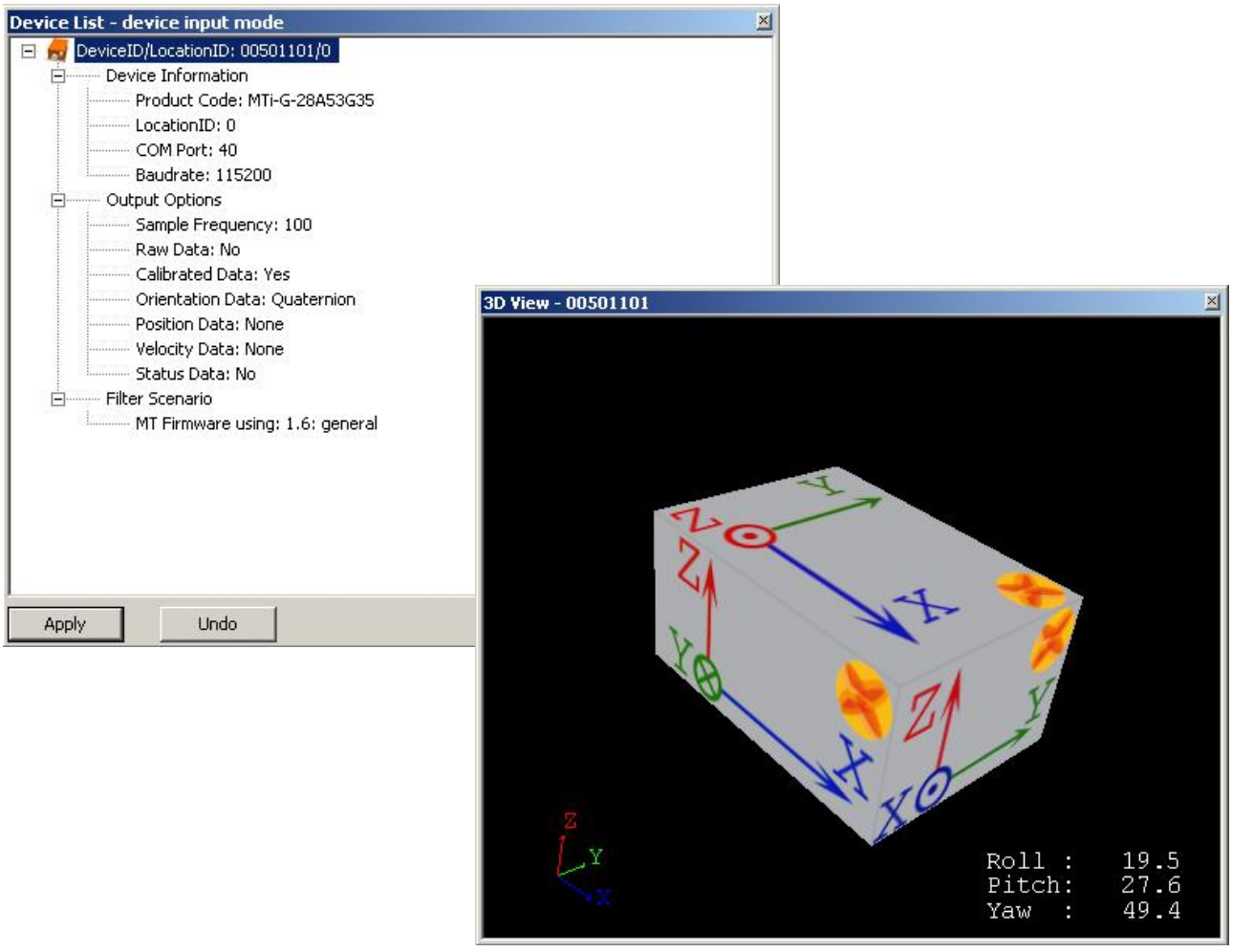
MT Manager User Manual

Document MT0216P, Revision G, 15 Oct 2010



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Revisions

Revision	Date	By	Changes
A	April 1 2008	MMI	First version.
B	May 5 2008	MMI	Added Firmware Updater section
C	July 1, 2008	JMU MMI	Added command line options Added Manual COM port selection section Added RS-485 compatibility mode
D	August 8, 2008	MMI	Removed high precision ASCII export mode Added Status Data in section 9 (Detailed Device properties)
E	October 31, 2008	MMI	Added menu bar explanation Added new icons and corresponding functionality Minor editorial changes Removed Manual Port Scan enabling/disabling (moved to Connectivity toolbar)
E.1	February 6, 2009	MMI	Firmware updater section is now a reference to the FW updater user manual
F	May 27, 2009	MMI MHA	Minor editorial changes Added the Configuration Wizard Added ASCII exporter specification New input file mask documented New corporate design
G	Oct 15, 2010	MHA	Added BIT

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Table of Contents

1 Terms, abbreviations and references

Term	Description
Quaternion	A non-commutative extension of complex numbers. A unit length quaternion is a convenient parameterization of rotations.
Euler Angles	Representation of the spatial orientation of any frame of the space as a composition of rotations from a reference frame.

Abbreviation	Description
DOF	Degrees Of Freedom
DSP	Digital Signal Processor
GPS	Global Positioning System
IMU	Inertial Measurement Unit
KML	Keyhole Markup Language
KMZ	Zipped Keyhole Markup Language
LLA	Latitude Longitude Altitude
MFM	Magnetic Field Mapping
MT	Motion Tracker
MTB	MT Binary Communication Protocol
MTM	MT Manager
OpenGL	Open Graphics Library
SDK	Software Development Kit
SVInfo	Space Vehicle Information
UTC	Coordinated Universal Time
WGS84	The latest revision of the World Geodetic System dating from 1984 (last revised in 2004), which will be valid up to about 2010 It defines a reference frame for the earth, for use in geodesy and navigation.
Xbus	Xsens digital data bus system
XFF	Xsens Firmware File format
XKF-3	Xsens Kalman Filter 3 DOF
XKF-6	Xsens Kalman Filter 6 DOF
XML	eXtended Markup Language

Reference id	Document description
[LLCP]	“MT Low-Level Communication Protocol Documentation.pdf”, document id MT0101P
[MFM]	“Magnetic Field Mapper Documentation.pdf”, document id MT0202P
[MTi_MTx]	“MTi and MTx User Manual and Technical Documentation.pdf”, document id MT0100P
[MTi-G]	“MTi-G User Manual and Technical Documentation.pdf”, document id MT0137P
[XBM]	“Users Manual Xbus Master B.pdf”, document id XM0100P “XM-B Technical Documentation.pdf”, document id XM0101P
[FWU]	“Firmware Updater User Manual.pdf”, document id FU0100P

2 Introduction

This user manual describes the product features and operating instructions for Xsens' MT Manager software application.

MT Manager is compatible with all Xsens Motion Trackers as of the MTx (for a complete list of supported MTs, refer to section 4.3) and the Xbus Master. Note that some sections in this document only apply to specific devices. For device specific details please refer to the documentation listed in section 1.

The MT Manager uses the XsensCMT.DLL with the dynamic library interface. This is the same API that is provided for software development in the SDK.

The MT Manager software for Windows XP/Vista/W7 is easy-to-use software with familiar Windows user interface, which allows you to:

- view 3D orientation in real-time
- view inertial and magnetic sensor data in real time
- view latitude, longitude, altitude plots in real time (depends on Motion Tracker used)
- export log files to other formats like ASCII and KMZ
- change and view various device settings and properties
- run a self test to check the mechanical functions of the inertial sensors and magnetometer
- interactively "chat" with a Motion Tracker through a terminal emulator

The MT Manager is therefore an easy way to get to know and to demonstrate the capabilities of the Motion Tracker.

Usage of scenarios (corresponding with XKF processing) is not available for devices with firmware version 1.x.

The MT Manager will start with a Configuration wizard to perform a quick set-up of your MT. This configuration wizard is described in 5.2. It is recommended to go through this configuration wizard upon first use.

3 Quick start

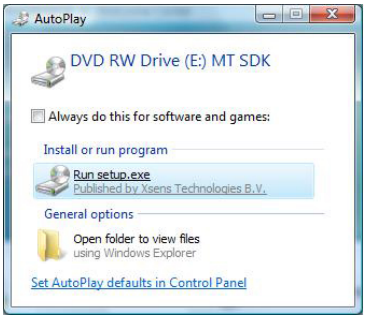
This section is intended to help you install and use the MT Manager quickly. For detailed instructions, please go to sections 4 and 5.

3.1 Installing the MT Manager

First you need to install the MT Manager on your computer running Windows XP, Windows Vista or Windows 7. This is easily done by using the MT SDK Setup application that guides you through the installation.
NOTE: the most recent version of the software, source code and documentation can always be downloaded on the support section of www.xsens.com.

For users of previous Xsens' MT software:
Be sure to uninstall the previous version of the USB converter drivers:
Open the Windows Control Panel and go to Add or Remove Programs.
Scroll down until you find an entry 'Windows Driver Package - Xsens USB-serial Converter Driver Package'. Please uninstall all entries of these drivers.

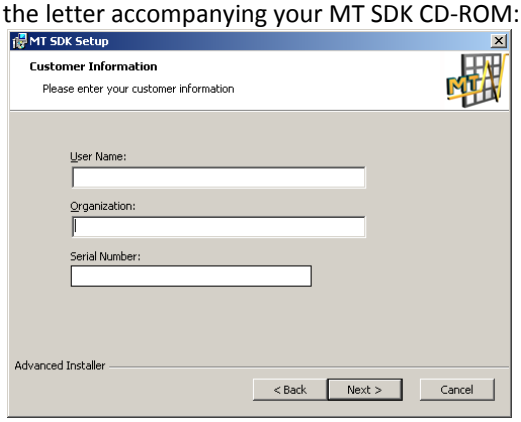
For Windows XP users:
After placing the MT SDK CD-ROM in the CD/DVD player, the installation will start automatically[1].
For Windows Vista/W7 users:
After placing the MT SDK CD-ROM in the CD/DVD player, choose to "Open folder to view files" in the Autoplay dialog. Then right-click on `setup.exe` and choose to run it as "administrator".



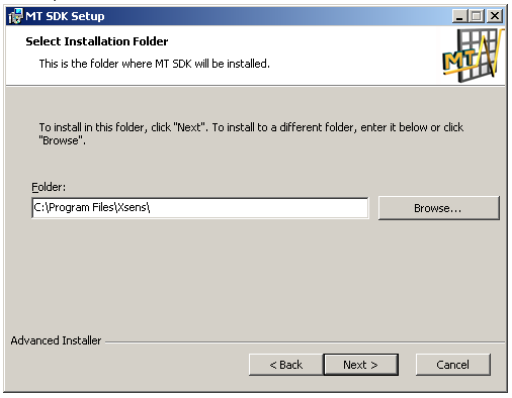
The installation procedure starts with displaying this splash screen:

[1] If the installation application does not start automatically, double-click "setup.exe" in the root folder of your CD-ROM/DVD drive, e.g. D:\

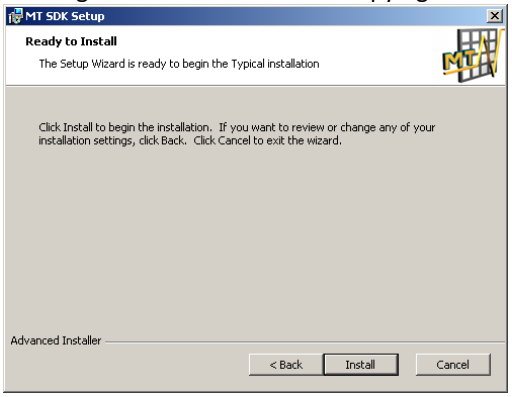
After pressing the “Next” button, you need to enter your individual registration number that you can find on the letter accompanying your MT SDK CD-ROM:

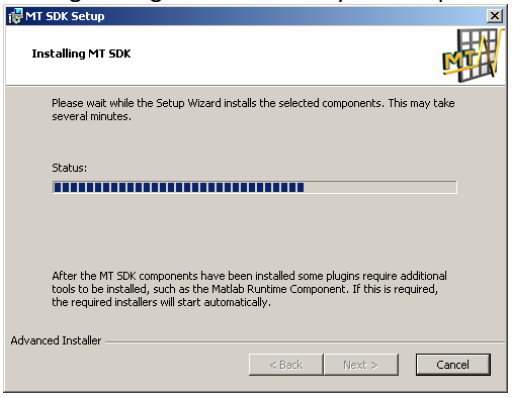


Then, either use the default installation folder or set your own:



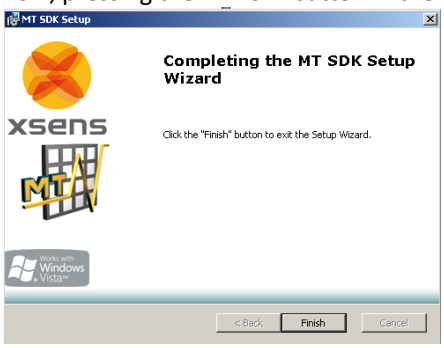
Pressing “Install” will then start copying files to and registering the MT SDK on your computer:





Intermediately, the MATLAB Component Runtime will be installed (if not already done); please refer to section 3.1.1 for details.

Now, pressing the “Finish” button in the next dialog concludes the installation:

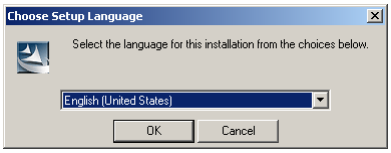


Now go to section 3.2 which describes connecting your device to the MT Manager.

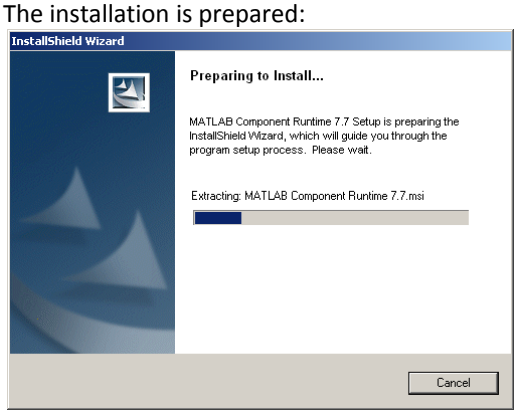
3.1.1 Installing MATLAB Component Runtime

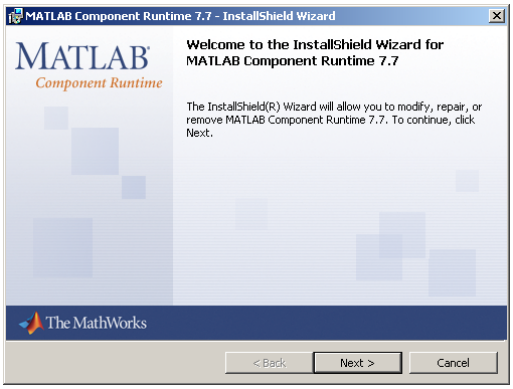
The Magnetic Field Mapper (as plug-in of the MT Manager) uses the MATLAB Component Runtime, which will also be installed during the installation of the MT Manager. Please follow the instructions in the dialogs as shown in the next dialogs.

At the start of the installation MATLAB Runtime Component, you can set the language[2] and then press “OK”:



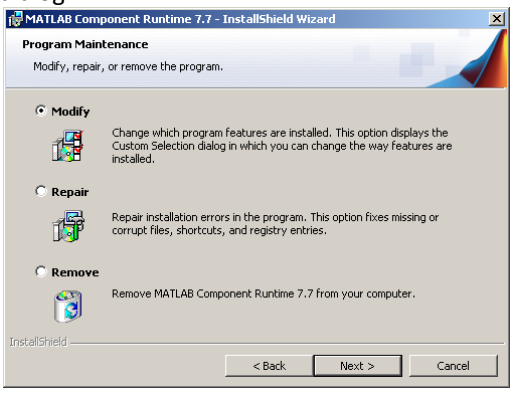
The installation is prepared:

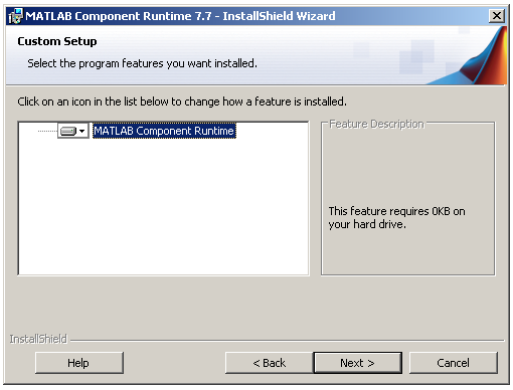




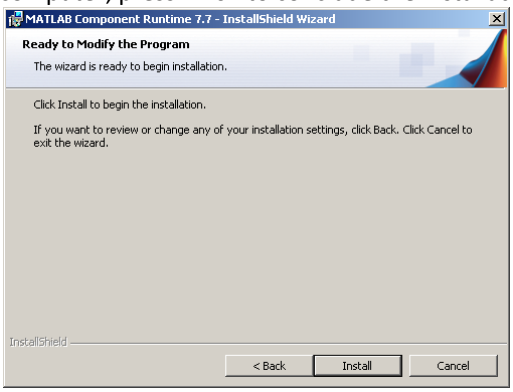
[2] English and Japanese are currently supported

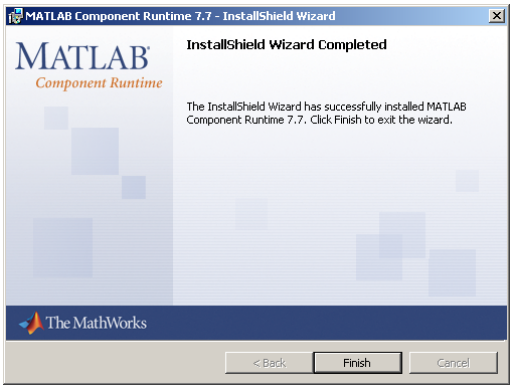
Leave the “Modify” option ticked (after the first-time installation) and press “Next” in this dialog and the next dialog:





Pressing “Install” will then start copying files to and registering the MATLAB Component Runtime on your computer; press finish to conclude the installation.





When MATLAB Component Runtime installation has finished, the MT SDK installation will continue.

