MicroStrain Product Datasheet

3DM-CX5-AHRS

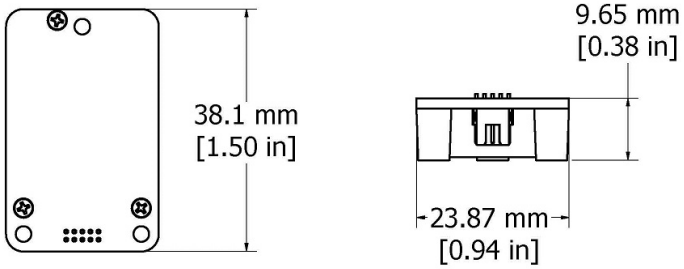
Attitude & Heading Reference System

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 ug/√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	
Integrated sensors	Triaxial accelerometer, triaxial gyroscope, and temperature sensors
Data outputs	**Inertial Measurement Unit (IMU) outputs:** acceleration, angular rate, magnetic field, ambient pressure, Delta-theta, Delta-velocity **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.

Inertial Measurement Unit (IMU) Sensor Outputs			
	Accelerometer	**Gyroscope**	**Magnetometer**
Measurement range	±8 g (standard) ±2 g, ±4 g, ±20 g, ±40 g (optional)	300°/sec (standard) ±75, ±150, ±900 (optional)	±8 Gauss
Non-linearity	±0.02% fs	±0.02% fs	±0.3% fs
Resolution	<0.1 mg	<0.003°/sec	--
Bias instability	±0.04 mg	8°/hr	--
Initial bias error	±0.002 g	±0.04°/sec	±0.003 Gauss
Scale factor stability	±0.03%	±0.05%	±0.1%
Noise density	20 µg/√Hz (2 g)	0.005°/sec/√Hz (300°/sec)	400 µGauss/√Hz
Alignment error	±0.05°	±0.05°	±0.05°
Adjustable bandwidth	225 Hz (max)	250 Hz (max)	--
Offset error over temperature	0.06% (typ)	0.04% (typ)	--
Gain error over temperature	0.03% (typ)	0.03% (typ)	--
Scale factor non-linearity (@ 25°C)	0.02% (typ) 0.06% (max)	0.02% (typ) 0.06% (max)	±0.0015 Gauss
Vibration induced noise	--	0.072°/s RMS/g RMS	--
Vibration rectification error (VRE)	0.03%	0.001°/s/g2 RMS	--
IMU filtering	Digital sigma-delta wide band anti-aliasing filter to digital averaging filter (user adjustable) scaled into physical units.		
Sampling rate	1 kHz	4 kHz	100 Hz
IMU data output rate	1 Hz to 1 kHz		

Pressure Altimeter	
Range	-1800 m to 10,000 m
Resolution	< 0.1 m
Noise density	0.01 hPa RMS
Sampling rate	25 Hz
Computed Outputs	
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)
Attitude heading range	360° about all axes
Attitude resolution	< 0.01°
Attitude repeatability	0.2° (typ)
Calculation update rate	500 Hz
Computed data output rate	EKF outputs: 1 Hz to 500 Hz CF outputs: 1 Hz to 1000 Hz
Operating Parameters	
Communication	USB 2.0 (full speed) TTL serial (3.0 V dc, 9,600 bps to 921,600 bps, default 115,200)
Power source	+ 3.2 to 5.2 V dc
Power consumption	500 mW (typ)
Operating temperature	-40°C to +85°C
Mechanical shock limit	500*g*/1ms absolute maximum survivability.*
Physical Specifications	
Dimensions	38 mm x 24 mm x 9.7 mm
Weight	8 grams
Enclosure material	Aluminum
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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