MicroStrain 3DM-GV7 Series

Tactical Grade Ruggedized IMU/AHRS, IMU/VRU, and INS

Designed for precision. Built for the elements.

The 3DM-GV7 offers tactical grade inertial performance in a miniature ruggedized package. Ready for the harshest environments, the 3DM-GV7 features a precision-machined aluminum enclosure and is tested to an IP68 rating.

The 3DM-GV7 touts a new feature set designed specifically for the demanding timing requirements of the robotics and automation industries. Available in IMU/VRU (Vertical Reference Unit), IMU/AHRS (Attitude and Heading Reference System), and INS (Inertial Navigation System) models.

Features:

	AR	AHRS	INS
1.5°/h Gyro Bias Instability	●	●	●
Low Latency	●	●	●
Superior Vibration Rejection	●	●	●
Adjustable Sampling Rates Up to 1 KHz	●	●	●
External Clock Synchronization	●	●	●
Adaptive Extended Kalman Filter	●	●	●
Custom Event Trigger System	●	●	●
Ruggedized IP68 Package	●	●	●
Integrated Magnetometer		●	●
External Position and Velocity Inputs			●
Industry-Standard NMEA Input Over AUX Port			●
Defense-Ready: Accepts Encrypted GNSS Receivers			●
Filter Body Frame Constraints			●

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MicroStrain 3DM-GV7 Series Specifications

System Performance

AHRS Accuracy	
Roll, Pitch (static)	0.25°
Roll, Pitch(dynamic) [1]	0.5°
Heading (static, AHRS only) [2]	0.5°
Heading (dynamic, AHRS only) [1,2]	2°

INS Accuracy [4]	
Position	External GNSS
Velocity	External GNSS
Roll, Pitch	TBD
Heading	TBD or External GNSS

IMU

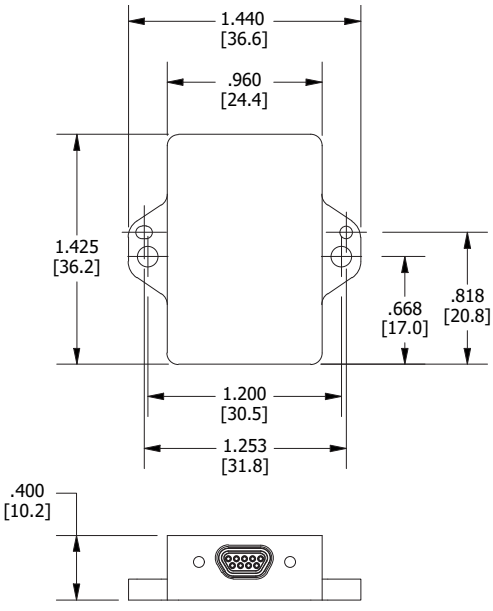
	Accelerometer	Gyroscope	Magnetometer	Barometer
Range	± 4g, 8g, 16g	± 250 °/s, 500 °/s, 1000 °/s	±8 Gauss	260 to 1260 mbar
Random Walk	31 µg/√Hz	0.2 °/√h	-	-
Bias Instability	20 µg	1.5 °/h	-	-
Noise Density	31 µg/√Hz	12 °/h/√Hz	-	-
Turn-on to Turn-on Bias [3]	51 µg	0.0054 °/s	-	-
Bias Error Over Temperature	0.90 mg	0.066 °/s	-	-
Scale Factor Error Over Temperature	318 PPM	1000 PPM	-	-

Interface

Connector	Micro D9 Standard
Communications Interface	RS-232, USB
Output Data Rate (IMU and EKF)	1 to 1000 Hz
I/O	2x GPIO
GPIO Functions	Event triggering, PPS Input/Output
Protocols	MIP, NMEA
Aiding Sensors	External Heading, Position [4], Velocity [4]

Physical and Electrical

Weight	17.7g
Size	36.2 mm x 36.6 mm x 10.2 mm
Power Consumption	320 mW (Typical), 380 mW (Max)
Operating Voltage	4.6 to 36 VDC
GPIO Voltage	3V (5V tolerant)
Operating Temperature	-40°C to 85°C
MTBF	2,058,917 hours (Telecordia Method, GM/35C)
Ingress Protection	IP68 [5]



