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Synchronising Xsens Systems with Cometa Wave EMG System

Step – by – step manual

Table of Contents

1

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1 Synchronization Workflow

The steps described below show how to configure the Xsens systems to control start and stop of a recording (Sync Out) in the Cometa Wave EMG system and to configure the Cometa Wave EMG system to control start and stop of a recording in an Xsens system.

1. Perform the calibration and get both systems fully set.
2. Set the specifications for synchronization in both systems and connect sync cable(s)
3. Start the recording on the slave software. The slave software will wait for a trigger from the Master software to start recording.
4. Start the recording on the Master software. Then, both systems will start recording at the same time.
5. Stop recording on the master software. Then both systems will stop recording at the same time.

Depending on the type of synchronization performed different specifications are required for both systems. A detailed explanation of the different characteristics according to the desired synchronization are described below.

This document is written to synchronize the XSens Awinda system. However, most of the steps performed in the MVN software are the same for the MVN Link system. You can see the differences in the setup of the system in the last chapter of this document "Using MVN Link to synchronize".

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2 Required Hardware

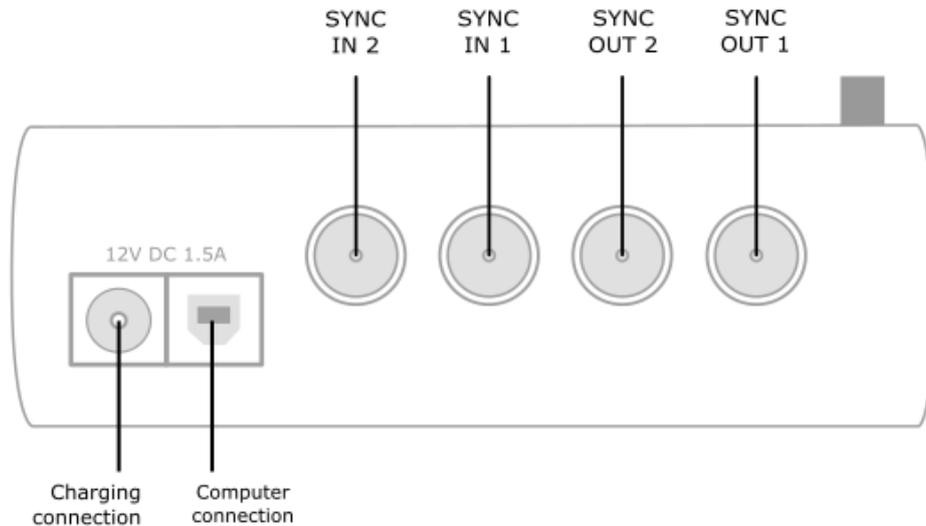| Cometa Wave Hardware	XSens Hardware
• Cometa Wave EMG system Figure 1 - Cometa Station	• MVN Awinda or MVN Link • Awinda station Figure 2 - Awinda Station. 4 BNC ports: SYNC IN 1, SYNC IN 2, SYNC OUT 1, SYNC OUT 2.
• An easy solution in this case is to use a cable with two BNC coax connectors at each end, and a BNC to Jack convertor for connecting the BNC to the Cometa hardware.	

3 Hardware connections scheme

Awinda Station/Sync Station

The Xsens Awinda and Sync Stations have four BNC connectors, with two Sync IN and two Sync OUT possibilities. These hardware connections are shown in Figure 1.

3.1 Sync IN
The Sync IN ports are for a third party device to send a signal to the Awinda or Sync Station. The Awinda or Sync Station can detect polarity changes on the input lines. When a trigger is detected on one of the input lines, the Awinda or Sync Station can be configured to perform a specific action.

3.2 Sync OUT
Sync OUT enables the Xsens system to send a trigger pulse via the Awinda or Sync Station to third party hardware. As with Sync IN, a combination of events are possible, based on a number of parameters.

3.3 Pulse Polarity
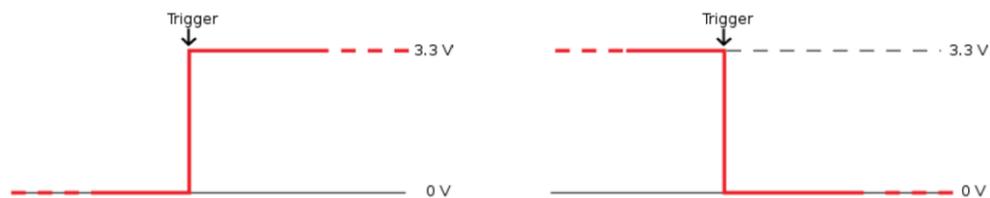A trigger may be a rising or falling edge, as illustrated in the figure below.

