Technical Note

BIOPAC MP System and The Observer XT

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1 Introduction

HOW TO USE THIS TECHNICAL NOTE

This document describes how to achieve automatic synchronization between observational data in The Observer XT and the physiological data acquired with and exported from the BIOPAC MP160 system using BIOPAC's AcqKnowledge 5.0 software.

- A large part of this note also applies to AcqKnowledge 4.x.
- The versions 4.4 and 5.0 of AcqKnowledge support the import and export of event markers in The Observer XT data format (see **Event markers** on page 22). This means that you can:
  - import AcqKnowledge markers into an observation in The Observer XT.
  - export the events scored in The Observer XT to an AcqKnowledge data file.

SYSTEMS USED

The Observer XT

Processing unit: Dell Precision T5810.

Processor: E5-1620 v3 (Xeon 3.50 GHz 4-core).

RAM Memory: 8 GB.

Operating system: Windows 10 Professional Edition.

Software: The Observer XT 14.1, N-Linx Server 1.0.

NOTE The N-Linx Server can also be installed on a third computer connected to The Observer PC and the BIOPAC PC.

BIOPAC MP160 and AcqKnowledge software

Processing unit: Dell Precision T5810.

Processor: E5-1620 v3 (Xeon 3.50 GHz 4-core).

RAM Memory: 8 GB.

Operating system: Windows 10 Professional Edition.

Software: AcqKnowledge 5.0.2032 with Network Data Transfer Module, N-Linx Agent 1.1.1.0.

Notes

- When you install the N-Linx Agent on the AcqKnowledge computer, you also install a second piece of software, called AcqKnowledge Control.
- You can also install N-Linx Server on a third computer, connected to The Observer XT computer and the AcqKnowledge computer through a local network. Use this configuration when you want to use N-Linx Server to communicate with other applications, independent of The Observer XT.

FOR FURTHER INFORMATION AND HELP

Other manuals

- The Observer XT Help.
- Quick Start Guide - The Observer XT.
- Reference Manual - The N-Linx.
- The BIOPAC MP hardware and AcqKnowledge software manuals.
- Manuals and user guides on www.biopac.com

Customer Support

For technical support, please contact the The Noldus Customer Support Center: https://www.noldus.com/support-center.

Browse the customer support database with questions asked by The Observer XT users and answers from the support department.

2 Automatic synchronization

OVERVIEW

After the software is properly installed and configured (page 9), Automatic synchronization of observational and physiological data is obtained with the following basic steps (see the figure below):

1. Set The Observer XT and AcqKnowledge for *DAQ co-acquisition*.

   On the AcqKnowledge computer, install the N-Linx Agent communication software, which ensures the files are correctly transferred between computers (see step 3).

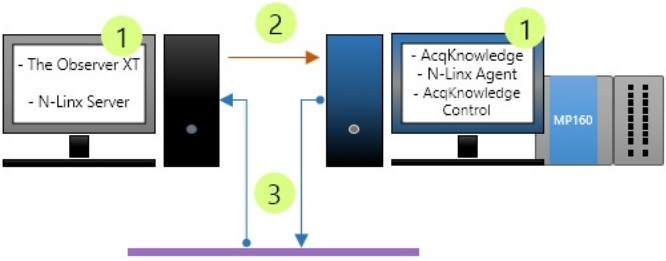
   In AcqKnowledge, define the channels for data acquisition and one channel for the synchronization signal. In The Observer XT, specify which synchronization signal you want to use (On-Off or Time Code (TCAP)) and the sample rate of the BIOPAC system.

   See **Software setup** on page 9.

   NOTE Connect the Observer XT computer and the BIOPAC system. with a **synchronization cable** (see page 7 for details).

2. Carry out a *Live Observation* while The Observer XT sends out the synchronization signal to the BIOPAC system. Simultaneously, the BIOPAC AcqKnowledge software acquires data through its modules (e.g., PPG, ECG, GSR).

   See **Data acquisition** on page 17.



3. When you stop the observation in The Observer XT, the AcqKnowledge data files (containing both the physiological data and the time information from the synchronization signal) are imported automatically into The Observer XT through the local network. The observational and physiological data are automatically synchronized.