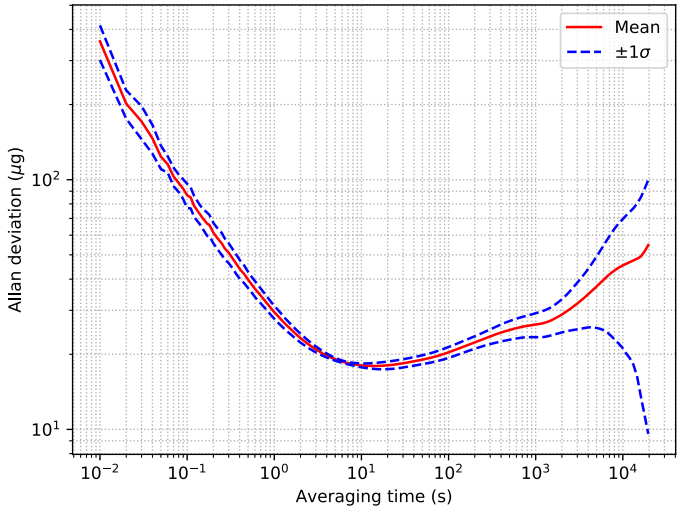
Product Variants

Name	Part Number	Description
3DM-GV7-INS	6290-9920	Inertial Navigation System
3DM-GV7-AHRS	6288-9920	Attitude and Magnetometer-Aided Heading
3DM-GV7-AR	6289-9920	Attitude and Relative Heading

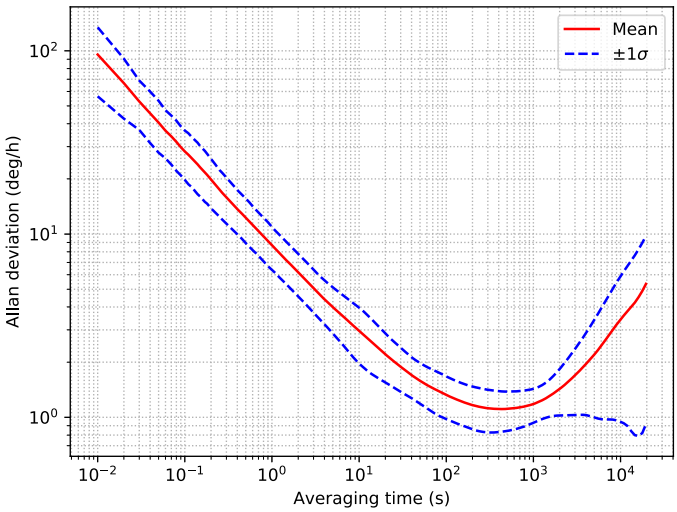
[1] Automotive conditions, vehicle dynamics dependent
[2] Magnetic heading, with valid declination, magnetic environment, and hard/soft iron calibration
[3] Bias repeatability, <24 hours
[4] INS model only
[5] With available IP-rated cabling

MicroStrain 3DM-GV7 Series Allan Variance (AVAR)

Accelerometer AVAR



Gyroscope AVAR



MicroStrain 3DM-GV7 Series Key Features

External Clock Synchronization ● Tighter synchronization with external sensors like LiDAR or cameras to improve state estimation

Tactical Grade Gyro ● Improved position accuracy during dead reckoning

Custom Event Trigger System ● Simplifies configuration of context-based events and frees up CPU on vehicle main board

Full Temperature Range Calibration ● Consistent and reliable performance over entire temperature range

Adjustable Sampling Rates ● Faster response to vehicle dynamics

Low Latency ● Reduces navigation errors from clock drift when combining with external aiding sensors

User-Adjustable Gyro & Accel Range ● Range flexibility enables improved noise performance

Auto-Adaptive EKF	
Adaptive Extended Kalman Filter (EKF)	More reliable than pre-configured vehicle dynamics model. Rejects the unexpected and auto-adapts its error model to dynamics in real-time

