19 – 08 – 2021

Synchronising Xsens Systems with Kistler force plate

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 trigger the start of a recording for the Kistler Force plate.

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. In the follower software perform all steps that would normally start the recording. The follower software will wait for a trigger from the Leader software to start recording.
4. Start the recording on the Leader software. Then, both systems will start recording at the same time.
5. Stop recording on the leader software. The Kistler software cannot receive a stop trigger and will therefore automatically stop at the time set in the BioWare software.

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

AMTI Hardware	Xsens Hardware
• Kistler force plate(s) • Kistler Sync Station Figure 1 - 5695 B sync station Kistler.	• MVN Awinda or MVN Link • Awinda station/sync station Figure 2 - Awinda Station. 4 BNC ports: SYNC IN 1, SYNC IN 2, SYNC OUT 1, SYNC OUT 2.
• D-Sub 9 pin male – BNC cable: 	

3 Cable design

For the D-Sub 9 pin male to BNC cable, a cable needs to be designed where the BNC is connected to pin 6 of the D-Sub 9 pin connector. Pin 6 has the function for the trigger input, where the BioWare software receives the start trigger of the MVN software. In case it is desired to have the possibility to provide trigger outputs from the Kistler BioWare software, it is necessary to add a second BNC connector with a connection to pin 3 of the D-Sub 9 pin connector. Please see https://www.kistler.com/files/document/003-093e.pdf for additional information on the pin functions.

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4 Hardware connections scheme

Awinda Station/Sync Station
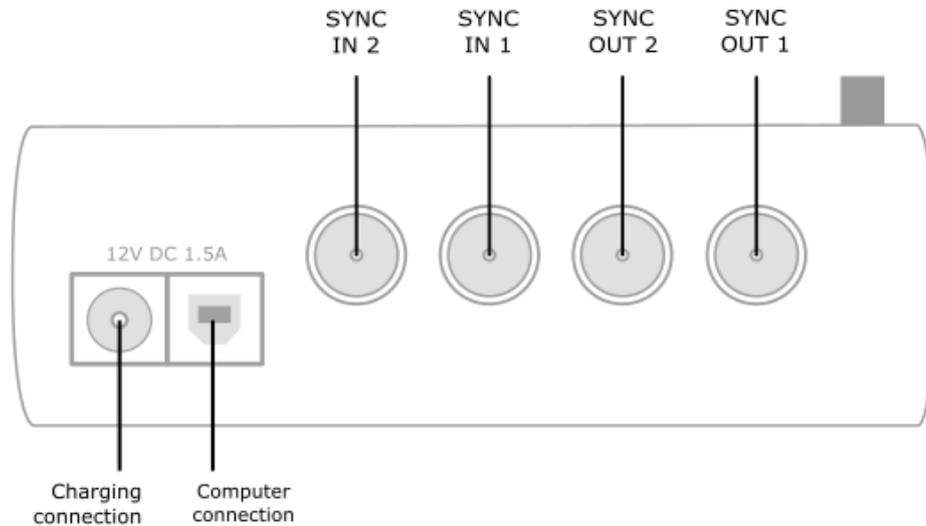
Figure 3 – Awinda Station, 4 BNC ports: SYNC IN 1, SYNC IN 2, SYNC OUT 1, SYNC OUT 2

The Xsens Awinda and Sync Station have four BNC connectors, with two Sync IN and two Sync OUT possibilities. These hardware connections are shown in Figure 3. The Xsens Awinda and Sync Station have been configured to send (Sync Out) or receive (Sync In) TTL pulses of 0-3.3V. The Xsens Awinda and Sync Station will damage when receiving 5V pulses from external systems.

4.1 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.

4.2 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.

4.3 Pulse Polarity
A trigger may be a rising or falling edge, as illustrated in the figure below.
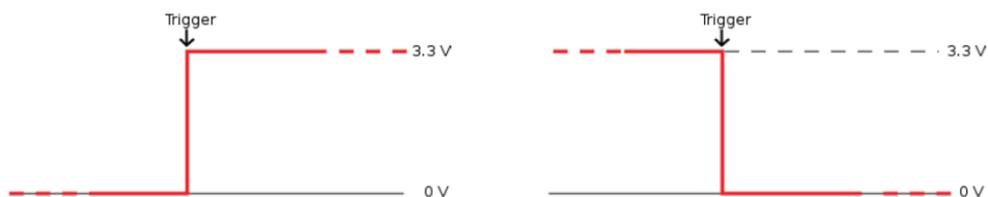
Figure 4 - Polarity: Rising/ falling edge (Sync IN) or positive / negative pulse (Sync OUT).