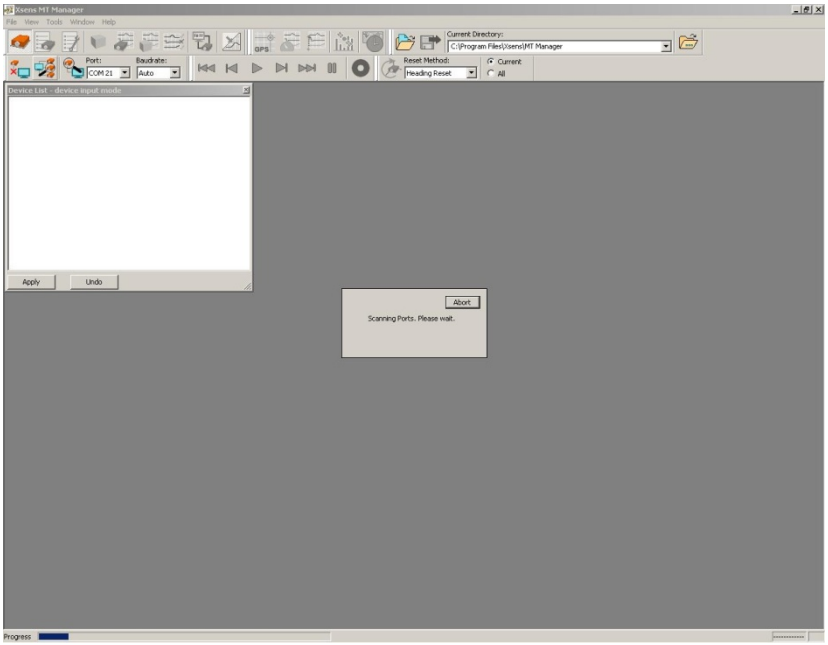
3.2 Connecting your device to MT Manager

To connect a device (standalone MT and/or MTx(s) connected to an Xbus Master) to your PC (with the supplied USB cable), you must **first** plug the cable with the USB connector into your PC and **then** to your MT or Xbus Master, see also section 8. The MT Manager will start with a Configuration wizard to perform a quick set-up of your MT. This configuration wizard is described in 5.2. It is recommended to go through this configuration wizard upon first use.

You have the option to have the COM port selected either automatically or manually.

3.2.1 Automatic COM port selection

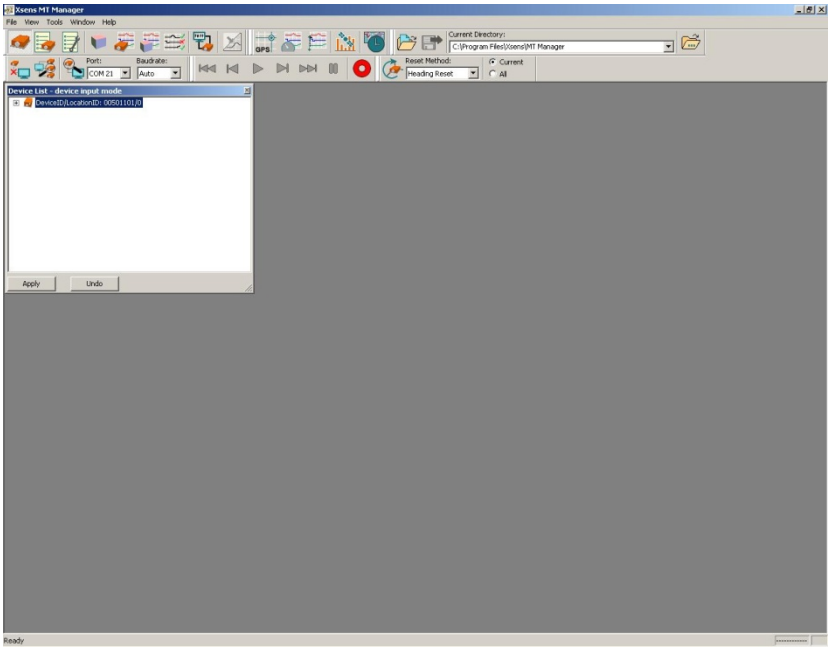
Upon execution of the MT Manager it automatically scans the available COM-ports on the PC for connected devices:



If your are using an RS-485 sensor, be sure to enable the RS-485 compatibility mode in the General pane via "Tools" → "Options…", refer to section 4.6.

If the PC has a large number of COM-ports (e.g. if Bluetooth drivers are installed) this may take some time. Progress is displayed during scanning in the status bar on the bottom of the main window. This is also done when starting the software.
Then (upon successful connection[3]), the connected device is listed in the "Device List" sub-window:

[3] Please refer to section 8 in case of problems.



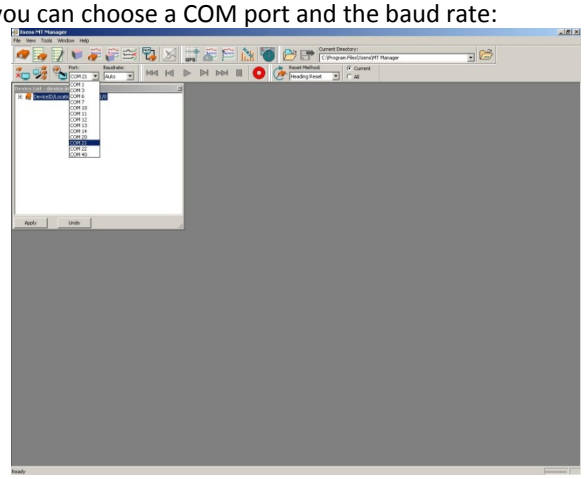
The MTs are displayed in the Device List with the respective unique MT device ID number.
If an Xbus Master is attached to one of the COM-ports, the MT Manager detects this and will query the Xbus Master for attached sensors. MTs found in this manner are treated the same as MTs found on separate COM-ports.
After physically connecting one or more devices, press the rescan button:

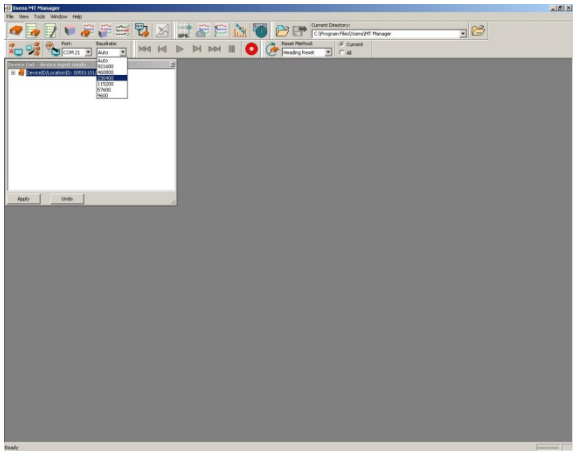
to let MT Manager search for connected devices on any available COM port and update the device list.
When you want to disconnect a device, select it in the device list and then press the disconnect button:

3.2.2 Manual COM port selection

If you want to select the COM port manually, then in the Connectivity toolbar:

you can choose a COM port and the baud rate:





For the COM ports you can choose between all active COM ports and for the baud rates the same values are available as listed in section 9 together with the “Auto” value.
It is recommended to use the “Auto” baud rate to have the baud rate determined automatically. Then, finally, press the “Scan Port” button[4]:

Now you are ready to go using your Motion Tracker and/or Xbus Master with the MT Manager.

[4] If you are using an RS-485 sensor, be sure to enable the “RS-485 compatibility mode” (refer to section 3.2.1).

4 Overview MT Manager

This section describes the options available to the user in the MT Manager.
In section 5 operating the MT Manager is described.

4.1 Purpose

The purpose of the MT Manager is to provide easy access to the capabilities of any of the currently supported devices (refer to section 4.3).
The MT Manager can be used to interface with the MT and to visualize and log data. It offers export options for ASCII and Google Earth KMZ XML-files. The ASCII export format can be customised to your needs.

4.2 MT Manager features

The MT Manager software for Windows XP/Vista/W7 is easy-to-use software with a familiar Windows user interface, which allows you to:

- view 3D orientation in real-time
- view inertial and magnetic sensor data in real time
- view latitude, longitude, altitude plots in real time (depends on Motion Tracker used)
- reprocess RAW binary data log files
- export log files to ASCII or KMZ
- change and view various device settings and properties
- run a self test, to check the mechanical functions of the inertial sensors and magnetometer
- interactively “chat” with a Motion Tracker through a terminal emulator

The MT Manager is therefore an easy way to get to know and to demonstrate the capabilities of your Xsens Motion Tracker and/or Xbus Master.

4.3 Supported devices

Currently the following devices are being supported[5] by the MT Manager:

- MTx
- MTi
- MTi-G
- Xbus Master

For detailed information about these MTs and Xbus Master, please refer to the corresponding User Manuals and Technical Documentation: [MTi_MTx], [MTi-G] and [XBM].
Future Xsens Motion Trackers will be supported as of their release.

4.4 Input Options

The MT Manager can handle real-time input and input from recorded binary files (see also sections 5.4.1 and 5.4.2).

Real-time: Serial data using COM port (via USB virtual COM-port or RS232[6]).

Files: .MTB (MT Binary Communication Protocol)[7] log files. Contain recorded output log-files from a Motion Tracker.

[5] Devices with firmware versions 1.x are not able to make use of sensor scenarios. Raw sensor data however can be processed through software scenario processing on the host PC.
[6] COM1 and COM2 only

In both cases the input (file) format is the same.

The .MTB log files generated with the MT Manager will contain the following MT Data messages:

- Configuration data
- For RAW data log files; Extended MT Specification data
- If enabled, UTC date and time at regular intervals (as configured)
- If enabled, GPS satellite SVInfo at regular intervals (as configured)
- MT data at sample frequency (as configured)

The MT Manager software handles the request of these additional data packets from the MT (not only requesting MT Data) to enable full analysis of log-files in the MT Manager software later.

NOTE: An MTB file can contain any MT Data packets that are requested from the MT. This includes the **RAW inertial** and **GPS PVT[8] MT Data** messages.
Only if an MTB file contains ***both*** the RAW inertial data and/or GPS PVT data messages, the data can be re-processed using different XKF Scenarios. In all other cases the .MTB file is considered a log-file, which can be played back again for viewing.
In the case that only RAW inertial data and/or GPS PVT data is requested from the MT, the MT Manager will run the XKF filter in XsensCMT.DLL (Level 4, see [LLC]) on the host PC (and not on the DSP on the MT) to estimate orientation, position, velocity.

4.5 Output Files

The MT Manager can export data logged in .MTB files to several formats (see also section 5.4.3).

ASCII text data

- Calibrated sensor data (3D acceleration, rate of turn, magnetic field)
- Orientation data
- Position
- Velocity

The output orientation can be presented in different conventions:

- Unit normalised Quaternions (also known as Euler parameters)
- Euler angles: roll, pitch, yaw (XYZ Earth fixed type, also known as Cardan)
- Rotation Matrix (Direction Cosine Matrix)

A sample counter and UTC time can also be included in the exported files.

The following column headers are used (list does not include all columns available):

Abbreviation	Data	Unit
Counter	Sample counter	(-), wraps at 65535
Acc_X	Acceleration x-axis	m/s^2
Acc_Y	Acceleration y-axis	m/s^2
Acc_Z	Acceleration z-axis	m/s^2
Gyr_X	Angular rate x-axis	rad/s
Gyr_Y	Angular rate y-axis	rad/s

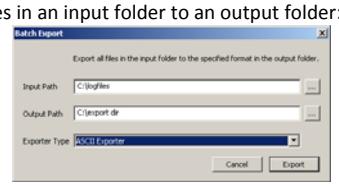
[7] The .MTB extension is associated with MT Manager.
[8] GPS PVT data: Position, Velocity, Time data directly from the GPS board, including barometric pressure. GPS PVT data has not been processed in XKF, MTi-G only

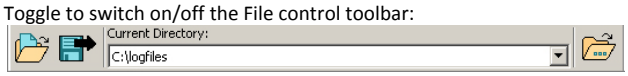
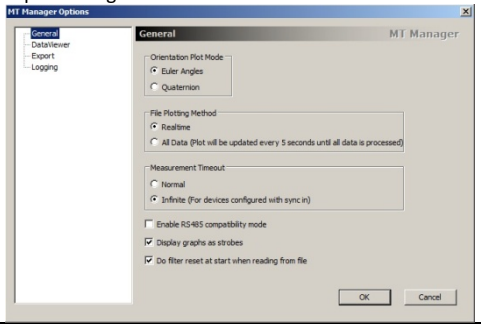
Gyr_Z	Angular rate z-axis	rad/s
Mag_X	Magnetic field x-axis	arbitrary unit; magnetic field strength at Xsens is 1
Mag_Y	Magnetic field y-axis	arbitrary unit; magnetic field strength at Xsens is 1
Mag_Z	Magnetic field z-axis	arbitrary unit; magnetic field strength at Xsens is 1
Roll/Pitch/Yaw	Orientation Euler angles format (3)	deg
Quat *	Orientation quaternion format (4)	
Mat [R#][C#]	Orientation matrix format [Row][Column] (3x3)	
Vel_X	Velocity North	m/s
Vel_Y	Velocity West/East (depends on setting)	m/s
Vel_Z	Velocity Up/Down (depends on setting)	m/s
Vel_Z	Velocity Up/Down (depends on setting)	m/s
Latitude	Latitude according to WGS 84	deg
Longitude	Longitude according to WGS 84	deg
Altitude	Height above earth	m

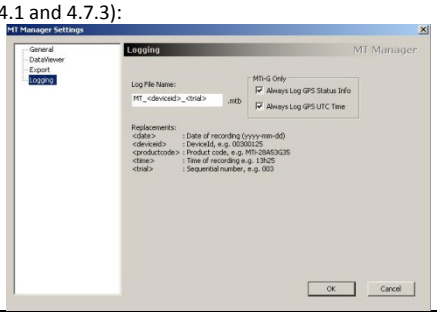
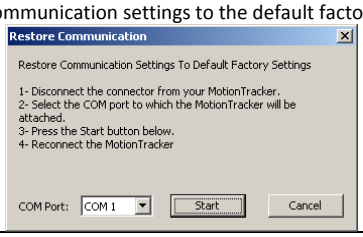
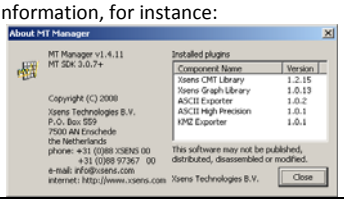
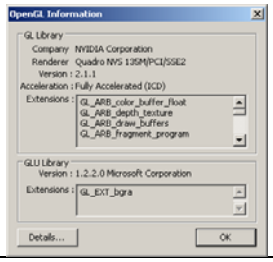
4.6 Menu bar

In the MT Manager menu bar you will find the following entries:

In the table below each (sub-) entry is explained.

Entry (level 1)	Entry (level 2)	Entry (level 3)	Description
File	Open…		Open a previously recorded (shortcut: CTRL-O): • MT Manager log file (`.mtb`) • Xsens log file (`.bin` and `.xm`) • Xbus Master log file (`.xm`) • Binary log file (`.bin`)
	Export…		Export an opened log file to (shortcut: CTRL-E): • ASCII formatted file • KMZ file (MTi-G only) For more details, refer to section 5.4.3.
	Batch export…		Export all log files in an input folder to an output folder:  The available formats are ASCII and KMZ (latter only for MTi-G).
View	Toolbars	Main view	Toggle to switch on/off the Main view toolbar. Refer to section 4.7.1 for details.

Entry (level 1)	Entry (level 2)	Entry (level 3)	Description
		File control	Toggle to switch on/off the File control toolbar:  Icon Action Open a previously recorded file (see also "File → Open…") Export an opened log file (see also "File → Export…") Set the Current Directory (by browsing)
		GPS	Toggle to switch on/off the GPS toolbar. Refer to section 4.7.1 for details.
		Connectivity	Toggle to switch on/off the Connectivity toolbar. Refer to section 4.7.2 for details.
		Playback & Recording	Toggle to switch on/off the Playback & Recording toolbar. Refer to section 4.7.3 for details.
		Orientation resets	Toggle on/off the Orientation resets toolbar. Refer to section 4.7.4.
	Status bar		Toggle to switch on/off the status bar at the bottom of the MT Manager window. This status bar shows playback information, "extended" tool tips etc.
	GPS in meters		If checked, the GPS position is displayed in meters. Otherwise, it is displayed in latitude and longitude.
	Analog clock		Toggle to switch between displaying the analog and digital clock. (The clock can be displayed showing UTC time by pressing the corresponding button in the GPS toolbar, refer to 4.7.1.13).
Tools	Options…	General	Here you can change the following general settings: 1. Orientation plot mode in either Euler Angles or Quaternion; also refer to section 4.7.1.6. 2. Toggle between displaying graphs as strobes ("wrap-around" timescale) and continuously sliding time scale. 3. File plotting mode in either Realtime or All Data (the latter to speed up displaying the graphs). 4. Tick the radio button "Infinite" in SyncIn mode (period is set to 0xFFFF). MT Manager will time out after several seconds if this option has not been selected. 5. Tick the "Enable RS485 compatibility mode" to improve RS485 communication. 6. Untick the box "Display graphs as strobes" to make that the latest data will be displayed at the end of the graph and older data scrolls away at the left side of the graph.. When displaying the graphs as strobes, the graph will wrap around and start from the left in the display again. 7. Untick the "Do filter reset at start when reading from file" to not reset the filter during post-processing. The MT Manager stores the current filter state (e.g. sensor biases) when recording a raw dataset such that the filter does not has to settle in again when reprocessing data. Unticking this box makes that this filter state is used during post-processing. 

