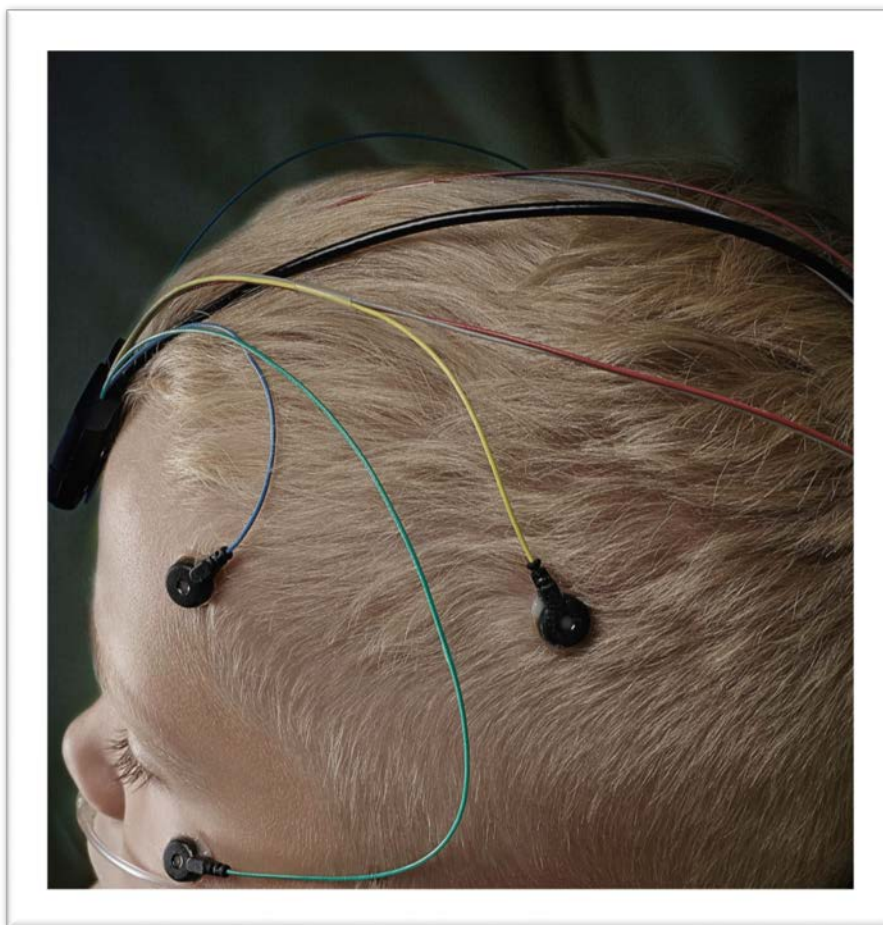


NOXTURNAL



Noxturnal Manual

Version 3.2

Latest Revision: June 2017

Copyright © 2017

Nox Medical - All rights reserved

Manufactured by:

Nox Medical ehf

Katrinartuni 2

IS - 105 Reykjavik

Iceland

Website: www.noxmedical.com

nox medical

For distributor information go to:
www.noxmedical.com



Copyright Notice

No part of this publication may be reproduced, transmitted, transcribed, stored in a retrieval system, or translated into any language or computer language, in any form, or by any means: electronic, mechanical, magnetic, optical, chemical, manual, or otherwise, without the prior written authorization from Nox Medical.

Disclaimer

This document may contain typographical errors or technical inaccuracies. Nox Medical does not accept any liability for the use or misuse whether direct or indirect of the products, or for damages arising out of the use of or inability to use the products. Users must accept all responsibility for any results obtained by or concluded from data obtained by the products including software from Nox Medical. All clinical conclusions and decisions that are based on the use of this product are the responsibility of the user.

Contents

Introduction.....	5
Intended Use.....	5
Contraindications.....	5
Scope	5
Warnings and Cautions for Use	6
Noxturnal Description	7
Noxturnal App Description	7
Supported Devices.....	7
Installing Noxturnal.....	7
Noxturnal System Requirements.....	7
Minimum System Requirements	8
Installation Instructions	8
Standard Operation	9
Connecting a Nox Recording Device to Noxturnal.....	10
Upgrading the Recording Device Firmware.....	10
Starting a New Ambulatory Recording	11
Recording Types.....	14
Device Profiles	18
Downloading an Ambulatory Recording from a Nox Recording Device	22
Setup of the Nox Sleep System for Online Recordings	23
Online System Network Overview	23
Online System Configuration	25
Online Room	25
Configuration of New Sensors	29
Device Profiles for Online Devices	30
Recording Types for Online Devices	30
Starting an Online Recording.....	30
Nox C1 Configuration.....	33

Nox C1 Network Configuration.....	33
Upgrading Nox C1 Access Point firmware	34
Activating Nox DC Channel License	36
Integration of Video Devices for Online Recordings.....	37
Setup an Online Room with a Video Device	37
Video Codecs	37
Video Camera Integration	38
Setup a Recording Type with a Video Device	41
Working with recordings in Noxturnal	44
Recording Results Page.....	44
Result Page Commands	44
Patient Information	45
Sleep Stages.....	45
Sleep Parameters.....	45
Signal Overview and Parameters.....	46
Signals and Events	47
Changing the Analysis Periods	48
Setting Units	49
Viewing Signals	50
Workspace Menu Button.....	50
Signal Sheets.....	51
Working with Signals	52
Keyboard Navigation	53
Working with Events.....	54
Scoring an Event	54
Single Click Scoring	54
Deleting an Event.....	55
Moving an Event	55

Resizing an Event	55
Navigating Events	55
Analysis Protocols	56
Working with Scorings	57
New Scoring	58
Select a Scoring.....	59
Save Scoring.....	59
Clear Scoring	59
Revert Scoring.....	59
Delete Selected Scoring	59
Scoring Keyboard Shortcuts.....	59
Noxturnal Reports.....	59
Generating Reports.....	60
Customizing Reports	61
Report Parts and Report Fields.....	62
Create a New Report Parts	63
Create a New Report Field.....	64
Add Report Parts and Fields to Reports.....	65
Report Header and Footer	65
Exporting Reports	67
Printing Reports	67
The Recording Library	68
Archiving Recordings	68
Single Body Source.....	68
Regulatory Information	70
Description of Symbols and Abbreviations.....	70
About	71

Introduction

Congratulations on choosing the Noxturnal® application software. The Noxturnal software is a modern sleep diagnostics software platform designed for ease of use and operation efficiency. The Noxturnal software is an essential part of the Nox Sleep System. Its main function is to work with physiological signals recorded/received using devices from Nox Medical (see Supported Devices chapter) and their linked devices and accessories. It takes the user through the workflow of configuring recordings, downloading data, analyzing and reporting.

Intended Use

The Nox Sleep System is used as an aid in the diagnosis of different sleep disorders and for the assessment of sleep.

The Nox Sleep System is used to measure, record, display, organize, analyze, summarize, and retrieve physiological parameters during sleep and wake in patients greater than 2 years of age.

The Nox Sleep System allows the user to decide on the complexity of the study by varying the number and types of physiological signals measured.

The Nox Sleep System allows for generation of user/pre-defined reports based on subject's data.

The user of the Nox Sleep System are medical professionals who have received training in the areas of hospital/clinical procedures, physiological monitoring of human subjects, or sleep disorder investigation.

The intended environments are hospitals, institutions, sleep centers, sleep clinics, or other test environments, including patient's home.

Contraindications

The Nox Sleep System does not provide any alarms and is not intended to be used for continuous monitoring where failure to operate can cause injuries or death of the patient.

Scope

This manual covers the use of the Noxturnal software. The use of the Nox devices and their accessories that are needed for the recording of physiological signals are covered in:

- Nox A1 Manual
- Nox C1 Manual
- Nox T3 Manual

The manual also includes a short introduction about the Noxturnal App and its features.

Warnings and Cautions for Use

- ▶ Warning: The Nox Sleep System is **NOT CERTIFIED TO BE USED FOR CONTINUOUS MONITORING** where failure to operate can cause injuries or death of the patient.
- ▶ Warning: The Nox Sleep System is intended as an aid in diagnosis of sleep disorders. The system must be used in conjunction with other methods of assessing clinical signs and symptoms.
- ▶ Warning: Automatic analyses in Noxturnal, especially analyses calculating heart rate and respiratory rate from the underlying electrocardiogram (ECG) and respiratory effort signals, are not validated for patients with diaphragm pacing/phrenic nerve stimulators.
- ▶ Warning: The pressure column in the Positive Airway Pressure (PAP) Overview section of the PAP report and the Polysomnography (PSG) PAP report represents the mask pressure of the corresponding device and NOT the Set Pressure of the device.
- ▶ Caution: U.S. federal law restricts this device to sale by, or on the order of, a physician.
- ▶ Warning: The Nox A1 and T3 Recorders shall under no circumstances be connected to the USB port on the PC while applied to the patient. This could result in electroshock to the patient and serious harm.



- ▶ Please read this manual carefully before use, especially sections marked with an exclamation mark.

Noxturnal Description

The Noxturnal software interacts with Nox Recording Devices and Nox Access Points. It allows the configuration of the devices as well as: displaying, navigating, organizing, analyzing, reporting, archiving and retrieving physiological signals recorded/received by use of the Nox devices. This section describes the main features of the application and installation instructions.

Noxturnal App Description

The Noxturnal App is an Android application that is used as a mobile interface to Nox A1 Recorders and Nox C1 Access Points. The app allows the user to perform certain tasks already known in the Noxturnal software with more flexibility and proximity to the patient.

The App features include:

- Configure ambulatory recordings
- Connect to online rooms that have been configured in Noxturnal
- Review signal quality
- Perform impedance check
- Perform bio calibration
- Start and stop recordings
- View status of online recordings (Recording, Standby, Not Prepared)



NOXTURNAL APP
Scan this QR code with your mobile device for easy access to the app. You can also search for "Noxturnal" in the Google Play Store.



To download the app, scan the QR code above or search for "Noxturnal" in the Google Play Store. The app runs on mobile devices running Android 4.3 or higher.

Supported Devices

Noxturnal supports the following Nox devices and their linked devices and accessories:

- Nox A1 Recorder
- Nox C1 Access Point
- Nox T3 Recorder

Installing Noxturnal

Before installing the Noxturnal software, review the system requirements for running the software application.

