Technical Note

MindWare and The Observer XT

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1 Introduction

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 MindWare system using the BioLab 3.1 software and the analysis modules.

SYSTEMS USED

The Observer XT

Processing unit: Dell Precision T5810.

Processor: Intel Xeon E5-1620 v3, at 3.50 GHz.

RAM Memory: 8 GB.

Operating system: Windows 10 64 bit.

Software: The Observer XT 14.1.

MindWare BioNex system

Processing unit: Dell Precision T5810.

Processor: Intel Xeon E5-1620 v3, at 3.50 GHz.

RAM Memory: 8 GB.

Operating system: Windows 10 64 bit.

Software: BioLab 3.3, EDA Analysis 3.1.5, HRV Analysis 3.1.5.

FOR FURTHER INFORMATION

- The Observer XT Help (press **F1** in The Observer XT).
- Quick Start Guide - The Observer XT.

On your The Observer XT installation CD

- All documents and technical notes.

***On the Noldus web site* www.noldus.com**

- The Noldus Customer Support Database: www.noldus.com/support-center.

The MindWare documentation

- The user manuals of MindWare products for more information about how to acquire data.
- The MindWare web site http://www.mindwaretech.com.

2 Automatic synchronization

OVERVIEW

Automatic synchronization of observational and physiological data involves a few basic steps:

1. Connect the Observer XT computer and the MindWare system using the special synchronization cable provided by MindWare. This must be done if you want to have the data of the two systems automatically synchronized.

   See **CABLE CONNECTIONS** on page 7.

2. Set The Observer XT for **DAQ co-acquisition**; here you specify which synchronization signal you want to use (On-Off or Time Code (TCAP)) and the sample rate used on the MindWare system.

   See **SET THE OBSERVER XT FOR DAQ CO-ACQUISITION** on page 8.

3. Set up the MindWare system. Set the sample rate and set up channels.

   See **SET UP THE MINDWARE SYSTEM** on page 9.

4. Carry out a live observation while The Observer XT sends out the synchronization signal to the MindWare system. Simultaneously, the MindWare BioLab software acquires data (e.g., ECG, GSR).

   See **CARRY OUT DATA ACQUISITION** on page 11.

5. Export the MindWare data file (native format: *.mw) to a text file. Choose the procedure depending on the type of data.

   See **Export data from MindWare** on page 12.

6. Import the MindWare text file (containing both the physiological data and the time information from the synchronization signal) into The Observer XT. At this point, the observational and physiological data are automatically synchronized.

   See **Import files into The Observer XT** on page 19.

Note

Optionally, you can next make a data selection, visualize your data, carry out quantitative analysis and export the synchronized observational and physiological data. For details, see The Observer XT Help.

CABLE CONNECTIONS

Before you make settings in The Observer XT with regard to DAQ co-acquisition, connect the Observer XT computer to the MindWare acquisition system using the synchronization cable.

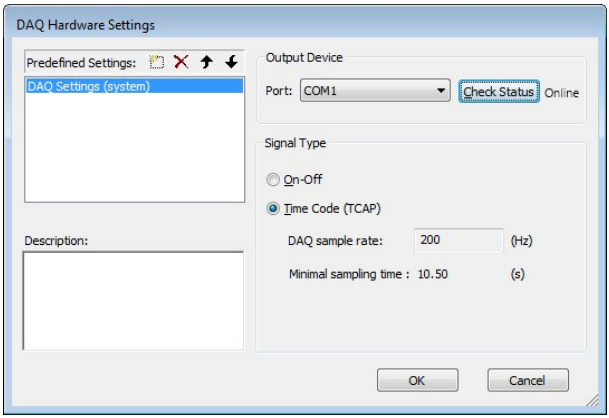
1. Plug connector **1** (see the figure below) into the 9-pin COM port of The Observer XT PC. If your computer does not have a physical COM port, use a a USB-to-COM converter.
2. On the BioNex chassis, connect the synchronization cable to **Transducer Channel 1** on the front using connector **3** and 'Trigger In' on the back of the chassis using connector **2** in the figure below.