Entry (level 1)	Entry (level 2)	Entry (level 3)	Description
		DataViewer	Here you can change the display settings for the Communication Data View (refer to sections 4.7.1.8 and 5.3.1.4).
		Export	Here you can change the export settings (refer to section 5.4.3).
		Logging	Here you can change the settings for recording log files (refer to sections 5.4.1 and 4.7.3): 
	Magfield Mapper…		Starts up the Magfield Mapper, refer to section 5.4.4
	Firmware Updater…		Starts up the Firmware Updater, refer to section 5.4.6
	Restore Communication…		Restores the communication settings to the default factory settings: 
	Configuration Wizard...		Runs the Configuration wizard
	Built-in self test...		Runs the built-in self test
Window	Tile Horizontal		Tiles the open graph windows horizontally. When 4 or more graph windows are tiled, the graphs will be tiled in multiple columns.
	Tile Vertical		Tiles the open graph windows vertically. When 4 or more graph windows are tiled, the graphs will be tiled in multiple columns.
Help	MT Manager User Manual		Opens the MT Manager User Manual (PDF)
	MTi and MTx User Manual		Opens the MTi and MTx User Manual (PDF)
	MTi-G User Manual		Opens the MTi-G User Manual (PDF)
	XM-B User Manual		Opens the Xbus Master User Manual (PDF)
	Other documentation		Opens documentation folder (…\Program Files\Xsens\Documentation)
	About MT Manager…		Display version information, for instance: 
	View OGL info		Displays Open GL information, for instance (only available when 3D View is active): 

4.7 Sub-windows, toolbars and buttons

In this section the sub-windows, toolbars and buttons of the MT Manager are explained:

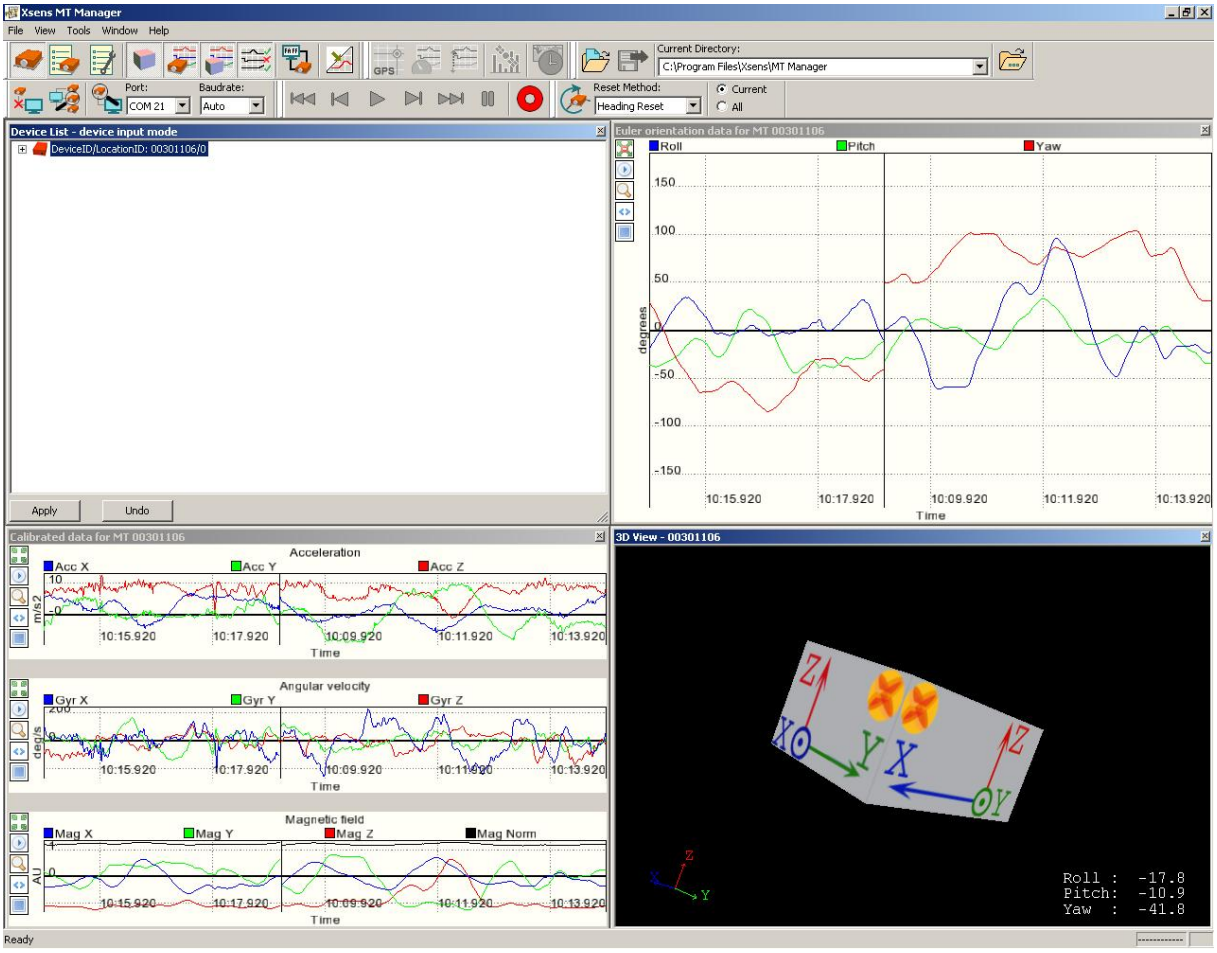
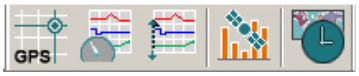


Figure 1: The MT Manager with its toolbars, buttons and sub-windows

4.7.1 The sub-windows

The MT Manager offers a wide range of information displayed in its sub-windows, which can be turned on and off via the (Main Views and GPS) toolbar buttons:



The individual buttons and their functionality will be explained in the next sub-sections; availability of some of the buttons and related sub-windows depends on the type of the connected device (e.g. position and velocity information will not be accessible with MTi and MTx).
The icons corresponding with the button that activates a specific sub-window are displayed on the top left of each subsection.

4.7.1.1 The Device List

By default, the Device List is displayed in a sub-window, showing useful information about your MT.

In Figure 2 the full tree of read-only and user configurable properties[9] for an MTi-G is shown; Figure 3 depicts the Device List for one Xbus Master with two MTx sensors connected.

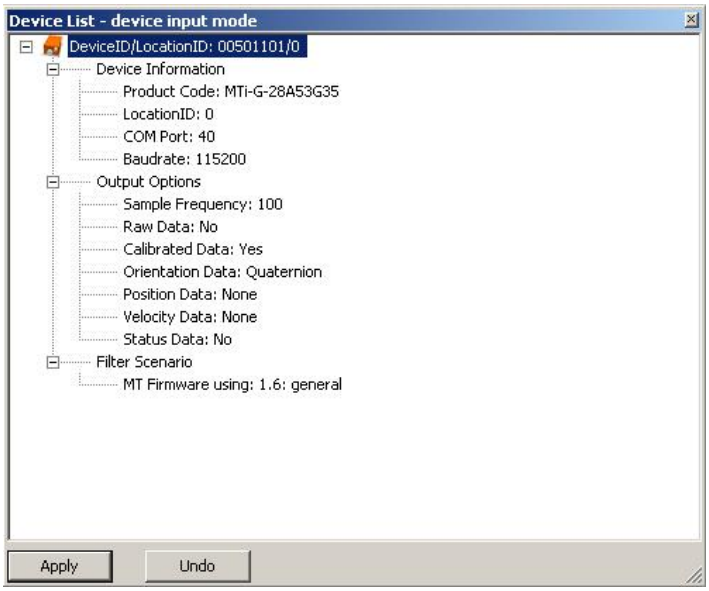


Figure 2: Device List tree for an MTi-G connected

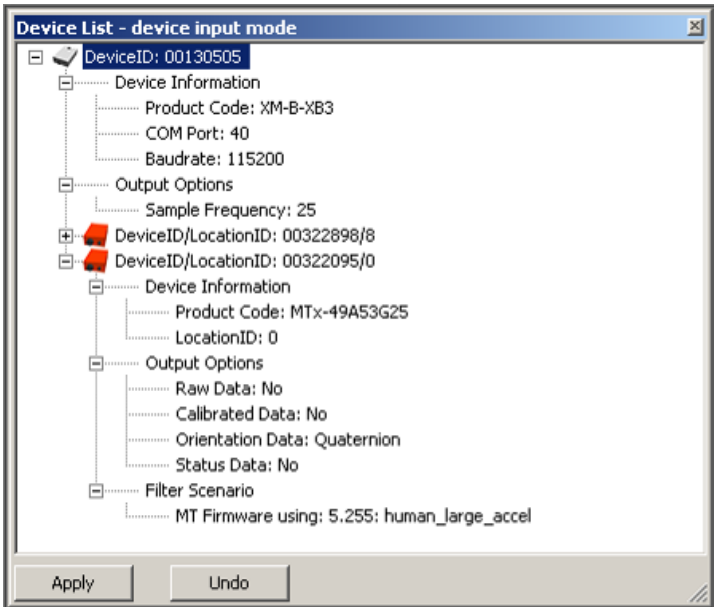


Figure 3: Device list tree for an Xbus Master with two connected MTx sensors

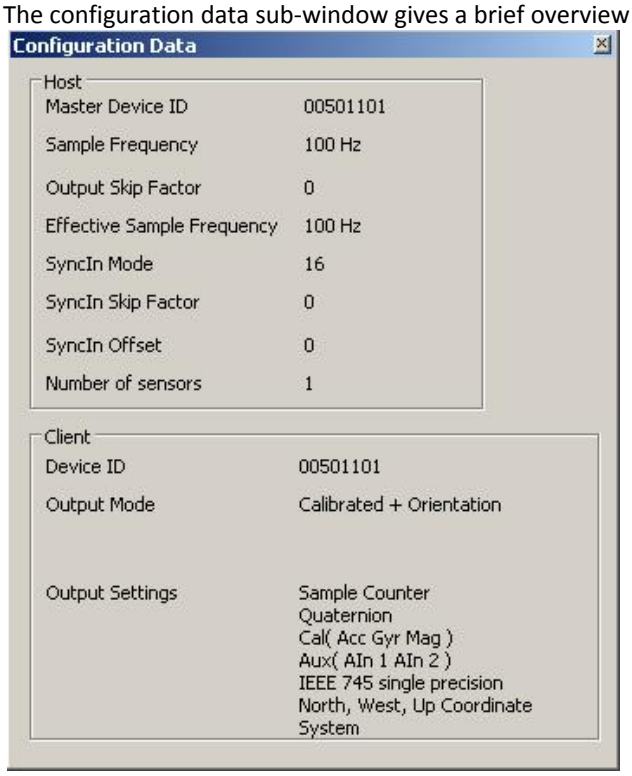
Please refer to section 9 for a detailed description of all properties.

Note: Changes only take effect when the "Apply" button is pressed. A star after Device List – device input mode (*) denotes that the changes are not yet applied. Also, when "Changes made" is displayed right from "Undo", changes are not yet applied.

[9] See also section 9.

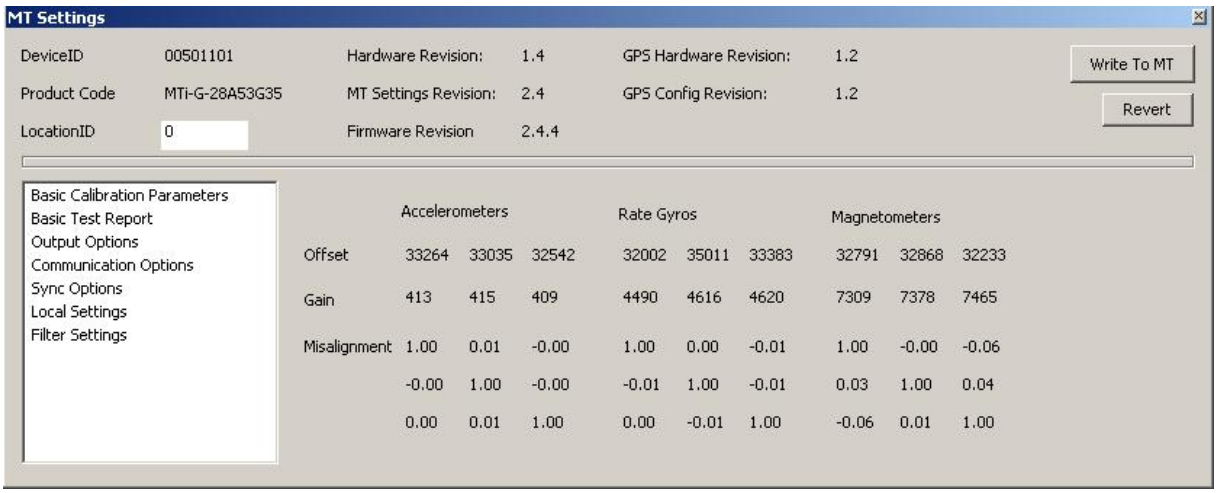
4.7.1.2 Configuration data

The configuration data sub-window gives a brief overview of the configurations of the host and the client.



4.7.1.3 MT Settings

In the MT Settings sub-window several (low-level) settings can be changed.
Caution is advised to avoid unwanted changes, causing your devices to work improperly and/or inaccurately.
You can always revert a device to its Factory Settings using the Revert button.



For details on the MT Settings, please refer to the documentation of the devices: [MTi_MTx], [MTi-G] and [XBM].

4.7.1.4 3D Box View

The 3D Box View is a real-time graphical (OpenGL) representation of the MT orientation measurements, i.e. roll, pitch and yaw, see Figure 4.

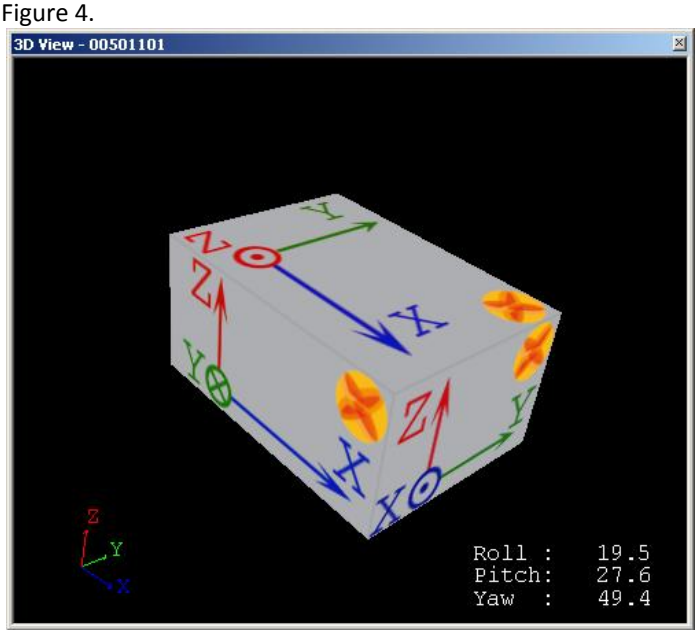
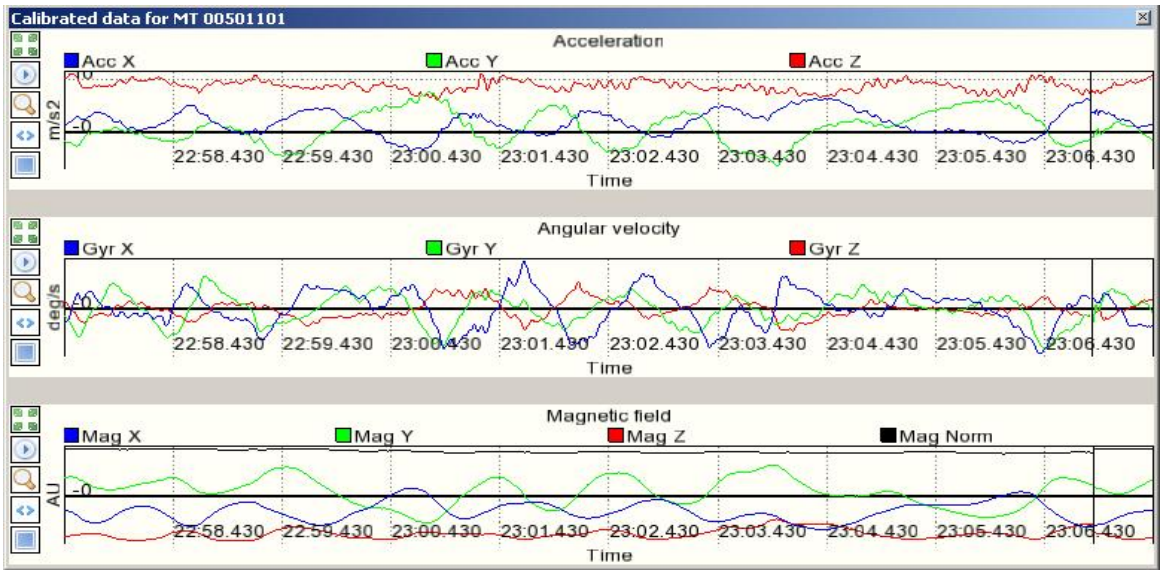


Figure 4: The 3D Box View, an OpenGL representation of the MT in 3D. Arrows on the sides of the box represent the three main axes. Each main axis is also associated with a colour. X = blue, Y = green, Z = red. By default Z is defined positive when pointing upwards and X is defined as positive when pointing to local magnetic north.

4.7.1.5 Calibrated Data view

Per sensor type, the Calibrated Data view graphically shows the 3D calibrated measurement data vs. time:

- acceleration (from the accelerometers) in m/s^2;
- angular velocity (from the gyroscopes) in deg/s;
- magnetic field (from the magnetometers) in normalised arbitrary units (AU).



The following tables explain the line colours[10] and the buttons in this view:

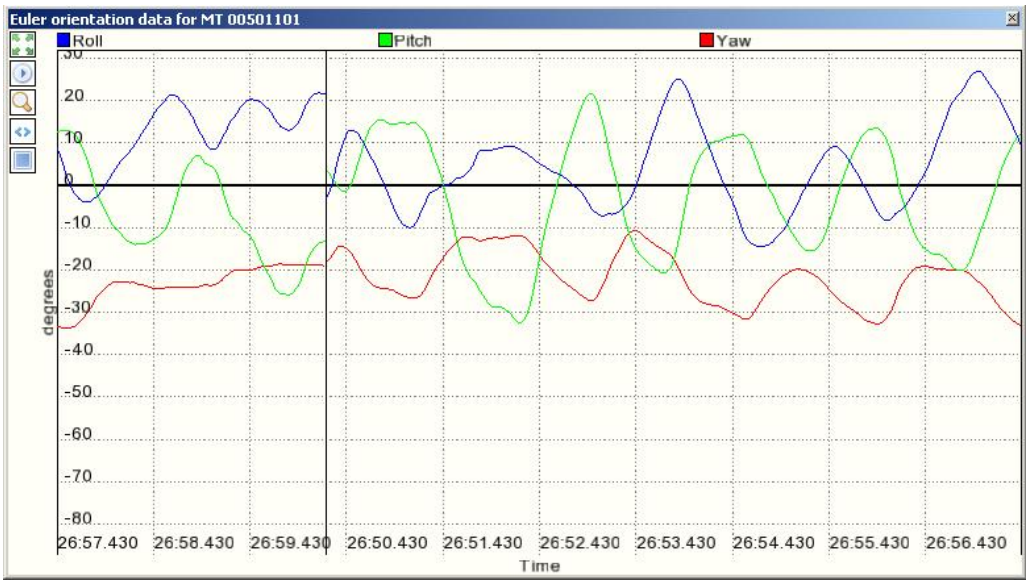
Colour	Corresponding axis
Blue	Acceleration, angular velocity (roll) and normalised magnetic field in X direction
Green	Acceleration, angular velocity (pitch) and normalised magnetic field in Y direction
Red	Acceleration, angular velocity (yaw) and normalised magnetic field in Z direction

Button name	Button icon	Functionality
Zoom (in/out)		When selected, zooming in is enabled with a left-click (and drag) to select an area (or center point, max zoom in one step x10) and zooming out with right-click (and drag, 'max' zoom in one step x0.5). NOTE: only possible with auto-scaling disabled.
Pan		When selected, panning in a graph is enabled with a left-click and drag. Panning and zooming share the same button, click to change the mode.
AutoScale		Toggle for 1. enabling full auto scaling (zoom in and out), 2. enabling limited auto scaling (zoom out only) and 3. disabling auto scaling
Full zoom out		This maximises the horizontal scale
Play/Pause		Toggle for playing and pausing the displaying of data
Clear graph		Clears the corresponding graph

[10] The colours correspond with the colours in the 3D Box View, see section 4.7.1.4.