Noxturnal System Requirements



- ▶ Note: The computer used must comply with the international standard IEC 60950-1 for the safety of information technology equipment.
- ▶ Note: It is recommended that a virus protection be installed on the computer running Noxturnal.

The following table shows the minimum hardware requirements needed to install and operate the software effectively.

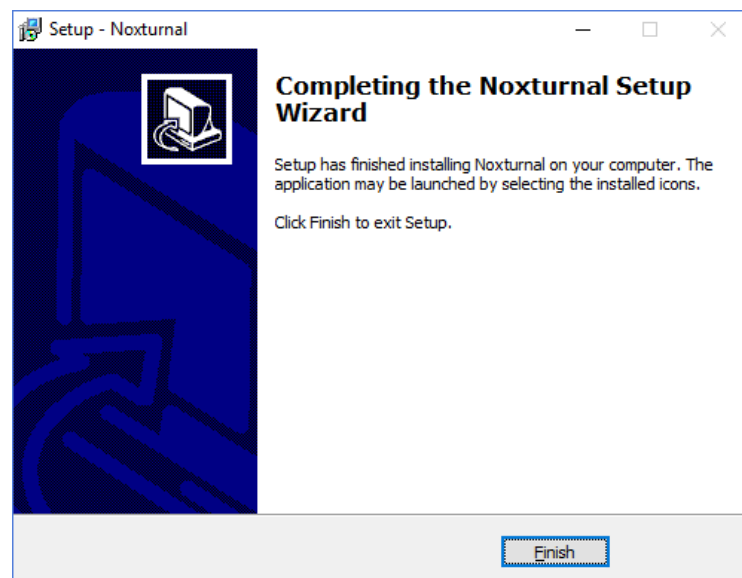
Minimum System Requirements

Hardware Type	Minimum Requirements
Operating System	Windows 7
Processor	x86 based Intel or AMD
Processor Clock Speed	1.7 GHz or faster
Memory	2 GB or more
Free Hard Drive Space	4 GB or more
Graphics Resolution	1024x768 or higher

For online system setup, the same minimum system requirements apply as listed above. It is highly recommended to use a separate computer for each online system. However, for expert users it is possible to run more than one system on a single computer.

Installation Instructions

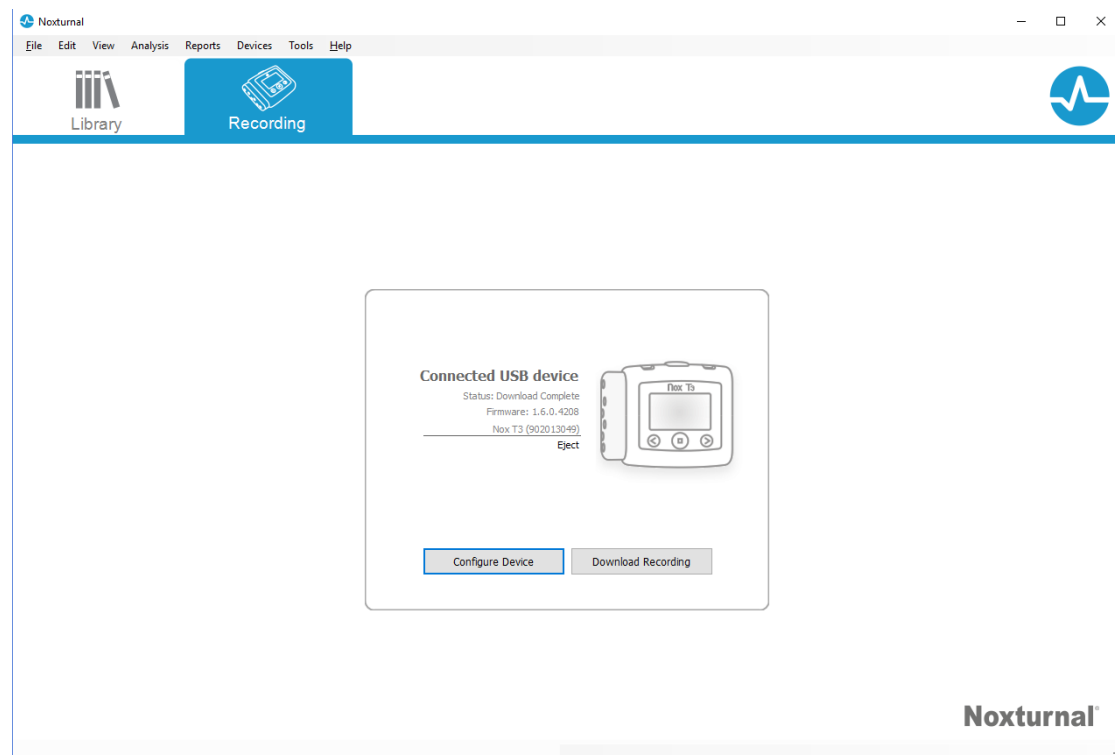
- Make sure to be logged onto the system with administrator privileges.
- Browse for a file on the installation CD called **Setup.exe** and run it.
- A wizard opens that guides the user through the installation. Follow the instructions to install the application.



Standard Operation

To run the Noxturnal application, double-click on the desktop icon or click on the application icon in the Windows start menu. To close the application either click on the **X** in the top right corner, or on the **File** menu choose **Exit**.

When Noxturnal starts up the workspace environment is displayed. If you have a device connected, you will see that in the picture, otherwise no device will be displayed. For the purposes of this document we have a Nox T3 Recorder connected as can be seen on the picture.



The **Recording** window is where the user works with Nox devices and the data recorded/received by use of those devices. This window guides the user through the most common tasks which are possible to perform in the application. These are:

- **Library:** In the top left corner, you will see this option. This option opens the recording library. The library stores a list of all recordings that have been recorded, downloaded or manually added to the recording library. For more information, refer to the section *The Recording Library*.
- **Configure Device:** To start a new ambulatory recording, select this option. A configuration wizard will guide the user through the configuration process. For more information, refer to the section *Starting a New Ambulatory Recording*.
- **Download Recording:** If a recording device is connected and it contains a recording, the user may download and review the recording. For more information, refer to the section *Downloading an Ambulatory Recording from a Nox Recording Device*.

To configure an online recording an online room needs to be pre-configured and it will appear in the Recording page and be selectable. For instruction on how to configure an online recording refer to the section *Setup of the Nox Sleep System for Online Recordings*.

Connecting a Nox Recording Device to Noxturnal



- Note: Please note that although it is recommended to eject the recording device before unplugging it from the computer the device can be disconnected without ejecting.

Noxturnal is used to configure and download recorded data from Nox recording devices. To work with a recording device, start by connecting it with a USB cable to the computer. Noxturnal automatically detects the device and displays information about the device. Detection can take 2-4 seconds.

When Noxturnal detects the connected device the following information about the device is displayed: **recording status**, **firmware version** and **device name**.

The tasks performed on the recording device depend on the device status which can be the following:

- **Empty** – The device has not been configured and does not contain any recordings. Click **Configure Device** to configure the device for a new recording. Please note that configuring the device will remove any existing recordings from the device.
- **Ready to Record** – The device has been configured but does not contain any recordings. At this point the user can disconnect the device and initiate the recording process.
- **Ready to Download** – The device contains a recording that has not been downloaded to the computer. Click on the **Download Recording** button to download the recording to the computer.
- **Download Complete** – The device contains a recording that has already been downloaded and has been added to the recording library. At this point the user can either click on **Configure Device** to configure the device for another recording or click on **Download Recording** to download the recording again.

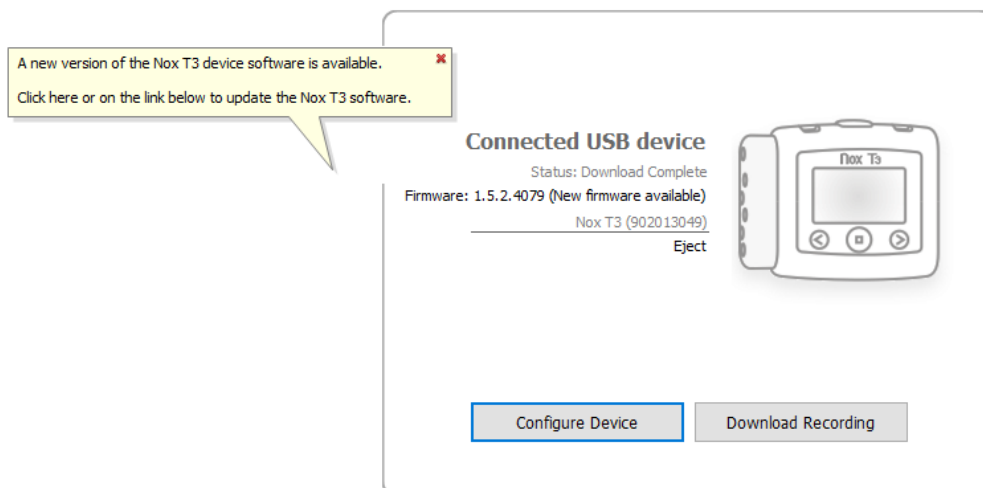
When you are done working with the device click on the **Eject** link and unplug the device from the computer.

Upgrading the Recording Device Firmware



- Note: After clicking the balloon for the upgrade, you must disconnect the recording device from the computer and reconnect it again for a device firmware upgrade to take place.
- Note: It is always recommended to perform the device firmware upgrade to make sure the Nox recorder is running on the latest firmware version. New firmware versions can include important updates for the operation of the recorder.

If a new version of the device firmware is available for the connected device, Noxturnal will notify the user by displaying a balloon tooltip next to the device. This behavior is device independent and you will see the type of device in this window, depending on which device you have connected. In this picture, we have a Nox T3 Recorder connected.



Choose either to ignore this message and continue working, or to upgrade the device firmware, which is always recommended. To upgrade click on the balloon and then follow the instructions presented.

Starting a New Ambulatory Recording

To prepare a recording device for a new recording, start the Noxturnal application and connect the device to the computer using a USB cable. Noxturnal automatically detects the device and shows information about it on the **Recording** page. Click on the **Configure Device** button on the **Recording** page and a wizard opens which guides the user through the configuration process of the device.

