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Synchronising Xsens with the Biometrics Ltd DataLOG Data Acquisition System

Step – by – step manual

Table of Contents

1 Synchronization Workflow	2
2 Required Hardware	3
3 Hardware connections scheme.....	4
4 MVN Analyze as Master and as DataLOG slave	6
4.1 Start and Stop a recording	6
4.1.1 Hardware connections	6
4.1.2 HM-Analyzer Software	6
4.1.3 Biometrics Ltd DataLOG Software	7
4.1.4 Xsens Software.....	7
5 DataLOG as Master and MVN Analyze as slave	8
5.1 Start and Stop a recording	8
5.1.1 Hardware connections	8
5.1.2 HM-Analyzer Software	8
5.1.3 Biometrics Ltd DataLOG Software	9
5.1.4 XSens Software	9
6 Using the Link System.....	11

1 Synchronization Workflow

The steps described below show how to configure Xsens systems to control start and stop of a recording of the Biometrics Ltd DataLOG, and how to configure the Biometrics Ltd DataLOG 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".

Note: NexGen Ergonomics Inc has developed the HM-Analyzer software solution which it integrates with the Xsens Awinda solution that performs the slave and master synchronization as a software feature. NexGen Ergonomics is a Xsens system integrator and can provide a total solution with our HM-Analyzer software.

HM-Analyzer maps from one to 15 inertial sensors to various segments of the body (such as trunk, pelvis, arms, etc.) in order to obtain joint angles according to ISB - International Society of Biomechanics (ISB angles are also anatomical angles) or according to AAOS. The software and system are totally scalable allowing you to use any number of sensors as required. The 3D skeleton which is used for visualization can be adjusted according to the subject's anthropometry.

2 Required Hardware

Biometrics Ltd DataLOG Hardware

- Biometrics Ltd DataLOG MWX8



Figure 1 – Biometrics Ltd DataLOG MWX8. SYNC cables connect to the digital ports (top of unit) for sync in and out.

XSens Hardware

- MVN Awinda or MVN Link
- Awinda station

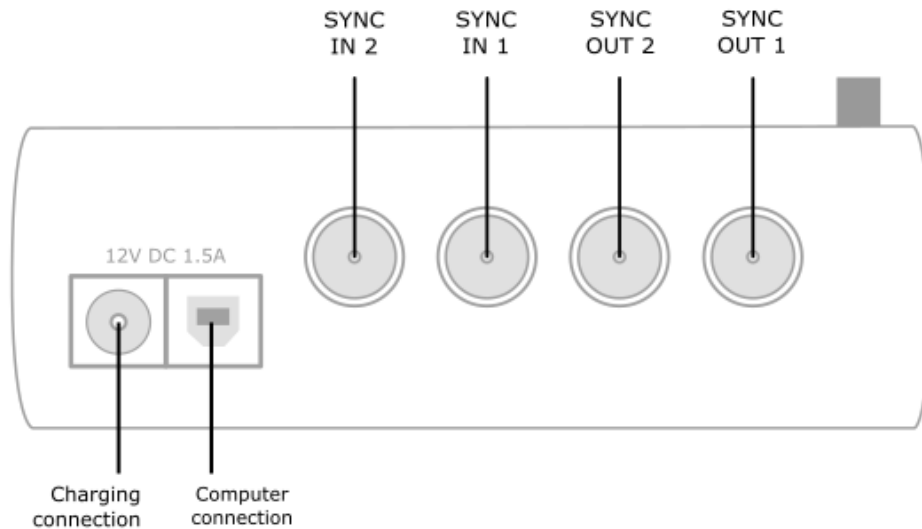


Figure 2 - Awinda Station. 4 BNC ports: SYNC IN 1, SYNC IN 2, SYNC OUT 1, SYNC OUT 2.

- SYNC5BNC cable (For MVN as a slave)
- SYNC1BNC cable (For MVN as a master)

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.

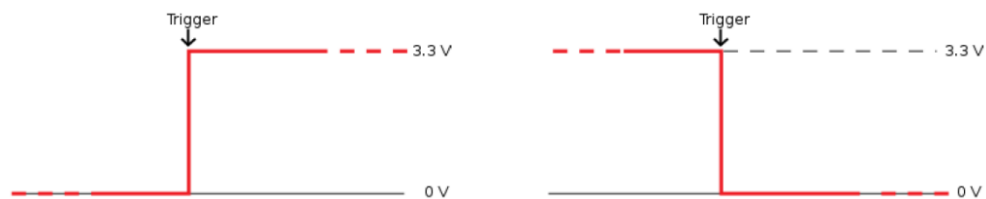


Figure 3 - Polarity: Rising/ falling edge (Sync IN) or positive / negative pulse (Sync OUT).

Sync hardware options on Biometrics Ltd DataLOG MWX8

The DataLOG MWX8 unit can be used as master or slave. Either of the two digital ports on the top of the DataLOG can be used to send or receive the synchronization signal. The SYNC5BNC cable must be used when the DataLOG is set as master (sends trigger signal to start/stop the Xsens) and the SYNC1BNC when it is used as a slave (receives trigger signal from Xsens to start/stop the DataLOG).

