MTi-G

Miniature AHRS with integrated GPS

The MTi-G is a small size and low weight measurement unit, excellent for control, navigation and analysis of (un)manned systems and other objects. The MTi-G is a MEMS based Inertial Measurement Unit (IMU) with integrated GPS and static pressure sensor. It delivers unprecedented performance for its size, weight, cost and low complexity in use.

The MTi-G has an onboard Attitude and Heading Reference System (AHRS) combined with GPS and a static pressure sensor. The internal low-power digital signal processor runs a real-time sensor fusion algorithm providing drift-free, GPS enhanced, 3D orientation data. Additionally, the MTi-G provides inertial and barometric enhanced 3D position and velocity data.

Highlights

- real-time computed GPS-enhanced attitude/heading and inertial enhanced position/velocity data
- GPS integration overcomes typical IMU challenges
- integrated AHRS, GPS and static pressure sensor
- on board DSP, running sensor fusion algorithm
- high update rate (120 Hz)
- individually calibrated for temperature, 3D misalignment and sensor cross-sensitivity
- UTC referenced output

Design

- compact and robust design
- easy integration in any system (OEM) application
- low weight, ultra-low power consumption

Sensor integration

The MTi-G is a combination of a MEMS IMU, GPS and barometer. Yet, the MTi-G is more than just a sensor assembly. The IMU, GPS and barometric information is blended together in Xsens' sensor fusion algorithm to estimate the most accurate orientation and position possible. Because of this fusion, the output is more accurate than the output from the IMU or GPS receiver only. For example, the MTi-G copes with transient accelerations; a typical error source for any AHRS using the gravity as its reference estimating roll and pitch.

The loose coupling works both sides: double-integrating the accelerometers for short periods, the MTi-G is able to calculate position and velocity even during short GPS outages. There are several more corrections realized to aid the IMU functionality and to enhance the GPS measurements.

User scenarios

The MTi-G is a sensor which can be used in a wide range of applications. Because of the specific requirements for all these applications, the MTi-G uses different filter settings and constraints, implemented in scenarios. Among others, there are scenarios for use in automotive and aerospace applications.

Output

- 3D Orientation (360°)
- 3D Position and Velocity (aided and unaided by inertial sensors)
- 3D acceleration, 3D rate of turn, 3D magnetic field

MTi-G TECHNICAL SPECIFICATIONS

Attitude and Heading

Static accuracy (roll/pitch)	<0.5 deg
Static accuracy (heading)[1]	<1 deg
Dynamic accuracy[2]	1 deg RMS
Angular resolution[3]	0.05 deg
Dynamic range:	
- Pitch	± 90 deg
- Roll/Heading	± 180 deg
Maximum update rate:	
- Onboard processing	120 Hz
- External processing	512 Hz

Position

Accuracy position:	
- SPS	2.5 m CEP
- SBAS[4]	2.0 m CEP
Maximum update rate:	
- Onboard processing	120 Hz
- External processing	512 Hz

Interfacing

Digital interface	RS-232 (max 921k6 bps) and USB (ext. converter)
Operating voltage	5 - 30V
Power consumption	600 mW
Interface options	SyncOut, AnalogIn
GPS antenna	SMA connector, active

Maximum operational limits

Altitude	18 km
Velocity	515 m/s (1854 km/h)
Ambient temparature operating range[5]	-20...+60 °C

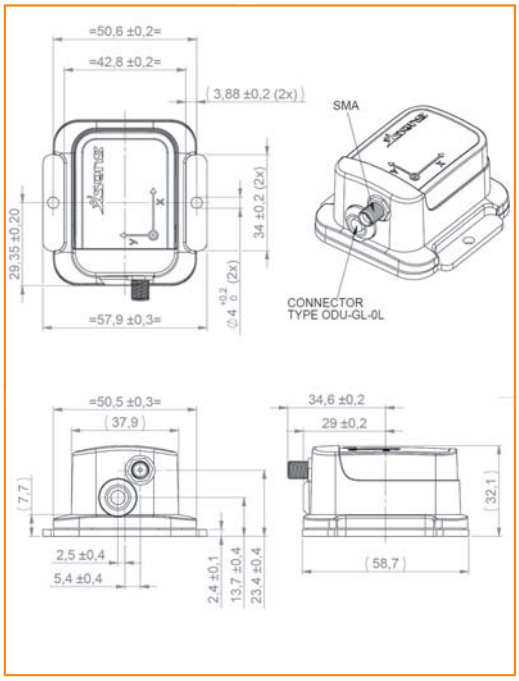
INDIVIDUAL SENSOR SPECIFICATIONS

Sensor performance

	rate of turn	acceleration	magnetic field	static pressure
Dimensions	3 axes	3 axes	3 axes	-
Full Scale (standard)	± 300 deg/s²	± 50 m/s²	± 750 mGauss	30-120 kPa
Linearity	0.1% of FS	0.2% of FS	0.2% of FS	0.5% of FS
Bias stability[6] (1σ)	1 deg/s	0.02 m/s²	0.1 mGauss	100 Pa/yr
Scale Factor stability[6] (1σ)	-	0.03%	0.5%	-
Noise	0.05 deg/s/√Hz	0.002 m/s²/√Hz	0.5 mGauss (1σ)	4 Pa/√Hz (0.3 m/√Hz)
Alignment error	0.1 deg	0.1 deg	0.1 deg	-
Bandwidth	40 Hz	30 Hz	10 Hz	-
Max update rate	512 Hz	512 Hz	512 Hz	9 Hz

GPS

Receiver type	16 channels L1 freqency, C/A code
GPS update rate	4 Hz
Start-up time cold start	34 s
Tracking sensitivity	-158 dBm
Timing accuracy	50 ns RMS



HARDWARE DYNAMICS

Housing

Dimensions (WxLxH)	58x58x33 mm
Weight	68 g

Options

Full scale acceleration:		Full scale rate of turn:	
1.7g (17 m/s²)	A33	150 deg/s	G15
5g (50 m/s²)	A53	300 deg/s	G35
18g (1800 m/s²)	A83	1200 deg/s	G25

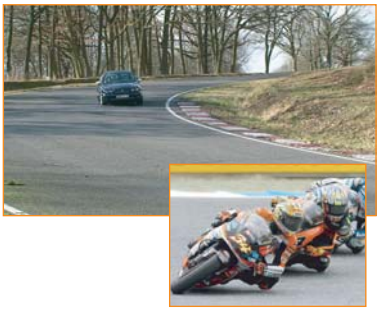
Product code:	MTi-G-28 A## G##
Standard version:	MTi-G-28 A53 G35

1 depends on usage scenario. In case the Earth magnetic field is used, it must be homogeneous
2 under condition of a stabilized Xsens sensor fusion algorithm and good GPS availability
3 1σ standard deviation of zero-mean angular random walk
4 depends on accuracy of SBAS service (WAAS, EGNOS, MSAS supported)
5 non-condensing environment
6 deviation over operating temperature range (1σ)

TYPICAL USAGE APPLICATIONS

Automotive

- Vehicle dynamics analysis
- Racing cars and motorbikes
- Performance testing



Full access to valuable data is availabe for engineers working in any level of sports car or motorbike competitions.

The MTi-G outputs are suitable to test and analyze the dynamic behavior of e.g. automobiles. Non-holonomic constraints are used to further enhance accuracy.

Aerospace

- Autonomous attitude and navigation control
- Dynamics of (aerobatics) planes
- Camera/LIDAR stabilization and correction
- Head-up display

The MTi-G allows implementing control and stabilization for any type of small to medium sized fixed-wing and rotary-wing aircraft. Because of the low latency, autonomous control can be designed in a simple and robust manner.

The MTi-G provides a wide variety of dynamic data, suitable for dynamics analysis of (un)manned airplanes. An easy software/hardware interface makes data processing possible post-flight or even real-time. The MTi-G is easy to install and computes all the data required for e.g. an accurate artificial horizon or a digital map.

Unmanned ground vehicles and robotics

- Autonomous control for driving and walking robots
- Military and civil ground vehicles
- Camera/LIDAR stabilization and correction

The MTi-G is an excellent sensor for driving and walking robots. The main functionality of the MTi-G in robotics applications is attitude control, even under dynamic conditions.

Accurate position and orientation makes autonomous navigation possible for Unmanned Ground Vehicles (UGV's), even on rough terrain or during short GPS outages. The MTi-G has been used in DARPA Grand Challenges for these purposes. These applications are typically out of reach for conventional MEMS IMU's.

Marine

- In-competition optimization of racing yachts
- State estimation of leisure yachts
- Backup system for high-grade GPS systems

For racing yachts, the MTi-G provides orientations of several parts of the ship, such as the roll angle of the hull or the direction of the sail. This allows a sailing team to refine the ship's performance during a race.

Another major application is commercial shipping. Measuring roll and pitch as well as heading is important for container ships, cargo ships and surveying vessels. Installing the MTi-G together with high grade GPS systems is a logical choice to enhance accuracy and to reduce costs, especially in situations with limited GPS reception.

MTi-G DEVELOPMENT KIT

MTi-G Development Kit (MTi-G DK)

The MTi-G DK contains the following:

- MTi-G (any configuration)
- Antenna
- USB cabling
- MT Software Development Kit (see below)
- Hardcopy documentation
- Optional: serial cabling
- Suitcase

MT Software Development Kit (MT SDK)

The MT SDK is an extensive set of tools for every level of interfacing, which allows configuring the MTi-G to the user needs, reading out and storing data and (re-)processing MTi-G data previously recorded. It also allows the user to extend own user source code using commands and code examples provided.

The MT SDK contains:

MT Manager Software
A specially developed, easy-to-use graphical user interface with possibilities to configure Xsens' sensors, read out, store and show data in real-time charts and visualizations.

MT COM-object API and DLL API for Windows
Integrating the MTi-G in Windows programs, such as Matlab, C++ and Excel is made easy with the MT COM-object API and the DLL API. User-modifiable example code for programs Matlab, C++ and Excel (VBA) is included.

C++ Class and binary communication for any (RT)OS
A C++ class is available for users who want to use the MTi-G on a binary level. Direct communication without using the C++ class is possible, following the fully documented communication protocol.

Magnetic Field Mapper plug-in
The Magnetic Field Mapper plug-in enables compensation for hard and soft iron effects.

ACCESSORIES

Cable options

CA-USB2G

USB cable

CA-SERi-2.5

Serial cable
RS232 + pigtail

CA-DB9iG

RS232, DB9
power

PA-MP

Power adapter
(for CA-DB9iG only)

ANT

Antenna

Xsens Technologies is a leading supplier of products for measurement of motion, orientation and position, based upon miniature MEMS inertial sensor technology. Xsens' products are small, low-cost and highly accurate 3D motion measurement units. These specific qualities enable applications such as control, stabilization and navigation of small (unmanned) vehicles and totally new applications such as inertial full-body human motion capturing.

Xsens was founded in 2000 and has grown to a leading company in its field. Xsens has won several awards for excellent entrepreneurship, innovative products and rapid growth. All employees in R&D and sales have a technical higher education or extensive experience in their field of technical sales. Xsens has customers in more than 50 countries.

specifications subject to change without notice

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