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Synchronising Xsens Systems with ANT eego™ sports

Step – by – step manual

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1 Synchronization Workflow




The steps described below show how to make it possible for Xsens Awinda or Sync Station to send a signal (Awinda or Sync Station is Sync OUT and ANT is Sync IN) and how to receive the synchronization signal (ANT is Sync OUT, Xsens Awinda or Sync Station is Sync IN).

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.

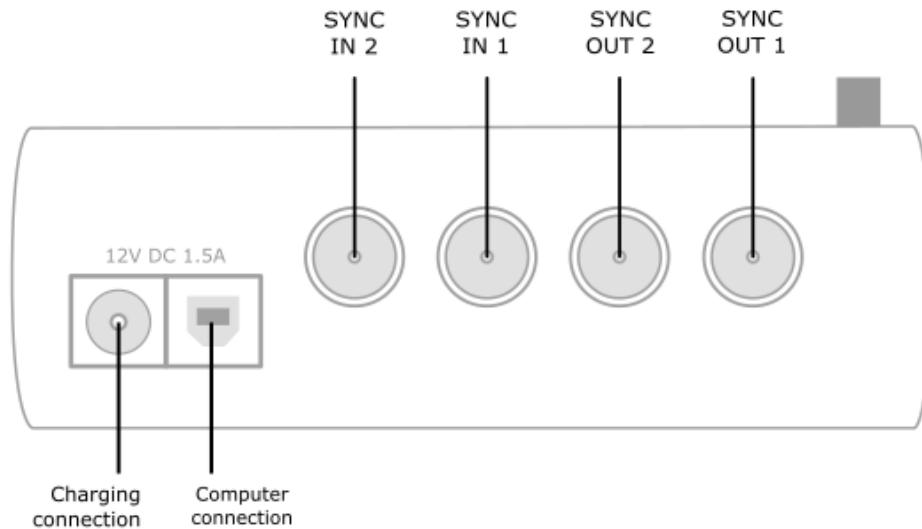
This document is written to synchronize the XSens Awinda system. However, most of the steps performed in the MVN software are the same for the MVN Link system. You can see the differences in the setup of the system in the last chapter of this document "Using MVN Link to synchronize".

2 Required Hardware

ANT Neuro Hardware	XSens Hardware
<ul style="list-style-type: none">Eego sports amplifier  <p>Figure 1 – Eego sports amplifier, view from the front</p>	<ul style="list-style-type: none">MVN Awinda or MVN LinkAwinda station  <p>Figure 2 - Awinda Station. 4 BNC ports: SYNC IN 1, SYNC IN 2, SYNC OUT 1, SYNC OUT 2.</p>
<ul style="list-style-type: none">XS-231 BNC adapter for trigger inputEegosports trigger adapter XS-230 	<ul style="list-style-type: none">Additional hardware: An external trigger button box. (only to use MVN as a slave)

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.

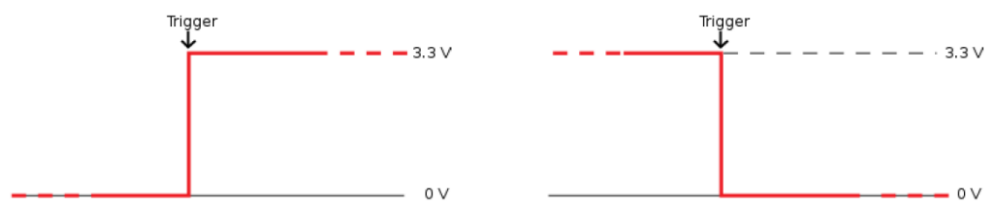
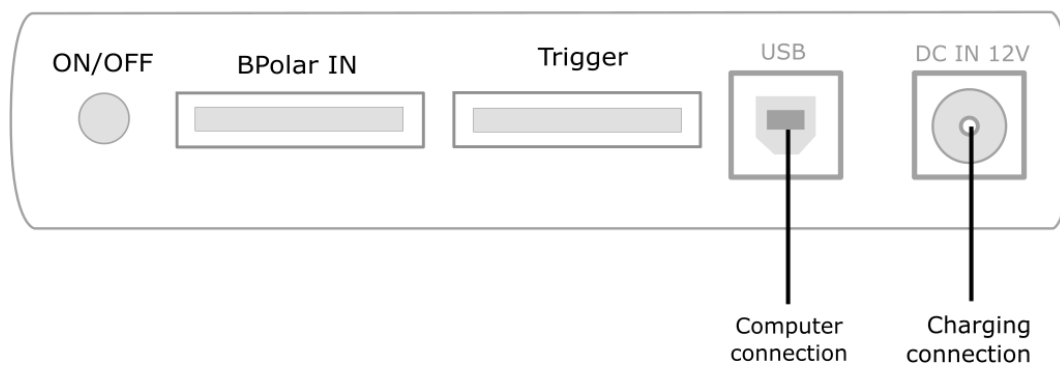


Figure 3 - Polarity: Rising/ falling edge (Sync IN) or positive / negative pulse (Sync OUT).

