<tr>
<td>±0.05 %</td>
<td>±0.05 %</td>
<td>±0.1 %</td>
</tr>
<tr>
<td>80 µG/√Hz</td>
<td>0.03°/sec/√Hz</td>
<td>100 µGauss/√Hz</td>
</tr>
<tr>
<td>±0.05°</td>
<td>±0.05°</td>
<td>—</td>
</tr>
</tbody>
</table>

#### AHRS Specifications

- **Attitude and Heading**
  - Attitude heading range: 360° about all 3 axes
  - Accelerometer range: ±5g 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, LLL, position, VEL, 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 ± 14 mm - excluding mounting tabs, width across tabs 37 mm
- **Weight**: 23 g
- **ROHS**: compliant
- **Shock limit**: 500 g
- **Software utility**: CD in starter kit (XP/Vista/Win7/Win 8 compatible)
- **Software development kit (SDK)**: complete communications protocol and sample code
- **CE**: compliant

### 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 (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**

### Options

<table>
<thead>
<tr>
<th>Accelerometer range</th>
<th>±1.7 g, ±16 g, ±50 g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gyroscope range</td>
<td>±50°/sec, ±600°/sec, ±1200°/sec</td>
</tr>
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