Sync Hardware 5695 B sync station Kistler
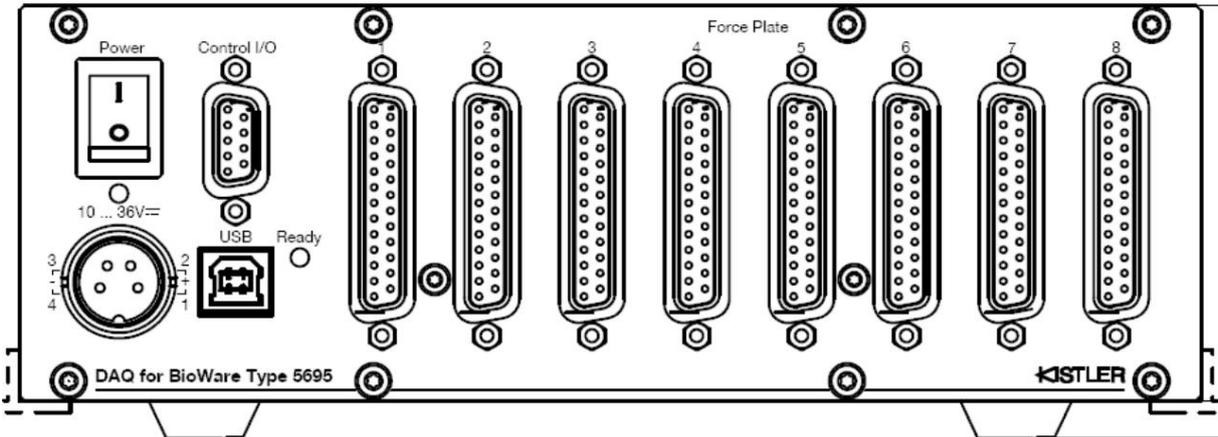
Figure 5 - 5695 B sync station Kistler

The Control I/O connection of the 5695 B sync station is used for the synchronization of the Force plate, via TTL pulses, with third party hardware. The technical details for the Kistler hardware can be found via https://www.kistler.com/files/document/003-093e.pdf.

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5 MVN Analyze as Leader and Kistler BioWare as follower

5.1 Start and Stop a recording

5.1.1 Hardware connections

Kistler   Xsens
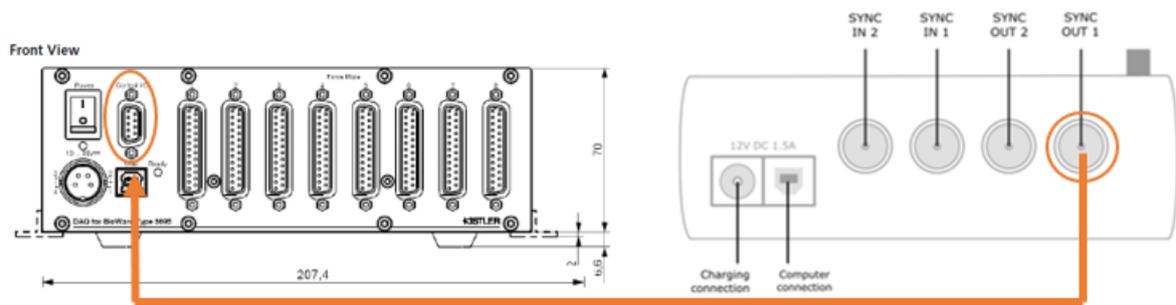
Figure 6 - Hardware connections 5695 B sync station Kistler and Awinda/Sync station

To synchronize the Xsens system with the Kistler Force plate, connect the D-Sub 9 pin male connector to the Control I/O connection of the 5695 B sync station. Connect the BNC connector to SYNC OUT 1 port of the Awinda or Sync Station.

5.1.2 Xsens Software

Initialize the synchronization setting of the Xsens software. In the Configuration window, select in the Sync tab the 'Sync Out (line 1 out)' settings via the drop-down window. Delete in the Configured settings the 'Out 1: Stop Recording (out)' section, by selecting the section and click the delete button. Displayed in Figure 7.

