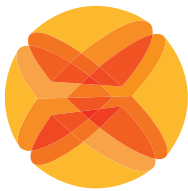


**xsens**



# **MTw Development Kit**

**WIRELESS MOTION TRACKERS**



# 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  $\mu$ s between each MTw on a wireless body area network.

## PRODUCT OVERVIEW

### MTw Development Kit:

#### Hardware

- 6 (standard) x MTw inertial motion tracker
- 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 ( $\leq 10 \mu$ s 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 (BNC) 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
- ASCII 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  $\leq 10 \mu$ s) 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



## MTW TECHNICAL SPECIFICATIONS

### Orientation performance

Dynamic Range	all angles in 3D
Static Accuracy (Roll/Pitch)	<0.5 deg
Static Accuracy <sup>1</sup> (Heading)	1 deg
Dynamic Accuracy <sup>2</sup>	2 deg RMS
Angular Resolution <sup>3</sup>	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 ~4 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/s <sup>2</sup>	± 1.5 Gauss	300 - 1100 mBar <sup>4</sup>
Linearity	0.1% of FS	0.2% of FS	0.2% of FS	0.05% of FS
Bias stability <sup>5</sup>	20 deg/hr	-	-	100 Pa/year
Noise	0.05 deg/s/√Hz	0.003 m/s <sup>2</sup> /√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 (analogue)	~120 Hz	~140 Hz	10-60 Hz <sup>6</sup>	-

## APPLICATIONS

- Biomechanics
- Research
- Rehabilitation
- Gait analysis
- Sports
- Ergonomics



<sup>1</sup> In homogenous magnetic environment

<sup>2</sup> May depend on type of motion

<sup>3</sup> 1σ standard deviation of zero-mean angular random walk

<sup>4</sup> -500 - 9000 m above sea level

<sup>5</sup> As measured from the Allan variance diagram

<sup>6</sup> Half of the chosen update rate

## AWINDA STATION TECHNICAL SPECIFICATIONS

- 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<sup>7</sup>.

### 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 (WxLxH)
- 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



## AWINDA USB DONGLE TECHNICAL SPECIFICATIONS

- 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 (WxLxH)
- Weight: 8g



<sup>7</sup> As condensation can damage the internal circuitry



## 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 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<sup>2</sup>)
  - 3D earth magnetic field (a.u.)
  - Pressure (Bar)
  - 3D orientation (Quat or deg in Euler angles)
  - Export 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++

MT SDK is Windows 7 compatible  
MT SDK is also compilable in Linux<sup>®</sup>

<sup>®</sup> The Linux API is a beta version



## 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

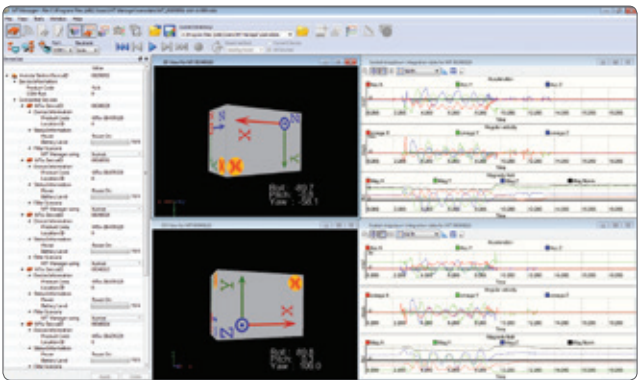
## PACKAGING

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 or higher (2.5 GHz or faster)
Graphics card:	Hardware acceleration for DirectX 11
Dedicated memory:	512 MB or more
USB Ports:	1 USB port per Awinda Master





## ABOUT XSSENS

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

Since its foundation in 2000, thousands of motion sensors and motion capture solutions have successfully been deployed for 3D character animation, movement science, control of autonomous vehicles and stabilization. Clients of Xsens include Electronic Arts, NBC Universal, INAIL Prosthesis Centre, Daimler, Saab, Kongsberg Defence Systems and many other companies and institutes throughout the world. Xsens is working with several industry partners, including Autodesk, Sagem (Safran Group) and Siemens.

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

Xsens is a privately held company with its headquarters in Enschede, the Netherlands and a US subsidiary in Los Angeles, California.

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