The Configuration Wizard is device dependent. This means that the configuration wizard will vary depending on the type of Nox recording device being configured. However, the key steps are always the same:

1. **Configuration** of the device. Where you select the Recording Type to use (auxiliary devices that may be connected and channels to be recorded).
2. **Schedule Recording** where you can select the time and date for a recording to start or to have a patient start the recording themselves.
3. **Patient Information** where you add the necessary patient information to the recording.

This manual shows the configuration wizard for the Nox T3 Recorder. The first step is to define which Recording Type to use for the recording. The Recording Types have descriptive names to exhibit the recordings they are used for.

See the *Recording Types and Device Profiles* sections for more information on creating and editing recording types and device profiles.

Nox T3 Configuration

Recording Type

1 2 3
Recording Type Schedule Recording Patient Information

Recording Type:
Respiratory

Other Devices:
Nonin 3150 Oximeter
PIN: 826235

Next > Finish Cancel

If your Recording Type is set up to record data from an auxiliary Bluetooth device, e.g. pulse oximeter you will see that in the Configuration Wizard. To be able to use auxiliary Bluetooth device it needs to be paired to the Nox recording device. Enter the appropriate Bluetooth device Pin/BDA (Bluetooth Device Address) number in the relevant field in the Configuration Wizard.

Click **Next** to move on to step two where you schedule the recording time.

Nox T3 Configuration

Schedule the recording time

1 2 3
Recording Type Schedule Recording Patient Information

☒ Manually Start Recording

☐ Start Recording At:
To schedule a recording click 'Start Recording At'

Duration:
☐ 7 Hours, ☐ 8 Hours, ☐ 10 Hours, Hours, ☒ Unspecified

< Previous Next > Finish Cancel

- If the **Manually Start Recording** option is checked, the user is responsible for starting/stopping the recording from the Nox recording device. This is done by pressing and

holding the **Middle** button on the device until the device display indicates that the recording has started.

- Check the **Start Recording At:** option to schedule a specific recording time. The device will turn itself on and automatically start recording at the specified time. If the user chooses to record for more than one night, each recording will start at the same time each night.
- To stop recording after a specific duration, specify the **Duration** to be either: **7 Hours, 8 Hours, 10 Hours** or enter a customized duration. If **Unspecified** is chosen, then the user is responsible for stopping the recording. This is done by pressing and holding the **Middle** button on the device until the device display indicates that the recording has stopped.

Click **Next** to continue to the third step, the patient information dialog. In this dialog, it is possible to enter detailed information about the patient. The only required field is the patient name or the patient ID.

Nox T3 Configuration

Patient Information

1 2 3
Recording Type Schedule Recording Patient Information

Name
First: Last: ID:

Gender
☐ Male
☐ Female

Date of Birth
☐ 1. 1.1960
☒ N/A

Body Metrics
Height: cm Weight: kg BMI:

Tags
use ';' to separate multiple tags

Notes
Edit...

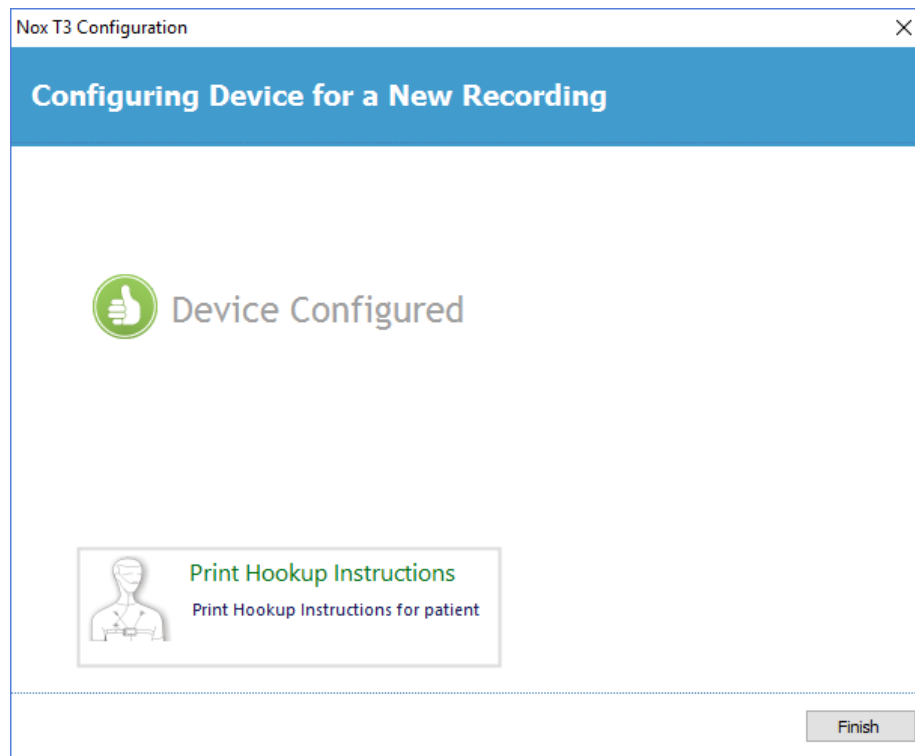
< Previous Finish Cancel

Enter Name or ID before Finishing

After having entered the patient information click **Finish** to write the configuration to the device.

After pressing **Finish** the device is configured. If there is a recording on the device, the user will be asked if he wants to erase the recording from the device.

Finally, a confirmation page appears confirming the device has been configured. For Nox T3 Recorders the hookup instructions can be printed by clicking the **Print Hookup Instructions** button. A PDF document containing the hookup diagram is launched and can be printed. If no hookup instructions are available, this option is not displayed.



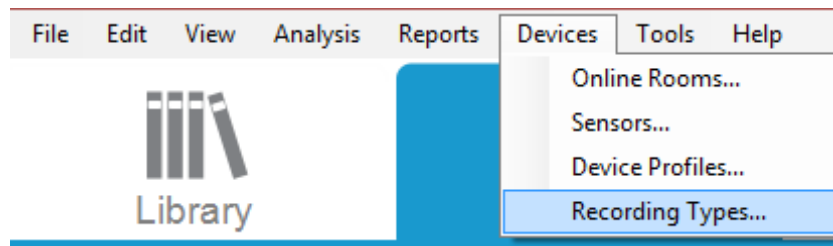
Recording Types

Noxturnal offers a range of **Recording Types** available for configuration of both ambulatory and online recordings. The Recording Types encompass the device combination used for different types of sleep studies and the device settings. The Recording Types also define the automation for the different recordings, the relevant Workspace Layout, Analysis and Report that are used for the recording. In Noxturnal you can easily create your own Recording Types to control devices and settings used for recordings. Follow these steps in order to create your own Recording Type.

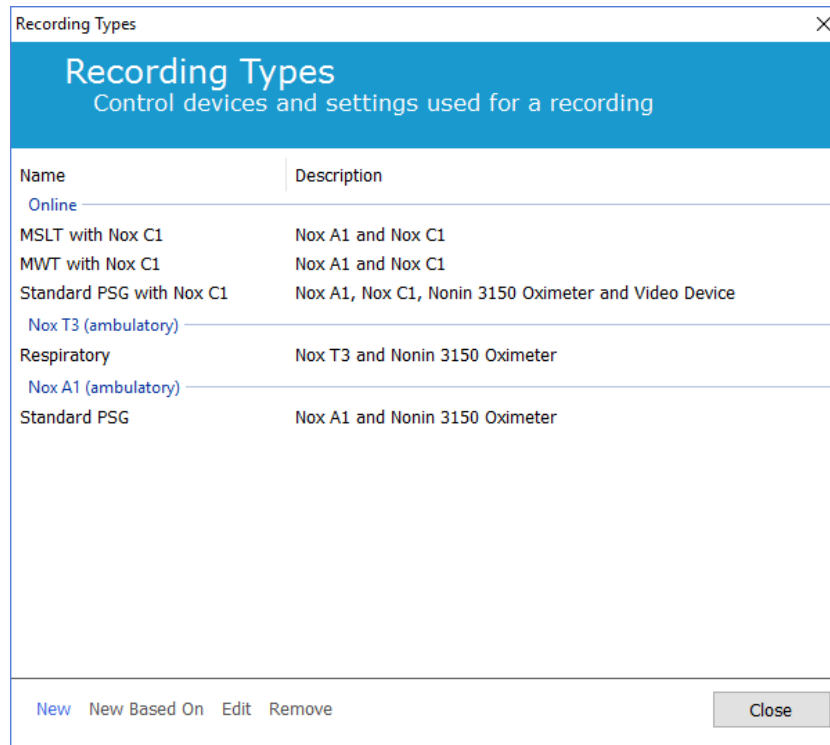
1. Select the Nox recording device you are creating the Recording Type for and if it is intended for ambulatory or online recordings
2. Set up the Recording Type to include Workspace Layout, Analysis, Report and devices and device profiles to be used, as applicable.

The Recording Type Wizard is device dependent. This means that the wizard will vary depending on the type of Nox recording device being configured. However, the key steps are always the same:

From the Noxturnal toolbar navigate to **Devices > Recording Types...**

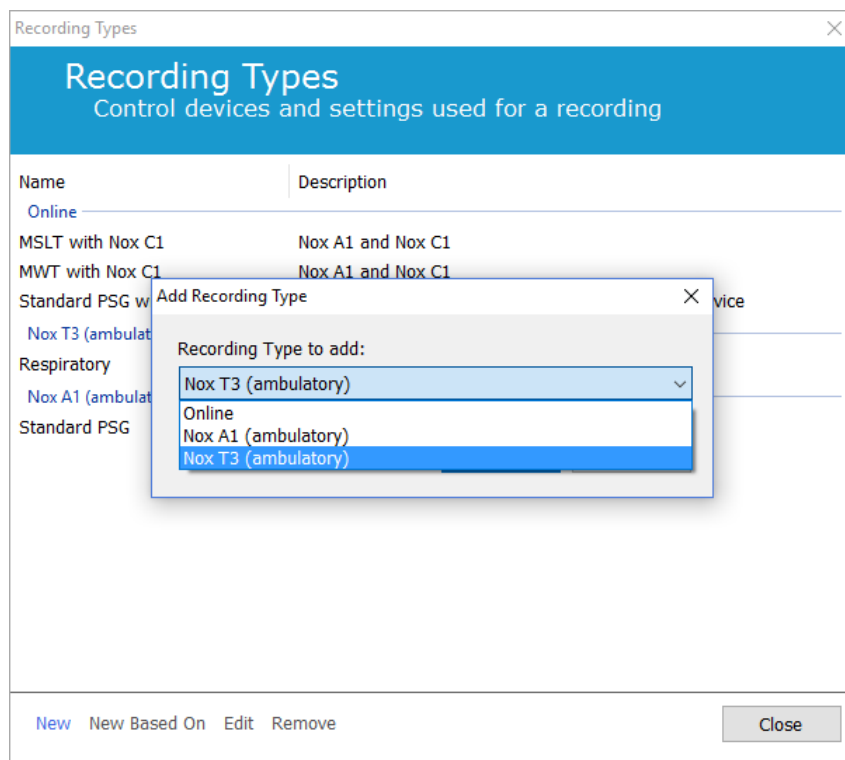


The Recording Types Wizard will open up.