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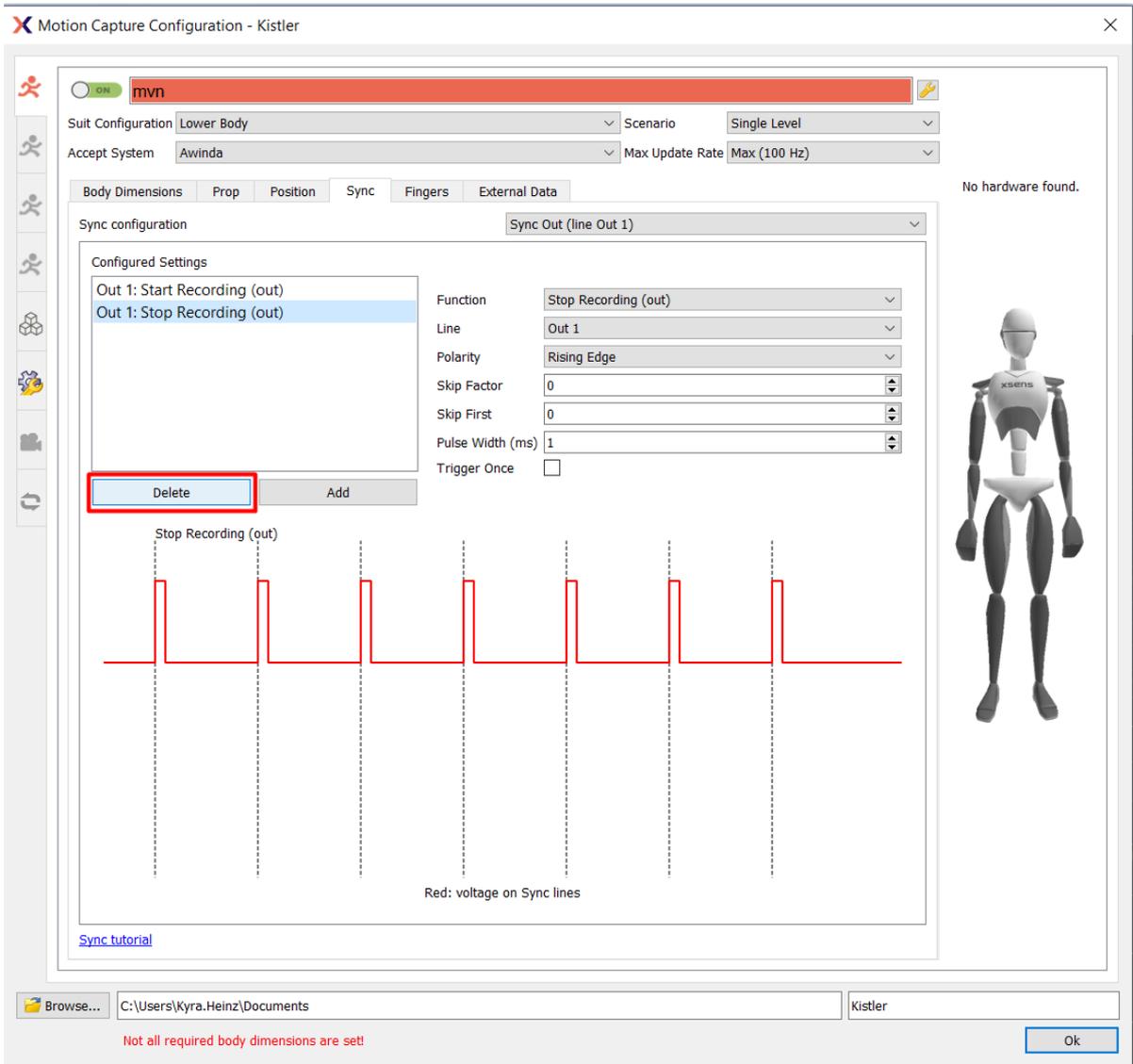
Figure 7 - Delete "Out 1: Stop