DEWESoft™ Plugin

Microstrain® 3DM-GX3®

Document-Version: 1.0.4
Plugin-Version: 1.0.4

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1 About this document

This is the user documentation of the DEWESoft™ Plugin for Microstrain® 3DM-GX3® version 1.0.4.

Page numbers in this document always refer to the *"3DM-GX3® Data Communications Protocol "* version *1.08* Revision May 26, 2010.

1.1 Legend

The following symbols and formats will be used throughout the document.

IMPORTANT	Gives you an important information about a subject.
⚠️	Please read carefully!

HINT	
💡	Gives you a hint or provides additional information about a subject.

EXAMPLE	
🛠️	Gives you an example of a specific subject.

Example	Meaning	Description
Cancel	Button	a button that you can click
File	Menu Item	a menu item, will open a sub menu or a dialog
Times New Roman	List Item	an item in a list (or tree) that you can select
Events	Tab Sheet	a tab sheet that you can select
`C:\Program Files\OpenOffice.org 3\readme.txt`	File Path and Name	a file name or path
Windows Key	a term	any kind of term (maybe also compound)

Table 1: Layout formats used in the documentation

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2   About the software

2.1 Links

- DEWESoft™ homepage
  http://www.dewesoft.com
  you can download DEWESoft™ plugins when you go to: *Downloads* - *Plugins*
- Sensor information and documentation
  http://www.microstrain.com/3dm-gx3-25.aspx
- Sensor documentation:
  http://www.microstrain.com/pdf/3DM-GX3-Data-Communications-Protocol.pdf

2.2 Compatibility

The plugin is compatible with *DEWESoft™* 7.

It has been developed and tested with:

- *DEWESoft™ 7.0.4b29*
- *MicroStrain® 3DM-GX3-25™* sensor: Firmware must be >= 1.1.27

2.3 Features

A list of supported features (page number refer to the *Sensor documentation*, if not otherwise stated):

- communication settings: selectable COM Port and BaudRate (not relevant for USB connection)
- reading firmware version: command *0xE9* on page 36
- reading model number: command *0xEA* on page 36
  used to determine the max. angular rate and acceleration
- reading serial number: command *0xEA* on page 36
- reading model name: command *0xEA* on page 36
- reading device options: command *0xEA* on page 36
- switching the continuous mode ON: command *0xC4* on page 15 (see chapter 6 Continuous mode on page 14 of this manual)
  - using *Acceleration, Angular Rate & Magnetometer Vectors & Orientation Matrix* see *0xCC* on page 21
  - or *Acceleration & Angular Rate (0xC2)* on page 14
- switching the continuous mode off: command *0xD4* on page 26
- setting the sampling rate: command *0xDB* on page 31
- activating/deactivating the magnetometer: command *0xDB* on page 31 (Bit 8 of Byte 7)
- realign up and north: command *0xDD* on page 33
- you can switch between degree and radians in channel setup
- DEWESoft™ soft-synchronisation is used
- Zeroing of Roll, Pitch, Yaw

2.4 Files and Directories

The actual location of the directories on your computer may vary dependant on your computer's locale settings and the settings you chose when installing DEWESoft™.

2.4.1 Important DEWESoft™ 7 Directories

2.4.1.1 DEWESoft™ Measurement Unit [recommended]

Directory name	Explanation	Default path
Bin	contains `DEWSoft.exe`	`D:\DEWESoft7\Bin\V7_0`
Addons	`.dll` files for plugins must be copied into this directory	`D:\DEWESoft7\Bin\V7_0\Addons`
Data	this is where DEWESoft™ will store your measurement data	`D:\DEWESoft7\Data`
Setups	this is where your DEWESoft™ setup files will be stored	`D:\DEWESoft7\Setups`
System	this is where DEWESoft™ project files are stored	`D:\DEWESoft7\System\V7_0`
Log	this is where DEWESoft™ will store log files	`D:\DEWESoft7\System\V7_0\Logs`

2.4.1.2 Windows Standard

Directory name	Default path
Bin	`C:\Programme\DEWESoft7\Bin\V7_0`
Addons	`C:\Programme\DEWESoft7\Bin\V7_0\Addons`
Data	user dependant directory: `C:\Dokumente und Einstellungen\All Users\Dokumente\DEWESoft7\Data`
Setups	user dependant directory: `C:\Dokumente und Einstellungen\All Users\Dokumente\DEWESoft7\Setups`
System	user dependant directory: `C:\Dokumente und Einstellungen\All Users\Dokumente\DEWESoft7\System\V7_0`
Log	user dependant directory: `C:\Dokumente und Einstellungen\All Users\Dokumente\DEWESoft7\System\V7_0\Logs`

2.5 Licensing

The plugin requires a valid DEWESoft™ license.
To test the plugin you can use an *Evaluation license*.