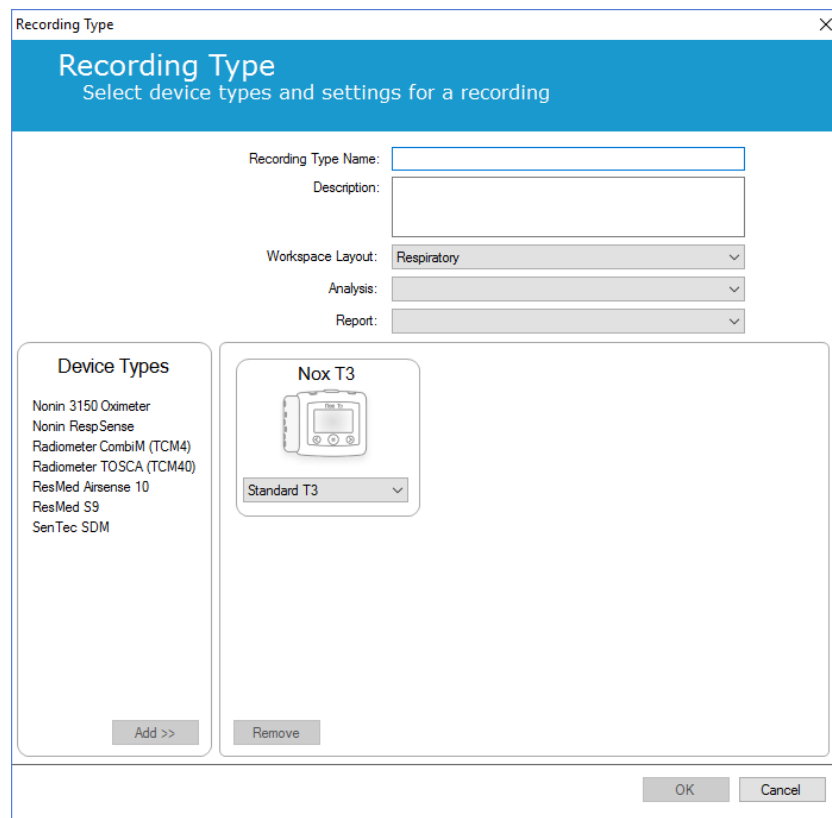


Here you can create a **New** Recording Type, a **New Based On** one of the available Recording Types and **Edit** or **Remove** custom Recording Types. For this example we will create a new Recording Type for the Nox T3 Recorder.

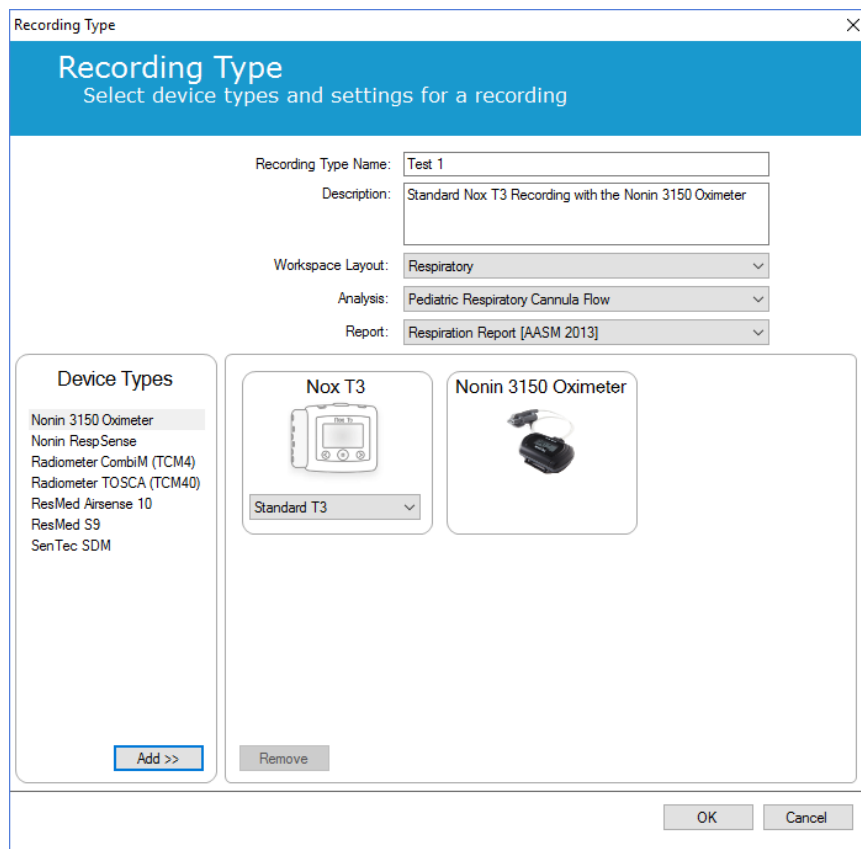
Select the **Nox T3 (ambulatory)** Recording Type from the dropdown list as shown below.



The next step is to set up the Recording Type as applicable. In the following wizard you can set up your Recording Type.

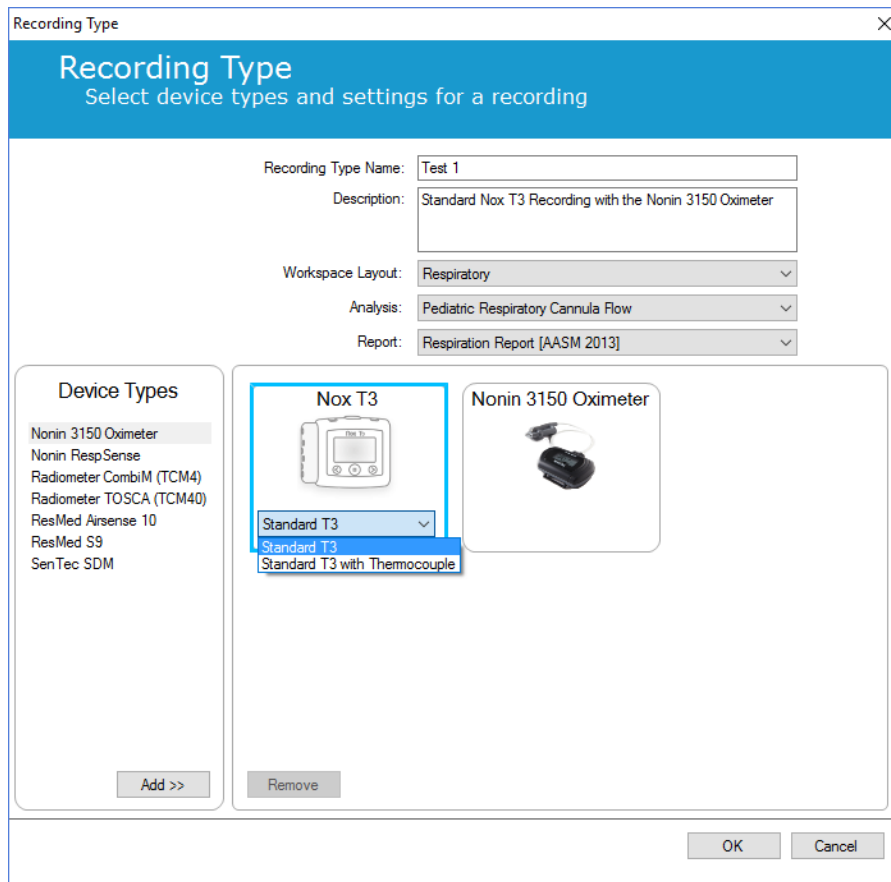


Type in the **Recording Type Name** and **Description** of the recording type. Choose the applicable **Workspace Layout**, **Analysis** and **Report**. You also have the availability to add auxilliary devices. Choose for example the Nonin 3150 (under Device Types) and click **Add>>**.



The image shows a software window titled "Recording Type" with a close button (X) in the top right corner. The window has a blue header bar with the title "Recording Type" and the subtitle "Select device types and settings for a recording". Below the header, there are several input fields and dropdown menus. The "Recording Type Name" field contains "Test 1". The "Description" field contains "Standard Nox T3 Recording with the Nonin 3150 Oximeter". The "Workspace Layout" dropdown is set to "Respiratory". The "Analysis" dropdown is set to "Pediatric Respiratory Cannula Flow". The "Report" dropdown is set to "Respiration Report [AASM 2013]". On the left side, there is a list of "Device Types" including "Nonin 3150 Oximeter", "Nonin RespSense", "Radiometer CombIM (TCM4)", "Radiometer TOSCA (TCM40)", "ResMed Airsense 10", "ResMed S9", and "SenTec SDM". Below this list is an "Add >>" button. In the center, there are two boxes: "Nox T3" with an image of a device and a "Standard T3" dropdown, and "Nonin 3150 Oximeter" with an image of a device. Below these boxes is a "Remove" button. At the bottom right of the window are "OK" and "Cancel" buttons.

Note that it is also possible to choose the applicable Device Profile for this Recording Type directly in the Recording Type wizard, see below.