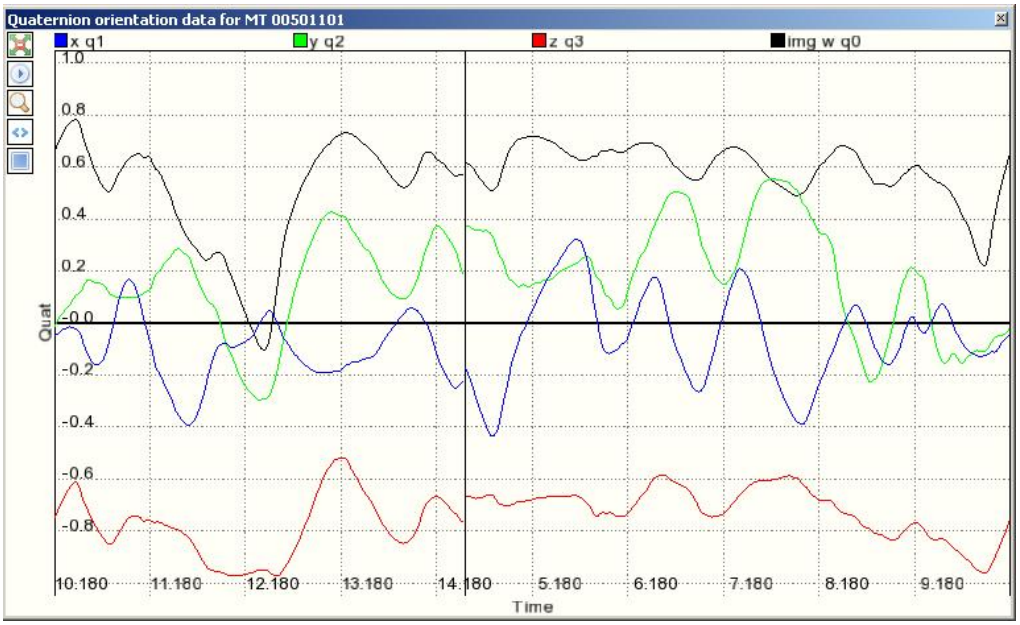
4.7.1.6 Orientation data view

The Orientation data view shows the 3D orientation (calculated from the angular velocities) in either Euler angles in degrees vs. time or Quaternions[11] vs. time



The following table explains the line colours in “degrees vs. time“ view:

Colour	Corresponding axis
Blue	Orientation of the X-axis
Green	Orientation of the Y-axis
Red	Orientation of the Z-axis



[11] Refer to [MTi_MTx] or [MTi-G] for a detailed description on Quaternions

The following table explains the line colours in the “Quaternions vs. time” view:

Colour	Description
Blue	q1
Green	q2
Red	q3
Black	q0

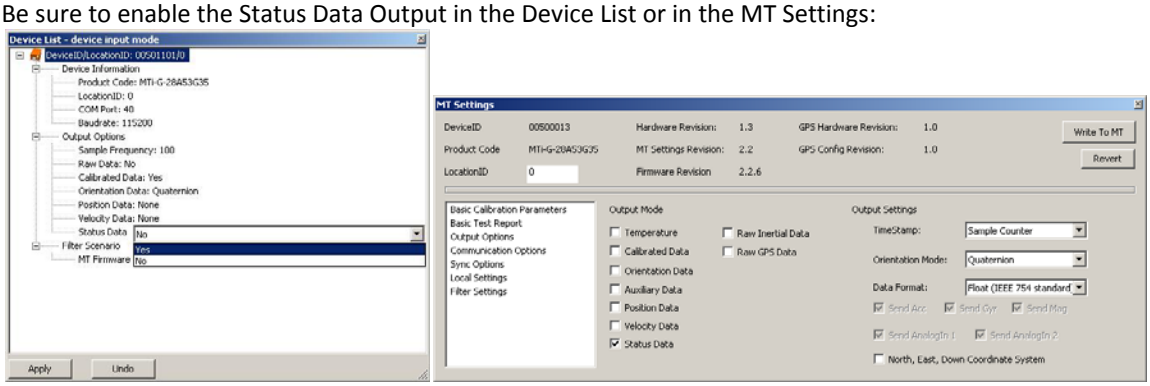
Please refer to the table in section 4.7.1.5 for explanation of the buttons (on the left-hand side).

4.7.1.7 MT Status

The MT Status sub-window displays the status for the following quantities:

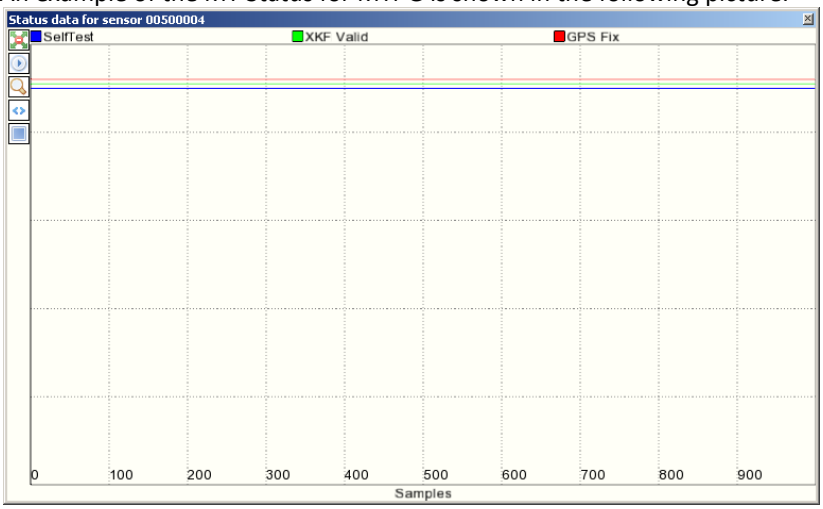
- Selftest enabled
- XKF accuracy
- GPS fix (MTi-G only)
- Bias estimation (MTi/MTx only)

Be sure to enable the Status Data Output in the Device List or in the MT Settings:

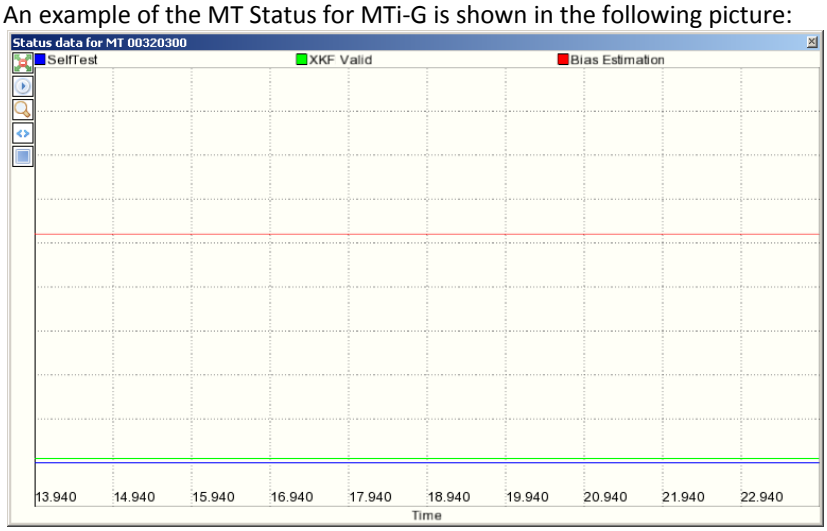


Press Apply (Device List) or Write to MT (MT Settings) to activate the status byte.

An example of the MT Status for MTi-G is shown in the following picture:



An example of the MT Status for MTi-G is shown in the following picture:

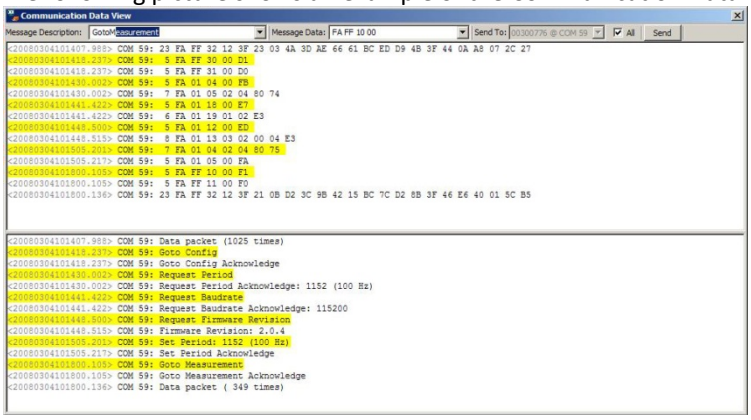


Colour	Status data description
Blue	Motion Tracker has passed the self test (see [LLCP], **`RunSelfTest`**)
Green	XKF accuracy indicator; low="not accurate", high="accurate"
Red	**For MTi-G**: GPS fix (high) or no GPS fix (low) **For MTi/MTx**: Bias estimation (refer to section 5.3.3.4 and [MTi_MTx]): 1 (high): running with no rotation assumption 2/3: error: rotation detected, procedure not started 1/3: estimation complete, some samples rejected 0 (low): estimation complete, no errors

4.7.1.8 Communication Data View

The Communication Data View is a useful tool to become familiar with the low-level communication between a host device and the MT Manager.
It may also be helpful when interfacing an Xsens MT with other devices using the low level communication without using the MT Manager (the MT Manager is not *required* to use and manage an MT and/or an Xbus Master).

The following picture shows an example of the Communication Data view sub-window:



The toolbar at the top of the window contains the following fields:

Field	Corresponding axis
Message Description	Description of the message to send to the device. Check the Low-Level Documentation for details. Auto-completion is enabled in this field. Press enter to send the message.
Message Data	Contents of the message selected, without the checksum. Field is updated when description is changed. Auto-completion is enabled in this field. Press enter to send the message.
Send To	Indicates to which device the message is sent. Check the All checkmark to select all devices at once. Some messages (`GotoConfig`, `GotoMeasurement` and `Reset`) can only be sent to all attached devices.
All	If this is ticked the currently selected message data will be sent to all COM ports when pressing "Send"
Send	Press to send the currently selected message data.

For details on the "Message Description" and the "Message Data" please refer to [LLCP].

Top split window

Column	Contents	Description
1	YYYYMMDDHHMMSS.sss	Year,Month,Day,Hour,Minute,Second,Milliseconds of the sent/arrived message (System time)
2	COM ppp	COM port at which the message is sent/received
3	Ddd	Number of bytes in the complete message (Including header and checksum)
4	Bytes	Hexadecimal representation of all bytes in a message (Including header and checksum)

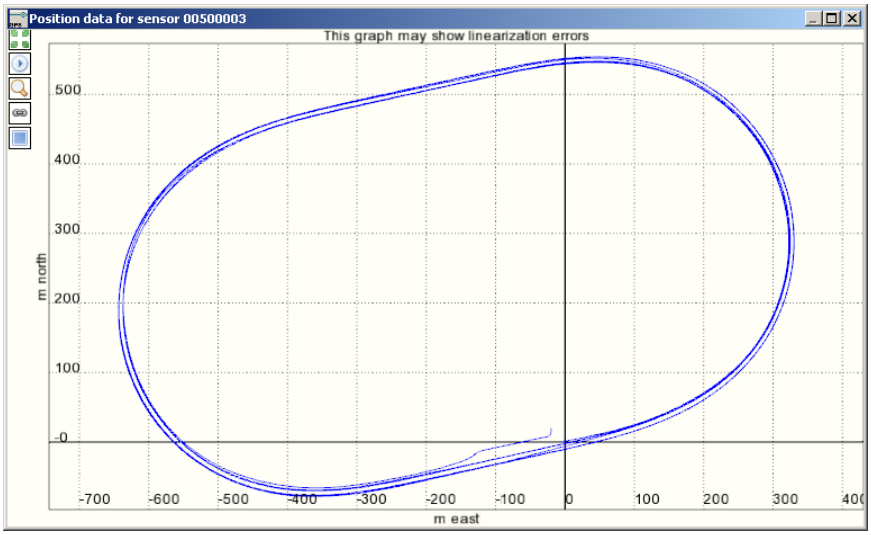
Bottom split window

Same as top split window except in the 4th column the Message description is displayed instead of the hexadecimal view.

To customise the presentation of displayed data, please refer to section 5.3.1.4.

4.7.1.9 Position (MTi-G only)

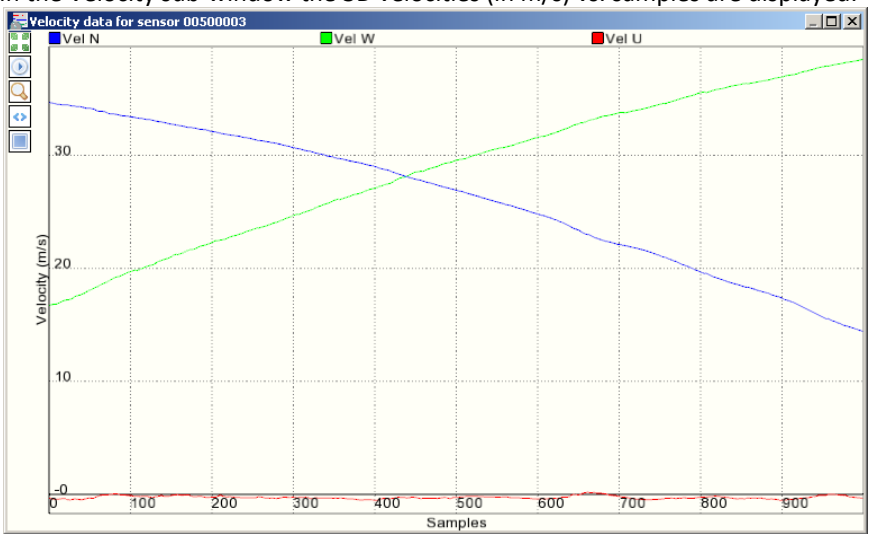
The Position as estimated by XKF sub-window shows the 2D trajectory in the horizontal plane. The default is to plot in degrees Latitude (N) and Longitude (E). It is also possible to linearize around the current position and plot the estimated Position in meters. Please note that that can lead to significant linearization errors over large distances.



Please refer to the table in section 4.7.1.5 for explanation of the buttons (on the left-hand side).

4.7.1.10 Velocity (MTi-G only)

In the Velocity sub-window the 3D velocities (in m/s) vs. samples are displayed.



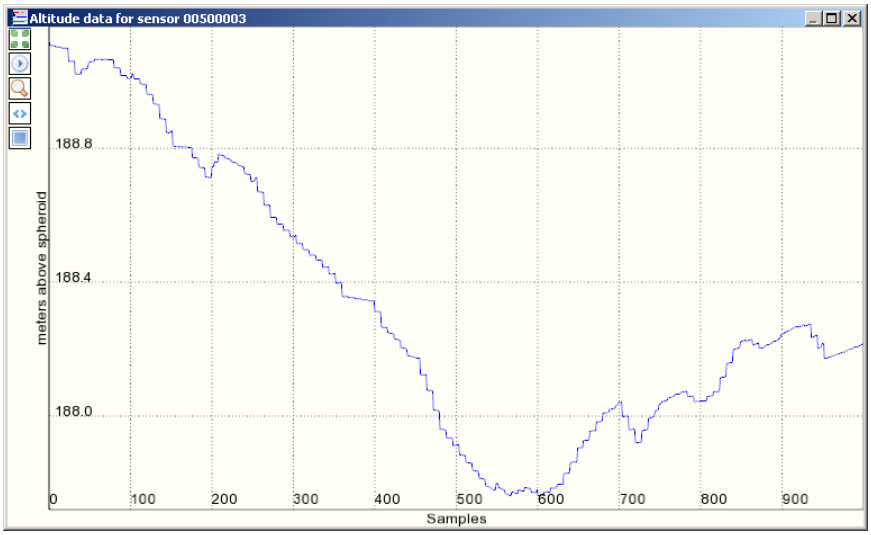
The following table explains the line colours in this view:

Colour	Corresponding axis
Blue	Velocity in X direction (North)
Green	Velocity in Y direction (East or West depending on output settings)
Red	Velocity in Z direction (Down or Up depending on output settings)

Please refer to the table in section 4.7.1.5 for explanation of the buttons (on the left-hand side).

4.7.1.11 Altitude (MTi-G only)

The Altitude sub-window shows the height (in m) above WGS84 spheroid vs. samples.



Please refer to the table in section 4.7.1.5 for explanation of the buttons (on the left-hand side).

4.7.1.12 GPS Status (MTi-G only)

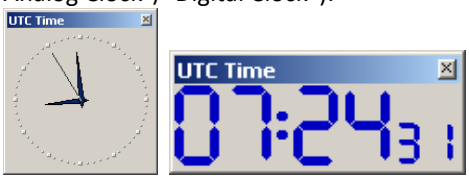
The GPS Status window is a bar chart in which, for each detected GPS satellite, the signal strength (in dbHz) and the Usage Status is depicted.

The colours of the bars indicate the Usage Status per satellite:

Bar colour	Usage Status description
Light Green	Data from this satellite is used for navigation and differential correction data is available
Dark Green	Data from this satellite is used for navigation
Dark Blue	This satellite is detected, but not used for navigation
Blue	This satellite is detected, but not used for navigation, differential correction data is available
Light Blue	This satellite is detected, but not used for navigation, orbit information is available
Cyan	This satellite is detected, but not used for navigation, orbit information and differential correction data are available
Red	This satellite is unhealthy and shall not be used for navigation

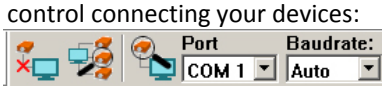
4.7.1.13 UTC time (MTi-G only)

The UTC time sub-window shows the UTC time as retrieved from the GPS data (either as analog or digital clock, which is selectable via "View" ➔ "Analog Clock"/"Digital Clock"):



4.7.2 Connectivity

With the Connectivity toolbar you can control connecting your devices:



Please refer to section 3.2 for details on how to connect and disconnect your devices.