Sync hardware options on Eego Sports



Synchronization is by means of the 8-bit TTL trigger input that is available on the eego sports system. The system supports single bit triggers through a BNC (coaxial) connection as well as multibit triggers through a parallel port (DB25).

4 MVN Analyze as Master and Eego Sports as slave

4.1 Start and Stop a recording

4.1.1 ANT Software

ANT's Eego Sports recording software will automatically record trigger inputs as long as the incoming pulse is at least one sample long. (Otherwise it might not get sampled.) After recording in the analysis software, the trigger can be used to synchronize the data streams.

The following is an example of an EEG recording session

STEP 1: PREPARE RECORDING

Start the eego software. Open the workflow "Acquire EEG"

- Select the subject or create a new Subject for this recording (you are going to do the latter)
- Select the amplifier setup. The default setting is OK.
- Select a proper montage for data display. The default setting is OK.
- Select the sampling frequency. The default is OK.

Push the "New Subject" button in the workflow page to the left. A dialog appears that allows entering Last Name, First Name and Date of Birth of the new subject. Press Enter to add the subject information to the data grid and to select her or him for the recording.

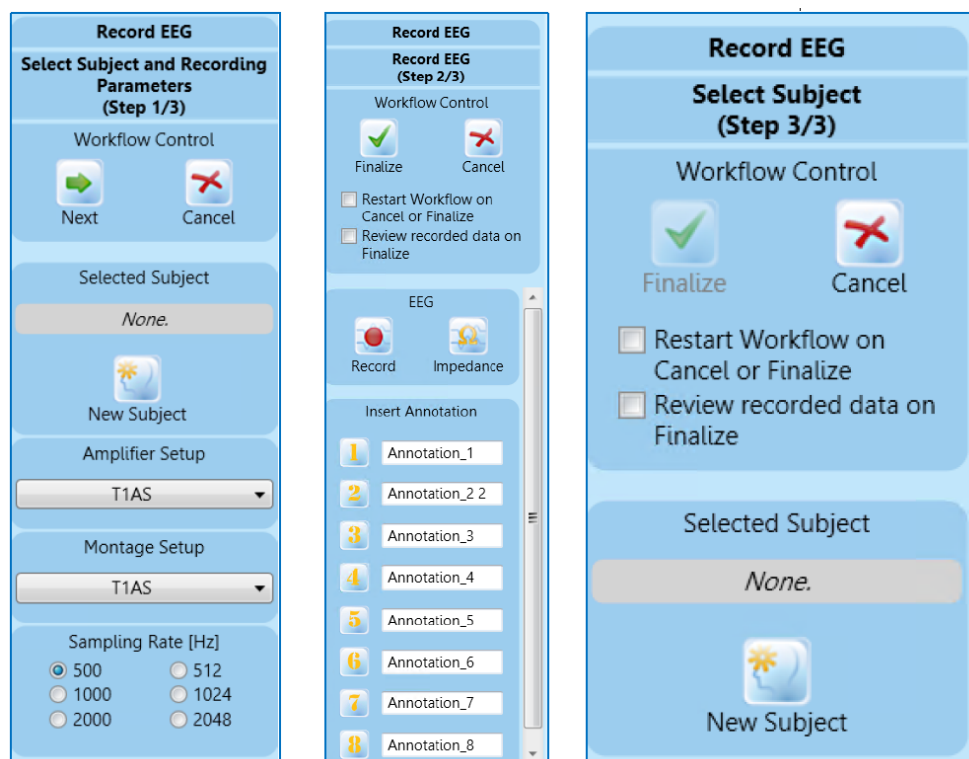


Figure 4 - Step of the record EEG workflow.

STEP 2: PREVIEW DATA AND CHECK IMPEDANCES

After having inserted the gel in all the electrode holders make use of the impedance measurement: please push the button "Impedance Check" in the workflow page.