Recording Type
Select device types and settings for a recording

Recording Type Name:

Description:

Workspace Layout:


Analysis:

Report:


Device Types

- Nonin 3150 Oximeter
- Nonin RespSense
- Radiometer CombiM (TCM4)
- Radiometer TOSCA (TCM40)
- ResMed Airsense 10
- ResMed S9
- SenTec SDM

Nox T3



Nonin 3150 Oximeter



You can also create custom Device Profiles, please follow the instructions in the *Device Profiles* section for further instructions. Once you have created a new Device Profile it will appear in the dropdown list in the Recording Type wizard.

When you have set up your Recording Type click **OK** and your custom Recording Type will be available for configuration.

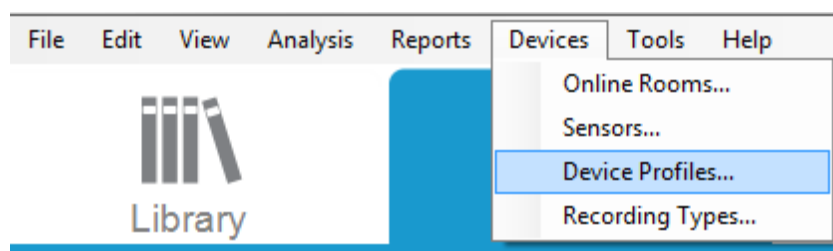
Device Profiles



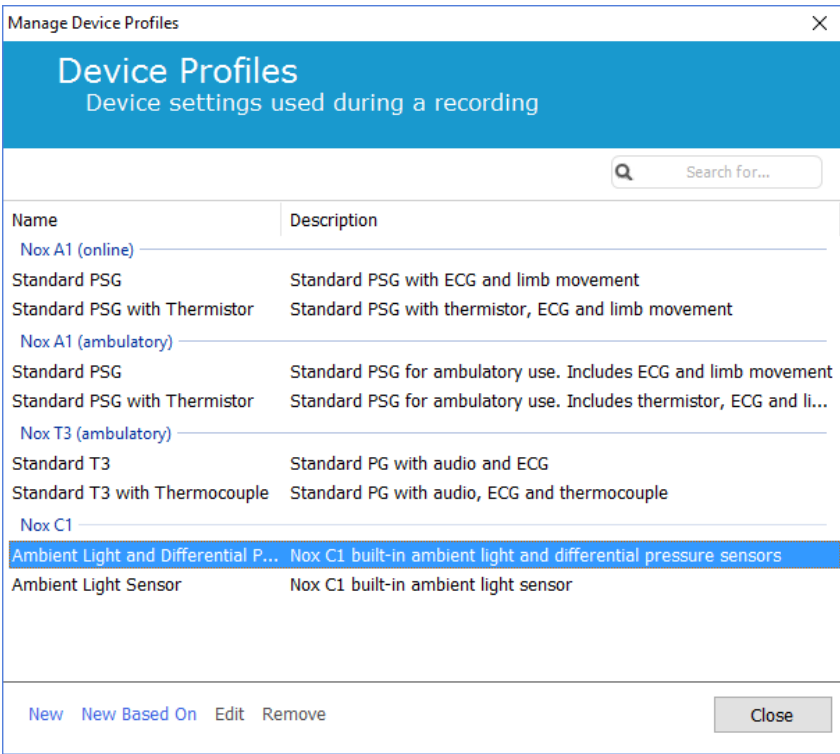
► Note: The Device Profiles wizards vary between Nox recording devices.

The Device Profiles are created for all standard recordings that you might perform with Nox devices. They allow for simple setup during the device configuration process.

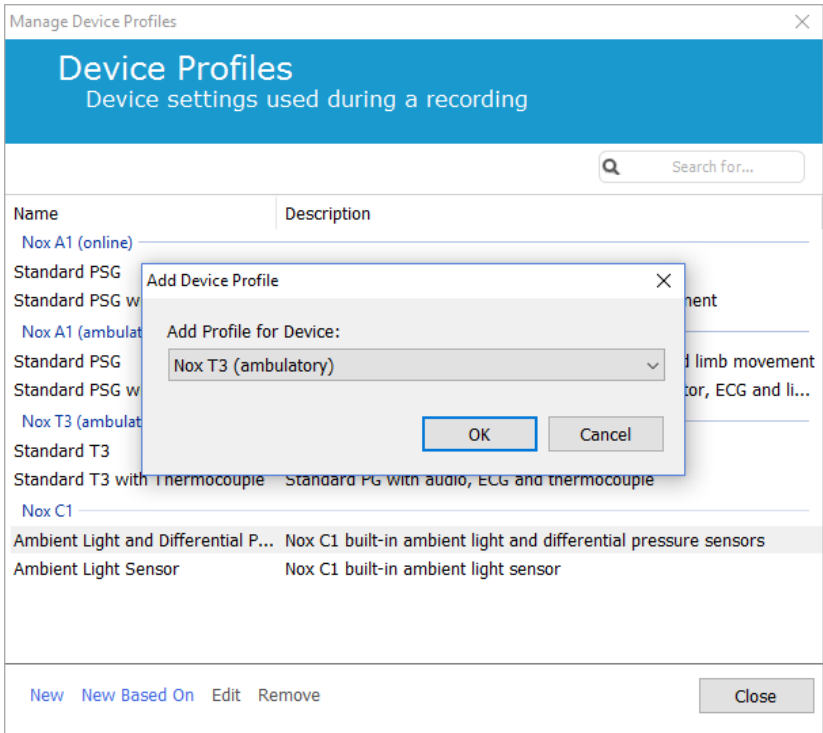
From Noxturnal toolbar navigate to **Devices > Device Profiles...**



In the Device Profiles wizard, you can see list of the available Device Profiles for the Nox recording devices and the Nox access point.



To create a custom device profile, select **New** or **New Based On**. You will then need to select for which recording device the template is for or from which of the current device profiles you wish to base your new template on. For this example, we will create a new device profile for the Nox T3 Recorder.



In the Profile Properties Wizard, you can setup the Device Profile. Type in the name (and description if you wish).

The screenshot shows a window titled "Nox T3 Device Profile Wizard" with a close button (X) in the top right corner. The window has a blue header bar with the text "Profile properties" on the left and three numbered steps (1, 2, 3) on the right. Step 1 is highlighted with a yellow box and labeled "Profile". Step 2 is labeled "Device Configuration" and Step 3 is labeled "Battery Type". Below the header, on the left, is an image of a Nox T3 device. To the right of the image is a text block: "This wizard enables you to create or modify device profiles for the Nox T3 device. The steps include selecting channels to use on the device and to set the respiratory sensors into appropriate modes of operation. The device profile is saved as a part of the Noxturnal device profiles and can be used when starting a new recording." Below this text are three input fields: "Name:" with a text box containing "New Device Profile", "Device:" with a dropdown menu showing "Nox T3", and "Description:" with a large text area. At the bottom right of the window are three buttons: "Next >" (highlighted with a blue border), "Finish", and "Cancel".

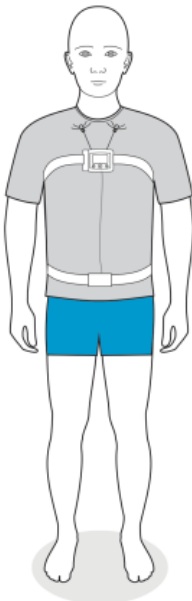
Click **Next** to proceed to the next step.

In the dialog below you can setup the channel configuration for the device. The Configure Device dialog is device dependent. This means that the wizard will vary depending on the type of Nox device being used. When you have setup the channel configuration, click **Next**.

Nox T3 Device Profile Wizard

Configure Device

1 Profile 2 **Device Configuration** 3 Battery Type



Audio Recording
☐ Enable Audio Playback

Cannula or Mask
☒ Not Used
☐ Nasal Flow
☐ Mask Pressure

General purpose channels
☐ Channel 1: Abdomen Piezo
☐ Channel 2: Abdomen Piezo

Device display
 Standard
 Standard user interface. Shows signals and connection status.

< Previous Next > Finish Cancel

The final step for configuring a Nox recording device is to define the battery type used. Select the applicable battery type and click **Finish**.

Nox T3 Device Profile Wizard

Battery Type Selection


1 Profile 2 Device Configuration 3 **Battery Type**

Select battery type that will be used in the recorder:

☐ Alkaline Battery
 Alkaline batteries can be used to record from 8 to 16 hours depending on the quality of the battery.

☐ Lithium Battery
 Lithium batteries can be used to record from 20 to 33 hours depending on the quality of the battery. Lithium batteries are optimal for multiple night recordings.

☐ Rechargeable Ni-MH Battery
 Rechargeable batteries can be used to record for 1 to 1.5 hours per 200mAh capacity. A standard 2000 mAh battery can record from 10 to 15 hours.

 Please note that it's recommended to use new or fully charged batteries for each new recording. When recording multiple nights the patient might be required to change the battery after each night.

< Previous Finish Cancel

The Device Profile you created will be available from the list of Device Profiles and available for configuration.

Downloading an Ambulatory Recording from a Nox Recording Device

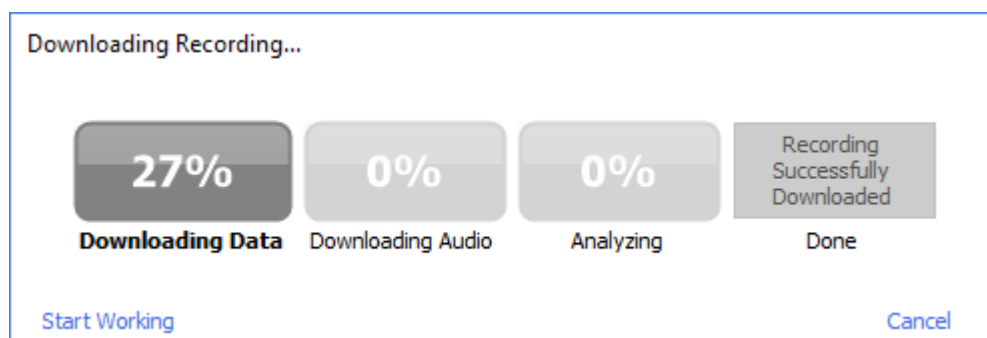


- ▶ Note: If a download partially fails for any reason, it can lead to inconclusive recording results. The user will be warned when this happens and needs to decide whether the recorded data is complete or not. It is possible to download the data from the device again.
- ▶ Note: The downloaded recording is not deleted from the device until the device is configured for another recording.