2.5.1 Requesting an Evaluation license

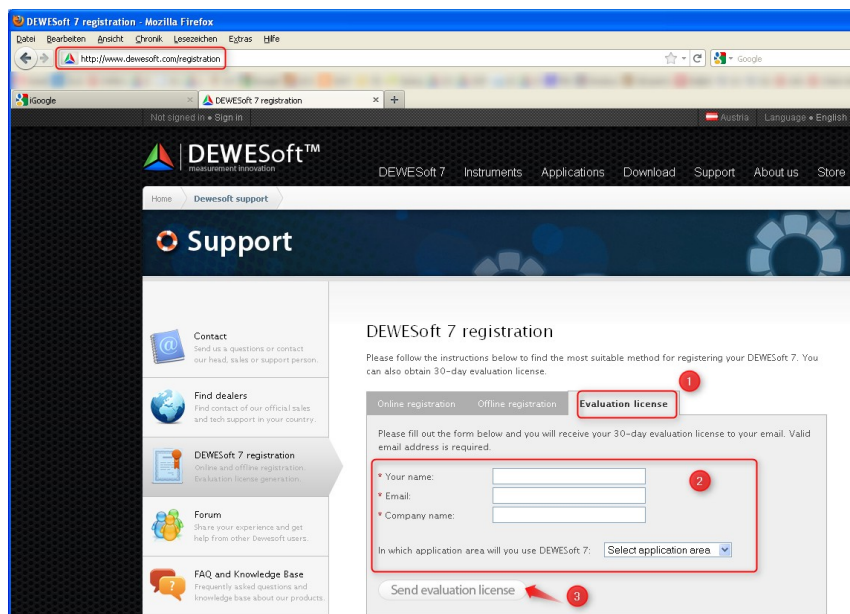You can request an an *Evaluation license* from our homepage: http://www.dewesoft.com/registration

Illustration 1: Request Evaluation License

(1) Click on Evaluation license

(2) Fill out all the required fields

(3) Click the **Send evaluation license** button

2.5.2 Activating the Evaluation license

When you have received your trial licence key, open DEWESoft™, go to Settings - Hardware Setup…, select the Registration tab sheet and enter the license code (if you already have other licenses, you may need to click the **Create** button).

Now enter the license code and click the **Register online** button.	Then your new license key will show up in the list and should have the *Status Valid*.
Illustration 2: Enter license key	*Illustration 3: Valid trial license*
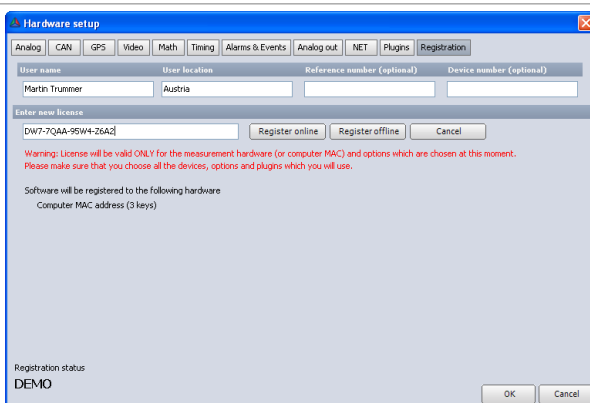
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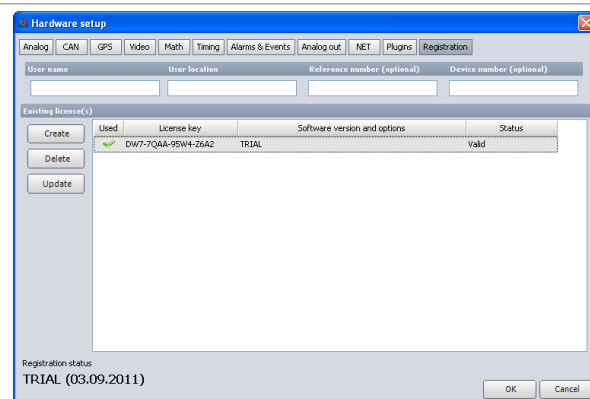
2.6 Plug-in Installation

Simply copy the file `Microstrain_3DM_GX3.dll` into the `Addons` folder of your DEWESoft™ installation. (e.g. `D:\DEWESoft7\Bin\V7_0\Addons\`) and then start DEWESoft™).

HINT

When you are using Windows® 7, then you must click the **Register plugins** button once and restart DEWESoft™ before the plugin shows up.