Notes

- If you do not have N-Linx installed on the AcqKnowledge computer, you must export the AcqKnowledge data file to an ASCII export file. Make sure to also include header information in this export file. See page 20.
- Optionally, in The Observer XT you can make a data selection, visualize your data, carry out further data analysis and export the synchronized observational and physiological data. For details, see The Observer XT Help.

SYNCHRONIZATION CABLE

Your Observer XT system comes with a synchronization cable. This has the following connectors:

For The Observer XT computer

A 9-pin serial connector.

Most modern computers do not have a 9-pin COM port; instead, connect this end to a USB-to-serial adapter, then the USB end to the computer.

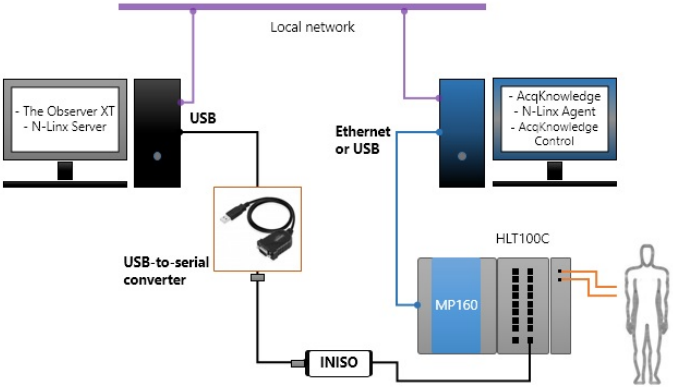
For the BIOPAC MP160 system

A mono mini-jack.

Connect this end to the input of the INSO isolation adapter.

Connect the INISO adapter to analog channel 16 (or any other available channel) on the HLT100C module with the RJ11 cable.

CONNECTION SCHEME



3 Software setup

INSTALL N-LINX SERVER

IMPORTANT Install N-Linx Server on the The Observer XT computer, or on a computer connected to both the AcqKnowledge computer and the The Observer XT computer through a local network.

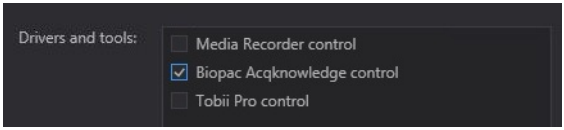
1. Insert The Observer XT installation USB stick in one of the PC's USB ports. Browse to **Drivers and Tools\N-Linx Server**.
2. Double-click **N-Linx Server Setup.exe**.
3. Next to **Installation type** choose **Standard**, unless you want to specify an installation folder other than the default one (C:\Program Files\Noldus\N-Linx Server).
4. Follow the instructions on your screen.

INSTALL AND CONNECT N-LINX AGENT

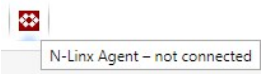
Install N-Linx Agent

IMPORTANT Install this piece of software on the AcqKnowledge computer.

1. Insert The Observer XT installation USB stick in one of the BIOPAC PC's USB ports. Browse to **Drivers and Tools\N-Linx Agent**.
2. Double-click **N-Linx Agent Setup.exe**.
3. Next to **Installation type** choose **Standard**, unless you want to specify an installation folder other than the default one (C:\Program Files\Noldus\N-Linx Agent 1).
4. Select **Biopac AcqKnowledge control**, and click **Next**.



5. Accept the license agreement, click **Install** and follow the instructions on your screen.
6. If the N-Linx Agent window does not open after installation, at the bottom-left corner of the screen, on the system tray, click the arrow icon and double-click the **N-Linx Agent** icon.



7. Next to **N-Linx Server Address**, enter the IP address of the computer where N-Linx Server is installed. This IP address must be *fixed*.

   If The Observer XT and N-Linx Server are installed on the same computer, enter *localhost*.

   TIP You can also enter the **Computer name** instead of the IP address. To find the **Computer name** of the computer where N-Linx Server is installed, on that computer open the Control Panel and choose **System**. Locate **Computer name**.
8. Click **Connect**. If connection is established, the message at the bottom of the N-Linx window says **Connected**.