4.7.3 Playback & recording

To be able to record data and playback recorded data, the MT Manager offers the Playback & Recording toolbar:

Figure 5: MT Manager Playback & Recording Toolbar

In Table 1 the functionality of each button is explained.

Table 1: Playback & Recording buttons

Button name	Button icon	Functionality
Record/ Stop Record		Pressing this button will turn on the logging of data to a file (see also section 5.4.1) Releasing this button in recording mode, will turn off the logging
Play		Pressing this button will start (or continue) playback of logged data (see also section 5.4.2)
Rewind		During playback, pressing this button will go to the start of the logging
Pause		During playback, pressing this button will toggle playback and pause the playback
Currently unused buttons		

4.7.4 Orientation resets

The Orientation resets toolbar offers functionality to reset specific global and local coordinate system related quantities:

Note: be cautious to use the orientation resets. Please refer to [MTi_MTx] and [MTi-G] for detailed information about orientation resets and the effects these have.

The following resets are available:

Reset type	Functionality
Heading reset	redefines North to the x-axis of the device (MTi and MTx only)
Object reset	redefines device coordinates system such that momentary inclination is zero
Alignment reset	combines the heading reset and the object reset (MTi and MTx only)

After choosing the reset type, press the Reset Orientation button:

You can also choose to apply the reset on the current device or on all connected devices.
After a reset you can store the new values to the MT Settings by selecting “Store” and pressing the button again.

4.8 Command line options

MT Manager supports several command line options. These are mostly useful for automatically exporting data from files, but there are also some other options that may help when solving problems.
Where relevant, the arguments are parsed in the order they are entered on the command line (i.e. specifying `-pd` and then specifying `–bd` will overwrite the `–pd` option).

Command	Parameter	Functionality
`-pd=`	path to plug-ins	Override the default plug-in path. The default path is 'plug-ins' in the MT Manager application path.
`-bd=`	path to base folder	Override the base path for MT Manager. This path is used for reading settings files (.xsb) and other files the application needs. The default path is the MT Manager application path. When this path changes, the plug-ins path is automatically updated as well.
`-export[=]`	[destination path]	Tell MT Manager to open the specified file(s) and export their contents to the given path. MT Manager will exit after exporting the last file. When -export is supplied without the optional = and path, the file(s) are exported to the path they're read from.
`-output=`	string of output options	This option tells MT Manager what to export when exporting files. Simply place all relevant options in a continuous string. Valid options are: c Calibrated data e Euler orientation data q Quaternion orientation data m Matrix orientation data
<other>	-	Any other string found on the command line is interpreted as an input file. MT Manager will try to open this file and handle it as specified by the other command line arguments. The default operation is to simply open the file in the MT Manager GUI.

Example (export calibrated data and Quaternions from `mymtbfile` to path `C:\exported files`):

```
"MT Manager.exe" –export="C:\exported files" –output=cq C:\mymtbfile.mtb
```

5 Operating guidelines

5.1 Overview

This section describes the configuration and typical utilisations for managing your devices with the MT Manager.

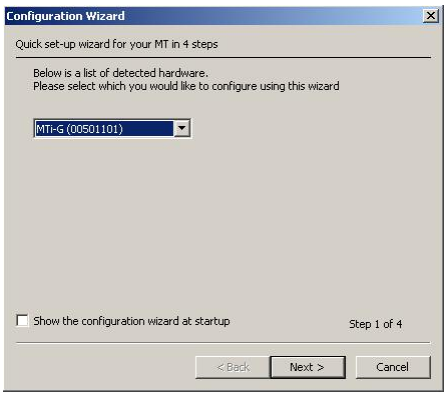
5.2 Using the Configuration Wizard

When an MT is connected to the PC and the MT Manager is started, a Configuration Wizard will appear. If this wizard does not appear, you can start it from Tools → Configuration Wizard…. You can also disable the Configuration Wizard by checking the box “Do not show this at startup”.

The configuration wizard is a quick step-through wizard that applies several basic settings to your MT in the following steps:
Step 1: Selection of MT
Step 2: Selection of output options
Step 3: Selection of output frequency and baud rate
Step 4: Selection of scenario and GPS lever arm (MTi-G only)

5.2.1 Step 1: Selection of MT

It is possible to setup only one MT at once.

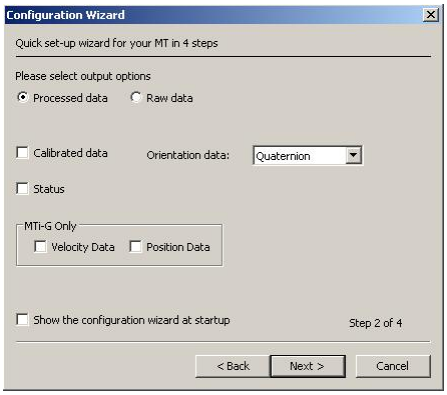


5.2.2 Step 2: Selection of output options

You must choose raw data or processed data. Raw data allows for later post-processing with various settings in MT Manager, including different scenarios and output modes. Processed data makes that the MT calculates calibrated data and/or orientation data on the processor onboard the MT.

If processed data is selected, you can choose calibrated data and or orientation data. For more information on the various outputs, refer to [MTi_MTx] and [MTi-G].

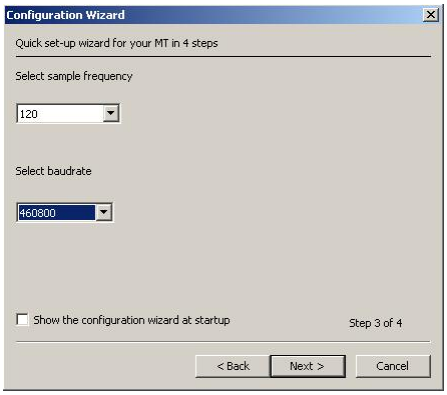
In case an MTi-G is connected, you can also choose to output velocity of position data.



5.2.3 Step 3: Selection of output frequency and baud rate

The third step is the selection of output frequency and baud rate. The maximum output frequency is 512 Hz for raw data, 256 Hz for processed data when using an MTi or MTx and 120 Hz for processed data when using an MTi-G.

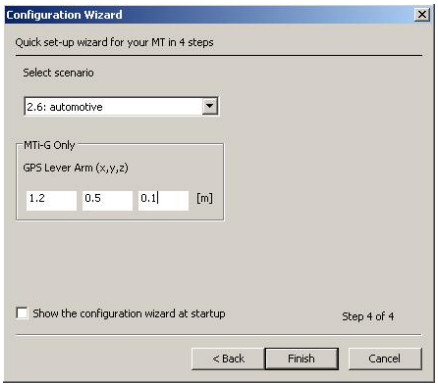
The default baud rate is 115200 baud, but a lower baud rate (down to 4800 baud) or a higher baud rate (921600 baud) is possible. Make sure that the baud rate is high enough for the combination of data and the output frequency. More information on data size can be found in [LLCP]. A baud rate of 921600 is recommended for the MTi-G.



5.2.4 Step 4: Selection of scenario and GPS lever arm (MTi-G only)

The selection of scenarios is very important for most accurate data output of the MT. For more information on the scenarios, refer to [MTi_MTx] and [MTi-G].

For the MTi-G, it is required to set the distance between the MTi-G and the antenna. This has to be specified in meters. The default axes x, y and z are displayed on the casing of the MTi-G.



The configuration wizard allows a quick set-up of basic settings. Various other settings can be set to make the MT more adapted to the specific application it is used in. This is described in the next section.

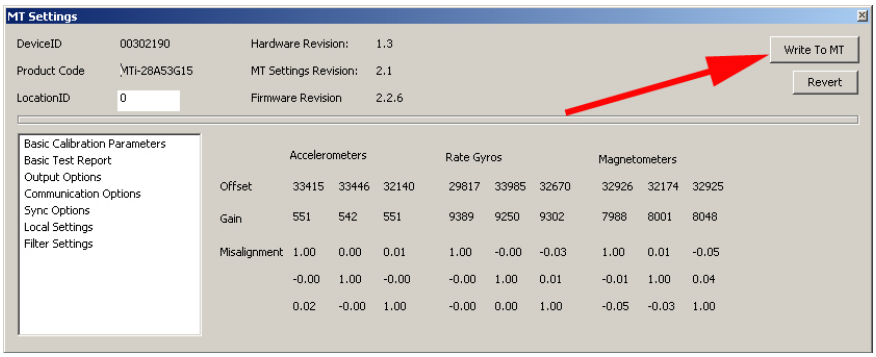
5.3 Manually configuring the MT Manager and your devices

5.3.1 General settings

Changing the settings of your devices can be done (dependent on the setting) in:

1. the Device List (refer to section 4.7.1.1)
2. the Configuration Data View (refer to section 4.7.1.2) and/or
3. the MT Settings sub-window (refer to section 4.7.1.3).

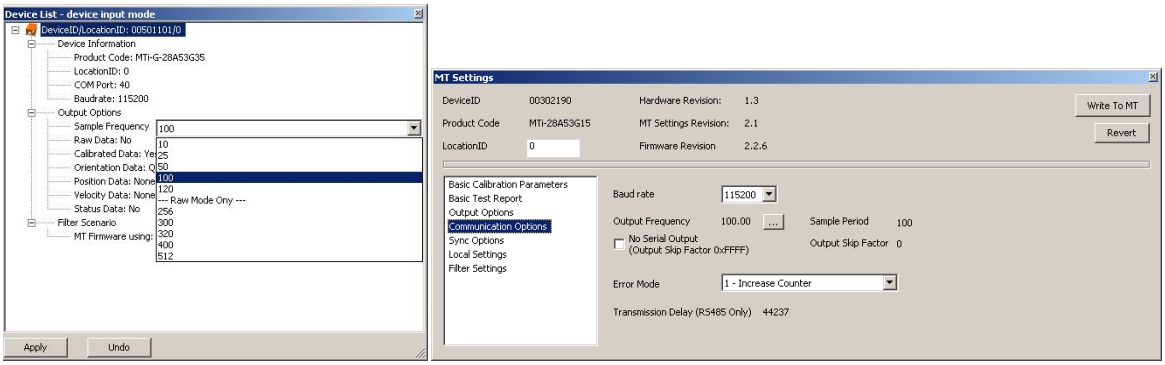
Note: changing the settings in the *MT Settings* window requires the user to explicitly invoke writing to the MT: Press the "Write to MT" button, **to actually save your changes** to non-volatile memory in the MT device. MT Manager will then write the settings to the device and rescan for devices:



When changing settings in the *Device List* and the *Configuration Data View*, changes will be applied immediately by the MT Manager.

5.3.1.1 Setting the sample rate

The sample rate can be set in the Device List and in the MT Settings:

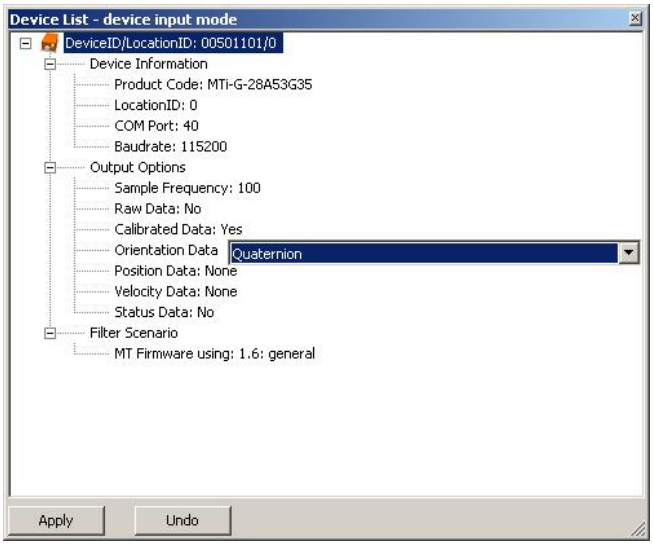


Refer to sections 9.1.1 and 9.2.1 for further details.

5.3.1.2 Setting the output modes

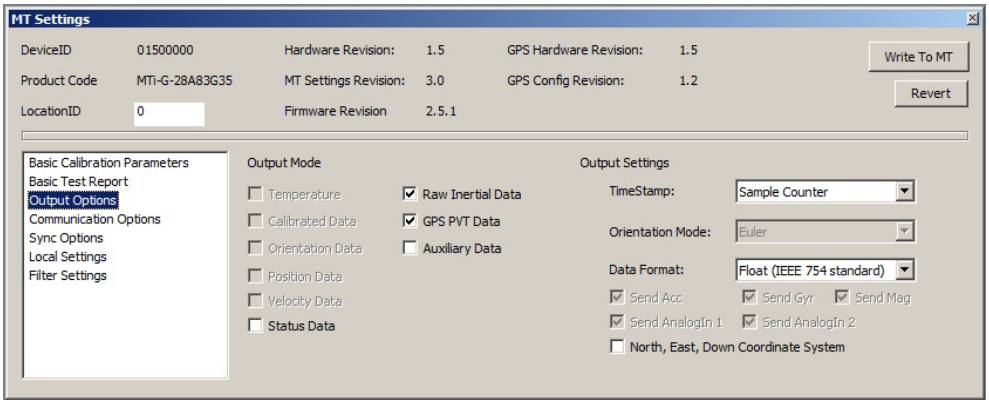
The output mode is configurable in both the Device List and the MT Settings sub-window (refer also to 9.1 and 9.2).

The Device List offers access to the basic set selection of output mode settings:



Press Apply after changing the output options.

Besides the Device List, the MT Settings sub-window also allows the same and more (detailed) settings, see below.

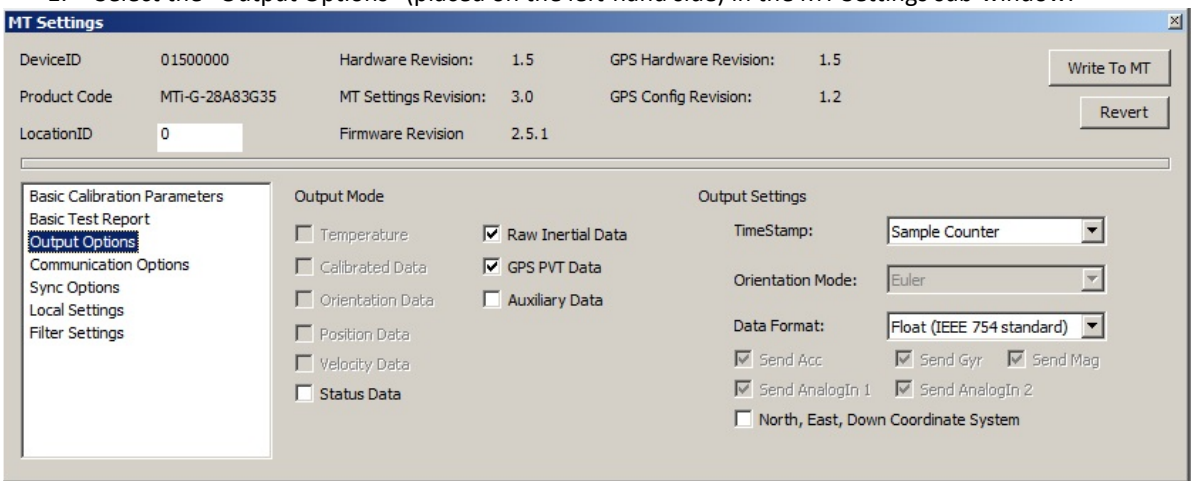


5.3.1.3 *Enabling High precision mode for the MTi-G*

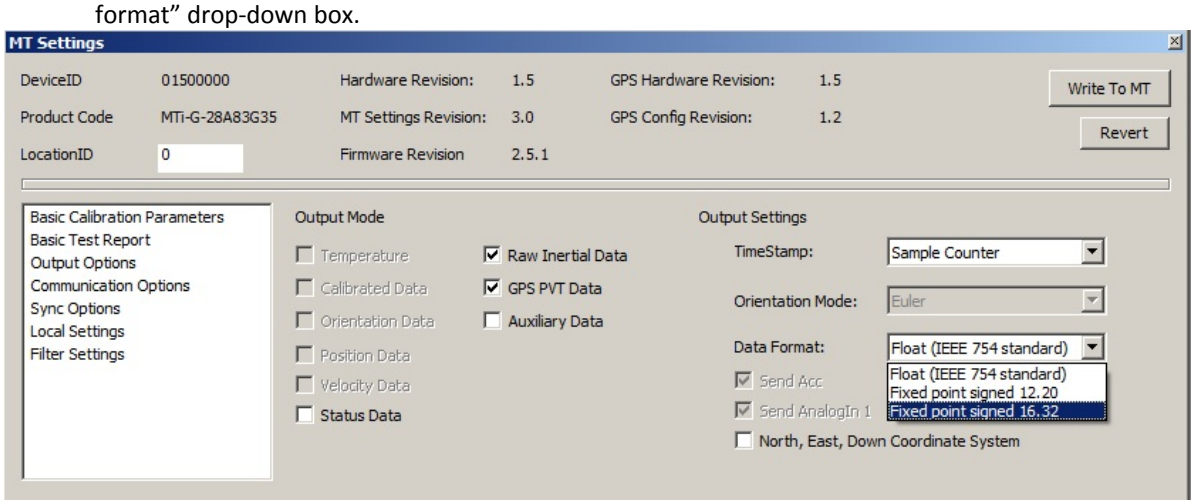
For high precision output by the MTi-G, it is recommended to change to the High precision Data format output (48bit); this format especially avoids quantisation[12] in position output (LLA) when high precision is required for position.

To enable the high precision mode, activate the MT Settings sub-window and then:

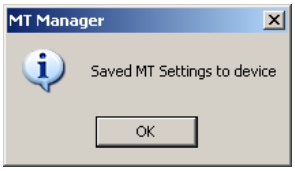
1. Select the "Output Options" (placed on the left-hand side) in the MT Settings sub-window:



2. Under "Output Settings" (on the right-hand side), select "Fixed point signed 16.32" in the "Data format" drop-down box.