recording (out) in Synchronization settings
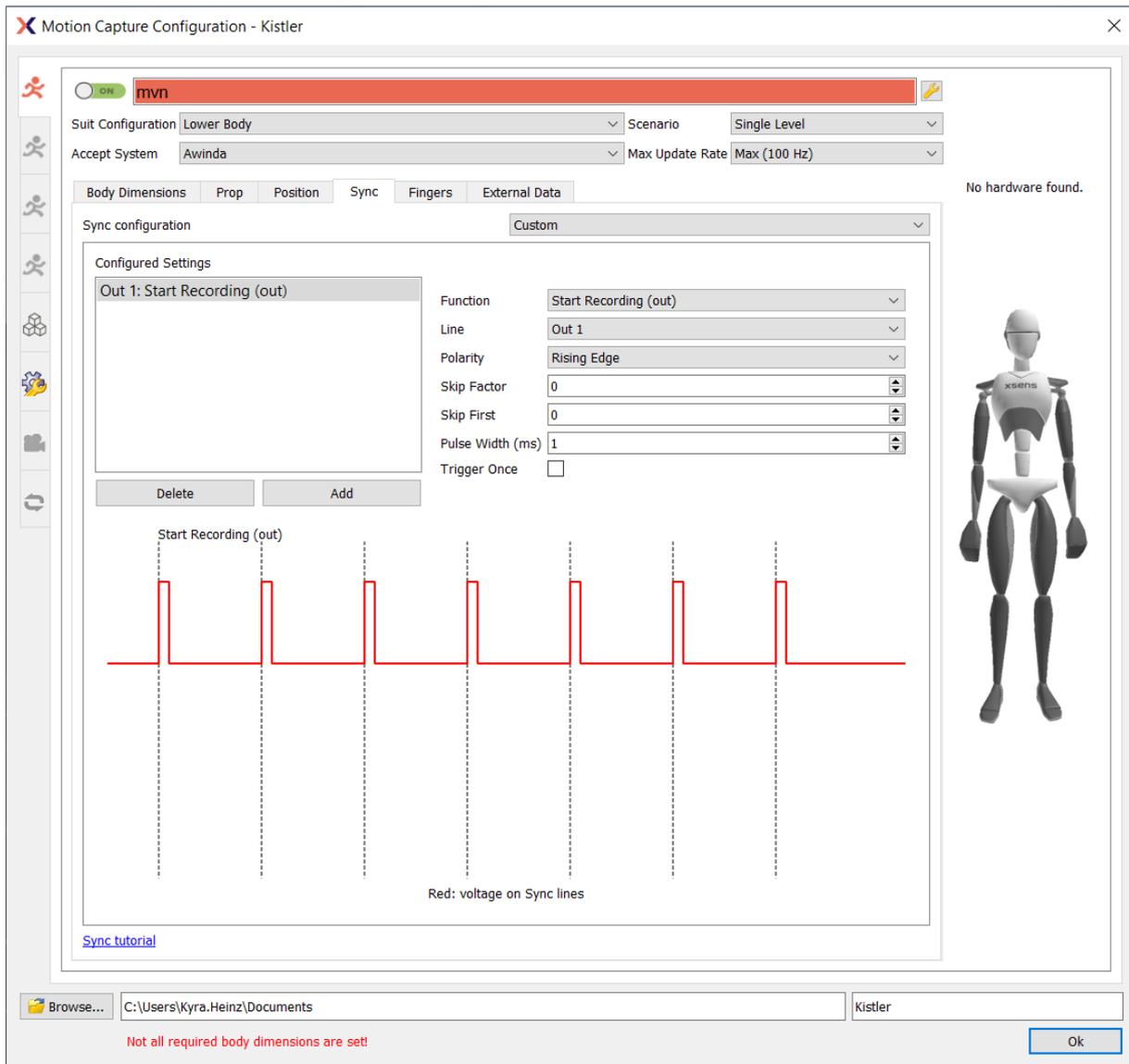
Figure 8 - Synchronization setting in MVN