3 Software setup

SET THE OBSERVER XT FOR DAQ CO-ACQUISITION

Procedure

1. Choose **Setup** > **Project Setup**.
2. In the **Project Setup** screen, 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 you use a USB-to-COM converter (for example, when there is no COM port available on the The Observer XT computer), you might need to select a different COM port. Please check the documentation of the USB-to-COM device to see which COM port the device uses.
   - Select **Time Code (TCAP)** under **Signal Type**.
   - Set the same **DAQ sample rate** as the Sample Rate in the MindWare BioLab program (see Figure).

5. Click **OK** twice.

SET UP THE MINDWARE SYSTEM

Aim

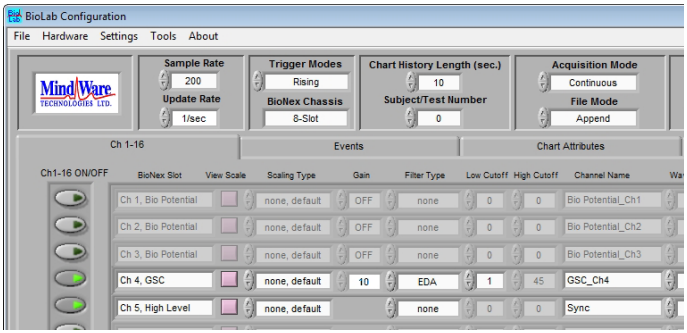
To set data acquisition to start automatically when you start an observation in The Observer XT.

Procedure

1. Connect your subject to the corresponding channels on the BioNex chassis depending on the type of signal you want to acquire. See the MindWare documentation for details.

2. Start the BioLab program on the MindWare computer.

   In the example below, a **Sample Rate** of 200 is used, **Triggering** is set to **Rising** and two channels are defined: channel **4** for skin conductance and channel **5** for the synchronization signal.



3. Turn on the Channels you want to acquire. Under **Filter Type** select the filter that will be used on the channel while acquiring data. Here are some examples:

   ECG. This is Channel 1 of the 3-Channel Bio-Amp and GSC module. Use a **Gain** of 500 or 1000.

EDA. This is Channel 4 of the 3-Channel Bio-Amp and GSC module. Use a **Gain** of 50 or lower.

Synchronization signal. This is Channel 5 which corresponds to Channel 1 on the 4-Channel pass-thru module. You do not need to set a filter for this channel.

Respiration. This is one of the Channels of the 4-Channel transducer module. Use a **Gain** of 100.

Skin temperature. This is one of the Channels of the 4-Channel transducer module. Set the **Filter Type** to **Low Pass** and the **Low Cutoff** to **1**. Use a **Gain** of **50**.

4. Under **Channel Name**, type in the name for each channel.
5. Set the **Sample Rate** at the top left, for the physiological signals you want to acquire.
6. Set the **Trigger Modes** to **Rising** so the MindWare system is started automatically with the first pulse of the synchronization signal at the start of an observation in The Observer XT.

   IMPORTANT Make sure the synchronization cable which connects The Observer XT computer and the MindWare system is connected both to the Trigger In and the Transducer Channel **1** on the BioNex chassis.

Note

It is not possible to automatically stop the MindWare program with The Observer XT. You must manually stop acquisition of physiological data by clicking the **Start/Stop (Enter)** button in the **BioLab Acquisition** window.

4 Data acquisition

CARRY OUT DATA ACQUISITION

In BioLab

1. Click the green **Acquire** button at the bottom of the window.
2. Type in a file name, select a folder and click **OK**.

In The Observer XT

3. Create a new observation (**Alt+F6**) and then click the **Start Observation** button.

4. The BioLab program is triggered and acquisition starts automatically.
5. Score events in The Observer XT if required.
6. Stop the observation.

In BioLab

7. Stop acquisition.

For more information

See **Carry out an Observation** and **External Data** in The Observer XT Help.

5 Export data from MindWare

EXPORT OPTIONS

There are three options for exporting MindWare data from the BioLab software:

- You can convert the raw physiological signal to text format and import this raw data into The Observer XT. For this, you use BioLab 3.3.