Note: DataLOG sends a 3.2V trigger signal and can receive a trigger signal between 3V to 5V. The Xsens Awinda and Sync Stations can send and accept up to 3.3V so no signal modification is needed to connect the Biometrics Ltd DataLOG directly to the Xsens station.

The Biometrics Ltd software allows the polarity to be chosen (rising or falling edge) and a choice of pulse or constant signal.

4 MVN Analyze as Master and as DataLOG slave

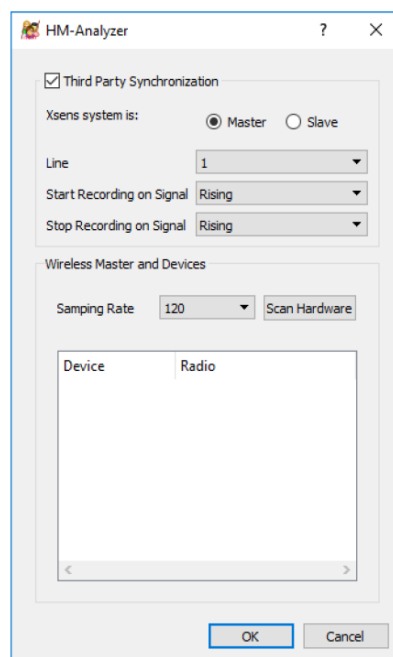
4.1 Start and Stop a recording

4.1.1 Hardware connections

Connect the BNC connector of the Biometrics Ltd SYNC1BNC cable to the Sync OUT 1 port of the Awinda or Sync Station. Connect the connector on the other end of the SYNC1BNC cable to either Digital port on the top of the Biometrics Ltd DataLOG MWX8.

4.1.2 HM-Analyzer Software

Initialize the synchronization setting of the Xsens system inside HM-Analyzer. Note: if you are using MT Manager, skip this section.



HM-Analyzer and Xsens as master

- Xsens system is: Master
- Line: 1
- Start Recording on Signal: Rising
- Stop Recording on Signal: Rising

Once the third party synchronization is done you can press the Scan Hardware button and continue the synchronization as usual.

4.1.3 Biometrics Ltd DataLOG Software

Prior to first use of the DataLOG, the communications must be set up between the DataLOG and the Biometrics Ltd software. Refer to the DataLOG MWX8 Operating Manual for instructions.

After initial set up of the DataLOG hardware and for subsequent use:

- Plugin the Bluetooth dongle adapter supplied with the DataLOG into the USB port
- Power on the DataLOG
- Open the DataLOG software
- Go to Setup -> Digital Inputs

Referring to the Biometrics Ltd DataLOG MWX8 Operating Manual:

- Set up and configure the sensors within the Biometrics Ltd software (Setup->Analogue Inputs)

Starting and stopping the Xsens will trigger the recording start/stop of the Biometrics Ltd DataLOG MWX8.

4.1.4 Xsens Software

Initialize the synchronization setting of the Xsens software using the following settings. Note: if you are using HM-Analyzer, skip to section 3.3.

1. In the Configuration window, in the Sync tab you should select:

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

5 DataLOG as Master and MVN Analyze as slave

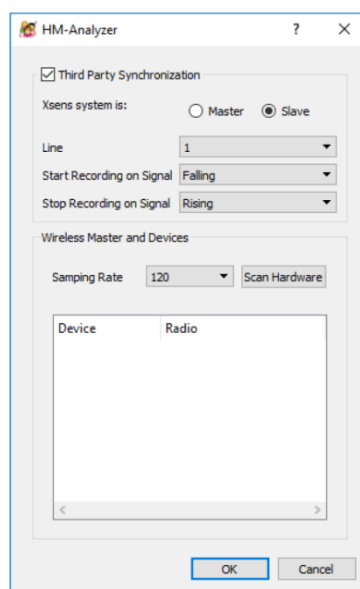
5.1 Start and Stop a recording

5.1.1 Hardware connections

Connect the BNC connector of the Biometrics Ltd SYNC5BNC cable to the Sync IN 1 port of the Awinda or Sync Station. Connect the connector on the other end of the SYNC5BNC cable to either Digital port on the top of the Biometrics Ltd DataLOG MWX8.

5.1.2 HM-Analyzer Software

Initialize the synchronization setting of the Xsens system using NexGen Ergonomics Inc.'s HM-Analyzer software. Note: if you are using MT Manager, skip this section.



HM-Analyzer and Xsens as slave

- Xsens system is: Slave
- Line: 1
- Start Recording on Signal: Falling
- Stop Recording on Signal: Rising

Once the third party synchronization is done you can press the Scan Hardware button and continue the synchronization as usual.



5.1.3 Biometrics Ltd DataLOG Software

Prior to first use of the DataLOG, the communications must be set up between the DataLOG and the Biometrics Ltd software. Refer to the DataLOG MWX8 Operating Manual for instructions.