Select the following recording settings (shown in Figure 7 and Table 1):

Table 1 "Out 1: Start Recording (out) settings

Start recording (Out)
• Out 1
• Polarity: Rising Edge
• Skip Factor = 0
• Skip First = 0
• Pulse width = 1 ms
• Trigger once: uncheck

5.1.3 Kistler BioWare Software

Open the InstaCal and BioWare software. In the BioWare software open the Acquire Data window via the Acquire Trial icon.

Figure 9 - BioWare software tool bar, Acquire Trial Icon highlighted in red

In the Acquire Data Window, make sure to change the Sampling information. The Length is the time in sec that you would like to record, the force plate will automatically stop the recording after the set time.
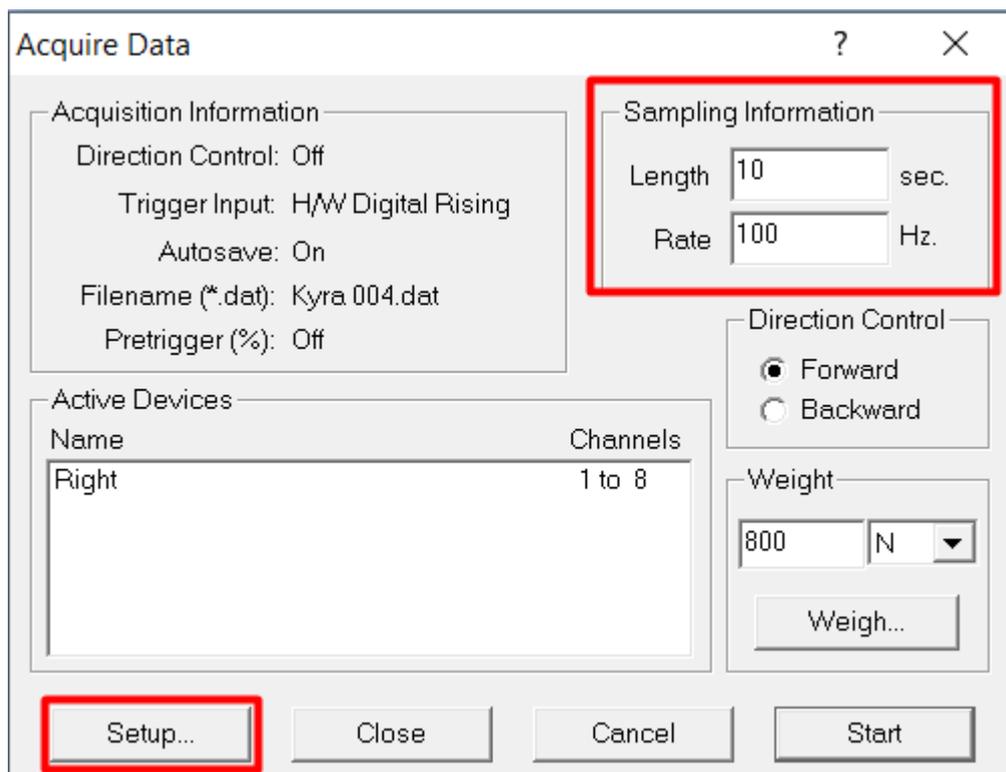
Figure 10 - Acquire Data Window

Use the Setup button in the Acquire Data Window to open the Advanced Acquisition Setup. Select in the Trigger Input section the H/W Digital Rising Edge. Make sure to enable the Auto Save Options and disable the "Show prompt before acquisition" option.
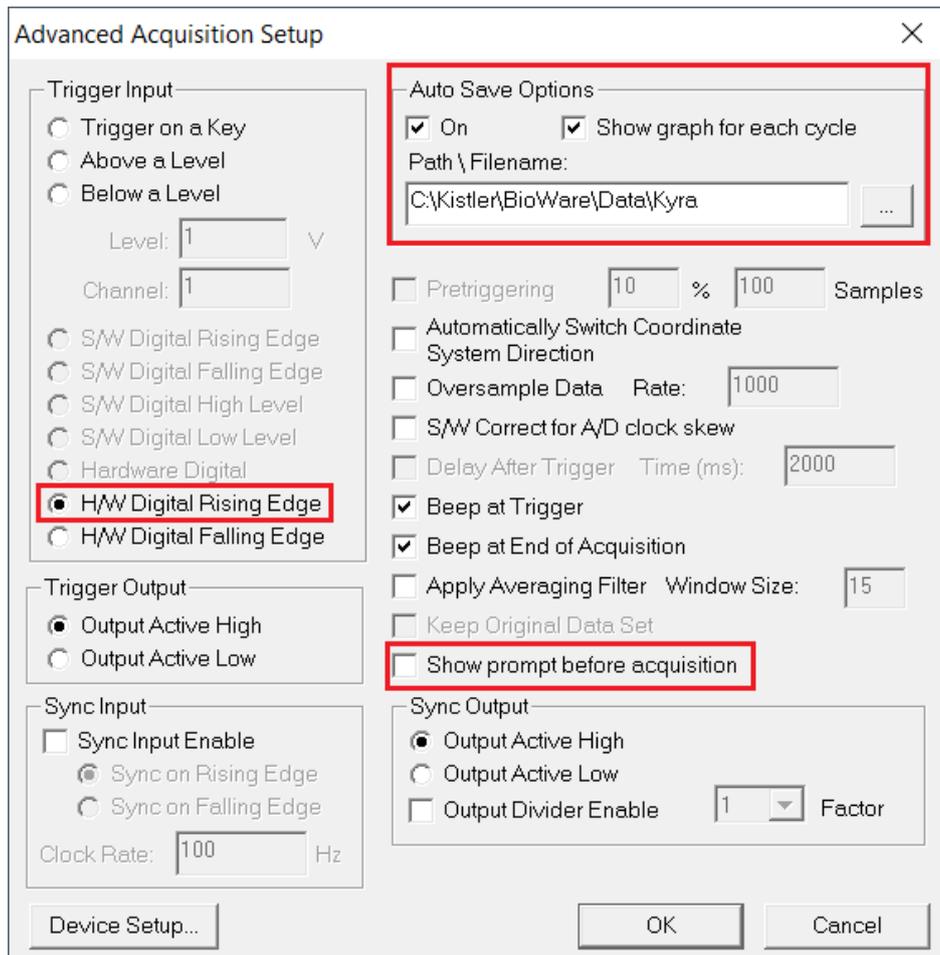
Figure 11 - Advanced Acquisition Setup window