  See **EXPORT THE MINDWARE RAW DATA** below.

- You can carry out pre-analysis of physiological data in one of the MindWare analysis modules, convert the analysis result to text and import these results into The Observer XT. Below is described how to process EDA and heart rate data.

  See **EXPORT THE MINDWARE EDA DATA** on page 13 and **EXPORT THE MINDWARE HEART RATE DATA** on page 16.

- If you do not use a synchronization signal, you can also export the BioLab data as EDF file. You can synchronize the Observer and MindWare data after import in The Observer XT, using the manual procedure.

  For details, see **External Data** in The Observer XT Help.

Note

Importing the BioLab data with a synchronization signal as EDF data into The Observer XT was not tested. Therefore, we cannot guarantee that automatic synchronization works correctly.

EXPORT THE MINDWARE RAW DATA

Aim

To export raw data to a file that can be imported as *external data* in The Observer XT. Each data line in the file is a sample.

Procedure

1. In BioLab, choose **File** > **Open File**. Select the MindWare data file (*.mw) and click **OK**.
2. Select the channels you want to export.

IMPORTANT Make sure to include the channel with the synchronization signal!

3. Click the **View** button at the bottom of the window.
4. Click the **Save All Text** button. Select where to save the file, type in a file name and click **OK**.

5. Proceed with importing the MindWare export file into The Observer XT (see page 19).

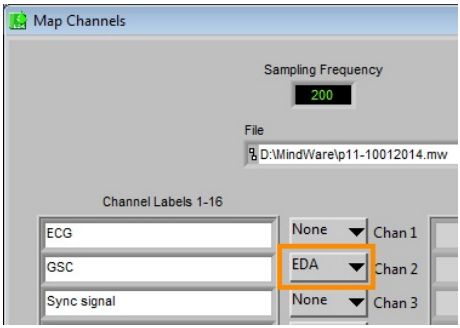
EXPORT THE MINDWARE EDA DATA

Aim

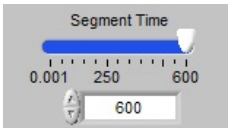
With the MindWare EDA Analysis application, you can calculate the number of significant peaks in the ElectroDermal Activity (or skin conductance) signal. These peaks can be exported as events and imported as *observational data* in The Observer XT.

Procedure

1. Start EDA Analysis. You need the MindWare dongle to do this. Select a MindWare file with EDA data (*.mw) and click **OK**.
2. In the window that appears, from the list next to the EDA/GSR Channel, select **EDA**, then click **OK**.



3. In the **EDA Setup** window, in the **Events and Modes** tab, drag the **Segment Time** slider all the way to the right to analyze the complete file.

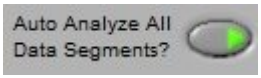


4. In the **EDA Calibration Settings** tab, set the value for **uS Thresh** to **0.01**.

5. Click the **Additional Settings** tab. Under **Output Settings**, select where to save the export file.

   By default, the file is written to a subfolder of the current folder: ...**\output data\[current date]**. De-select **Use Default Output Path Yes/No** to specify another location.

6. Make sure to turn on the **Auto Analyze All Data Segments** button.



7. Click the **Analyze** button or press **Enter**.

   The EDA Analysis window displays the following Skin Conductance Response (SCR) Stats:

SCR Type. This specifies whether a SCR is non-specific (NS) or event-related (ER, in case you have scored events in the BioLab program during acquisition).

Event Time. If a SCR is event-related, this field shows the time of the related event.

Event Type. If the SCR is event-related, this field specifies the type of the related event.

Trough Time. This specifies the time of the trough associated with each SCR.

Peak Time. This specifies the time of the peak associated with each SCR.

HR Time. This specifies the half-recovery time associated with each SCR.

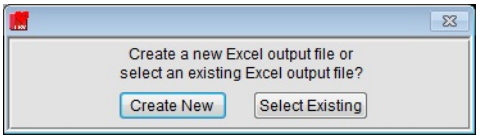
Trough SCL. This specifies the amplitude of the trough associated with each SCR.

