

MicroStrain Product Datasheet

3DM-CX5-AHRS

Attitude & Heading Reference System

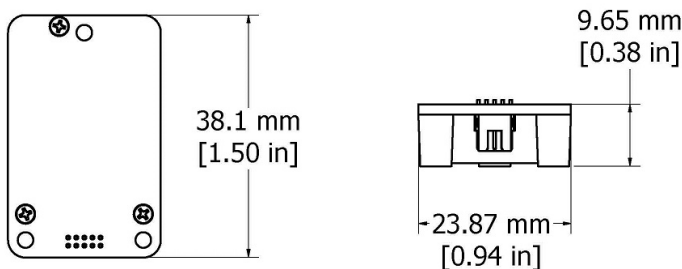


The MicroStrain Sensing 3DM-CX5 family of high-performance, industrial-grade, board-level inertial sensors provides a wide range of triaxial inertial measurements, computed attitude, and navigation solutions.

In all models, the Inertial Measurement Unit (IMU) includes direct measurement of acceleration and angular rate, and is fully temperature-compensated and calibrated over the operating temperature range. The use of Micro-Electro-Mechanical System (MEMS) technology allows for highly accurate, small, lightweight devices.

SensorConnect software is a user friendly program for device configuration. MIP Monitor (MicroStrain Internet Protocol) can also be used. Both packages provide 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.

The sensor operates independent of computer platform, operating system, or coding language.



PRODUCT HIGHLIGHTS

- Triaxial accelerometer, gyroscope, temperature sensors achieve the optimal combination of measurement qualities
- Dual on-board processors run a new Auto-Adaptive Extended Kalman Filter (EKF) for outstanding dynamic roll, pitch, and yaw performance

FEATURES AND BENEFITS

BEST IN CLASS PERFORMANCE

- Bias tracking, error estimation, threshold flags, and adaptive noise modeling allow for fine tuning to conditions in each application
- Accelerometer noise as low as 20 $\mu\text{g}/\sqrt{\text{Hz}}$
- Smallest and lightest industrial AHRS with Adaptive Kalman Filter available

EASE OF USE

- Sensor Connect enables simple device configuration, live data monitoring and recording
- Development kit available
- The MSCL API allows easy integration with C++, Python, .NET, C#, Visual Basic, LabVIEW and MATLAB environments
- MIP open byte level communication protocol
- Automatic magnetometer calibration and anomaly rejection eliminates the need for field calibration
- Automatically compensates for vehicle noise and vibration

COST EFFECTIVE

- Out-of-the box solution reduces development time
- Volume discounts

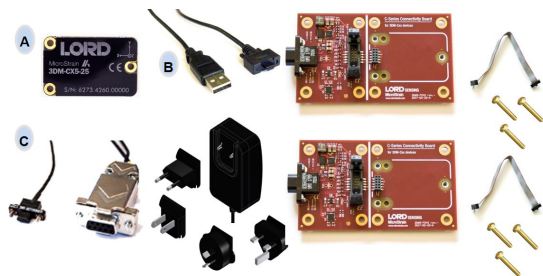
APPLICATIONS

- Unmanned vehicle navigation
- Robotics
- Platform stabilization, artificial horizon
- Health and usage monitoring of vehicles

Attitude & Heading Reference System

Specifications

General				Pressure Altimeter	
Integrated sensors	Triaxial accelerometer, triaxial gyroscope, and temperature sensors			Range	-1800 m to 10,000 m
Data outputs	Inertial Measurement Unit (IMU) outputs: acceleration, angular rate, magnetic field, ambient pressure, Delta-theta, Delta-velocity			Resolution	< 0.1 m
	Computed outputs Extended Kalman Filter (EKF): filter status, timestamp, attitude estimates (in Euler angles, quaternion, orientation matrix), linear and compensated acceleration, bias compensated angular rate, pressure altitude, gravity-free linear acceleration, gyroscope and accelerometer bias, scale factors and uncertainties, gravity and magnetic models, and more.			Noise density	0.01 hPa RMS
Inertial Measurement Unit (IMU) Sensor Outputs				Sampling rate	25 Hz
	Accelerometer	Gyroscope	Magnetometer	Computed Outputs	
Measurement range	±8 g (standard) ±2 g, ±4 g, ±20 g, ±40 g (optional)	300°/sec (standard) ±75, ±150, ±900 (optional)	±8 Gauss	Attitude accuracy	EKF outputs: ±0.25° RMS roll and pitch, ±0.8° RMS heading (typ) CF outputs: ±0.5° RMS roll and pitch, ±1.5° RMS heading (typ)
Non-linearity	±0.02% fs	±0.02% fs	±0.3% fs	Attitude heading range	360° about all axes
Resolution	<0.1 mg	<0.003°/sec	--	Attitude resolution	< 0.01°
Bias instability	±0.04 mg	8°/hr	--	Attitude repeatability	0.2° (typ)
Initial bias error	±0.002 g	±0.04°/sec	±0.003 Gauss	Calculation update rate	500 Hz
Scale factor stability	±0.03%	±0.05%	±0.1%	Computed data output rate	EKF outputs: 1 Hz to 500 Hz CF outputs: 1 Hz to 1000 Hz
Noise density	20 µg/√Hz (2 g)	0.005°/sec/√Hz (300°/sec)	400 µGauss/√Hz	Operating Parameters	
Alignment error	±0.05°	±0.05°	±0.05°	Communication	USB 2.0 (full speed) TTL serial (3.0 V dc, 9,600 bps to 921,600 bps, default 115,200)
Adjustable bandwidth	225 Hz (max)	250 Hz (max)	--	Power source	+ 3.2 to 5.2 V dc
Offset error over temperature	0.06% (typ)	0.04% (typ)	--	Power consumption	500 mW (typ)
Gain error over temperature	0.03% (typ)	0.03% (typ)	--	Operating temperature	-40°C to +85°C
Scale factor non-linearity (@ 25°C)	0.02% (typ) 0.06% (max)	0.02% (typ) 0.06% (max)	±0.0015 Gauss	Mechanical shock limit	500g/1ms absolute maximum survivability.*
Vibration induced noise	--	0.072°/s RMS/g RMS	--	Physical Specifications	
Vibration rectification error (VRE)	0.03%	0.001°/s/g ² RMS	--	Dimensions	38 mm x 24 mm x 9.7 mm
IMU filtering	Digital sigma-delta wide band anti-aliasing filter to digital averaging filter (user adjustable) scaled into physical units.			Weight	8 grams
Sampling rate	1 kHz	4 kHz	100 Hz	Enclosure material	Aluminum
IMU data output rate	1 Hz to 1 kHz			MTBF	400,094 hours (Telcordia method GM35C)
				Regulatory compliance	CE, REACH, ROHS
Integration					
				Connectors	Data/power: Samtec FTSH Series Connectivity kit: Micro-D9
				Software	SensorConnect and MIP Monitor software included; Windows XP/Vista/7/8/10 compatible
				Data Communications Protocol (DCP)	Protocol compatibility across GX3, GX4, RQ1, GQ4, GX5 CX5 and CV5 product families
				Software development kit	MicroStrain Communication Library (MSCL) open source license includes full documentation and sample code.
				Hardware development kit	Available option



* Note: Repeated exposure to > 2x full scale can result in permanent damage.



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