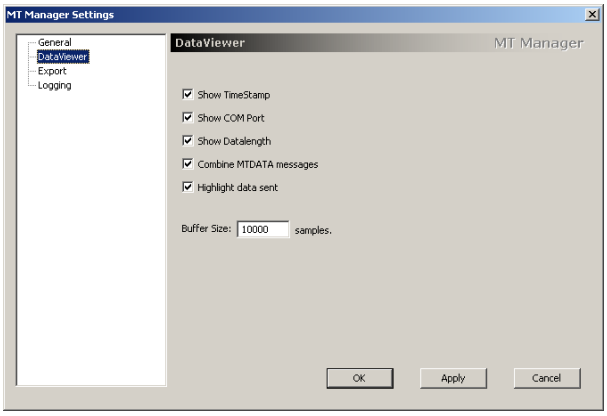
3. Finally, press "Write to MT" to save your changes to non-volatile memory in the MT device. MT Manager will then write the data and reconnect to the device:



5.3.1.4 *Data viewer settings*

To customise the presentation in the Data Viewer, select "DataViewer" via "Tools" ➔ "Options…":

[12] Worst case quantisation for position on the equator for single (i.e. 4 byte) precision is around 0.11 [m]; for 2.4 fixed precision (i.e. 16 + 32 = 48 bits) this is approximately 2.6×10^{-5} [m].



In the table below each parameter is explained:

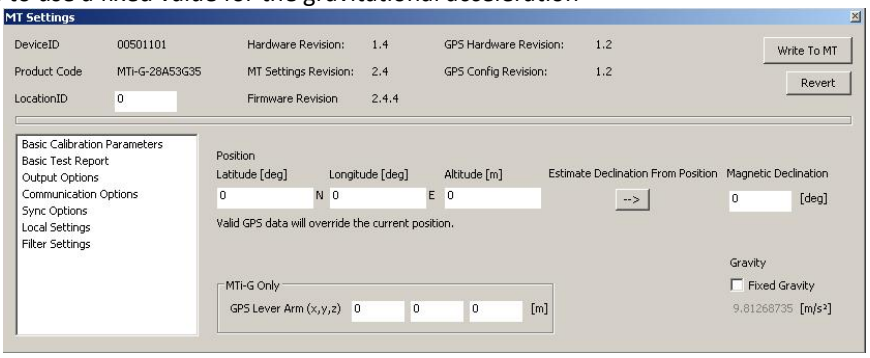
Parameter	Description
Show timestamp	Show/Hide column 1 in the Data viewer sub-window (see also section 4.7.1.7)
Show COM port	Show/Hide column 2 in the Data viewer sub-window (see also section 4.7.1.7)
Show DataLength	Show/Hide column 3 in the Data viewer sub-window (see also section 4.7.1.7)
Combine MTData messages	When selected, MTData messages are now shown individually (Highly recommended). Instead a counter informs how many data packets are being received. The hexadecimal view is overwriting its current line in this case.
Highlight data sent	Adds a Yellow highlight to the data sent by the PC.
Buffer Size	Screen buffer size (each line counts as 1). After this number of lines, the buffer will overwrite itself from the beginning (circular buffering).

For details on the “Message Description” and the “Message Data” please refer to [LLCP].

5.3.2 Local settings

In the MT Settings the following quantities can be set:

- GPS Lever Arm (for MTi-G only),
- Magnetic Declination (for MTi-G only)
- Gravity (gravitational acceleration)
- Option to use a fixed value for the gravitational acceleration

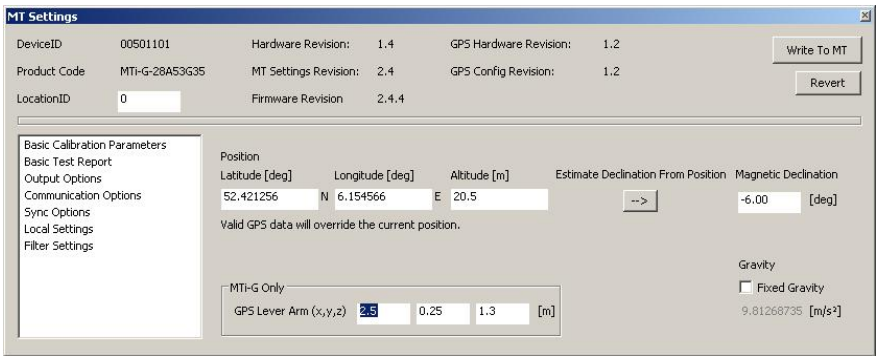


The next sub-sections describe how to change these settings.

5.3.2.1 Setting GPS antenna to IMU distance (MTi-G only)

For higher accuracy of the XKF-6 output, it is possible to define the offset (*GPS lever arm*) between GPS antenna and the IMU.

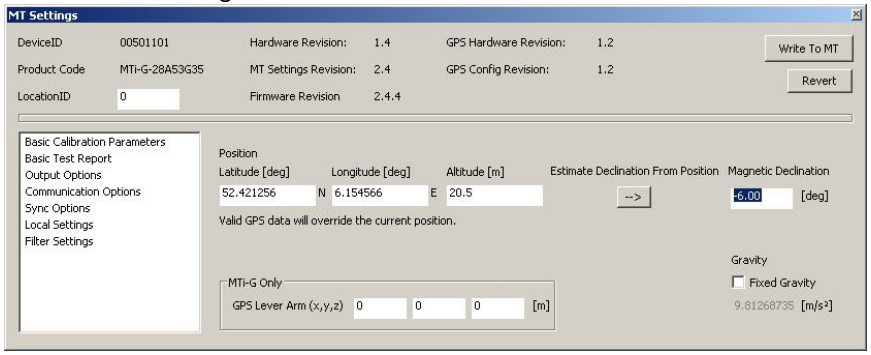
To set the GPS Lever Arm, fill in the offset vector (in the Sensor Coordinate system) between the GPS antenna and the MTi-G, on the right-hand side; units are meters.



5.3.2.2 Setting magnetic declination

5.3.2.2.1 Directly setting the magnetic declination

If the local declination of the earth magnetic field is known, this quantity can be directly set in the "Magnetic Declination" field in the Local Settings:

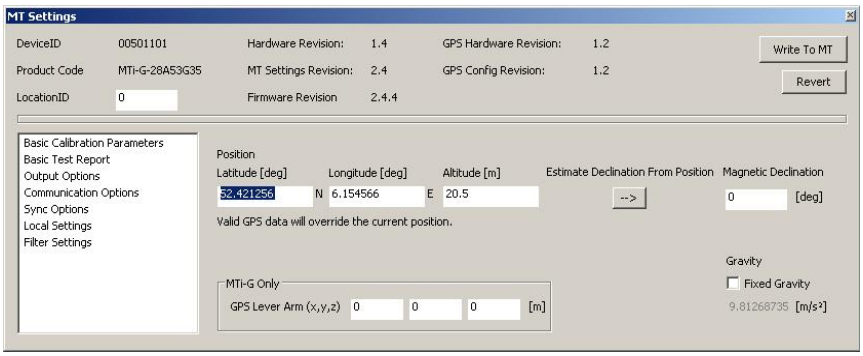


The unit is in degrees, 0 degrees corresponds with North and anticlockwise is the positive direction.

If there is valid GPS data, the manually entered magnetic declination will be overridden by the calculated magnetic declination. This function is valid for MTi-G only.

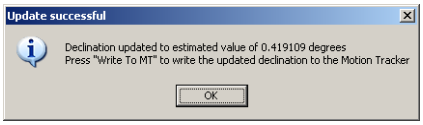
5.3.2.2.2 Calculating the magnetic declination

The declination can also be calculated[13] given the current latitude, longitude and altitude, which can be entered as depicted below:

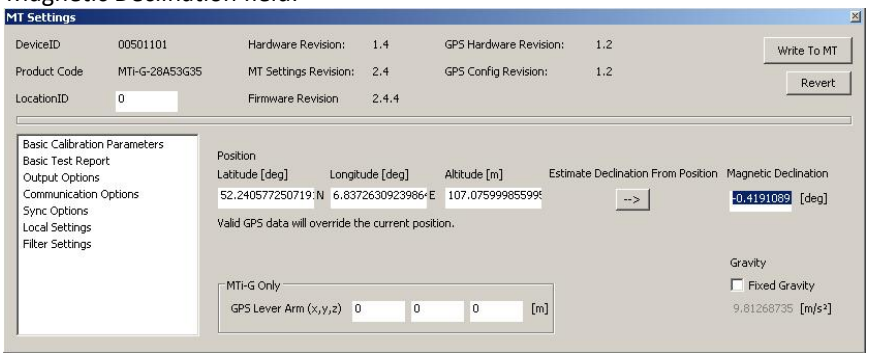


Press the button to "Estimate Declination From Position" and then the declination will be calculated:

[13] From the WMM 2005 model, refer to http://www.ngdc.noaa.gov/geomag/WMM/soft.shtml.

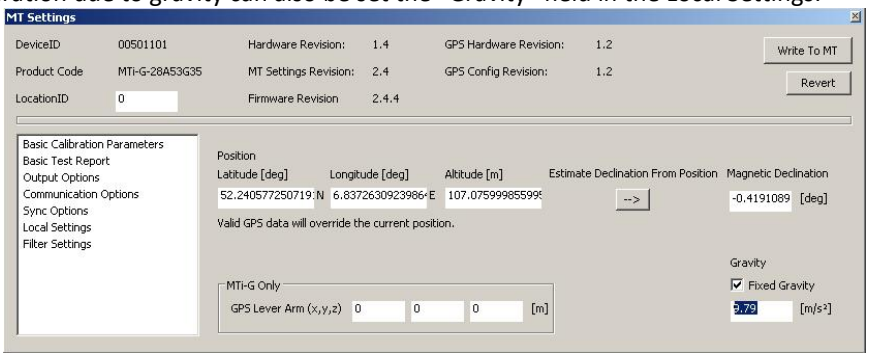


and filled in the Magnetic Declination field:



5.3.2.3 Setting the acceleration due to gravity

The local acceleration due to gravity can also be set the “Gravity” field in the Local Settings:

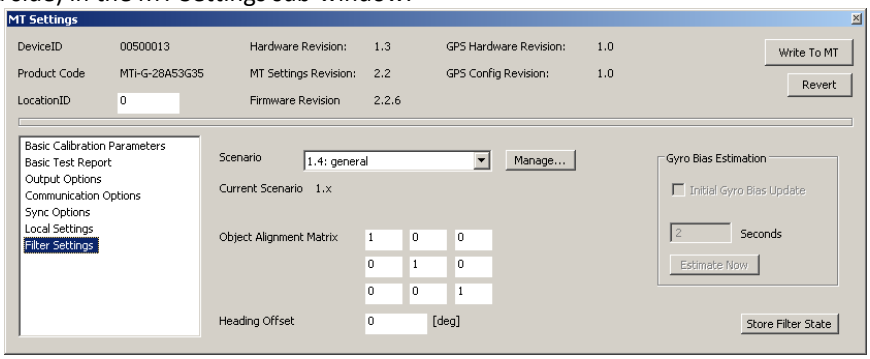


Note: for the MTi-G this value will be overwritten after the next GPS position update.
Refer also to [MTi-G].
Ticking the Fixed Gravity field will prevent recalculation of the gravity and the default value will be used.

5.3.3 XKF Filter Settings

In this section the settings for the XKF filter are discussed. For a detailed explanation of all the configurable parameters, please refer to [MTi-G], [MTi_MTx] and [XBM].

To change the Filter Settings, activate the MT Settings sub-window and then select the “Filter Settings” (placed on the left-hand side) in the MT Settings sub-window:

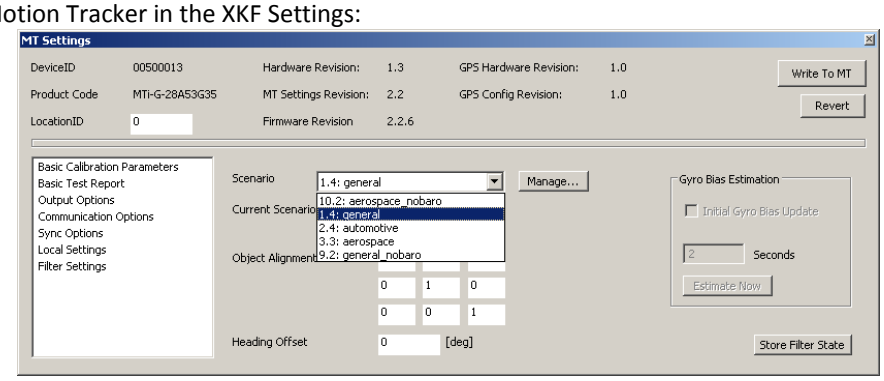


Note: changing the settings in the MT Setting sub-window requires writing to the device explicitly invoked by the user:
Press the "Write to MT" button, **to actually save your changes** to non-volatile memory in the MT device. MT Manager will then write the data and reconnect to the device.

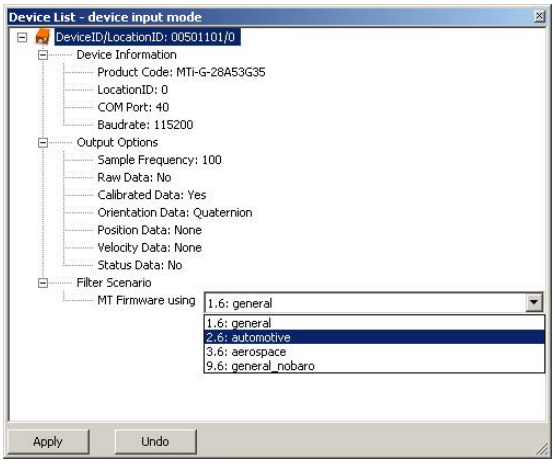
In the next sub-sections, configuring the Filter settings in the MT Manager is explained.

5.3.3.1 Setting the scenario

The Xsens Kalman Filter (XKF) can be used with different settings and assumptions, tweaked for different types of motion for a certain application. With the MT Manager you can set the XKF scenario[14] currently used by the DSP on your Motion Tracker in the XKF Settings:



The scenario can also be set in the device list:



Press "Apply" in order to make sure that the changes in the Device List take effect.

5.3.3.2 Object alignment matrix

Please refer to [LLCP].

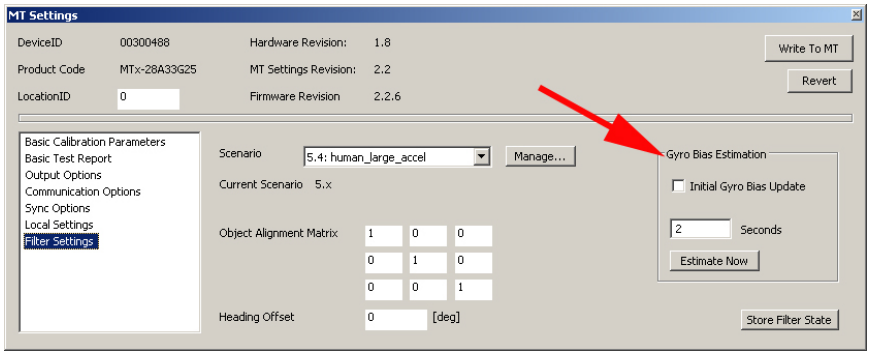
5.3.3.3 Heading offset

Please refer to [LLCP].

[14] See the MTx/MTi and MTi-G User Manuals ([MTi_MTx] and [MTi-G]) for a more detailed description of the available scenarios.

5.3.3.4 Gyro bias estimation (MTi/MTx only)

The gyroscope bias is continuously estimated to improve tracking accuracy. There are some special situations in which it may not be possible to obtain a good gyroscope bias estimate. This may occur in an application in which the roll and pitch hardly change *and* a no-magnetometer scenario is selected, see [MTi_MTx]. To still reduce the amount of drift in these situations as much as possible, a 'gyro bias estimation' routine may be employed:



The initial gyro bias can be estimated at the next start-up of the device[15], **if the device is kept motionless for 2 seconds** (for the initial gyro bias estimation this period is fixed).

During a measurement the gyro bias is continuously estimated, but a re-estimation can also be done manually (in case of abovementioned conditions):

- First set the time period in which the sensor will be kept motionless (in seconds)[16].
- Then press the “Estimate now” button and **keep the device motionless for the specified period** to be able to estimate the gyro bias.

Be very cautious to use this gyro bias estimation functionality and first read [MTi_MTx] for important details on background and usage.

5.3.3.5 Store Filter State

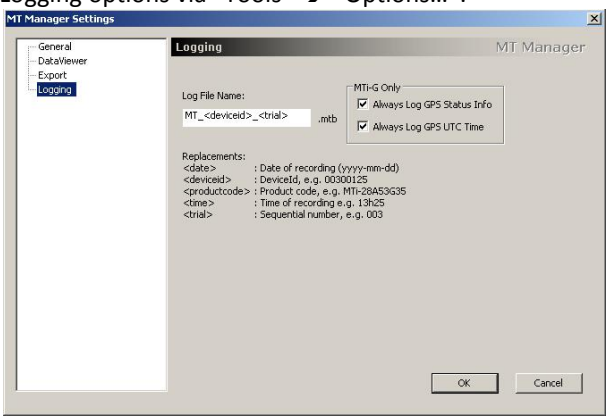
To reduce start-up effects during future measurements, the current filter state can be stored in the device when the filter has stabilised.
Note: Store Filter State is only valid in orientation data mode. When outputting raw data, pushing the button “Store Filter State” will have no effect.

[15] In general, the initial gyro bias is estimated when going into measurement mode. Refer to [LLCP].
[16] Here, the period is configurable. The default is set to 2 seconds.

5.3.4 Getting ready for logging

Before you start logging your data, be sure to make the following steps first:

1. Set the Log File Name and set the desired working directory, refer to section 5.4.1
2. Choose the desired output format, refer to section 5.3.1.2. For future post-processing purposes, make sure to use Raw Data output format.
3. Choose the desired coordinate system. The orientation is outputted by default in a North-West-Up coordinate system. To set this to North-East-Down, tick the appropriate box in the MT Settings dialog, see section 4.7.1.3, select "Output options". With the MT Manager, the coordinate system used in the raw data cannot be changed during post-processing. Note that the 3D View will be upside down for the time that the dialog box has not been acknowledged.
4. Choose the desired sample rate and the corresponding baud rate; refer to sections 9.1 and 9.2 .
5. Choose the XKF scenario most appropriate for your application, refer to section 5.3.3.1.
6. If needed, have the "GPS Status Info" and the "GPS UTC Time" logged[17], which can be set in the Logging options via "Tools" ➔ "Options…":



Note: The first sample counter is an arbitrary number between 0 and 65535 due to the recording concept used in MT Manager.UTC Time is valid from the first logged UTC time message (typically requested at 1 Hz), so the first (few) samples will have UTC time 0.

5.4 Typical utilisations

This section describes a selection of typical utilisations of the MT Manager.

Note: It is necessary to let the system stabilise right after start-up (filter stabilisation can take up to 60 seconds) in order to get more reliable measurements.