Peak SCL. This specifies the amplitude of the peak associated with each SCR.

SCR. This specifies the total SCR associated with each SCR as derived from: (Peak SCL) – (Trough SCL).

8. Click the **Write** button in the **Controls** window.

Next, click **Create New**.



9. Click **Done** to save the file.

10. The Excel file opens on the background. Click the **SCR Stats** tab.
11. Choose **File** > **Save As**. Save this sheet to **Text (tab-delimited)**.Close the Excel file.
12. Copy the text file to the The Observer XT computer.
13. Proceed with importing this file into The Observer XT (see page 20).

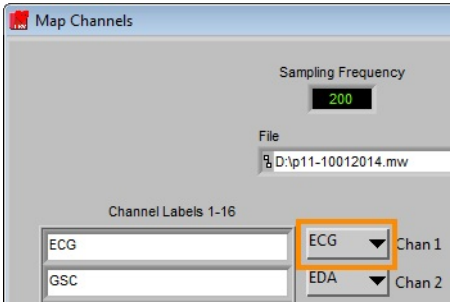
EXPORT THE MINDWARE HEART RATE DATA

Aim

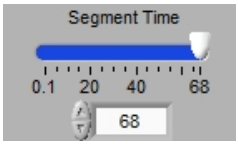
With the MindWare HRV Analysis application, you can use the ElectroCardioGraph (ECG or EKG) signal to calculate the Heart Rate (in beats per minute) and also the Heart Rate Variability. This data can be imported as *external data* in The Observer XT.

Procedure

1. Open HRV Analysis. You need a MindWare dongle to do this. Select a MindWare file (*.mw) with ECG data and click **OK**.
2. In the **Map MindWare Channels to Channel Type** window, from the list next to the ECG Channel, select **ECG** and click **OK**.



3. Click the **Events and Modes** tab. Drag the **Segment Time** all the way to the right to analyze the complete file.

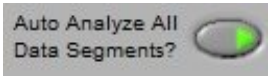


4. Click the **HRV Calibration Settings** tab. Set the **Calculation Method** to **Interval**, and the **Interval Period** to **1.00 second**. This calculates the Heart Rate in 1-sec intervals from the ECG signal.

5. Click the **Additional Settings** tab. Under **Output Settings**, select where to save the export file.

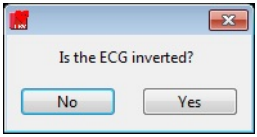
   By default, the file is written to a subfolder of the current folder: **...\output data\[current date]**. De-select **Use Default Output Path Yes/No** to specify another location.

6. Make sure to turn on the **Auto Analyze All Data Segments** button.

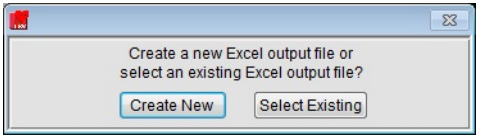


7. Click the **Analyze (ENTER)** button.

8. Click **No** when asked whether the ECG is inverted.



9. In the window that opens, select **Create New**.



10. In the **HRV analysis** window, the **HRV Stats** table, shows the **Mean HR** (Heart Rate) and **Mean IBI** (Inter-Beat Interval) for each 1-sec interval you set in step **4**.
11. The Excel sheet opens on the background.
12. Click the **Write** button in the **Control** window, then click **Done** to save the file.
13. In the Excel file, click the **Interval Stats** tab. This is the last tab in the workbook.
14. Choose **File** > **Save As**. Save this sheet to **Text (tab-delimited)**. Close the Excel file.
15. Copy the export file to the The Observer XT computer.
16. Proceed with importing the text file as *external data* into the corresponding observation in The Observer XT (see page 22).

6 Import files into The Observer XT

IMPORT THE BIOLAB TEXT FILE INTO THE OBSERVER XT

In this section you find the instructions:

- To import the raw MindWare data as *external* data (see below).

  For the export procedure, see **EXPORT THE MINDWARE RAW DATA** on page 12.

- To import the pre-analyzed data:
  - GSR peaks (see page 20)
  - Heart rate data (see page 22).