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3 Plugin configuration

3.1 Hardware Setup

After you have installed the plugin (see 2.6 Plug-in Installation), start DEWESoft™ and go to *Settings* – *Hardware setup...*.The plugin must show up in the *Hardware Setup* dialog (the following numbers refer to the markers in the image below):
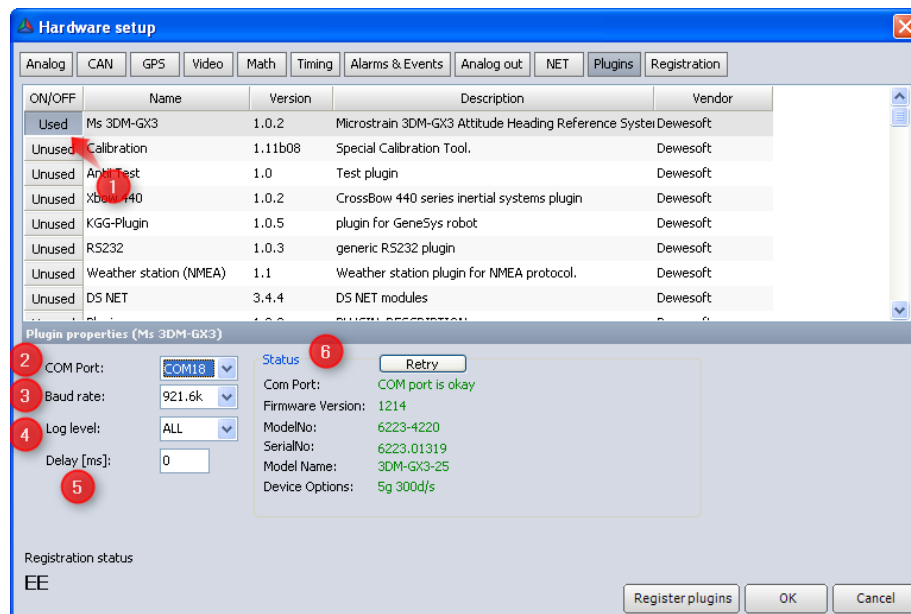
Illustration 4: Hardware Setup Screen - Status Okay

(4) Click this button to set the plugin to **Used**.

(5) Select the *COM port* that your device is connected to.
The drop down box will show a list of all available *COM ports* on your computer.

(6) Select the *Baud rate* that your device is using.
Note: This setting only relevant if your sensor is connected via RS232 to your PC (and irrelevant for USB connections)

(7) Keep the default *Log level*: *INFO* (see 3.1.3.1 Log levels for more details on logging)

(8) Here you can set a delay time in ms: see 5 Delay time on page 13

(9) When your device is correctly connected, powered up and all settings are okay, then all fields in the *Status box* should be green (see also 3.1.1 Status box):

3.1.1 Status box

The status box (see ❺ in Illustration 4) will indicate the connection status of your sensor:

The status will be updated when:

- 🔺 the hardware setup section of the plugin is displayed for the first time
- 🔺 you change the *COM Port* (see ❷ in Illustration 4)
- 🔺 you change the *Baud rate* (see ❸ in Illustration 4)
- 🔺 you click the **Retry** button (see top of Illustration 5)

Illustration 5: Hardware Setup: Status Box okay

3.1.2 Status conditions

A short overview of status conditions and possible solutions.

Status request in progress

When the status request starts, all status labels will be blue and show *'in progress...'* until the corresponding status is received or a time-out occurs.
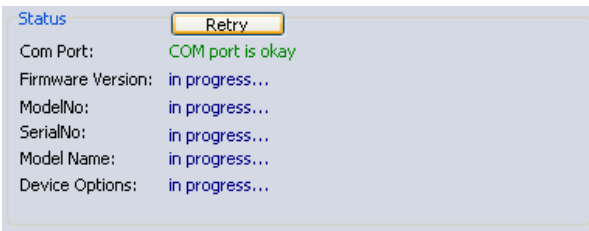

Illustration 6: Status request in progress

COM Port failure

This means that the plugin cannot open the *COM Port* that you have selected.
A possible reason for this is, that another application is connected to this *COM port* (e.g. the *3DM-GX3 Monitor* application).
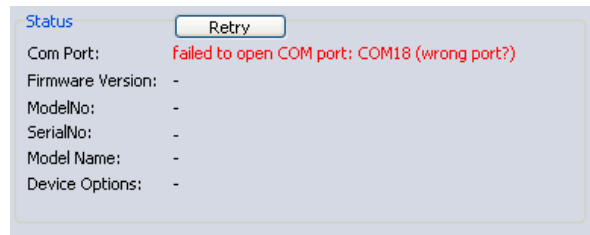Close all other applications and click the **Retry** button.