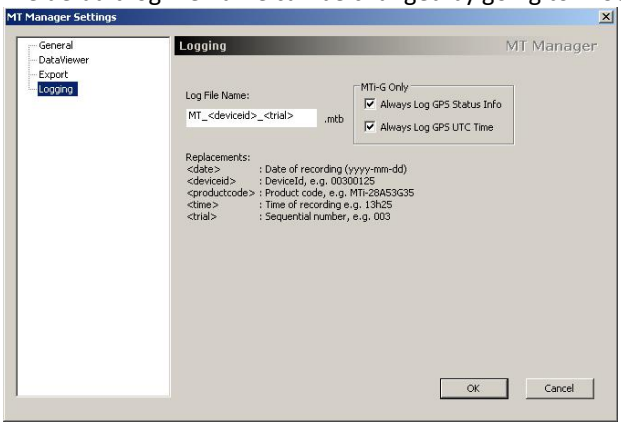
5.4.1 Logging data

Logging data can be started and stopped by pressing the "Record / Stop Record" button (see also section 4.7.3):

The generated log file (.MTB file) will be written to the folder specified in the toolbar in the top of the main window under "Current directory". By default, this is the root directory of the MT Manager installation (e.g. C:\Program Files\Xsens\MT Manager).
This setting can be changed in the toolbar in the top of the main window under "Current directory".

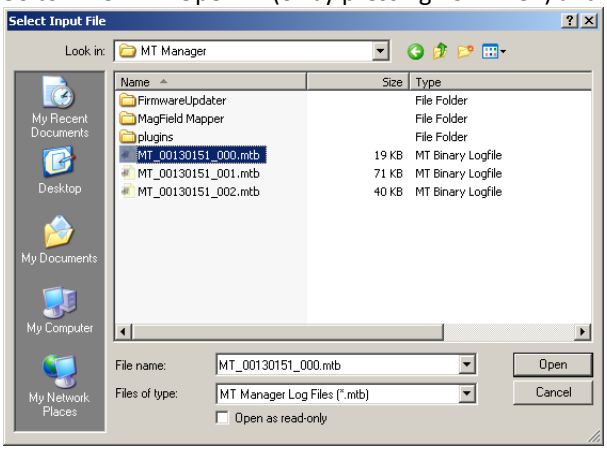
[17] For MTi-G only.

The default log file name can be changed by going to “Tools” ➔ “Options…” and selecting “Logging” is dialog:

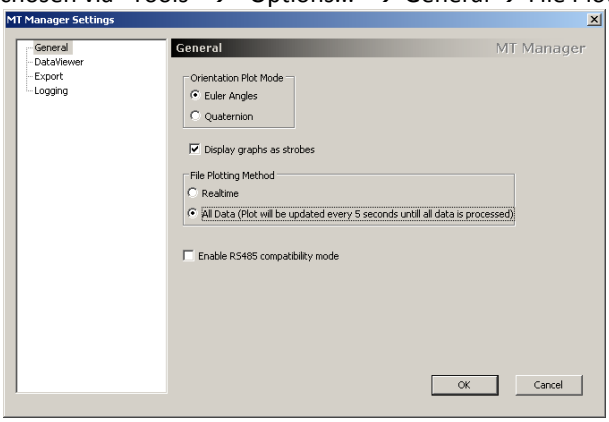


5.4.2 Replaying logged data

Playback of logged data can be done by opening an .MTB file that has been previously recorded:
Go to “File” ➔ “Open…” (or by pressing “CTRL+O”) and select the .MTB file:



Logged data can either be presented at once in a graph or played back in real time. These two settings can be chosen via “Tools” → “Options…” → General → File Plottng Method: Realtime or All Data

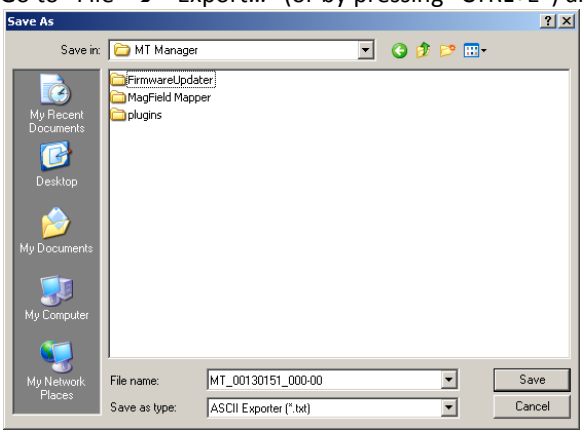


The “Play”, “Pause” and “Rewind” buttons can then be used to control the playback (see also section 4.7.3):

It is recommended to open the desired views before starting the playback.

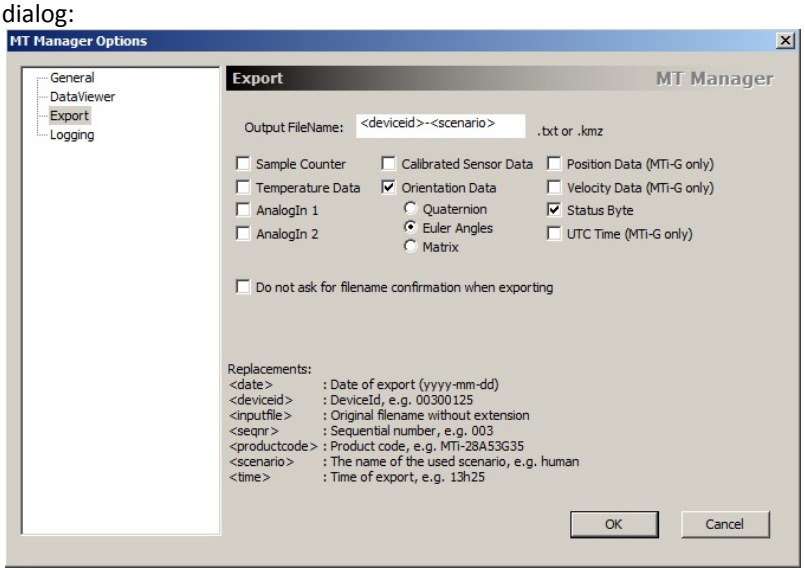
5.4.3 Exporting data

Data previously logged into an .MTB file can be exported to the ASCII format (see section 5.4.2 on how to open log files):
Go to “File” ➔ “Export…” (or by pressing “CTRL+E”) and browse to the desired destination folder:



Press the “Save” button to complete the export.

The default export file name can be changed by going to “Tools” ➔ “Options…” and selecting “Export” in this dialog:



Here the default file name is defined as:

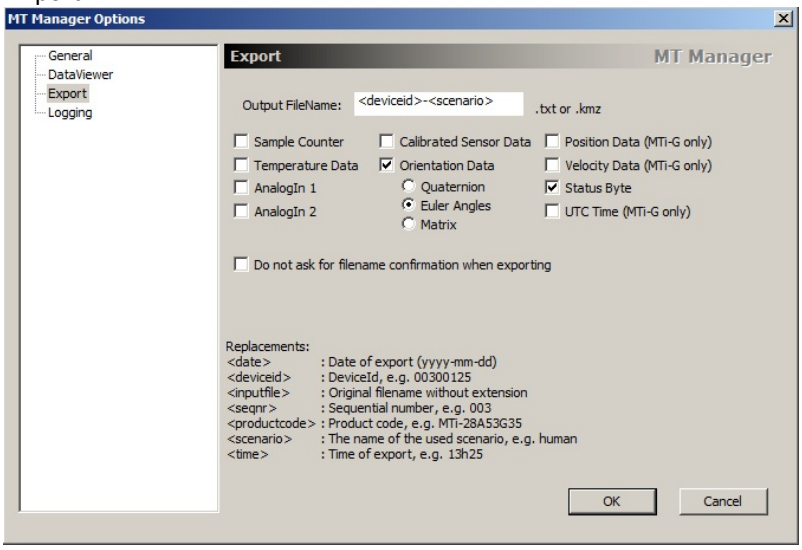
`<inputfile>-<deviceid>-<seqnr>.txt`, where
`inputfile` is the original name of the logged file
`deviceid` is defined in the corresponding device and
`seqnr` is incremented each time the corresponding .MTB file is processed.

In the next sub-sections you will find details of the exporter types.

5.4.3.1 Export type ASCII

Exporting to the ASCII format is configurable:

- Choose the quantities you want exported in ASCII output configuration by going to “Tools” ➔ “Export”.



Ticking the box “Do not ask for filename confirmation when exporting” will start the export process immediately to the “Current Directory” as specified in the main screen of MT Manager. If this box is not ticked, you will be able to change the output directory and file name before saving.

The desired data can be selected in the same dialog by selecting or deselecting the appropriate checkboxes.
Note: The sample counters in the export file are the counters sent by the sensor. Since the MT’s sample counter starts when the MT is recognized by the MT Manager, the sample counter in the log file will not start at 0, but at the absolute number since the start of the sensor.

The output consists of a header with settings information and the actual data which is TAB delimited.
The following picture shows the first part of an example exported ASCII data file:

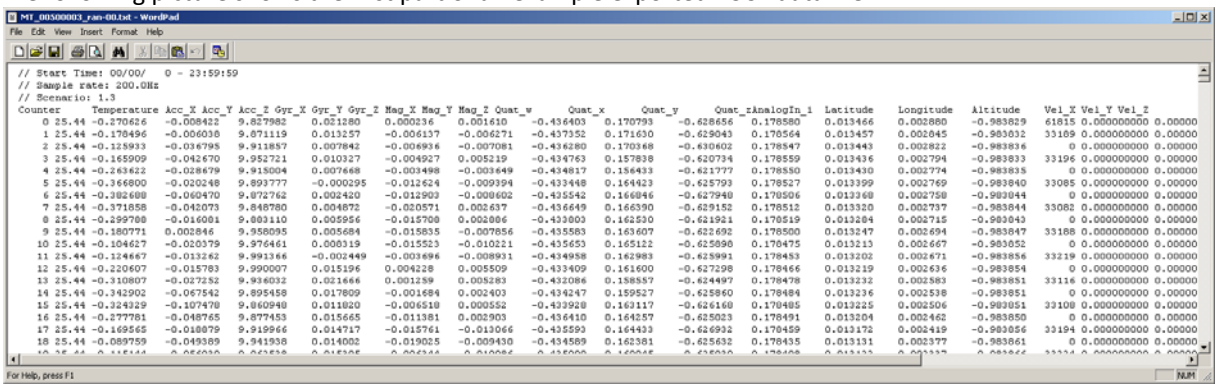


Figure 6: Exported ASCII data

5.4.3.2 Export type KMZ

Exporting to the KMZ format will yield compressed (“zipped”) KML[18] data with 3D positions and orientations which is outputted once per second.

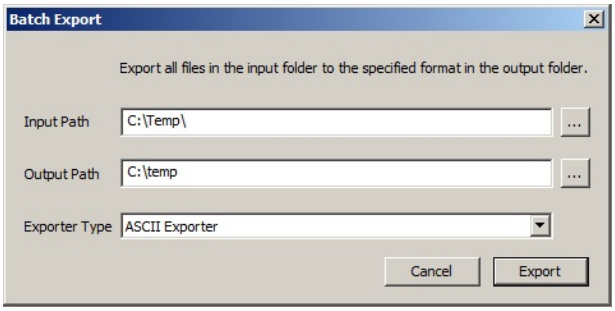
[18] Please refer to http://code.google.com/apis/kml/documentation/kml_tut.html for the detailed KML specifications.

The next figure shows the first part of example exported KML data:

Figure 7: Exported KML data

5.4.3.3 Batch exporter

When there are multiple files in a folder, it is possible to perform a batch export. Via File – Batch Export... the input and output folder can be selected.

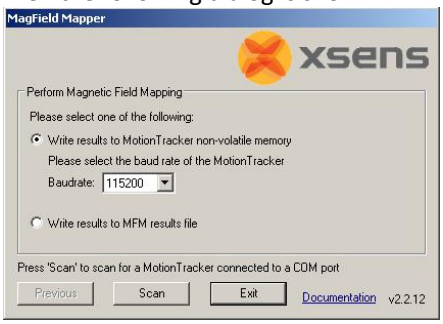


The scenario that is being used to process the batch export is “4. Human” for MTi’s and MTx’s and “1. General” for MTi-G’s. When the file name already exists, the batch exporter will give the user the choice to overwrite the file, overwrite all the following files in the batch export, not to overwrite the current file or not to overwrite any of the following files in the batch export.

5.4.4 Mapping the magnetic field

The Magfield Mapper can be used to compensate for hard and soft iron effect (both 3D and 2D calibration).

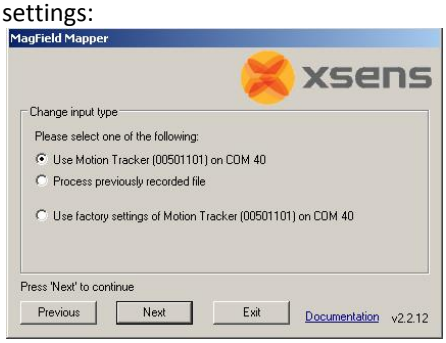
To start the Magfield Mapper plug-in, go to “Tools” ➔ “Magfield Mapper…”.
Then the following dialog is shown:



You can either write the MFM results to the non-volatile memory of the MT or to an MFM results file.

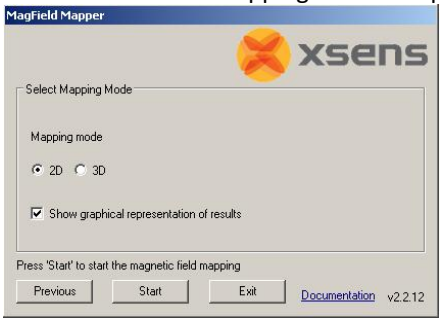
5.4.4.1 Writing the MFM results to the non-volatile memory of the MT

After pressing “Scan” when chosen for writing to the non-volatile memory, you will be prompted to choose for either using the currently connected MT (to directly execute the Magfield mapping) or using a previously recorded log file (which has to correspond with the connected MT; you can also choose to use the factory settings:

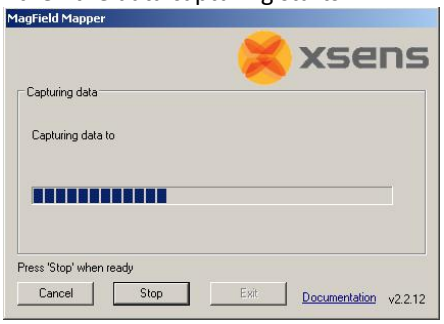


Select the desired directory for the output of the Magfield Mapping:

Choose the desired mapping mode and press start…

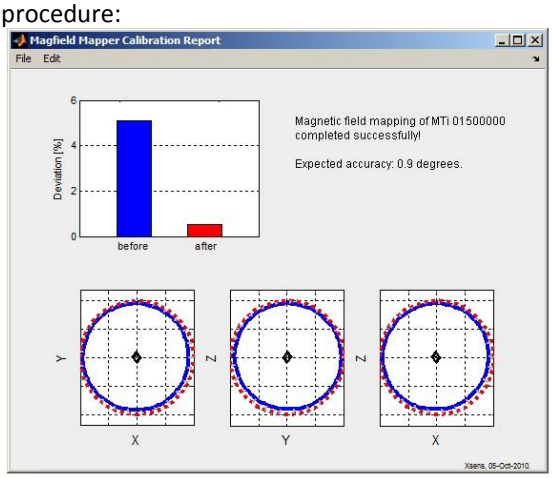


…then the data capturing starts:

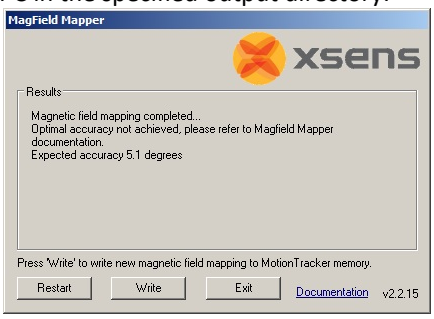


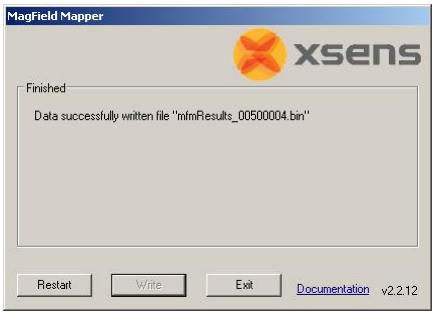
For more information on handling your MT during data capturing, refer to [MFM].

Upon successful Magfield Mapping, a further window will open displaying the results of the Magfield Mapping procedure:



Pressing the “Write” button will write the results to the MT and the resulting `.BIN` file will be saved on your PC in the specified output directory:



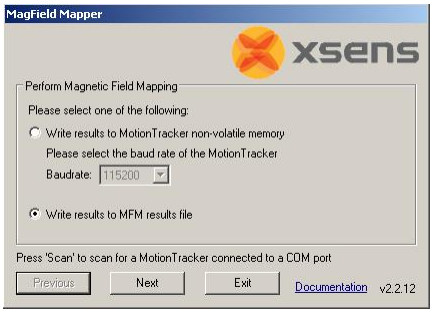


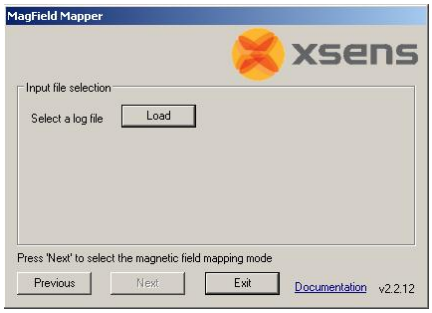
The `.BIN` file that has been written can be used for Magfield Mapping, refer to section 5.4.4.2).

For more information refer to [MFM].

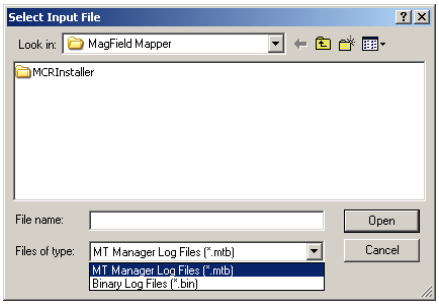
5.4.4.2 Writing the results to an MFM results file

When “Write results to MFM results file” has been chosen, you can load input log file:

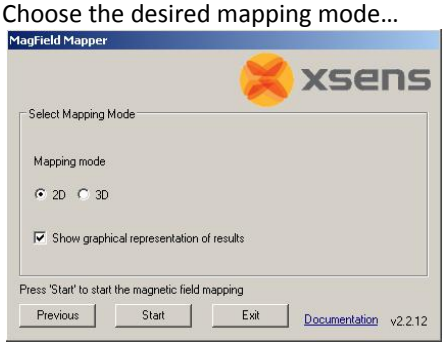




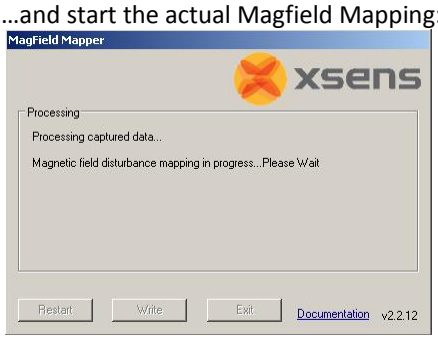
Select the desired `.BIN` or `.MTB` file and press “Open”:



Choose the desired mapping mode…



…and start the actual Magfield Mapping:



For the remaining of this procedure refer to section 5.4.4.1.
For more information refer to [MFM].