  For the export procedure, see **EXPORT THE MINDWARE EDA DATA** on page 13 and **EXPORT THE MINDWARE HEART RATE DATA** on page 16.

IMPORT THE RAW MINDWARE DATA

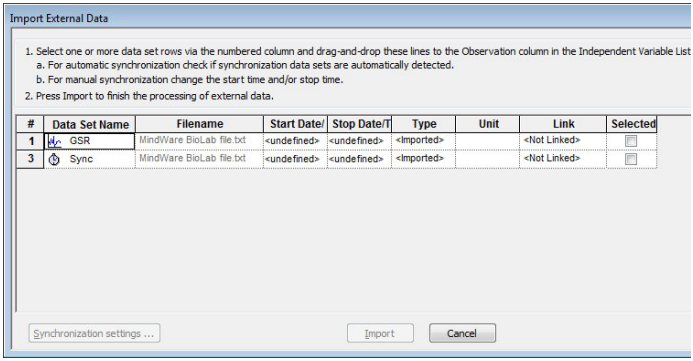
Aim

To import the raw data exported from BioLab (page 13).

Procedure

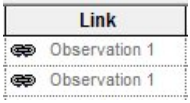
1. Start The Observer XT and open the project in which you want to import the MindWare physiological data. If you created EDF (*.edf) files, choose **File** > **Import** > **European Data Format Files** and select the file. Skip the rest of this paragraph. If you created text files, follow the procedure below.
2. Choose **File** > **Import** > **External Data**.
3. In the **Import External Data** window, select the **MindWare BioLab 3.3 (*.txt)** pre-defined import profile from the **Files of type** list.
4. Select the MindWare export text file and click the **Manual import** button.

The window that opens shows all Channels / Data Sets that have been acquired, including the synchronization signal. The example below shows two Data Sets, skin conductance (**GSR**) and the synchronization signal (**Sync**).



5. Select all the data set names you want to import (press **Ctrl** to select multiple rows).
6. Drag the rows to the observation they belong to, in the **Independent Variables** window (this is open in the background).
7. Finish the import by clicking the **Import** button.

   The **Link** column in the **Import External Data** window shows the name of the observation linked with that data set.



IMPORT THE MINDWARE PRE-ANALYZED GSR PEAK DATA

Aim

To import the GSR peak data exported from EDA Analysis Application (page 13).

Procedure

1. In The Observer XT, open the observation in which you want to import the MindWare pre-analyzed data.
2. Click the **Import Data** button, then choose **Import observational data**.

3. From the **Files of type** list, select the pre-defined import profile **MindWare GSR peaks (*.txt)**, select the MindWare export file and click **Open**.
4. When asked, click **Yes, import new coding scheme elements**.

Notes

- In the MindWare GSR Peaks import profile, the values for **Peak SCL** and **SCR** are imported as numerical modifiers in two groups, **New numeric Modifier (1)** (for Peak SCL) and **New numeric Modifier (2)** (for SCR). In the coding scheme, you can rename them to, for example, Peak SCL and SCR, respectively.
- In the coding scheme, behaviors are added that represent the column **SCR type** in the MindWare EDA Analysis export data file. A behavior is scored in the event log, at each sample time, together with the modifiers **Peak SCL** and **SCR**.
- The time stamps imported are from the column **Trough time** of the MindWare EDA analysis export data file.

IMPORT THE MINDWARE PRE-ANALYZED HEART RATE DATA

Aim

To import the heart rate data exported from HRV Analysis (page 16).

Procedure

1. In The Observer XT, open the observation in which you want to import the MindWare pre-analyzed data.
2. Choose **File** > **Import** > **External Data**.
3. From the Files of type list, select the pre-defined import profile **MindWare Heart Rate (*.txt)**, select the MindWare export file and click **Open**.

Note

- The import profile **MindWare Heart Rate** makes it possible to import two columns of the HRV export file: **Mean HR** and **Mean IBI**.
- To create a new import profile or edit an existing one, in The Observer XT Help see **External Data** > **Import external data, special cases**.