Select OK to close the Advances Acquisition Setup window. Select the Start button in the Acquire Data Window, the BioWare software is waiting for a trigger to start the measurement.

NOTE: the Kistler BioWare software is not able to receive a stop trigger. The force plate measurement can only measure on duration.

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6 Using the Link System

To use the Xsens Link system instead of the Awinda system you need to have an Awinda Station/Sync 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.
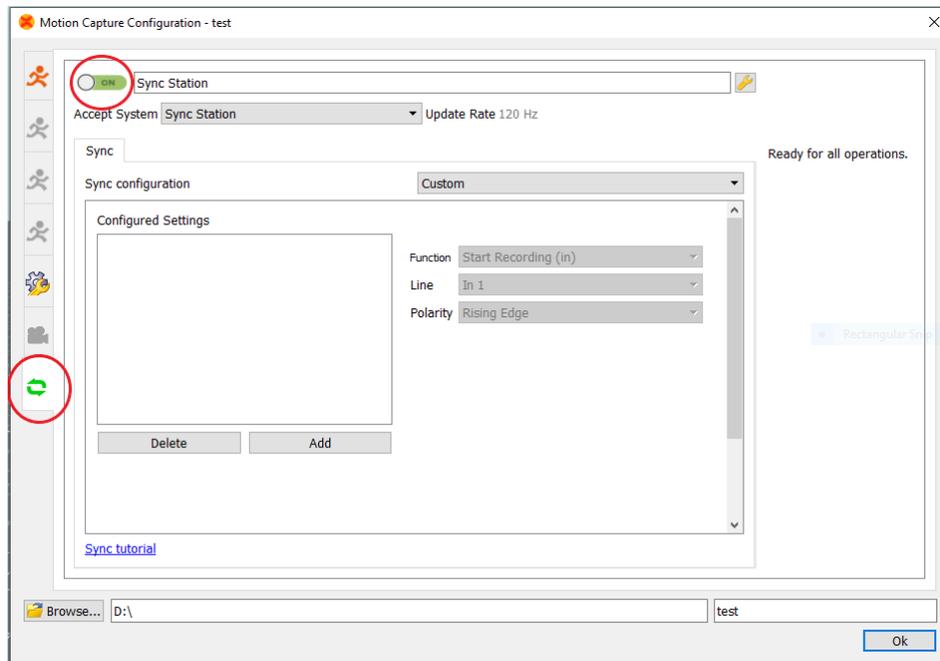
Figure 12 - Motion Capture configuration window in MVN Analyze. Indications to activate the Awinda station as sync station with the Link system.

Note: When using the Xsens Link system, which has an output rate of 240Hz, you will still need to use an Awinda Station/ sync station to send synchronization signals. As our Awinda station/ sync station has a maximum frame rate of 120Hz, you will realize 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 down sample 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 down sampling)" value.

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