To download recorded data from a Nox recording device to the computer, ensure that Noxturnal is running and then connect a device to a USB port on the computer.

Noxturnal automatically detects the device and shows information about it on the **Recording Page**. Detection can take 2-4 seconds.

Click on the **Download Recording** button on the **Recording Page** and Noxturnal will start downloading the recording from the device to the computer. A download progress dialog will appear that displays the steps involved while downloading. The data is first downloaded then the default analysis protocol is run and, if the device was configured to record audio, the audio download starts. It is possible to start working with the data at any time while it is being downloaded by clicking on the **Start Working** link.



After the download is completed the user is notified and can start working with the whole recording.

Recordings are always downloaded to the default data storage location. It is possible to change the default data storage location on the automation tab in the tools options dialog (**Tools** → **Settings...** → **General**). Downloaded recordings are automatically added to the recording library and can be reviewed any time by going to the recording library and opening it. For more information, refer to section *The Recording Library*.

Setup of the Nox Sleep System for Online Recordings

Online System Network Overview

To ensure steady operation of the online functionality for the Nox Sleep System please follow the recommended system setup below.

- It is recommended to use a separate computer for each online system setup. However, it is possible to run more than one online system on a single computer; refer to *Minimum System Requirements* section for details.
- Use a separate local area network (LAN) for each Nox C1 Access Point and a computer running the Noxturnal software.
- Use a separate Nox C1 Access Point for each Nox A1 Recorder to be used.

The table below describes the setup of the control room where the computer with Noxturnal installed is located.

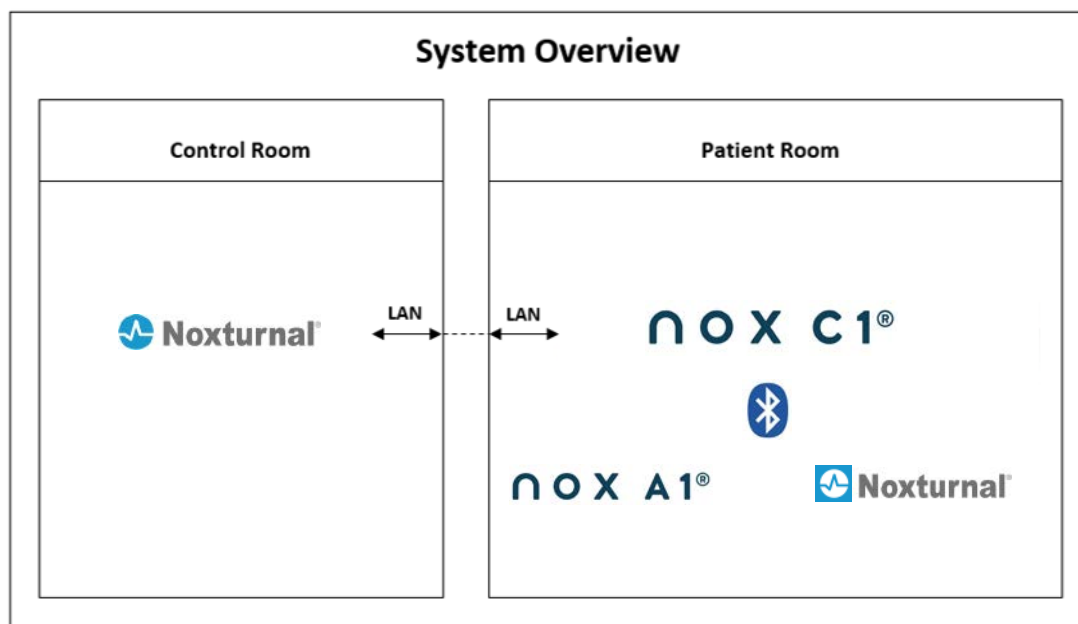
Control Room	
Item	Connection
PC	Connected to the same network as the Nox C1 Access Point with a network cable
Noxturnal	Installed on PC

The table below describes the setup of the patient room where the patient is sleeping during a sleep study.

Patient Room			
Item Name	Description	Function	Setup/Connection
Nox C1 Access Point	Bluetooth access point with analog and serial inputs and built in light sensor and differential pressure sensor	<ul style="list-style-type: none"> ▶ Data transfer received from Nox A1 over Bluetooth connection and forwarded to Noxturnal via Ethernet ▶ Commands received from Noxturnal via Ethernet and forwarded to Nox A1 using Bluetooth connection ▶ Data transfer received from auxiliary devices connected to analog and/or serial inputs and forwarded to Noxturnal via Ethernet 	Located in the patient room. Connected to the same LAN as the PC running the Noxturnal software
Nox A1 Recorder and applicable sensors	Recording device that may be configured for different types of sleep studies	Records physiological signals from built-in and attached sensors	Attached to the patient in the patient room
Medical auxiliary	Any medical device	Depends on the auxiliary	The applicable

devices	that fits the input channel specifications of the Nox C1 Access Point. Medical devices supported by the system to be connected to Nox A1 Recorder via Bluetooth link	device being used	connection cable connected to the analog input/serial input on the Nox C1 access point. Via Bluetooth link to the Nox A1 Recorder
Noxturnal App	Android App	Can be used to connect to Online Rooms, review signal traces and perform bio calibration and impedance check. Can also be used to start and stop recordings	Set the App to Online Mode and connect to the applicable online room

Figure below shows the overview of the online setup for the Nox Sleep System.



The Nox C1 Access Point is operated by the Noxturnal software.

For further instructions on the Nox C1 Access Point and the Nox A1 Recorder refer to the Nox C1 Manual and the Nox A1 Manual.

Online System Configuration



- **Note:** To perform online recording with the Nox A1 Recorder you will need a Noxturnal A1 Online Acquisition License to be active on your computer and a Nox C1 Access Point. For further information, please consult with Nox Medical or their sales representatives.

This chapter describes how to setup the Nox Sleep System for online configuration. First make sure that you have setup all the devices and accessories needed, such as the Nox C1 Access Point, Ethernet cables and switch. Detailed information on how to setup your network, including the Nox C1 Access Point, is found in the Nox C1 Manual.

To set up the Nox Sleep System for online configuration you must perform the following steps in Noxturnal, as applicable:

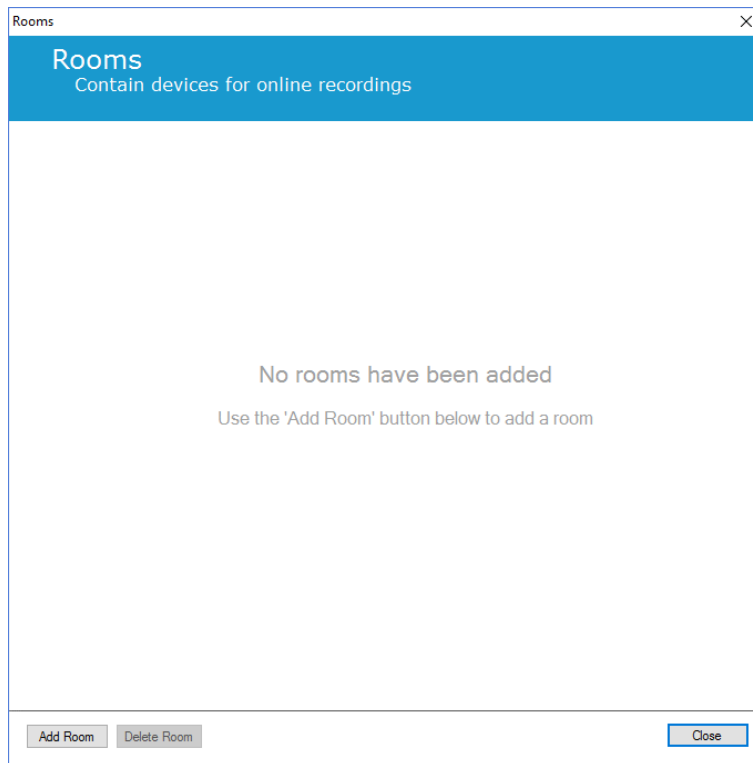
1. Set up **Online Rooms**
2. Configure new **Sensors**
3. Set up **Device Profiles**
4. Set up **Recording Types**

These steps are outlined below. Following these steps will allow you to start your online recording and then start working with the signals in Noxturnal.

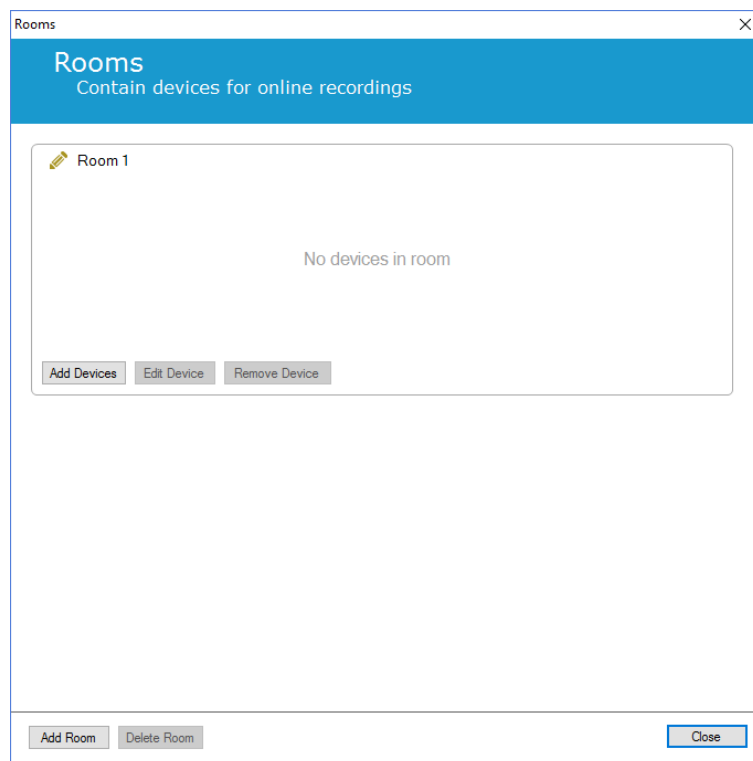
Online Room

Setting up an Online Room is part of setting up Noxturnal for online recordings. The Online Room encompasses collection of devices which you normally keep together in a room. These may, for example, be all the devices that you keep in a particular hospital room dedicated for sleep studies.