Note

When properly connected, N-Linx Agent shows the following icon:

SET ACQKNOWLEDGE FOR DAQ CO-ACQUISITION

Aim

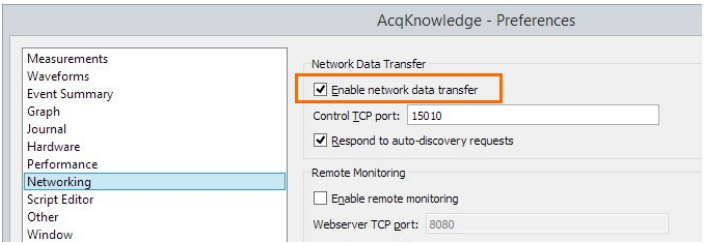
- To allow The Observer XT to gain access to AcqKnowledge. This is done in Networking Preferences in AcqKnowledge.
- To specify the sample rate, the recording channels, and the triggering event (optional) in AcqKnowledge.

Prerequisites

- AcqKnowledge is running, the experiment is open and the MP160 system is powered up.
- AcqKnowledge must have the licensed Network Data Transfer (NDT) module. If that is not the case, automatic import of AcqKnowledge data into The Observer XT will not work.

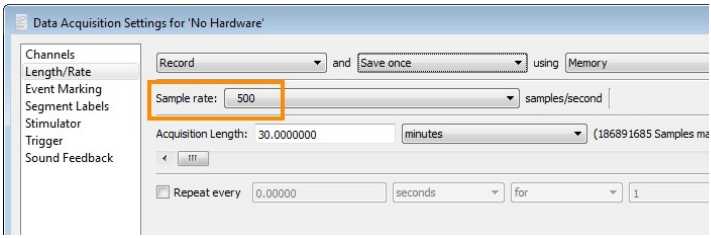
Networking Preferences

1. In AcqKnowledge, choose **Display** > **Preferences**.
2. Click **Networking** and select **Enable network data transfer**.
3. Next to **Control TCP port**, leave the number as it is. Next, click **OK**.



Set the sample rate

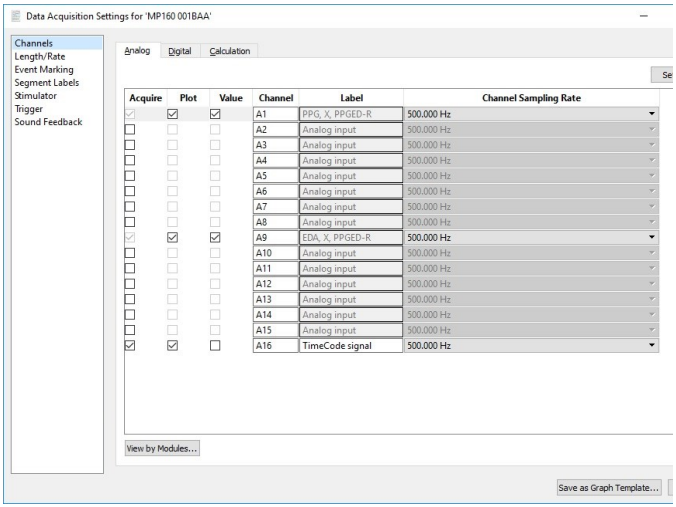
1. Choose **MP160** > **Set Up Data Acquisition**.
2. In the Data Acquisition Settings window, select the **Length/Rate** tab.
3. Choose the **Sample Rate**.



Define the Channels for data acquisition

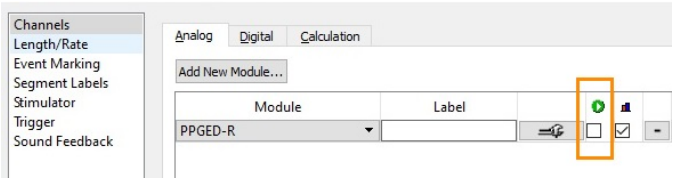
1. Click the **Channels** tab.

2. Select the channels you want to use.



TIP Set up channels automatically by using the **Add New Module** button to add the modules currently connected to the BIOPAC system. For details, see the AcqKnowledge documentation.