Illustration 7: Status request COM Port failure

COM Port okay

This means that the plugin could open the *COM Port* that you have selected (in contrast to *COM Port failure* above.) In Illustration 8 below, you can see that the *COM Port* is okay, but all other requests failed.
Possible reasons for this may be:

- you have selected a wrong *COM Port:* change the *COM Port* in *Hardware Setup*

- you have selected a wrong *Baud rate:* change the Baud rate in *Hardware Setup*

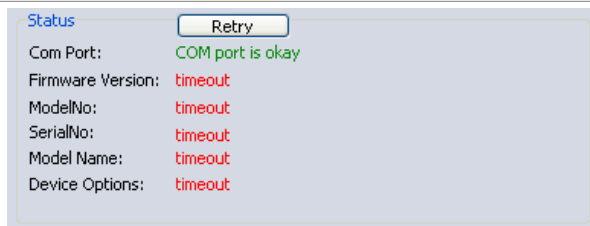- your sensor is not powered on or is defect.

Old Firmware

The plugin only supports firmware version 1.1.27 or higher. If your Microstrain® device has an older firmware you must update it.
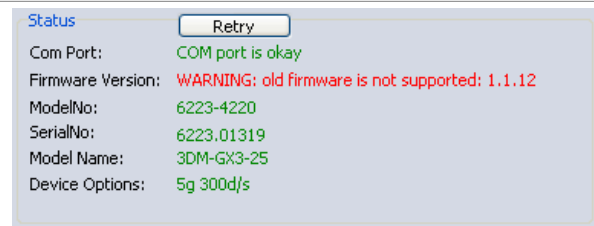

Illustration 8: Status request COM Port okay

Illustration 9: Status: Old Firmware

Status okay

when everything is okay, the *Status box* should look like in Illustration 10 below.
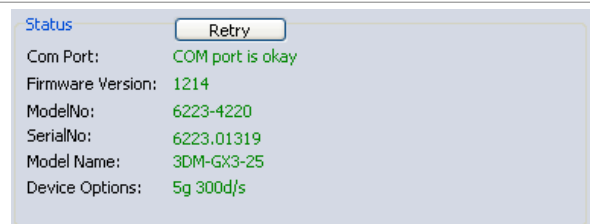

Illustration 10: Status request okay

When your settings are okay (like in Illustration 10), you can close the *Hardware setup* and go to *Channel setup* (see 3.2 Channel setup.

3.1.3 Log files

The plugin will write log files during operation. The amount of log messages is configurable via the *Log level* drop down box in the *Hardware setup*. The name of the log-file is `Microstrain_3DM_GX3.log`.

When the plugin is started, it will immediately start to log to the windows temporary directory.

As soon as the DEWESoft™ application is available to the plugin, all subsequent logs will be written to the standard DEWESoft™ log directory (e.g. `D:\DEWESoft7\System\V7_0\Logs`).

Note: There is also a log file called `Microstrain_3DM_GX3.dll.log` in the `Addons` directory (see 2.4.1 Important DEWESoft™ 7 Directories). This will normally be empty. It will only contain messages when there is a bug very early in the plugin initialization.

3.1.3.1 Log levels

With the *log level* drop down box you can set the detail level of the logging function.

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If you set a high log level (e.g. *TRACE*, *ALL*) a lot of log messages will be written and the logfiles will roll over quite often. This is also dependent on the sample rate – the higher the sample rate is, the more often data will be fetched and thus more log messages will be written.
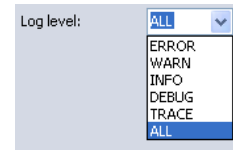
For production-use the log level *INFO* is recommended.

Log level	Description
Error	will only log error messages
Warn	will also log warning messages
Info	will also log info messages – this is **recommended** for production use
Debug	will also log debug messages
Trace	will also log trace messages: e.g. data that is received via the RS232 port.
All	will log all messages

3.2 Channel setup

Go to Ch. setup (❶) and click on the *Ms 3DM-GX3* (❷)icon:

Illustration 11: Channel Setup

(1) *Ch. Setup:* to switch to `Ch. setup` mode

(2) *Ms 3DM‑GX3:* the channel setup section of the *Ms 3DM‑GX3®* plugin

(3) *Sample Rate:* rate at which the device will send the measurement data packets in *Measure Mode*
see also 6 Continuous mode on page 14

(4) *Show Online Values:* If online values are shown in the *Value* column of the *Setup grid*
Below you can see the delay time (see 5 Delay time on page 13) that can be configured in Hardware setup
(3.1 Hardware Setup on page 5).