EKF for Orientation Estimation (-AR, -AHRS)	
Adaptive EKF for Orientation	Reduces attitude error due to linear acceleration
IMU Bias Error Tracking	Improves performance over traditional complementary filters
Integrated Magnetometer	Allows for absolute heading tracking (-AHRS and -INS only)

EKF for Position, Velocity, Attitude Estimation (-INS)	
External Position, Velocity, Heading Inputs	Improves position, velocity, attitude (PVA) estimate of standalone GNSS receiver
Industry-Standard NMEA Input Over AUX Port	Simplifies GNSS input by providing configurable AUX port on any of the 4 GPIO ports
Defense-Ready: Accepts Encrypted GNSS Receivers (SAASM or MCode)	Improves reliability of Position, Navigation, and Timing (PNT) solution during jamming and spoofing events
Filter Body Frame Constraints	Improves position accuracy for known dynamics
Vehicle Frame Velocity I/O	Allows users to input measurements in a non-global frame, enabling sensors like radar and vision as aiding sources (with preprocessing)

MicroStrain 3DM-GV7 Series Integration

Designed for Harsh Environments ● Ruggedized IP68 aluminum housing ensures reliable sensor performance even when operating in challenging environments.

Backward Compatibility ● MicroStrain Inertial Packet (MIP) protocol enables simple upgrades from other MicroStrain devices.

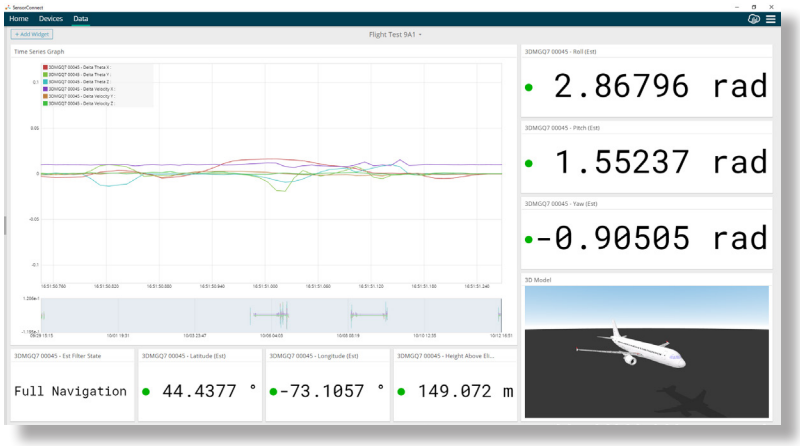
Actively Maintained Software ● Engineers actively supporting software products ensures features are available, and can assist in integration with your application's nav stack.

Complimentary Support ● Support and Application Engineers provide product integration guidance to provide a smooth test and integration experience.

SensorConnect®

SensorConnect is PC software for sensor configuration and data collection. Configure inertial parameters, device settings, data channels, and sample rates.

Visualize massive amounts of data instantly using built-in intelligent data collection and graphing algorithms. Create immersive dashboards with rich data visualization.



MSCL™ API and MIP SDK

MATLAB®

C++

python™

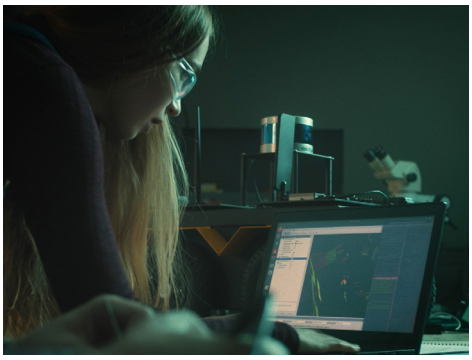
The MicroStrain Communication Library (MSCL) is our open-sourced API that simplifies writing code to interact with our sensors. MIP SDK is a lightweight C/C++ library for interacting with MicroStrain G and C-series products via bare-metal and resource constrained microcontrollers.

Both APIs are readily available and fully-documented on GitHub, featuring valuable tools such as full documentation, example code, and a quick start guide.

ROS

MicroStrain offers an open source, license-free (MIT License) series of actively supported drivers specifically designed and tested for ROS and ROS2.

Use ROS for building and simulating robotics applications, unmanned ground vehicles (UGVs) and simultaneous localization and mapping (SLAM).



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