3. Click the **View by Modules** button. For each module, de-select the option below the green symbol.



IMPORTANT If the calibration option is selected, The Observer XT won't be able to start recording using N-Linx, because AcqKnowledge is set to start calibration automatically every time you start acquisition.

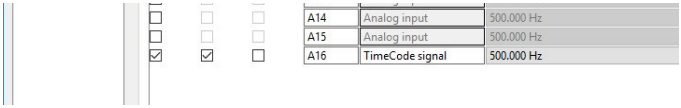
NOTE If you require to perform the auto calibration before acquisition, create a separate graph template with the option selected. Name the

template for example “PPG EDA for Calibration”. Use that template to do calibration and a short test recording. Then, load the graph template with the option de-selected (named for example “PPG EDA for Acquisition”) before starting acquisition from within The Observer XT.

Define the channel for the synchronization signal

1. Click the **Channels** tab.
2. Select the channel to which you connected the synchronization cable.

   Click the **Analog** tab and select the channel to which you connected the synchronization cable.



   OPTIONAL Rename the **Label** for this channel to a logical name (for example, *Sync signal* or *Time code signal*).

3. For this channel and all channels defined for data acquisition, select the **Acquire** and **Plot** check box.

SET THE OBSERVER XT FOR DAQ CO-ACQUISITION

Connect The Observer XT to N-Linx Server

Follow this procedure just once. The settings are also valid for any new The Observer XT project that you create.

1. In The Observer XT, choose **File** > **Preferences**.
2. Click **N-Linx Settings** on the left.
3. Select **Use N-Linx Server to connect with other applications**.
4. Next to **N-Linx Server address**, enter the IP address of the computer with N-Linx Server. Leave the default entry **localhost** if The Observer XT and N-Linx Server are installed on the same computer.

TIP You can also enter the **Computer name** of the computer where N-Linx Server is installed, instead of its IP address. On the computer where N-Linx Server is installed, open the Control Panel and choose **System**. Locate **Computer name** (not Full Computer name).

5. Make sure the **N-Linx Server port** is **5672**.

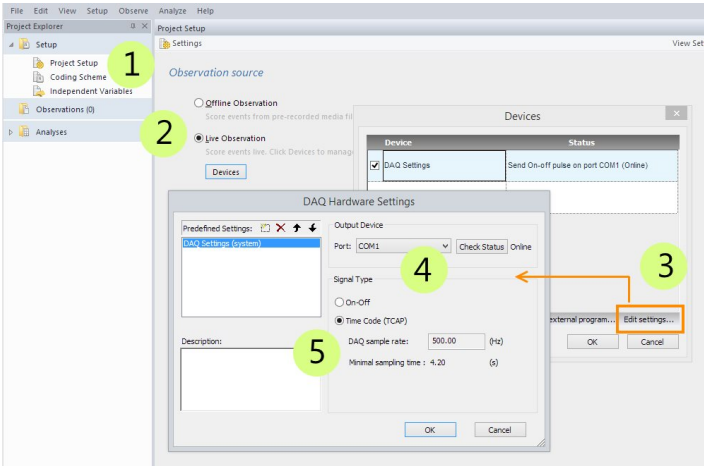
   Ask your system administrator for assistance if this port is used by another program.

6. Click **Test connection**, and check that the message appears **Connected**.

If connection fails, it means that N-Linx Server is not installed properly. Reinstall N-Linx Server (page 9), or check that the Windows Firewall is not blocking traffic through port 5672 (page 28).

Project Setup

Follow these steps for each new The Observer XT project you create to work together with the BIOPAC acquisition system.



1. Open the project and choose **Setup** > **Project Setup**.
2. Under **Observation Source**, select **Live Observation**.

3. In the Devices window, select **DAQ Settings** and click the **Edit settings** button at the bottom-right.

4. In the DAQ Hardware Settings window, select the **COM1** port as the **Output Device**.

   If there is no COM port available on the The Observer XT computer, use a USB-to-COM converter. The COM port number is randomly assigned by the USB-2-serial converter driver, so make sure to select the active COM port, that is, the one that is **Online**. For more information, see the documentation of the USB-to-COM device to see which COM port the device uses.