5.4.5 Using multiple MTs

Multiple Motion Trackers can be managed with the MT Manager with or without the Xbus Master. Figure 8 shows two MTx Motion Trackers connected to an Xbus Master; the Device List indicates all three devices separately with their own properties.

Note: When you do not use an Xbus Master be sure to select the same output and sample frequency for all the devices.

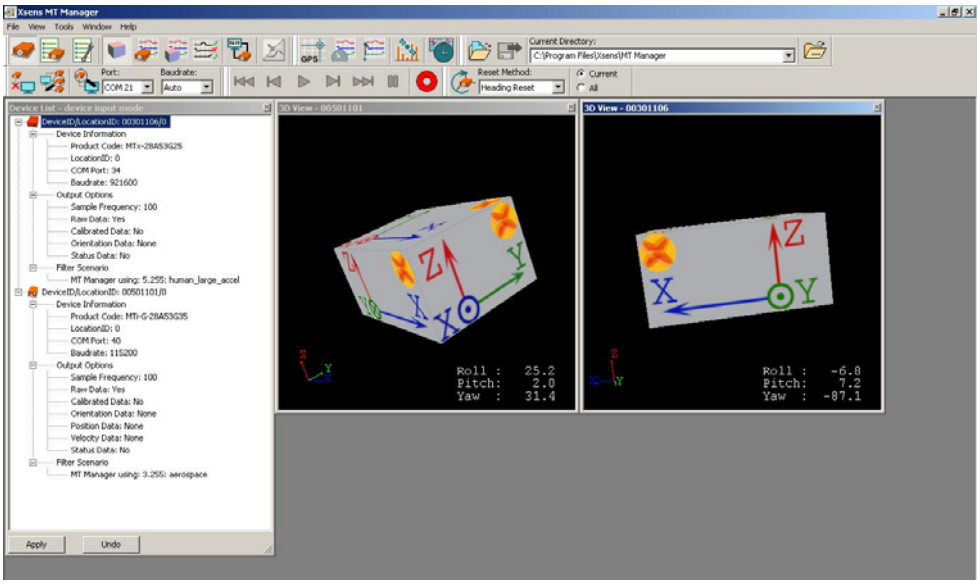


Figure 8: Managing an MTx and an MT-G sensor

5.4.6 Updating the firmware of a sensor

Please refer to [FWU].

6 System requirements

The MT Manager is designed for Windows XP/Vista/7 and the following system setup is recommended to properly run the software:

- Windows XP (Service Pack 2 installed), Windows Vista or Windows 7
- Intel® Pentium® or AMD® processor, 1 GHz (minimum) Pentium® IV 2.00 GHz or AMD Athlon® XP 2000+ or higher (recommended)
- USB port (1.1 or higher) or standard PC serial COM-port (RS-232) [19,20]
- Graphics card with 3D hardware acceleration and OpenGL support. Contact your graphics card manufacturer to ensure your graphics card drivers are up to date.

NOTE: MT Manager is designed to assign a low priority to graphics functions if your computer can not update the screen smoothly due to insufficient computing resources. This is done on purpose to avoid interfering with the core functionality of the MT Manager.

[19] RS-232 add-on cards are not supported
[20] Custom RS-232 USB converters are not supported

7 Important notices

7.1 Warranty and liability

Xsens Technologies B.V. warrants the products manufactured by it to be free from defects in material and workmanship for a period of 1 year from the date of delivery. Products not subjected to misuse will be repaired, replaced or credit issued at the sole option of Xsens Technologies B.V.
Visit http://www.xsens.com/support for return material authorization (RMA) prior to returning any items for calibration, repair or exchange. The product **must be returned in its original packaging** to prevent damage during shipping.

The warranty shall not apply to products repaired or altered or removed from the original casing by others than Xsens Technologies B.V. so as, in Xsens Technologies B.V. opinion, to have adversely affected the product, products subjected to negligence, accidents or damaged by circumstances beyond Xsens Technologies B.V.'s control.

NOTE: Xsens reserves the right to make changes in its products in order to improve design, performance, or reliability.

Subject to the conditions and limitations on liability stated herein, Xsens warrants that the Product as so delivered shall materially conform to Xsens' then current specifications for the Product, for a period of one year from the date of delivery. ANY LIABILITY OF XSENS WITH RESPECT TO THE SYSTEM OR THE PERFORMANCE THEREOF UNDER ANY WARRANTY, NEGLIGENCE, STRICT LIABILITY OR OTHER THEORY WILL BE LIMITED EXCLUSIVELY TO PRODUCT REPAIR, REPLACEMENT OR, IF REPLACEMENT IS INADEQUATE AS A REMEDY OR, IN XSENS' OPINION IMPRACTICAL, TO REFUND THE PRICE PAID FOR THE PRODUCT. XSENS DOES NOT WARRANT, GUARANTEE, OR MAKE ANY REPRESENTATIONS REGARDING THE USE, OR THE RESULTS OF THE USE, OF THE PRODUCT OR WRITTEN MATERIALS IN TERMS OF CORRECTNESS, ACCURACY, RELIABILITY, OR OTHERWISE. Xsens shall have no liability for delays or failures beyond its reasonable control.

7.2 Technical Support

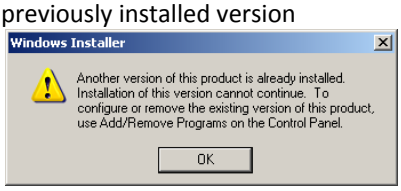
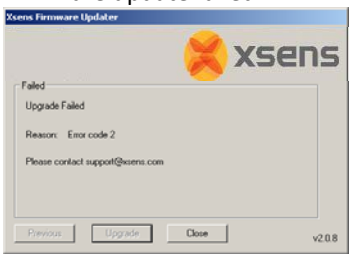
Xsens Technologies B.V. is glad to help you with any questions you may have about the MT Manager or about the use of the technology for your application. Please contact Xsens' Support Team:

Internet: http://www.xsens.com/support
telephone: +31(0)88-9736700 (+31 88 XSENS 00)

To be able to help you, please mention your **MT Manager version number** and **software license registration number** in your e-mail.

8 Troubleshooting

This section helps to solve problems you might encounter while using the MT Manager.
If your problem with the MT Manager is not mentioned here, please contact www.xsens.com/support.

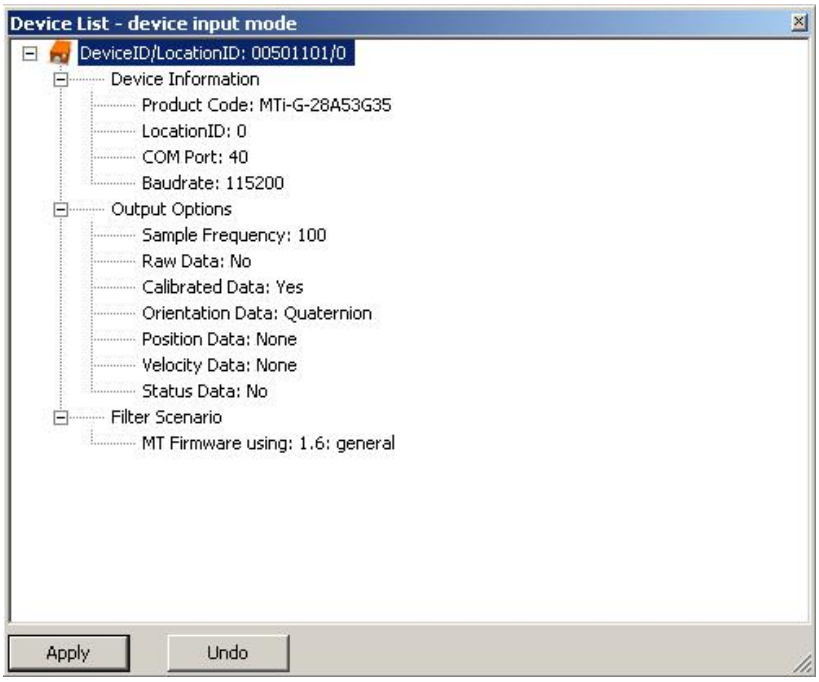
Problem	Solution
During installation	
Installation is aborted due to previously installed version 	Use Add/Remove Programs on the Control Panel to remove the previously installed version. Then re-try installing the desired version.
Firmware update failed 	Please contact Xsens' support team: http://www.xsens.com/support
At start-up	
No device listed in the Device List	Make sure you connected your device to your computer: For USB cable connection • By first connecting the supplied USB cable to your PC and then • Connecting the USB cable to the MT or Xbus Master For WR-A connection (refer also to [XBM]) • By first connecting the MTs to the Xbus Master, then • Connecting the WR-A to a USB port of your PC and then • Turning on the Xbus Master Then, press the "Rescan" button in the Connectivity toolbar.
Erratic mouse cursor movement	Disconnect the supplied USB cable from both your PC and your device (MT or Xbus Master). Then reconnect your device to your computer by: • First connecting the supplied USB cable to your PC and then • Connecting the USB cable to the MT or Xbus Master Then, press the "Rescan" button in the Connectivity toolbar.
RS-485 sensor not found	Enable the "RS-485 compatibility mode": Go to the General options pane via "Tools" ➔ "Options…" and tick the "Enable RS-485 compatibility mode" option.

Problem	Solution
During operation	
Incorrect orientation data and/or lag in visualisation	Increase the baud rate for the communication between sensor and PC: • Open the Device List • Increase the Baud Rate
Magnetic field mapping not completed successfully. 	Please contact the Xsens support team: http://www.xsens.com/support
Magnetic field mapping does not start (dialog is shown indicating "`mclmcrrt77.dll` cannot be located")	Restart your PC (after the first time the Matlab Component Runtime has been installed) If the problem persists, please contact the Xsens support team: http://www.xsens.com/support

9 Detailed device properties

This section describes detailed device properties which can be accessed through the Device List sub-window.

9.1 Device List tree properties for Motion Trackers



	Property	Description	Data type	User configurable
1	DeviceID/LocationID			
1.1	Device information			
1.1.1	Product Code		Text String	✗
1.1.2	LocationID		Integer	✓
1.1.3	COM Port		Integer	✗
1.1.4	Baud rate		Enumeration “921600”, “460800”, “115200”, “57600”, “9600”	✓
1.2	Output Options			
1.2.1	Output Frequency		Refer to 9.1.1	✓
1.2.2	Raw Data		Enumeration “No”, “Yes”	✓
1.2.3	Calibrated Data		Enumeration[21] “No”, “Yes”	✓

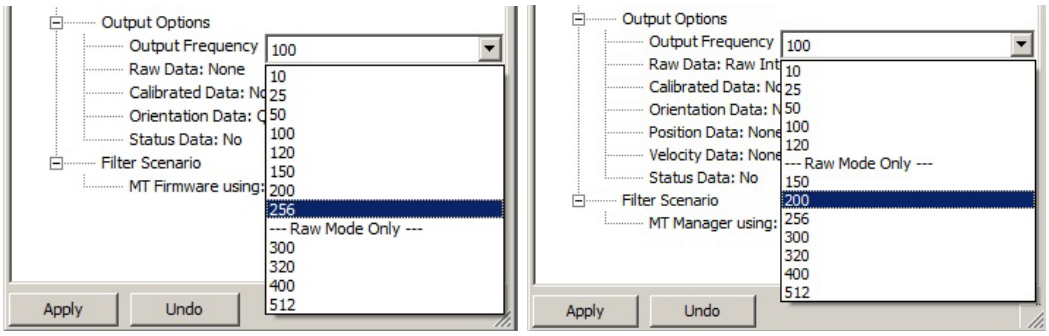
[21] Availability depends on ‘Raw Data‘ option

	Property	Description	Data type	User configurable
1.2.4	Orientation Data		Enumeration “None”, “Quaternion”, “Euler”, “Matrix”	✓
1.2.5	Position Data[22]		Enumeration “None”, “LLA WGS84”	✓
1.2.6	Velocity Data[23]		Enumeration “None”, “m/s (NED/NWU)”	✓
1.2.7	Status Data		Enumeration “No”, “Yes”	✓
1.3	XKF Scenario			
1.3.1	MT Manager using:	Scenarios available on the PC	Enumeration[24]	✓
1.3.2	MT firmware using:	Scenarios available in the Motion Tracker	Enumeration[25]	✓

9.1.1 MT Output Frequency selection

Dependent on Data Mode (either Raw Data Mode or Calibrated Data Mode) several output frequencies are selectable in the device list. The maximum selectable output frequency for the MTi and MTx in processed data mode is 256 Hz, the maximum selectable output frequency of the MTi-G in processed data mode is 120 Hz.

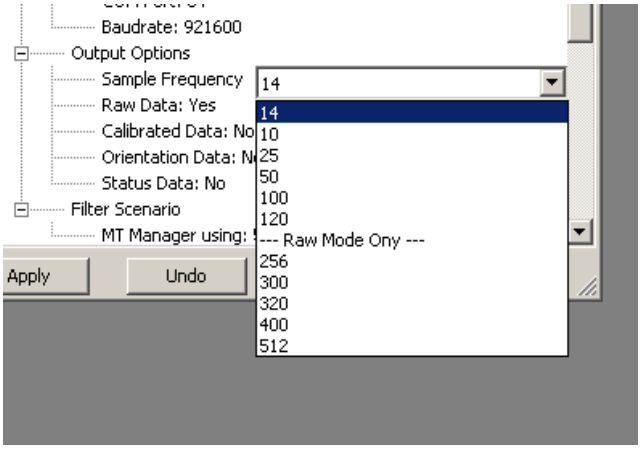
MTi and MTx output frequency selection (left) and MTi-G output frequency selection (right):



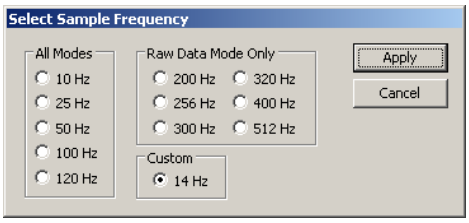
Also Data Mode independent output frequencies can be selected.

Further, using the output skip factor (settable in the Configuration Data dialog, refer to section 4.7.1.2 and in the Communication Data view, refer to section 4.7.1.8 and [LLCP]), a non-listed output frequency can be set (this value is rounded) which will then be displayed in the list (top entry):

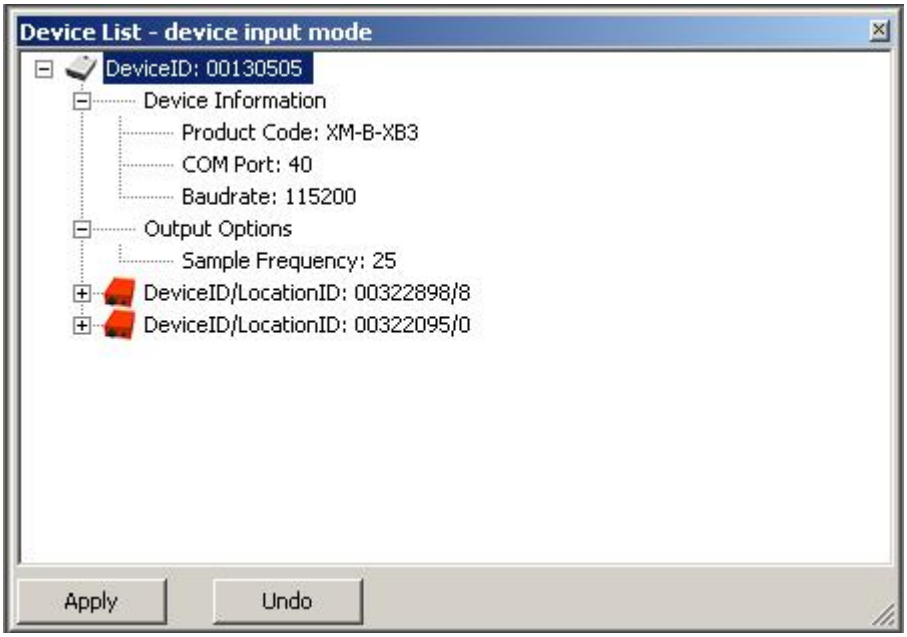
[22] Available in MTi-G only
[23] Available in MTi-G only
[24] Availability depends on ‘Raw Data‘ option
[25] Availability depends on ‘Raw Data‘ option; only available for firmware versions 2.0 or higher



In the MT Settings dialog window, the non-standard output frequency will be displayed under “Custom”.



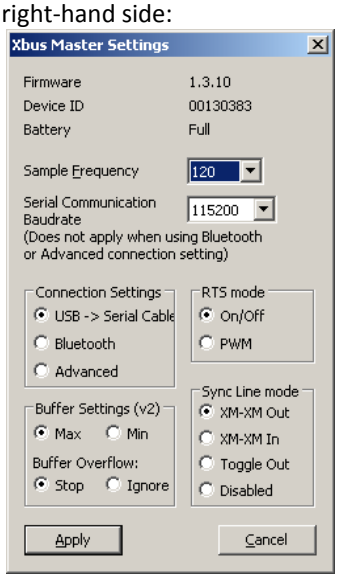
9.2 Device List tree properties for Xbus Master



	Property	Description	Data type	User configurable
1	DeviceID			
1.1	Device Information		Refer to 9.2.1	✓
1.1.1	Product Code		Text String	✗
1.1.2	COM Port		Integer	✗
1.1.3	Baud rate		Enumeration “921600”, “460800”, “115200”, “57600”, “9600”	✓
1.2	Output Options			
1.2.1	Sample frequency		Enumeration “25 Hz”, “50 Hz”, “100 Hz” “120 Hz” “150 Hz” “200 Hz” “256 Hz”	✓

9.2.1 Xbus Master Settings

For the Xbus some additional settings (compared to the MTs) are available and can be configured, the Xbus Master Settings. Select “Device Information” of the Xbus Master in the Device List and press the button on the right-hand side:



Setting the Sample Frequency and the Serial Port Baud rate: