MTw

WIRELESS MOTION TRACKER

XSENS

MTw™ Development Kit incorporates multiple wireless motion trackers (MTw) with the Awinda™ Station, dedicated software and a set of full body-click-in straps.

The MTw is a highly accurate, completely wireless, small and lightweight 3D human motion tracker. It provides drift-free 3D: orientation, acceleration, angular velocity, earth-magnetic field as well as static pressure.

The Awinda radio protocol ensures time-synchronisation better than 10 µs between each MTw on a wireless body area network.

PRODUCT OVERVIEW

MTw Development Kit:

Hardware
- 6x MTw inertial motion trackers
- 1x Awinda Station
- 1x Awinda USB Dongle
- 1x Set of click-in body straps

Software
MT Manager
MT Software Development Kit

The MTw is a small, highly accurate wireless inertial and magnetic sensing unit with pressure measuring capabilities. The MTw communicates with the PC using the unique Awinda radio protocol developed by Xsens®. The Awinda protocol guarantees very accurate ($\leq$ 10 µs difference) time synchronization between multiple MTw's comparable to the wired measurement systems from Xsens. The Awinda Station links up to 32 MTw's (wirelessly) to the PC (USB).

The Awinda Station has multiple hardware connections for synchronization with third party devices. Additionally, it charges up to 6 MTw's simultaneously.

Specially designed click-in body straps improve the efficiency of subject preparation, reducing the overall time needed for measurements.

The MTw Development Kit, incorporating multiple MTw's, the Awinda Station (or Awinda USB Dongle), MT software and click-in body straps, is ideal for measuring motion and orientation of the human body - anywhere.

FEATURES

Freedom of movement
- Completely wireless
- Portable case for easy transportation
- No occlusion or line-of-sight restrictions
- Use anywhere, under any lighting condition: outside, in the office, no lab or simulated environment required

Ease of use
- Fast click of MTw into the specially designed body straps
- Intuitive Windows software for real-time view, easy logging and export
- Text export for easy import to many software applications
- SDK with example code facilitating real-time access to all levels of component data
- Button-free operation

Accurate data
- Highly sensitive MEMS inertial sensors capture every twitch
- Awinda wireless protocol ensures highly accurate time-synchronized data sampling (within $\leq$10 µs) in all connected MTw's
- Internal sampling at almost 2 kHz and internal pre-processing maintains accuracy under challenging dynamic conditions
- MTw fusion algorithms ensures highly accurate, drift free output
- Sensors securely fastened to straps to minimize skin motion artifact
- MTw barometer makes it possible to calculate change in vertical height

Orientation performance

Dynamic Range	all angles in 3D
Static Accuracy (Roll/Pitch)	<0.5 deg
Static Accuracy[1] (Heading)	1 deg
Dynamic Accuracy[2]	2 deg RMS
Angular Resolution[3]	0.05 deg

Operating temperature range

Ambient	-10°C - 60°C
Specified Performance	0°C - 55°C

Physical Properties

Dimensions
34.5 x 57.8 x 14.5 mm (W x L x H)
Weight
27g (including battery [battery = 9g])

- Completely wireless inertial and magnetic motion trackers
- Button-free Awinda wireless protocol based on IEEE 802.15.4 PHY
- Use up to 32 MTw's in a configurable wireless-area network
- ISM 2.4 GHz radio frequency, worldwide license free use
- Transmission range
  - Up to 50 m in open space
  - Up to 20 m in an office space
- Internal data buffering for temporary out of range data collection
- Rechargeable maintenance-free lithium-ion battery
  - Rechargeable on Awinda Station
  - LED charging status
  - Charging time   ~1 hour
  - Stand-by time   90 hours
  - Continuous use   ~3.5 hours (typical)
- Internal sample rate   1800 Hz
- Wireless update rates
  - 1 MTw   120 Hz
  - 6 MTw   75 Hz
  - 12 MTw   50 Hz
  - 32 MTw   20 Hz
    (depends on amount of MTw's used and if retransmissions are required)

Sensor Component Performance

	Angular Velocity	Acceleration	Magnetic Field	Pressure
Dimensions	3 axes	3 axes	3 axes	-
Full Scale	± 1200 deg/s	± 160 m/s2	± 1.5 Gauss	300 -1100 mBar[4]
Linearity	0.1% of FS	0.2% of FS	0.2% of FS	0.05% of FS
Bias stability[5]	20 deg/hr	-	-	100 Pa/year
Noise	0.05 deg/s/√Hz	0.003 m/s²/√Hz	0.15 mGauss/√Hz	0.85 Pa/√Hz
Alignment error	0.1 deg	0.1 deg	0.1 deg	-
Internal Sampling Rate	1800 Hz	1800 Hz	120 Hz (max.)	-
Bandwidth[6] (analogue)	~150 Hz (max.)	~150 Hz (max.)	~60 Hz (max.)	-

APPLICATIONS

- Biomechanics
- Research

- Rehabilitation
- Gait analysis

- Sports
- Ergonomics

- The Awinda Station can receive data from up to 32 MTw's simultaneously
- Data from multiple MTw's is time-synchronized to within 10μs
- Charges up to 6 MTw's simultaneously

Operating temperature range
- Ambient   -25°C - 80°C
- Specified Performance   0°C - 65°C

- Specifications for non-condensing environment. Avoid wet and humid conditions[7].

Power supply
- EU/US/UK power adapters provided

Communication
- Awinda Station - PC Interface: USB

Physical Properties
Dimensions (without antenna):
89.5 x 144 x 31.9 mm (W x L x H)
Weight: 200g

Synchronisation with third party devices
- 4 BNC connectors
  - 2 for sync in
  - 2 for sync out
- TTL 0-3.3V levels
- Software configurable

- Miniature replacement of wireless functionality of Awinda Station
- LED status indicates MTw connectivity

Physical properties
Dimensions (including USB connector)
20.4 x 45 x 10.6mm (W x L x H)
Weight: 8g

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MTw DEVELOPMENT KIT

MT Manager

For ease of use, data can be collected in the Windows software package MT Manager. This software allows configuration of the MTw's, real-time view of 3D orientation and sensor data, recording of data streamed from the MTw's through the Awinda Station and export to ASCII files for further analysis.

- Intuitive user interface
- MTw battery level indicator
  - During use
  - While charging in Awinda Station
- Received signal strength indicator
- Wireless synchronization status indicator
- Control Awinda Station AUX synchronization settings
- Configure wireless network settings and update rates
- Real-time graphical data visualization and export of:
  - 3D angular velocity (deg/s)
  - 3D acceleration (m/s^2)
  - 3D earth magnetic field (a.u.)
  - Pressure (Bar)
  - 3D orientation (Quat or deg in Euler angles)
    - Export as orientation as Quaternion, Direction Cosine Matrix or Euler
- Record and save data with ease
- Export data as ASCII text for further processing

MT Software Development Kit (MT SDK)

MT SDK is a software package made available for users to gain access in real-time to the capabilities of the MTw. The SDK provides access to all levels of data (calibrated sensor data, 3D orientation estimates) and enables application developers to create their own specialized environments for visualizing, recording and processing MTw data. To facilitate this process, example code is provided for:

- Matlab
- C/C++/C#
- LabVIEW

MT SDK is Windows 7 compatible
MT SDK is also compilable in Linux[8]

STRAPS SPECIFICATIONS

Full-body straps

- Fast and easy click-in system to securely click MTw into body straps
- Strong elasticated straps, fastened using Velcro
- Dryflex biocompatible material
- 1 head band with Dryflex holder
- One size fits all

PACKAGING

Entire system conveniently packed and shipped in a compact carrying case:

Strong and durable
Suitable as hand-luggage
Shipping weight   ~6 kg

RECOMMENDED COMPUTER SYSTEM

Operating system:	Windows 7
Processor:	Dual core e.g. Core2 or AMD X2 (minimal Pentium 4 - 2.6 GHz)
Graphics card:	Any graphics card with DirectX 9 hardware acceleration
USB Ports:	1 USB port per Awinda Master
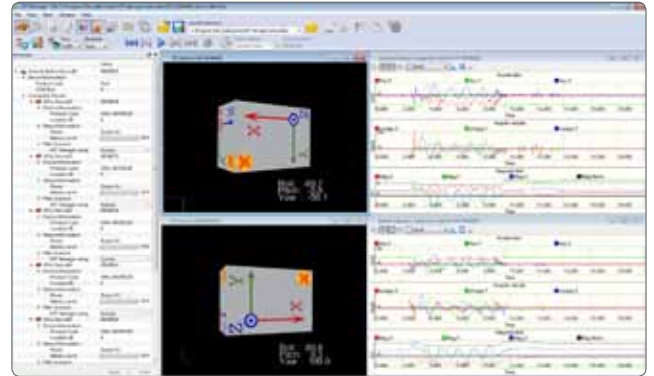
[1] In homogenous magnetic environment
[2] May depend on type of motion
[3] 1σ standard deviation of zero-mean angular random walk
[4] -500 - 9000 m above sea level
[5] As measured from the Allan variance diagram
[6] Half of the chosen sampling rate
[7] As condensation can damage the internal circuitry
[8] The Linux API is a beta version

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ABOUT XSENS TECHNOLOGIES

Xsens is a leading global supplier of 3D motion tracking products based upon miniature MEMS inertial sensor technology.

Since its inception in 2000, several thousands of motion sensors and motion capture solutions have successfully been deployed in areas such as 3D character animation, rehabilitation and sports science, and robot and camera stabilization. Customers include Electronic Arts, Sony Pictures Imageworks, INAIL Prosthesis Centre, Daimler, Saab Underwater Systems, Kongsberg Defence & Aerospace and many other companies and institutes throughout the world.

Xsens' research department has created unique intellectual property in the field of multi-sensor data fusion algorithms, combining inertial sensors with aiding technologies such as GPS and RF positioning and biomechanical modeling. The company and its products have received several awards, amongst which five consecutive entries in Deloitte's ranking of fastest growing technology companies in Europe.

Xsens is headquartered in Enschede, The Netherlands and has a subsidiary, Xsens North America Inc. in Los Angeles, California, US.

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