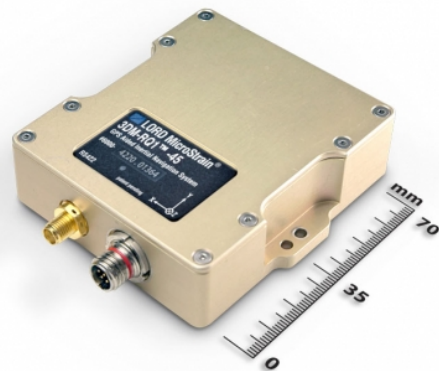


## 3DM-RQ1™ -45

### Ruggedized Tactical Grade GPS-Aided Inertial Navigation System

The 3DM-RQ1™ -45 Ruggedized Tactical Grade GPS-Aided Inertial Navigation System (GPS/INS) combines a MEMS inertial sensor core with a high sensitivity GPS receiver, and a sophisticated Extended Kalman Filter to generate optimal position, velocity, and attitude (PVA) estimates. Time aligned raw GPS outputs and IMU measurements are also available to the user.

The 3DM-RQ1™ -45 has been designed to meet the needs of applications that require tactical grade performance in a harsh operating environment while simultaneously demanding low cost and a small package size.



## Features & Benefits

### Best in Class

- precise position, velocity & attitude estimates
- fully configurable data outputs
- high immunity to shock and vibration
- compact, low profile, & light weight
- galvanically isolated
- coldstart to -55 °C
- designed to DO-160G for deployment in harsh environments

### Easiest to Use

- simple integration supported by SDK & comprehensive API
- robust, forward compatible MIP™ packet protocol

### Cost Effective

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

## Applications

Accurate navigation and attitude under dynamic conditions such as:

- camera stabilization
- satellite dish, radar, & antenna pointing
- platform stabilization, artificial horizon
- primary and/or secondary GPS-aided navigation system
- unmanned vehicle navigation
- health and usage monitoring of vehicles
- reconnaissance, surveillance, & target
- robotic control
- personnel tracking

## System Overview

The advanced GPS/INS Kalman Filter embedded in the 3DM-RQ1™ -45 provides high accuracy position, velocity and attitude & heading outputs. A full set of supporting data quantities are also available including: PVA uncertainties, estimated gyro and accel bias and scale factor errors, filter status and gravity-free linear acceleration.

All data is transmitted using LORD MicroStrain's robust MIP™ packet protocol. This allows the user to fully configure the data stream to meet the needs of the application. It ensures forward and backward software compatibility.

The 3DM-RQ1™ -45 utilizes LORD MicroStrain's IMU7 inertial sensor core which provides tactical grade performance. All inertial measurements 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. The hardware architecture has been carefully designed to substantially eliminate common sources of error. On-board coning and sculling compensation allows for use of lower data output rates while maintaining the performance of a fast internal sampling rate.

The 3DM-RQ1™ -45 is housed in a compact, low profile enclosure. It is designed to meet a comprehensive set of DO-160G Environmental requirements for airborne equipment including: altitude, temperature, humidity, shock, vibration, water proofness, voltage spike and EMI/EMC.