(5) *Magnetometer enabled*: if this is deactivated the following channels will not show up: *Mag X, Mag Y, Mag Z*

(6) *Info channels enabled*: if this is deactivated the following channels will not show up: *Firmware version, Model number, Serial number, Model name, Device options*
The info channels have static textual information from the device. The *Unit* column is not relevant for these channels. When these channels are activated, only one value per measurement will be stored in the data file. This can be very useful, because you can tell which hardware and firmware version has been used to create the data file.

(7) *Realign*: when you press the **Realign** button *Up*/*North* realignment will be done: Realign time is 10s.

(8) *Angle unit*: will affect the unit used for the channels: *Pitch, Roll, Yaw, Ang rate X, Ang rate Y, Ang rate Z*

(9) *Setup Grid:* shows information about all channels of the plugin

- *ON/OFF*: only channels that are set to **Used** will show up in *Measure Mode* and can be stored in DEWESoft™ data files.
When you click on the header cell (labelled: '*ON/OFF*') a pop-up menu will appear and you can set all channels to used/unused at once.
For **Used** channels you can also deactivate the **Store** button. Then you can see and use the values of this channel in measure mode (and also e.g. in *Math* channels to do some calculations or data reduction), but the values of this channel will not be stored in the data file.

- *Color*: this colour will be used by the displays in *Measure Mode*. You can click on the colour to change it.

- *Name*: the name of the channel that will be used in *Measure Mode*. This can be changed by the user.

- *Description*: the name of the channel that will be used in *Measure Mode* This can be changed by the user.

- *Value*: the data value that has been read from the device (only available if *Show Online Values* is checked).

- *Unit:* the measurement unit of the channel

- *ZERO*: see 3.2.1 Zeroing below

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3.2.1 Zeroing

Some input channels allow for mathematical zeroing:

Left-click the **Zero** button to activate zeroing, and the right-click to deactivate it (reset to the default input offset). When zeroing is already active (e.g. channel *Roll* in the illustration above) you can press the left mouse button again to calculate a new offset.

When you do the zeroing, some of the last samples will be used to calculate an average. This average is then used as offset of the channel values. The number of samples used for the average calculation is $1/10^{th}$ of the sample rate: e.g. for 100Hz the last 10 samples will be used, for 1000Hz, the last 100 samples will be used.

You can activate the auto-zero function by clicking on the **Auto** button. Then you can zero all those auto-channels at once by using the pop-up menu of the *ZERO* column (see below for details) or you can even do the zeroing during measurement (see also 4.1 Zeroing below).

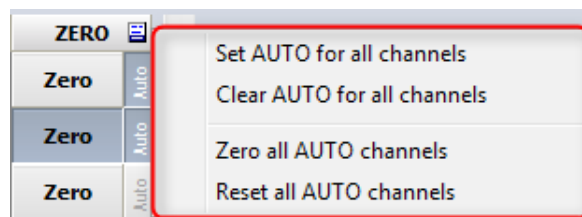When you click on the header row of the *ZERO* column, you can see the zeroing pop-up menu:

Illustration 12: Zeroing pop-up menu

- 🔺 *Set AUTO for all channels*: will activate the **AUTO** button for all channels
- 🔺 *Clear AUTO for all channels*: will deactivate the **AUTO** button for all channels
- 🔺 *Zero all AUTO channels*: will perform zeroing on all AUTO-channels
- 🔺 *Reset all AUTO channels*: will clear the zeroing on all AUTO-channels

When you save the channel setup, also the status of the **Zero** and **AUTO** buttons and the currently used offset will be saved (and also restored when you reload the channel setup later).

4 Measurement

4.1 Zeroing

See also 3.2.1 Zeroing above.

Even during measurement you can perform zeroing on all AUTO-channels:	After you have pressed the **Zero** button, you can see that *Pitch* and *Roll* are now almost zero.
Illustration 13: TODO: name	*Illustration 14: TODO: name*

4.2 Realign

During measurement you can use the *Realign* control channel to realign up and north.

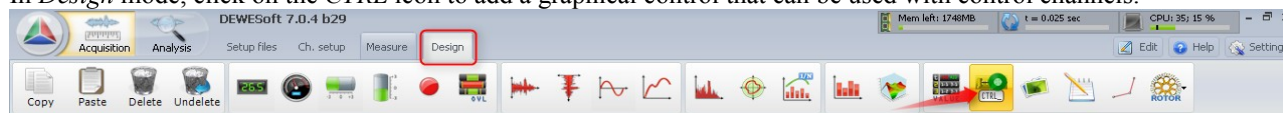In *Design* mode, click on the *CTRL* icon to add a graphical control that can be used with control channels.