Figure 3 - Polarity: Rising/ falling edge (Sync IN) or positive / negative pulse (Sync OUT).

4 MVN Analyze as Master and Cometa Wave as slave

4.1 Start and Stop a recording

4.1.1 Cometa Wave Software

1. Wave EMG system
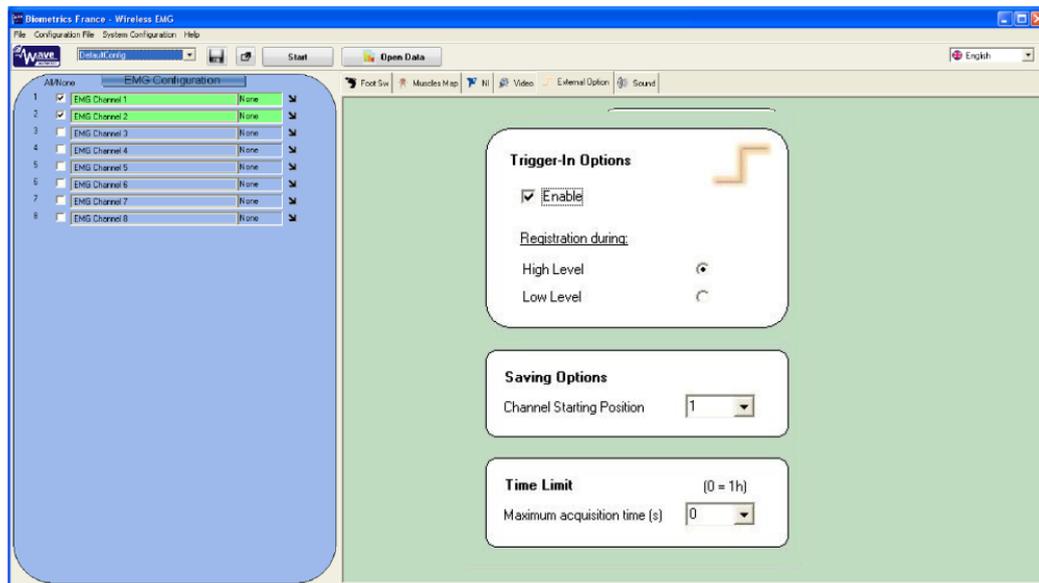2. Trigger-In Options: Enable
3. Active High: Enable

Figure 4 - Screenshot of Cometa Wave EMG software settings.

4.1.2 MVN Software

1. Connect the other end of the BNC cable into the OUT 1 port of the Awinda Station.
2. In the Configuration window, in the Sync tab you should select:

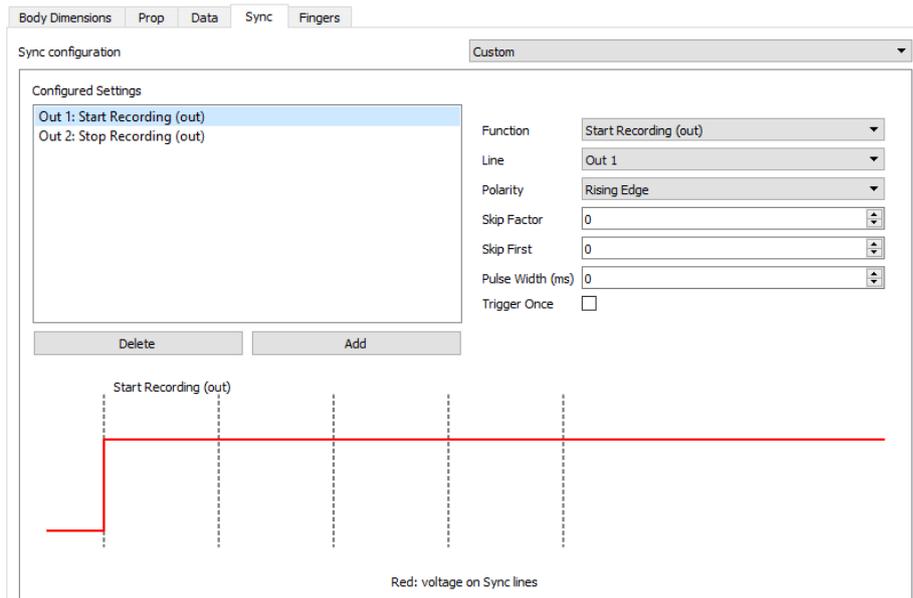| Strat recording (out)	Stop Recording (out)
• Out 1	• Out 1
• Polarity: Rising Edge	• Polarity: Falling Edge
• Skip Factor = 0	• Skip Factor = 0
• Skip First = 0	• Skip First = 0
• Pulse width = 0ms	• Pulse width = 0ms
• Trigger once: uncheck	• Trigger once: uncheck

5

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Figure 5 - Motion Capture Configuration window in MVN Analyze. Setting on the sync tab.