5. Under **Signal Type**, select **Time Code (TCAP)**, and next to **DAQ sample rate**, enter the same value as the acquisition sample rate specified in AcqKnowledge.

   NOTE There may be other programs that use COM ports. In that case one or more COM ports in the list are not available. De-install those programs if necessary to free a COM port that can be used by The Observer XT.

6. In the Devices window, check that **Biopac AcqKnowledge** is selected.

   If you do not see this item, it is likely that N-Linx Agent is not installed, or **Biopac AcqKnowledge Control** was not selected when you installed N-Linx Agent. See page 9.

7. **OPTIONAL** If more persons are being observed during a single test session, and the BIOPAC system collects data of one of those persons, not the others, it is a good idea to label the data with the subject name. In the Devices window, double-click the item **Biopac AcqKnowledge Control** and next to **Identify device as** enter the role of that subject. When imported to The Observer XT, the physiological data sets will be marked with the subject's role.

8. Click **OK**.

Note

- Also use the option **Identify device as** to specify the subject' role in case you connect multiple BIOPAC systems. Always give unique

names. The physiological data streams will be imported with those names.

- You can also specify a template for recording physiological data directly in The Observer XT. In the Devices window, double-click the item **Biopac AcqKnowledge Control** and under **Identify device as** select the template you want to use. Make sure that the template corresponds to the channels currently connected to the MP 160 system.

4 Data acquisition

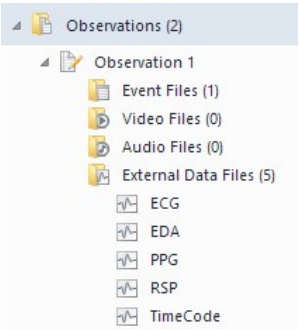
CARRY OUT DATA ACQUISITION

To carry out data acquisition:

1. In The Observer XT, create a new observation (**Alt+F6**).
2. To start data acquisition, click the **Start Observation** button.

3. To stop data acquisition, click the **Stop Observation** button.

4. At the end of acquisition, the physiological data sets are imported automatically. Check that the data sets are listed in the Project Explorer, under **External Data Files** for the current observation.



NOTES

AcqKnowledge

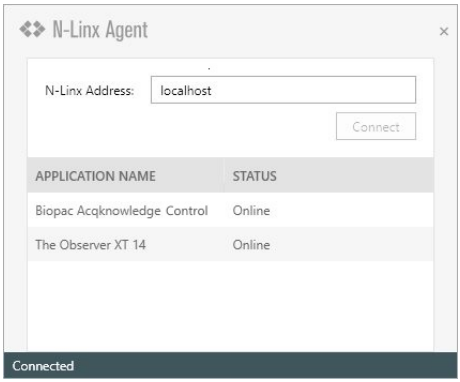
In the AcqKnowledge program, you can visualize your channels during acquisition. This is handy when you want to check whether the synchronization signal is actually received by the BIOPAC system. Select

the **Plot** check box in the **Channels** tab of the **Data Acquisition Settings** window (See the figure on page 13).

N-Linx Agent window

On the AcqKnowledge computer, you can check the status of N-Linx Agent. Click the arrow icon on the system tray, then double-click the **N-Linx Agent** icon.

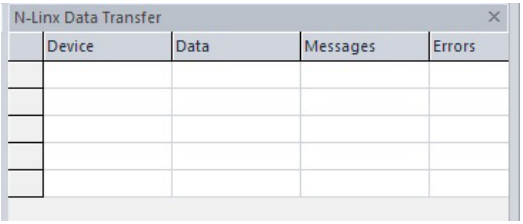
The N-Linx Agent window shows the status of **Biopac AcqKnowledge Control** and **The Observer XT**.



- **The Observer XT** is visible and **Online** when the program is open.
- **Biopac AcqKnowledge Control** is **Offline** when it is installed, but not active. This is the case immediately after installation of N-Linx Agent and after the computer is restarted.
- After creating an observation in The Observer XT, the status of **Biopac AcqKnowledge Control** becomes **Online**.
- **Online** means that Biopac AcqKnowledge Control is started and therefore available for communication. Once Biopac AcqKnowledge Control is started, it remains running until the PC is shut down.