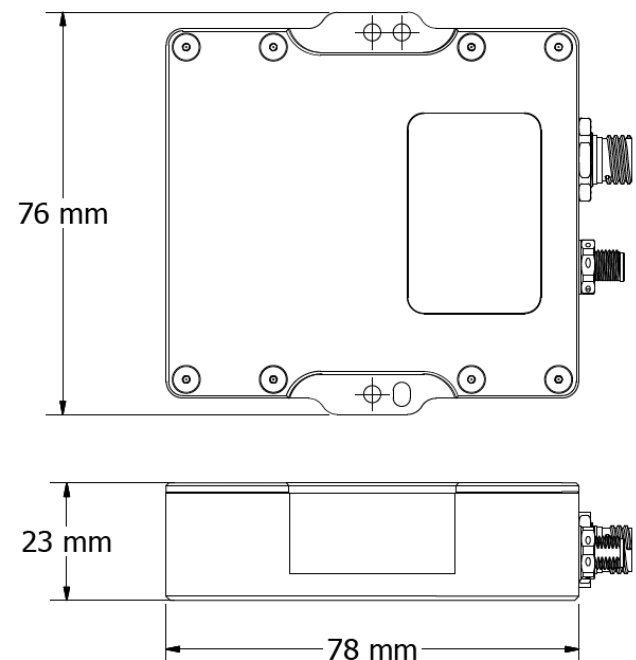
## Specifications

### INS Specifications

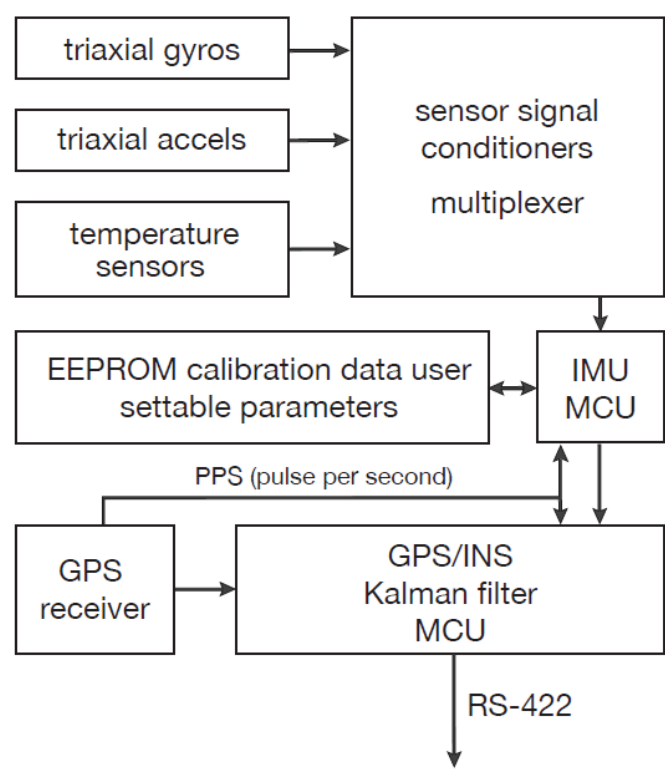
Performance	
Typical position accuracy	±2.5 m RMS horizontal, ±5 m RMS vertical
Typical velocity accuracy	±0.1 m/s RMS
Typical attitude accuracy	±0.1 deg RMS roll & pitch ±0.5 deg RMS heading
Typical attitude repeatability	0.1°
Attitude resolution	<0.01°
Attitude, heading range	360° about all axes
Navigation filter update rate	500 Hz
Features	vehicle dynamics mode selection, user-defined sensor to vehicle frame transformation and offset, antenna offset, bias enable/disable, external GPS and heading input support, WGS84 gravity model, WMM 2010 geomagnetic model
Output quantities	LLH position, NED velocity, attitude (Euler angles, orientation matrix or quaternion), acceleration, angular rate, deltaTheta, deltaVelocity, GPS time, filter status, PVA uncertainties, gravity-free linear acceleration, bias-compensated angular rate, estimated accel and gyro bias and scale factors
Data output rate	1 Hz to 500 Hz
General	
Interface	RS422
Baud rate	9,600 bps to 230,400 bps (115,200 bps default)
Power supply voltage	+10 to +24 volts DC
Power consumption	2.5 W (-40 to +65°C) Optional internal heater for -55°C operation 25 W pre-heater for 1 minute on startup 0 to 6W heater continuous depending on temperature
Connector	Glenair series 801 "Mighty Mouse" 7 pin circular
Operating temperature	-55 °C to +65 °C ambient
Vibration	6g RMS 10-2000Hz
Shock	750g half sine 2msec powered any axis
Dimensions	79 mm x 77 mm x 23 mm 3.08 in x 3.00 in x 0.88 in
Weight	205 grams
Standards	ROHS Compliant, DO-160G
Software utility	CD in starter kit (XP/Vista/Win7/Win8 compatible)
Software development kit (SDK)	complete data communications protocol and sample code
API	MIP™ Packet Protocol

### IMU Specifications

General		
	Accels	Gyros
Measurement range	±5 g	±300°/sec
Non-linearity	±0.03 % fs	±0.03 % fs
In-run bias stability	±0.02 mg	5°/hr
Initial bias error	±0.001 g	±0.05°/sec
Scale factor stability	±0.05 %	±0.05 %
Noise density	50 µg/√Hz	0.002°/sec/√Hz
Alignment error	±0.05°	±0.05°
Bandwidth (maximum)	250 Hz	160 Hz
Sampling rate	10 kHz	10 kHz
Resolution	<0.04mg	<0.0025°/sec
Vibration rectification error (Typical)	0.025%	0.001°/s/g2 rms
Vibration induced noise	—	0.06°/srms/g2 rms
4 Stage Filtering	analog low pass filter, digital sigma-delta anti-alias filter, user adjustable low pass filter, coning & sculling at 1000Hz	
Options		
Gyroscopes	±75°/sec, ±150°/sec, ±900°/sec	



# 3DM-RQ1™ -45 Ruggedized Tactical Grade GPS-Aided Inertial Navigation System



GPS Receiver	
GPS receiver type	50 Channels, L1 frequency, GPS C/A Code SBAS: WAAS, EGNOS, MSAS, GAGAN
GPS solution update rate	Up to 4Hz
Time-to-First-Fix	Cold Start (Autonomous): 36 sec Warm Start (Autonomous): 36 sec Hot Start: < 1 sec
GPS tacking and navigation sensitivity	-159 dBm
GPS reacquisition sensitivity	-159 dBm
GPS cold start (autonomous) sensitivity	-141 dBm
GPS velocity accuracy	0.1 m/sec
GPS heading accuracy	0.5°
GPS horizontal position accuracy	< 2.5 m Autonomous < 2.0 m SBAS (CEP, stationary 24 hours, SEP 3.5 m)
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
Data output rate	1 Hz to 4 Hz