5 Cometa Wave as Master and MVN as slave

5.1 Start and Stop a recording

5.1.1 Cometa Wave Software

Simply recording in Cometa Wave EMG will generate an active high in both systems, so no additional settings are needed in Wave software.

5.1.2 MVN Software

1. Connect the other end of the BNC cable into the IN 1 port of the Awinda Station.
2. In the Configuration window, in the Sync tab you should select:

Strat recording (in)	Stop Recording (in)
• In 1 • Polarity: Rising & Falling Edge • Skip Factor = 1 • Skip First = 1 • Delay = 0ms • Trigger once: uncheck	• In 1 • Polarity: Rising & Falling Edge • Skip Factor = 1 • Skip First = 1 • Delay = 0 ms • Trigger once: uncheck

3. To initialize recording, click the record button.
   The normal red dot icon will change to a pause symbol, indicating that the software is waiting for an external pulse.

a)   b)

Figure 6 - Record button. a) before clicking, b) after clicking, with sync-in activated.

6 Using the Link System

To use the XSens Link system instead of the Awinda system you need to have an Awinda Station. Then you should activate the Awinda station in the "Motion Capture Configuration window" by turn on the bottom on the sync station configuration tab. In this tab you can find all the details described above.
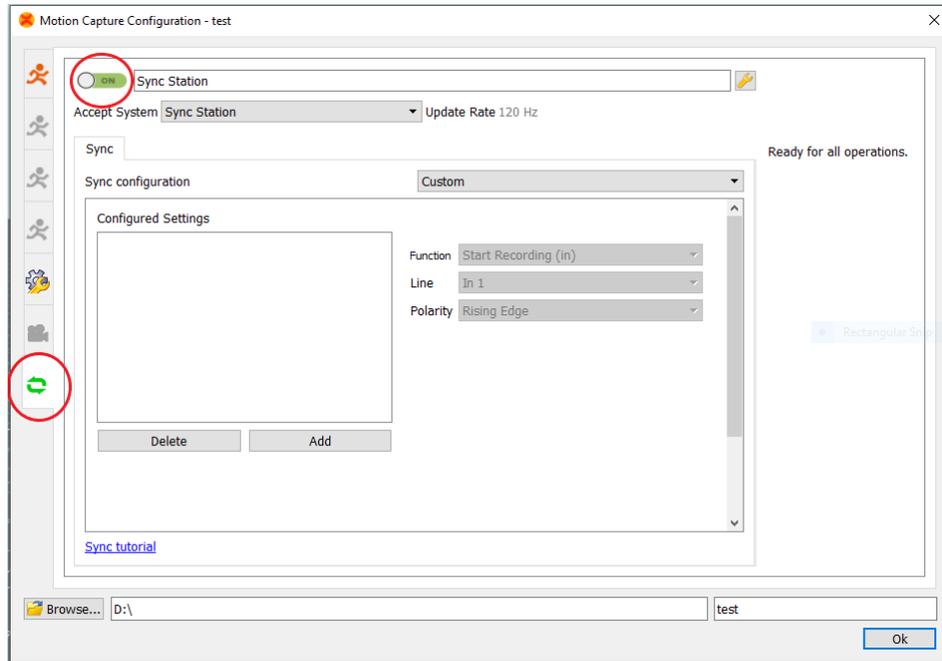

Figure 7 - Motion Capture configuration window in MVN Analyze. Indications to activate the Awinda station as sync station with the Link system.

Note: When using the Xsens Link system, which has an output rate of 240Hz, you will still need to use an Awinda Station to send synchronization signals. As our Awinda station has a maximum frame rate of 120Hz, you will realise that the maximum frame rate that the output signal will have is 120Hz. Practically, this entails that every other frame of Xsens will be synchronize with the frame of the other party system. This still gives an optimal synchronization between both systems.

If you would like to have both systems with the same sampling frequency you should downsample the file while export. To do so follow the following steps:
-   Go to "File" tab - > "Export"
-   Select the format you would like to export the data
-   Click "Show options" and select the right "Exporter frame skip (for downsampling)" value.