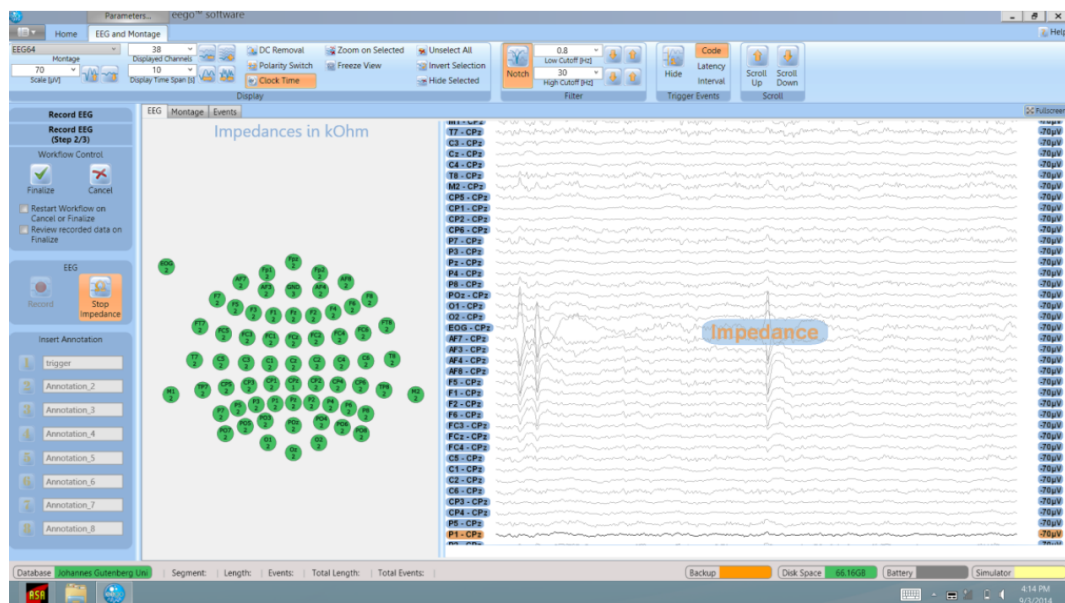
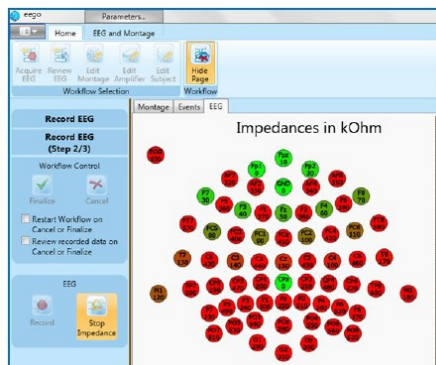


Figure 5 - Screen capture of the eego software in EEG impedance check mode. All electrodes were prepared with electrolyte gel.

Once all electrodes in the EEG cap have been filled with gel and you have obtained acceptable impedance values for them, you can actually start recording.

Push the "Start Recording" button in the workflow page and run the recording. The system is then ready for receiving an external pulse.

When a trigger is sent from the Awinda or Sync Station it will be recorded by the eego sports system and it will appear as an orange vertical line on the trace.

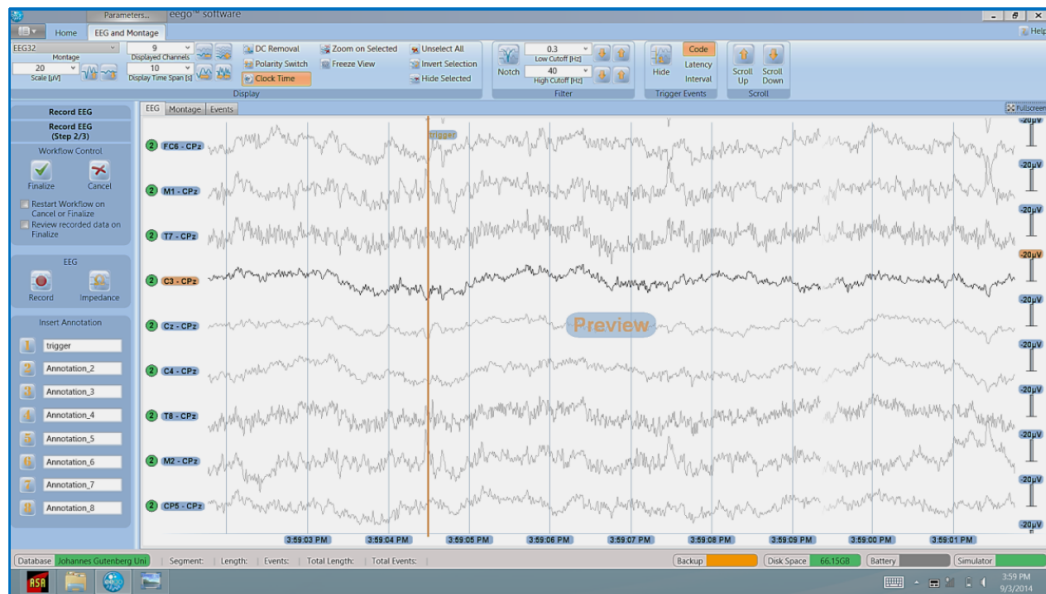


Figure 6 - Image of the EEG trace in which orange vertical line indicates the incoming trigger.