The Observer XT computer

- When setting communication between The Observer XT and AcqKnowledge, use the option **Identify device as** (page 15) to label the subject's role in case you collect data of multiple subjects, also when using two or more BIOPAC systems. This way the physiological data streams will get unique names.
- In the observation screen of The Observer XT, the N-Linx Data Transfer window shows feedback information about the ongoing acquisition. Each row in the table represents one channel. The **Data** column shows the channel name. The **Messages** column shows the number of samples recorded up to that time.



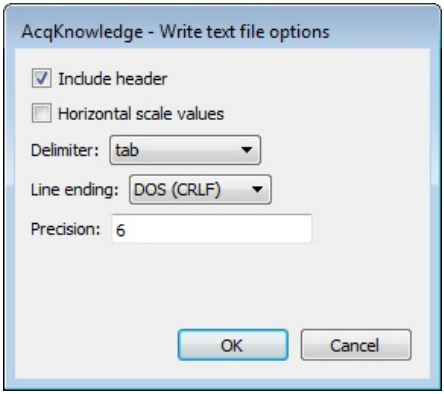
- For more details about carrying out an observation, see **Carry Out an Observation** in The Observer XT Help.

MANUAL IMPORT PROCEDURES

IMPORTANT Follow the procedures below only if you do not have the N-Linx Agent software installed on the BIOPAC computer, or if automatic data import fails. In that case you must export the data files from AcqKnowledge and import them to The Observer XT.

Export the AcqKnowledge data file

1. In AcqKnowledge, choose **File** > **Save As**.
2. In the **Save Graph As** window, from the **Save as type** list, select **Text (*.txt, *.csv)**.
3. Click **Save**.
4. In the **Write text file options** window, select **Include Header**.



5. Click **OK**.

NOTE If you do not use a synchronization signal, you can also export the Acknowledge data as EDF files.

Import the AcqKnowledge data file into The Observer XT

1. In The Observer XT, open your project, and choose **File** > **Import** > **External Data**.

   NOTE To import EDF files, choose **File** > **Import** > **European Data Format Files** and select the file.

2. In the Import External Data window, under **Files of type** select the predefined **BIOPAC AcqKnowledge 5.0 (*.txt)** import filter.

3. Select the AcqKnowledge export file and click **Open**. The observational and physiological data are synchronized.

For more information on importing external data into The Observer XT, see **External Data** in The Observer XT Help.

Check the synchronization signal

Before importing the data file, you can check whether the sync data set is actually considered as the synchronization signal.

1. In the Import External Data window, click the **Manual Import** button instead of **Open**.

2. In the next Import External Data window, the synchronization signal is indicated with a clock icon.

   The data streams are indicated with a graph icon.

3. Select the data sets that you want to import and drag-and-drop them on the corresponding observation in the **Independent Variable List** (which might be partly hidden by the Import External Data window).

4. Click the **Import** button in the **Import External Data** window.

5 Event markers

EXPORT THE ACQKNOWLEDGE MARKERS

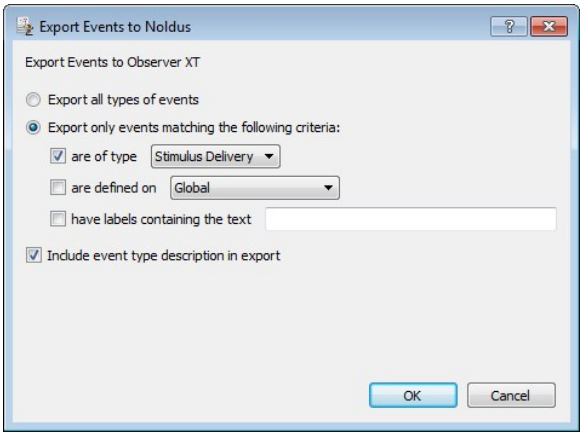
In AcqKnowledge 4.3-4.4 and 5.0 you can export markers to The Observer XT. For example, you may want to export the stimulus delivery markers scored in AcqKnowledge and combine them with events scored manually in The Observer XT.