To add a new room, select **Devices > Online Rooms...** from the Noxturnal toolbar. This will bring up the **Rooms** dialog.



From here you can add a new room or edit an existing one. To add a new room click **Add Room** and in the dialog below you can give the new room a name, by clicking the pencil icon and add devices to your room by clicking **Add Devices**.



In the **Add Devices** Wizard you can add devices to your room. To add a device, select the applicable device from the **Device Types** list and click **Add>>** or double-click the device from the list. You can scan for connected IP devices on your network by clicking **Scan for IP Devices**.

Add Devices

Add Devices to Room

Select one or more available devices to add to room

Device Types

- Masimo Radical-7
- Nonin 3150 Oximeter
- Nonin RespSense
- Nox A1
- Nox C1
- Radiometer CombIM (TCM4)
- Radiometer TOSCA (TCM40)
- ResMed Airsense 10
- ResMed S9
- ResMed Tx Link
- SenTec SDM
- Video Device

Add >>

Available Devices

Remove Device

Scan for IP Devices

Add to Room Close

When you add a Nox A1 Recorder you will need to select the applicable Nox C1 Access Point being used in the room and click **Scan** for your Nox A1 Recorder or manually type in the A1 serial number. Remember to have your A1 Recorder turned on for this step. Select your recorder from the list and click **Next**.

Device Properties

Nox A1

1

2

Select device Device Settings



Enter the 9 digit serial number (found on the A1 device label) or scan for it via Access Point

SN: 9xxxxxxxxx

id:

GTIN(01): 1569431111XXXX

PROD DATE(11):YYMMDD

SERIAL(21):9xxxxxxxxx



☒ Via Serial Number:

☐ Via Access Point:

Nox C1 - 109

Scan

Device Type	Device Name	Serial Number	BDA

Next >

Finish

Cancel

When you have added a selection of devices to collection of available devices you can select the devices to add to your Online Room.







Add Devices to Room

Select one or more available devices to add to room

Device Types

Maximo Radical-7
Nonin 3150 Oximeter
Nonin RespSense
Nox A1
Nox C1
Radiometer CombIM (TCM4)
Radiometer TOSCA (TCM40)
ResMed Airsense 10
ResMed S9
ResMed Tx Link
SenTec SDM
Video Device

Available Devices

<p>Video Device</p>  <p>IP: 192.168.101.4</p>	<p>Nox C1</p>  <p>License: DC Licensed SN: 931010058 IP: 192.168.101.10</p>	<p>ResMed Tx Link</p>  <p>IP: 192.168.101.15</p>
<p>Nox A1</p>  <p>SN: 972901527</p>	<p>Nonin 3150 Oximeter</p>  <p>BDA: 13:15:28:69:42:96</p>	<p>SenTec SDM</p>  <p>C1 Serial Port: 1</p>

Add >>

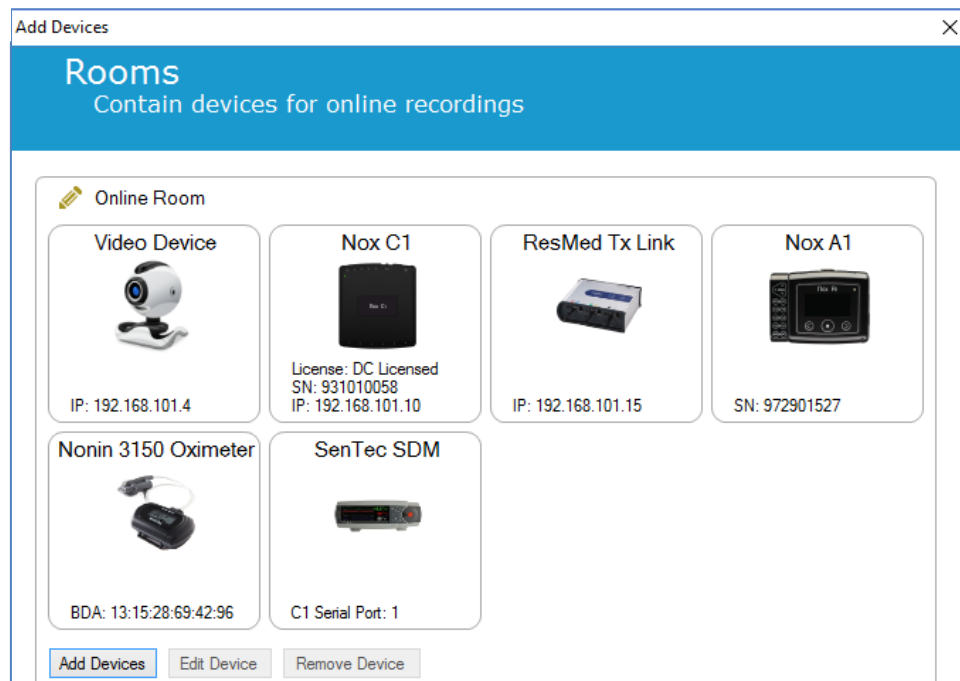
Remove Device

Scan for IP Devices

Add to Room

Close

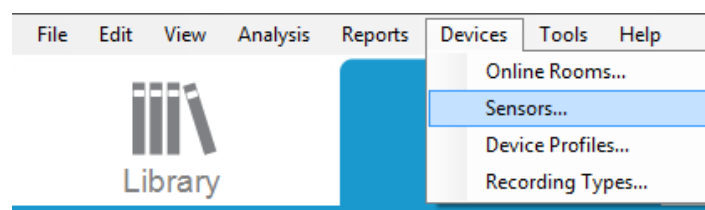
To select devices to add to your room click the device and a blue bold frame will appear around each selected device. When you have selected the devices to add to the room, click **Add to Room** and your room with this selection of devices will be added.



You have now completed the configuration of the online room. You can in the same way as described here above add additional rooms.

Configuration of New Sensors

If you want to create new sensor configurations, e.g. to use with the Nox C1 Access Point, you can do that by navigating to **Devices > Sensors...** from the Noxturnal Toolbar.



From the **Manage Sensors** Wizard you can create a new sensor and edit/delete existing sensors. To create a new patient or auxiliary device sensor click **New**. Patient sensors are sensors connected to Nox A1 or T3 Recorders and the patient. Auxiliary device sensors are connected to Nox C1 Access Point and an auxiliary device.

Manage Sensors

Sensors

Patient and auxiliary sensor configuration

Label	Location	Unit	Auxiliary	Bipolar	Description
Respiratory					
Abdomen Piezo	Piezo.Abdomen		No	Yes	Abdomen Piezo sensor
Abdomen RIP	Inductive.Abdomen		No	Yes	Abdomen RIP sensor
Pneumoflow	Pneumoflow	V	No	Yes	Differential Pressure
Thermistor	Thermistor.NasalOral		No	Yes	
Thermocouple	Thermocouple.NasalOral		No	Yes	Thermocouple for nasal and oral
Thorax Piezo	Piezo.Thorax		No	Yes	Thorax piezo sensor
Thorax RIP	Inductive.Thorax		No	Yes	Thorax RIP sensor
EMG					
Both Legs	Leg	V	No	Yes	EMG sensor for the sum of both
Bruxism		V	No	Yes	
BruxismLeft	Left	V	No	Yes	
BruxismRight	Right	V	No	Yes	
Left Leg	Leg.Left	V	No	Yes	Left leg EMG sensor
Right Leg	Leg.Right	V	No	Yes	Sensor for right leg EMG
Submental	Chin	V	No	Yes	Sensor for submental EMG
ECG					

New
New Based On
Edit
Remove
Close

You can select whether a new patient sensor or an auxiliary device sensor is to be created. Fill in the applicable fields and click **OK** to save the sensor configuration.

Device Profiles for Online Devices

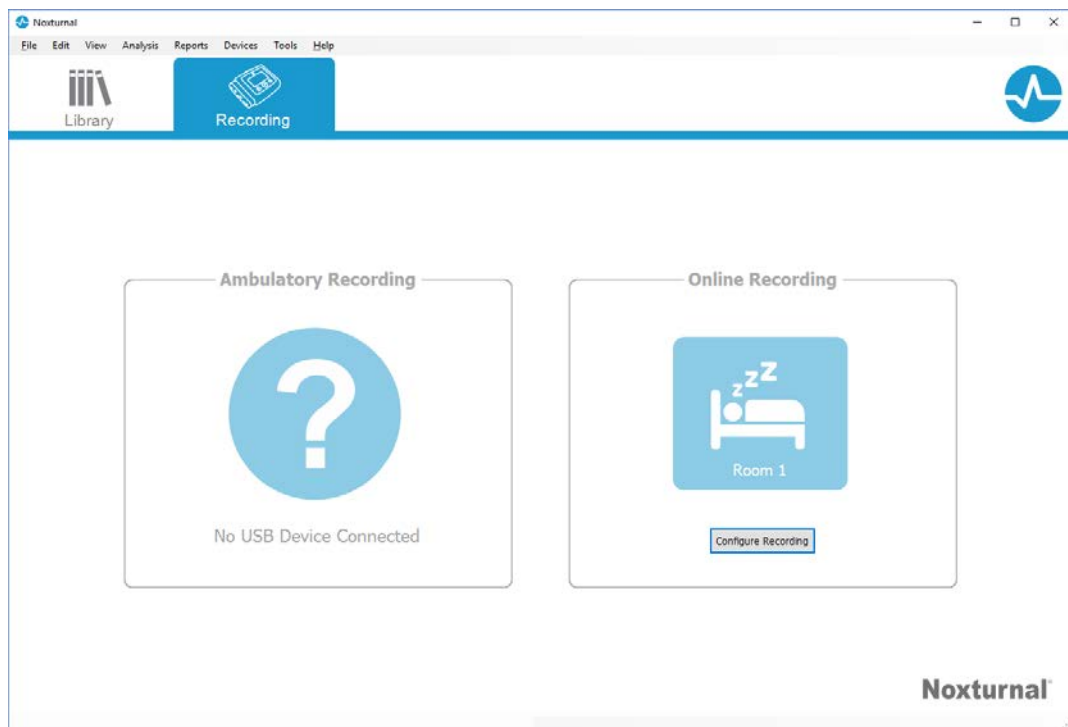
For the Nox devices used for online recordings you can set up **Device Profiles**. The Device Profiles encompass the device's channel configuration. Noxturnal offers a range of default Device Profiles and you can also easily setup new Device Profiles. For instructions on how to customize Device Profiles refer to the *Device Profiles* section.