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)
<ul style="list-style-type: none"> • Out 1 • Polarity: Rising Edge • Skip Factor = 0 • Skip First = 0 • Pulse width = 10ms • Trigger once: uncheck 	<ul style="list-style-type: none"> • Out 1 • Polarity: Rising Edge • Skip Factor = 0 • Skip First = 0 • Pulse width = 10ms • Trigger once: uncheck

Note: Make sure that the pulse width is at least $1/F_s$ wide. So for example when sampling at 1000Hz the trigger pulse width should be at least 1ms or 1000 μs .



Figure 7 - Motion Capture Configuration window in MVN Analyze. Setting on the sync tab.

5 Eego Sports as Master and MVN as slave

5.1 Hardware connections

Connect the external trigger button box through a splitter to both the ANT eego sports and Xsens Awinda. Pressing the button on the trigger button box will send a trigger pulse to both machines as to facilitate synchronization. Please note that instead of an external trigger button box, in the case of a more elaborate lab set-up other devices might be used to send a synchronization trigger as well.

Make sure that the trigger button box generates a trigger that is at least $1/F_s$ wide. So for example when sampling at 1000Hz the trigger pulse width should be at least 1ms.

5.2 Start and Stop a recording

5.2.1 ANT Software

Follow the steps for an EEG recording session (see sync out).

ANT's Eego Sports recording software will automatically record trigger inputs as long as the incoming pulse is at least one sample long (otherwise it might not get sampled). After recording in the analysis software, the trigger can be used to synchronize the data streams.

5.2.1 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)
<ul style="list-style-type: none">• In 1• Polarity: Rising Edge• Skip Factor = 0• Skip First = 0• Delay = 0ms• Trigger once: uncheck	<ul style="list-style-type: none">• In 1• Polarity: Rising Edge• Skip Factor = 0• Skip First = 0• Delay = 0ms• 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.



Figure 8 - 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.

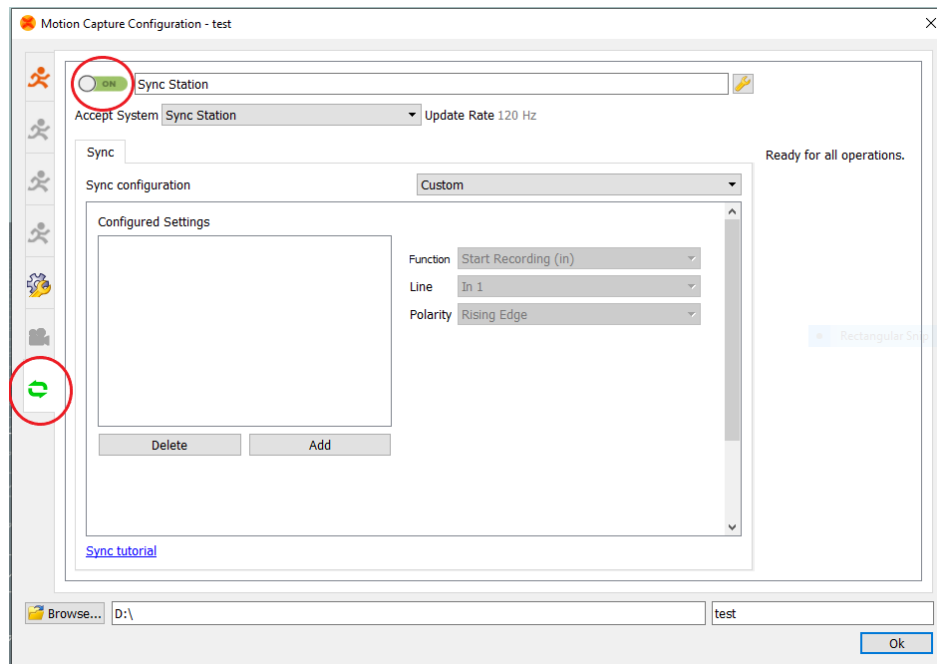


Figure 9 - Motion Capture configuration window in MVN Analyze. Indications to activate the Awinda station as sync station with the Link system.

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.