After initial set up of the DataLOG hardware and for subsequent use:

1. Plugin the Bluetooth dongle adapter supplied with the DataLOG into the USB port
2. Power on the DataLOG
3. Open the DataLOG software
4. Go to Setup -> Digital Inputs

Referring to the Biometrics Ltd DataLOG MWX8 Operating Manual:

1. Set up and configure the sensors within the Biometrics Ltd software (Setup->Analogue Inputs)
2. Start the data recording either from the DataLOG unit:
 - Press the center navigation button (joystick) on the DataLOG unit
 - Select Record
 - Select Start
 - Select Confirm
3. OR from the Biometrics Ltd Software:
 - pressing the Start button  on the toolbar or selecting start from the *Transfer* menu
4. Stop the data recording either from the DataLOG unit:
 - Press the center navigation button (joystick) on the DataLOG unit
 - Select Record
 - Select Stop
 - Select Confirm
5. OR from the Biometrics Ltd Software:
 - Pressing the Stop button  on the toolbar or selecting stop from the *Transfer* menu

Starting and stopping the Biometrics Ltd DataLOG MWX8 will trigger the recording start/stop of the Xsens.

5.1.4 XSens 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:

Start recording (in)	Stop Recording (in)
<ul style="list-style-type: none">• In 1• Polarity: Falling Edge• Skip Factor = 0• Skip First = 0• Pulse width = 1ms• Trigger once: uncheck	<ul style="list-style-type: none">• In 1• Polarity: Rising Edge• Skip Factor = 0• Skip First = 0• Pulse width = 1ms• Trigger once: uncheck

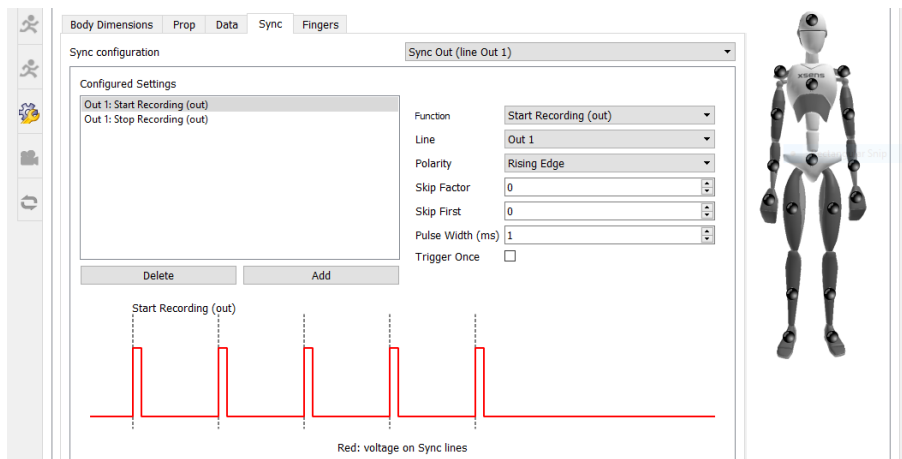


Figure 4 - Motion Capture Configuration window in MVN Analyze. Setting on the sync tab.

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 5 - 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.

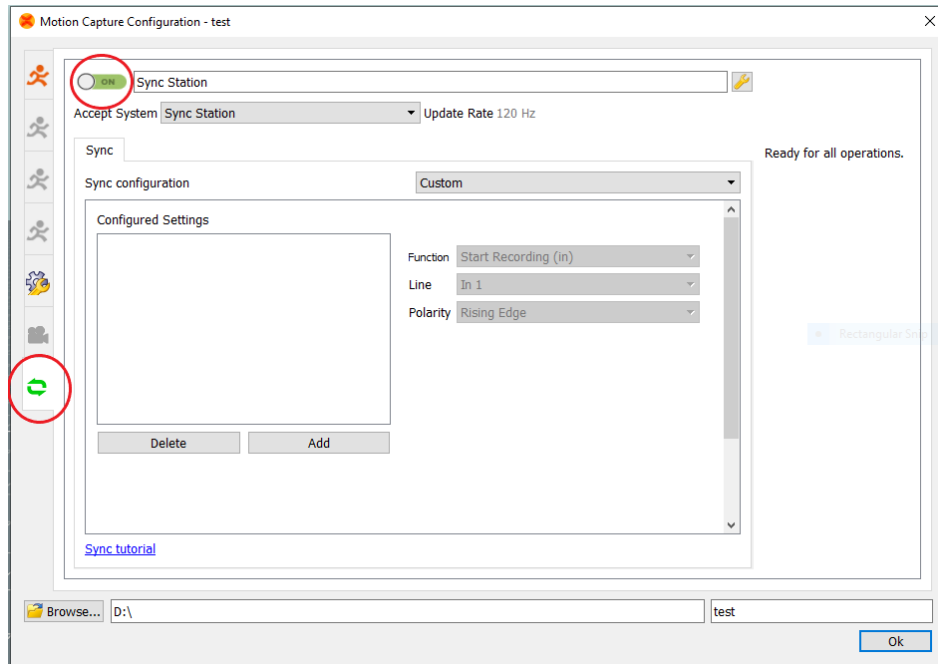


Figure 6 - Motion Capture configuration window in MVN Analyze. Indications to activate the Awinda station as sync station with the Link system.

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.