Illustration 15: Add control channel

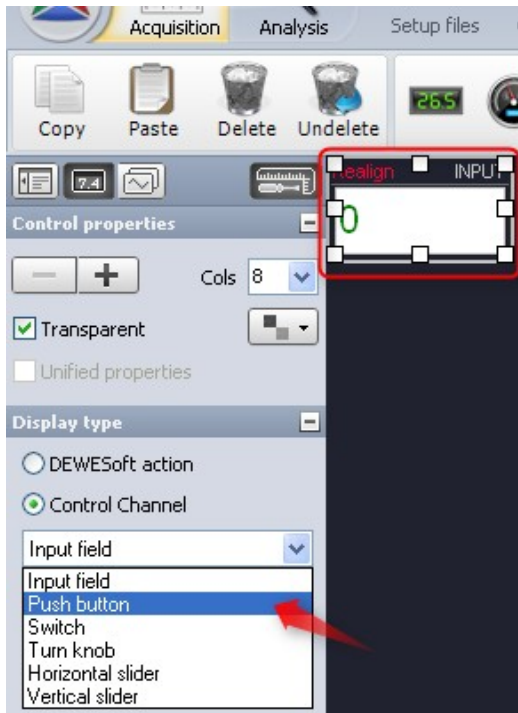| Assign the *Realign* channel to the control (from the channel list at the right) and then change the *Display type* to *Push button*:	Now the control channel display should look like in the image below and if you press this button during measurement, the realign command will be sent to the sensor.
Illustration 16: Change display type	*Illustration 17: Push button*

5 Delay time

There is of course a certain delay, between the real time when the measurement data is taken and when it is received in DEWESoft™: e.g. because the device is doing some filtering, some calculations and also the transmission of the data to the PC takes some finite amount of time.

With the delay time you react to these time delays.

The following example shows 3 signals:

- the green signal is a fast acceleration sensor (10kHz) that is physically attached to the Microstrain® sensor
- the blue signal is the fast signal of a tuning fork (10kHz)
- the red signal is the *'Accel Z'* signal from the Microstrain® sensor (1kHz)

For the test the fast signals have been acquired via a DEWE-43 USB device. Then the Microstrain® sensor (with the fast acceleration sensor attached) has been hit with the tuning fork). In Illustration 18 below you can see that the delay between the fast sensor signal and the change of the slow Microstrain® signal is 1,4 ms in this case.
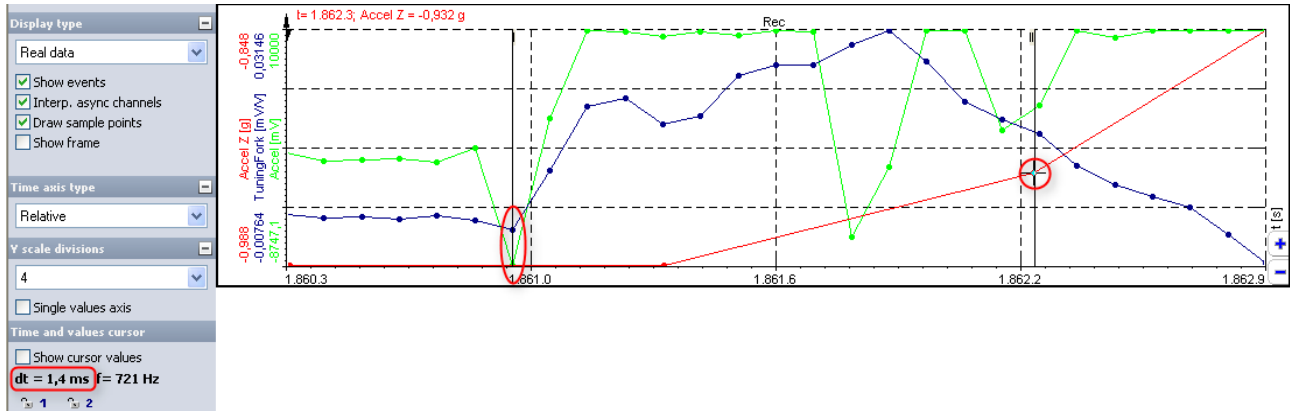
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Illustration 18: No delay time set