NOTE Export of events can only be done offline.

In AcqKnowledge

1. Choose **Analysis** > **Noldus** > **Export Events to Observer XT**.
2. Choose to export all marker events, or those of a specific type. For example, **Stimulus Delivery**.

   Keep the option **Include event type description in export** selected.



3. Click **OK**.

In The Observer XT

1. Create an import profile using this export file.

In the **Import Profile Definition** window, under **Data Sets**:

- Drag the column **A** to the **Time** column in the **Data Definition** table.
- If you exported the event type description (for example **Stimulus Delivery**), drag the column **B** to **Subject** in the **Data Definition** table.
- Drag the column for **Label** to **Behavior** in the **Data Definition** table.

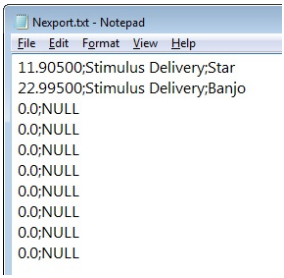
2. Save the import profile with a new name.
3. Open the observation you require. Choose **File** > **Import** > **Observational Data**, and select the import profile just created. Select the file to import, and whether the events to import are points or states (see below).
4. In the event log, when necessary, delete the event lines marked with NULL in the **Subject** column.

TIP Watch the video tutorial

https://www.biopac.com/video/?video_category=data-integration&v=noldus-observer-xt-importexport-in-acqknowledge.

Notes

- The AcqKnowledge export file is a text file with a column for timestamps, a column for the event type description (for example "Stimulus Delivery"), and a column for the event **Label**.



If the number of markers in the file is lower than 10, additional lines marked with **NULL** are added automatically. This because The Observer XT requires at least 10 lines of data.

- It is in principle possible to import AcqKnowledge markers as Observer *state events*. In that case the Observer state event will be defined by two consecutive AcqKnowledge events. The first event is the start and the second is the stop of the state. When you define your import profile, drag the column of the event type description to **Behavior**, and Label to **Event Type**. In the **Define Event Keywords** window, enter the label of the AcqKnowledge events that mark the start and the stop of the state, respectively.

EXPORT THE OBSERVER XT DATA TO ACQKNOWLEDGE

NOTE Export of The Observer XT data can only be done offline.

In The Observer XT

1. In The Observer XT, choose **File** > **Export** > **Observational Data**.
2. Choose **Other software**, then select the observation you require.
3. Under **Export options**, select **Tab** as **Column delimiter**.
4. In the next window, choose a destination folder and click **Export**.

In AcqKnowledge

1. Choose **Analysis** > **Noldus** > **Import Markers from Observer XT**.
2. In the **Open Observer XT Export File** window, select the file and click **Open**.
3. The events are imported as markers.

   If the event log includes *state events*, these are imported as start and stop events (event type: **Selections**). State starts are represented with "Selection Begins", state stops with "Selection Ends".

Notes

- The time stamp in AcqKnowledge is the relative time in the Observer event log.

- To display the events, in AcqKnowledge from the **Display** menu select **Show**, then **Events**.

TIP Watch the video tutorial

https://www.biopac.com/video/?video_category=data-integration&v=noldus-observer-xt-importexport-in-acqknowledge.

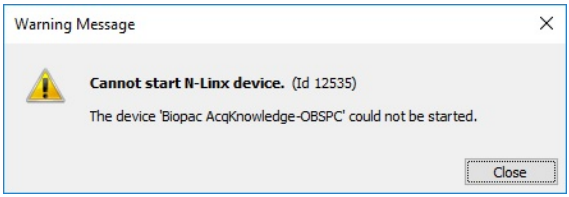
6 Additional information

TROUBLESHOOTING

Communication between The Observer XT and AcqKnowledge does not function properly

- Review all procedures in **Software setup** on page 9 and make sure that the settings are correct.
- On the computer with AcqKnowledge, check that the status of the N-Linx Agent is **Connected**. To do so, on the AcqKnowledge computer, double-click the **N-Linx Agent** icon on the taskbar.
- On all computers, check that an exception is made in Windows Firewall for all inbound and outbound traffic through port 5672 (page 28).

Error message: Cannot start N-Linx device



This error may occur when auto-calibration is selected for one or more modules.

Choose **MP160** > **Set Up Data Acquisition**. Click the **Channels** tab and for each module make sure that the auto-calibration option is *not* selected (see page 12).

AcqKnowledge seems not to receive the synchronization signal from The Observer XT

This may be due to number of reasons:

- The channel number you define in the software does not match the channel to which the synchronization cable is connected.
- You may have not selected the correct COM port in the **DAQ Hardware Settings** in The Observer XT. If you run The Observer XT on a PC, it usually is COM1, but if you use a USB2COM converter (which is often necessary on modern computers without a COM port), you should select another COM port number.

I do not see the clock icon in the Import External Data window

It is most likely that one of the following settings in the **DAQ Hardware Settings** were incorrect:

- The sample rate you entered in the **DAQ Hardware Settings** window in The Observer XT does not correspond to the acquisition sample rate in the AcqKnowledge program.
- Your observation duration was shorter than the **Minimal sampling time** required, indicated in the **DAQ Hardware Settings** window in The Observer XT.

Automatic Import of AcqKnowledge data into The Observer XT fails

In AcqKnowledge, choose **Display** > **Preferences** and locate the **Networking** tab. If that tab is not available, it means that the necessary Network Data Transfer (NDT) functionality is not enabled. Contact Noldus for information.

Import of Observer XT events to AcqKnowledge 4.3 fails

If you have AcqKnowledge 4.3, import of Observer events does not work properly because AcqKnowledge expects data separated by quotes instead of tabs. You have two options:

- Upgrade to AcqKnowledge 5.
- In The Observer XT, export data to Excel, then save this file to a tab-delimited text file. Next, import this file to AcqKnowledge.

FIREWALL SETTINGS

Aim

When N-Linx Agent is installed, it enables the necessary communication ports. Follow this section in case communication is for some reason blocked by Windows Firewall.

Prerequisites

- The Observer XT and N-Linx Server run on different computers. If not, skip this section.
- The computers must be in the same network.

NOTE Acknowledge and The Observer XT could run on the same computer and N-Linx Server on another one. In which case they should still open port 5672 in Firewall. In that case, follow the procedure below for both computers.

Procedure

IMPORTANT Do the following in all computers: AcqKnowledge computer, The Observer XT computer, and the computer where N-Linx Server is installed (if different from the others).

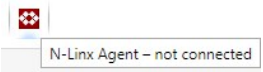
1. Open the Windows Control Panel and choose **Windows Firewall**.
2. On the left side of the window, click **Advanced Settings**.
3. In the pane on the left, click **Inbound Rules** and then in the Actions pane on the right click **New Rule**.
4. In the window that opens, select **Port** and click **Next**.
5. Select **TCP** and **Specific local ports**. Next to that option enter **5672**, then click **Next**.
6. Select **Allow the connection** and click **Next**.
7. Select to which network the rule applies and click **Next**.
8. Give the rule a name, for example *N-Linx connection* and click **Finish**.
9. Check in the Inbound Rules list that this rule is set to **Enabled**.

10. Click **Outbound Rules** and click **New Rule** in the Actions pane. Repeat steps **4** to **9** for the outbound rule.

11. Close all Control panel windows.

CHECK CONNECTION IN N-LINX AGENT

1. At the bottom-right corner of the screen, on the system tray, click the arrow icon and double-click the **N-Linx Agent** icon.



2. Next to **N-Linx address**, enter the IP address of the computer where N-Linx Server is installed. This IP address must be *fixed*.

   If The Observer XT and N-Linx Server run on the same computer, enter *localhost*.

   TIP You can also enter the **Computer name** of the computer where N-Linx Server is installed, instead of its IP address. On the computer where N-Linx Server is installed, open the Control Panel and choose **System**. Locate **Computer name** (not Full Computer name).

3. Click **Connect**. If connection is established, the message at the bottom of the N-Linx Agent window says **Connected**.

1. Click the **Close** button to close the N-Linx Agent window.