When we now set a delay time of 10 ms in the Hardware setup (see 3.1 Hardware Setup on page 5), the Microstrain® signal will be shifted by 10 ms to the left on the time axis:
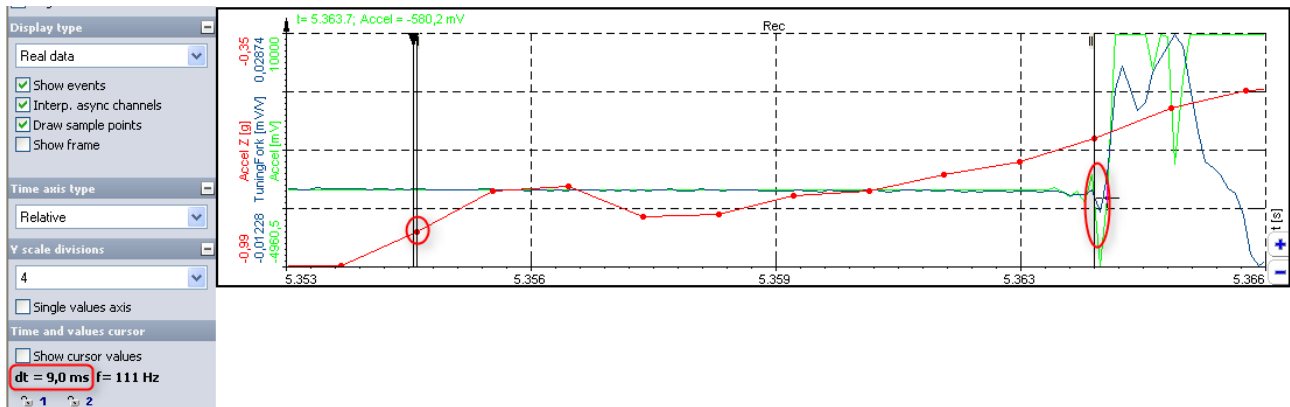

Illustration 19: 10ms delay time set

You can see that the red signal now even appears before the fast signals. There is absolutely no check if the value you enter for the delay is reasonable or not. It is up to the user to select a suitable value.

The delay may vary dependant on the interface (RS232/USB), the size of the data-packets and also on the host-PC (thus, it is not possible to have one fixed delay time).

6 Continuous mode

During the measurement the sensor will be switched to the so called Continuous mode, so that it will automatically send data in a periodic interval that can be configured via the sample rate.

The plugin currently supports 2 different continuous mode commands:

     ▲ using *Acceleration, Angular Rate & Magnetometer Vectors & Orientation Matrix* see *0xCC*

     ▲ or *Acceleration & Angular Rate (0xC2)*

The plugin will automatically choose which of the 2 commands to use.

If only *Acceleration* and *Angular Rate* channels are set to used (note: the information channels and the command channels are irrelevant) in the *Channel setup* (see 3.2 Channel setup on page 9), the command *Acceleration & Angular Rate (0xC2)* will be used. This command sends less data and thus also works reliable at the highest possible sample rate of 1kHz
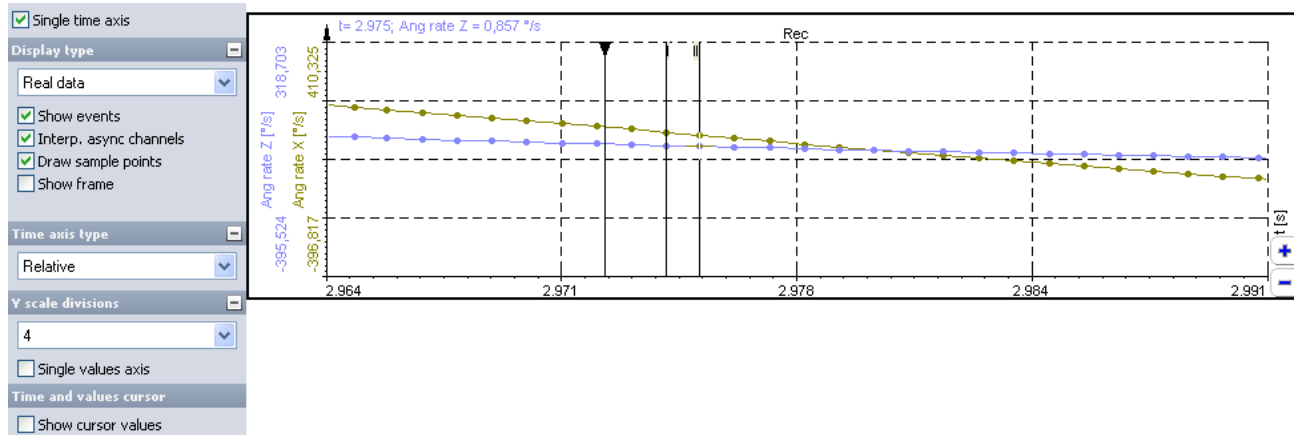

Illustration 20: 0xC2 command at 1kHz sample rate

If you activate any other measurement channel (e.g. *M1, 3*) and use the highest sample rate of 1kHz, then you will see a warning in the *Channel setup* screen:

Illustration 21: Channel setup warning

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If you ignore the warning and record the data, you will see that some samples are missing (see Illustration 22 below). This is not a problem of the plugin, but a limitation of the Microstrain® sensor.
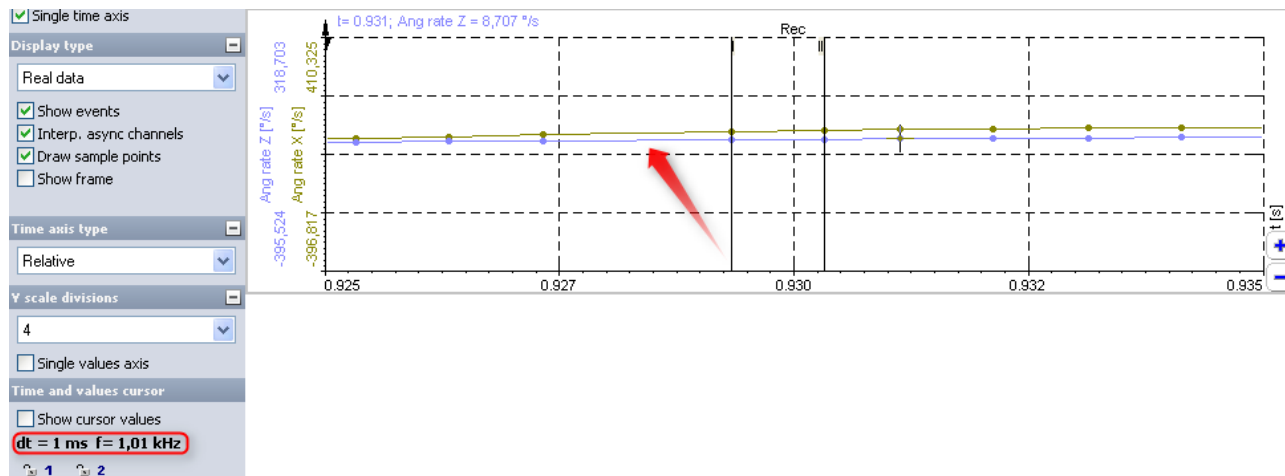

Illustration 22: Missing samples

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7 Version History

7.1 Plugin Version

Plugin-Version	Date [dd.mm.yyy]	Notes
1.0.0	28.07.2011	initial revision
1.0.1	08.08.2011	☑ SoftSync works now ☑ fixed memory leak with unused channels ☑ removed useless lot number ☑ improved delay time when starting the measurement ☑ OnStartStoring: changed logic to reset data ☑ ExpectedAsyncRate of channels is now set to improve display in recorders ☑ added control channel to realign up and north ☑ realign time is now 10s ☑ fixed problem in TCommunicationHandler.SendCommand() ☑ improved handling of sensor-timer rollover ☑ online values in display now use the DefaultRes for the number of decimal places
1.0.2	10.08.2011	☑ information channels were not stored in the data file ☑ continuous mode now supports 0xCC and 0xC2 commands. ☑ setup-grid had problems when you scrolled down to the end and then deactivated some channels ☑ added delay time to hardware setup ☑ Magnetometer channels always were set to Used after activating Show Online Values ☑ using channel groups
1.0.3	12.08.2011	☑ fixed problem when you had a new setup and increased the sample rate to e.g. 500Hz, only the last data buffer was stored (and displayed in the *Recorder* screen): now the *ExpectedAsyncRate* of all channels is also changed when you increase the sample rate ☑ added Store button to the ON/OFF column in Ch. Setup
1.0.4	28/09/11	☑ Zeroing for Roll, Pitch, Yaw ☑ Delay: you can also use decimal places

7.2 Documentation Version

Revision number: 39
Last modified: Wed 28 Sep 2011, 14:16

Doc-Version	Date [dd.mm.yyy]	Notes
1.0.0	28.07.2011	initial revision for plugin version 1.0.0
1.0.1	08.08.2011	☑ updated screenshots to fit plugin version 1.0.1 ☑ added chapter "4 Measurement"
1.0.2	10.08.2011	☑ updated to plugin version 1.0.2 ☑ improved Licensing chapter ☑ added chapter "5 Delay time" ☑ added chapter "6 Continuous mode"

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1.0.3	12.08.2011	☑ improved Licensing chapter (again) ☑ Store button: added some description and updated images
1.0.4	28/09/11	☑ updated to plugin version 1.0.4 ☑ added description for zeroing