Recording Types for Online Devices

The final step is to set up **Recording Types**. This is a list of the types of recordings that you will record online in your clinic. Each **Recording Type** brings together a collection of available online device types which would be grouped together. Examples are: **Standard PSG with Nox C1**, would bring together a Nox C1 Access Point, Nox A1 Recorder, Nonin 3150 Oximeter and a Video Camera. For instructions on how to setup new Recording Types refer to the *Recording Types* section.

Starting an Online Recording

When you have completed the steps above to setup your online configuration an online recording can be started. From the **Recording** page you can start an online recording within the room you have set up. To start the recording either double-click the room icon or click **Configure Recording**.



This will bring up the **Start Online Recording** wizard. This wizard will allow you to:

- Select the **Recording Type** which is about to be performed from the dropdown list.
- The selection of **Devices** is dependent on the **Recording Type** selected. All devices available in the online room are listed, however the devices not included in the recording type are greyed out. You can include the disabled devices for the recording by checking the appropriate boxes from the list of devices.
- Select **Device Profile** for some devices, such as the Nox A1 and the Nox C1.

Start Online Recording

Select Recording Type

Recording Type: MSLT with Nox C1

Devices

Nox A1	Profile: Standard PSG SN: 972901527		<input checked="" type="checkbox"/>
Nox C1	Profile: Ambient Light Sensor IP: 192.168.101.10 SN: 931010058 License: DC Licensed		<input checked="" type="checkbox"/>
Nonin 3150 Oximeter	BDA: 13:15:28:69:42:96		<input checked="" type="checkbox"/>
SenTec SDM	C1 Serial Port: 1		<input checked="" type="checkbox"/>
ResMed Tx Link	IP: 192.168.101.15		<input checked="" type="checkbox"/>

Next > Standby Mode Start Recording Cancel

When you have selected your **Recording Type** and the applicable devices along with their **Device Profiles** you can click **Next** to enter the patient information. The final step is to start the recording and you do that by clicking **Start Recording** or clicking **Standby** within the **Patient Information Wizard**.

Start Recording:

You will then see your selected Workspace Layout appear with a status window showing the status of the recording which is starting. Finally, you will see the recorded signals appear in real time and you can start working with them.

Standby Mode:

The **Standby Mode** will open your selected workspace with a status window showing you have entered **Standby Mode** that gives you the option to connect to the Online Room for preparing, evaluating, and assisting the patient hook-up and finally start the recording using the **Noxturnal App** or **Start Recording** as is described in the step above.

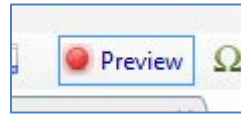
Online Recording Standby

● Recording Ready

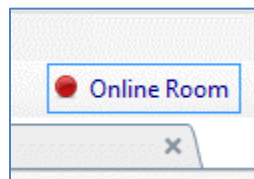
Start Recording or Connect via Noxturnal App

Start Recording Cancel Recording

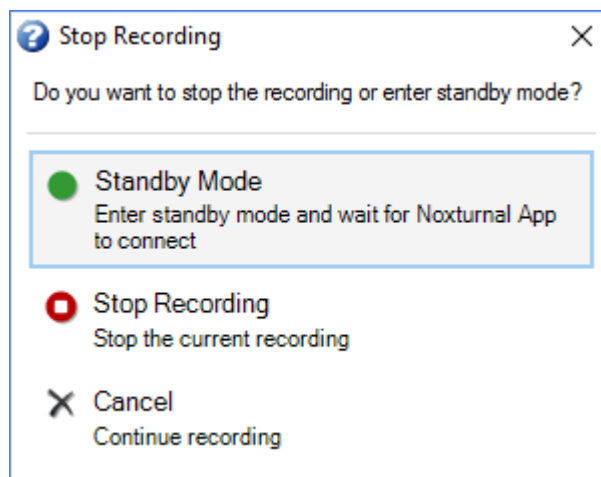
When the user has connected the Noxturnal App to the online room the live traces that start to appear are **NOT** being saved to the recording. It is only a preview as is indicated by the preview status. The signal will start to record as soon as the user hits **Start Recording** either in the Noxturnal App or in the Noxturnal software.



The user can also enter the standby mode any time after the recording has been started if he wants to pause the recording for some period of time by clicking the red rec button on top of the screen.



By clicking the rec button, it will give you the option to either enter standby mode, stop the recording or cancel and continue with the recording.



Nox C1 Configuration

The Nox C1 Access Point is equipped with 12 analog channels suitable for collecting of DC signals from auxiliary devices. The channels are collected on 6 ports, labeled DC IN from 1 to 12 on the top of the device; each analog port yields 2 channels. Auxiliary devices can be connected to the Nox C1 analog inputs. The voltage range allows interfacing signals from -5V to +5V. For further information on the Nox C1 Access Point, refer to the Nox C1 Manual.

Nox C1 Network Configuration

The default factory configuration of the Nox C1 Access Point is listed in the table below. The Nox C1 network configuration can be managed through Noxturnal.

Nox C1 Network Configuration	Details
DHCP server	DHCP pool: 192.168.101.64-192.168.101.127
Static IP address	192.168.101.10
Universal Plug and Play (UPnP) discovery	Networking protocol that permits the Nox C1 to be discovered on a network

To manage the network configuration of the Nox C1 you can open an Online Room that has been configured (Devices > Online Rooms...) and select the Nox C1 within the room and click **Edit Device**. In the dialog below you can see how you can change the network configuration of the Nox C1.

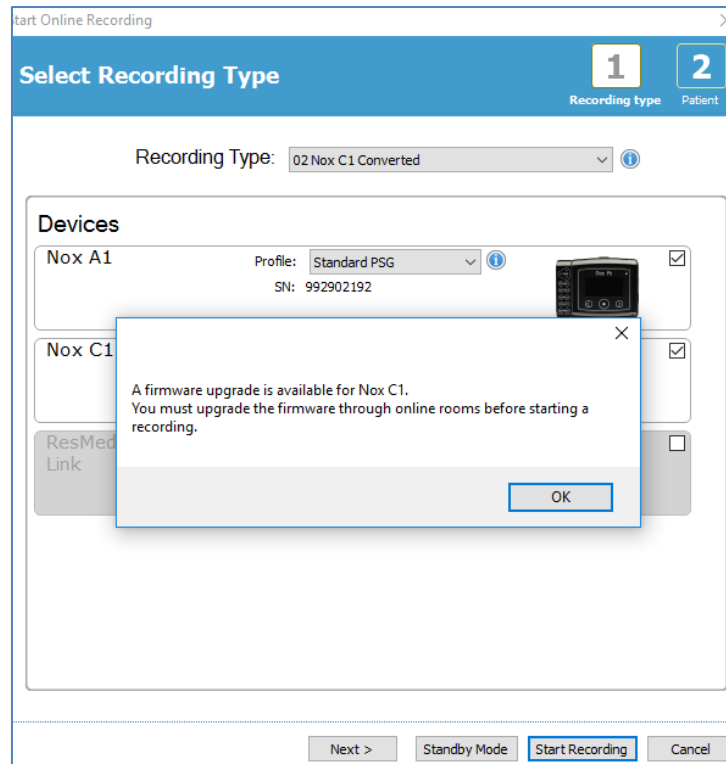
The screenshot shows the 'Device Properties' dialog for a Nox C1 device. The dialog has two tabs: '1 Network Settings' and '2 Device Settings'. The 'Network Settings' tab is selected and shows the following configuration:

- IP Address:**
 - ☐ Obtain an IP address automatically
 - ☒ Use the following IP address:
 - IP Address: 192.168.101.10
 - Subnet Mask: 255.255.255.0
 - Default Gateway: . . .
 - DNS: . . .
 - MAC Address: 00:14:2d:4a:4b:22
- Server settings:**
 - ☒ DHCP Server Enabled
 - Pool Offset: 64
 - Pool Size: 63
 - Lease Time (sec): 86400

At the bottom of the dialog, there are three buttons: 'Set Password', 'Set License', and 'Upgrade Firmware'. At the very bottom, there are three buttons: 'Next >', 'Finish', and 'Cancel'.

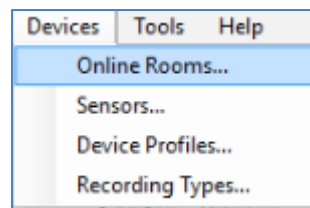
Upgrading Nox C1 Access Point firmware

If a new version of the Nox C1 Access Point firmware is available for the connected device, Noxturnal will notify the user by displaying this message when the user starts an online recording.



The user can access the firmware upgrade by navigating to the **Devices** tab in the menu bar.

Devices >> Online Rooms...



Select the Nox C1 access Point and click **Edit Device**.



In the device properties window select **Upgrade Firmware**.

The firmware upgrade will be indicated with a status bar and when finished will display like this.

Activating Nox DC Channel License

The DC channels on the Nox C1 Access Point are locked by default. To be able to use the DC channels on the Nox C1 you will need to have a Nox DC Channel license activated. For further information on this, please consult with Nox Medical or their sales representatives.

The license is activated by clicking **Set License** in the **Device Properties** dialog that is shown below and following the instructions on the page.

Integration of Video Devices for Online Recordings

Noxturnal supports online video recording. To use the digital video support provided by Noxturnal in an online recording you need to configure your system to include a video device.

A video device can be added to your online system configuration and the setup saved for future use. To configure a video device with your system you must:

1. Ensure that you have **video codecs** installed on your computer
2. Ensure that the video device is connected to the same network as the Nox C1 Access Point and the computer running Noxturnal
3. Setup an **Online Room** including the video device
4. Setup a **Recording Type** including the video device and define the video profile
5. Select the Online Room and start an online recording from the Noxturnal **Recording** page

Setup an Online Room with a Video Device

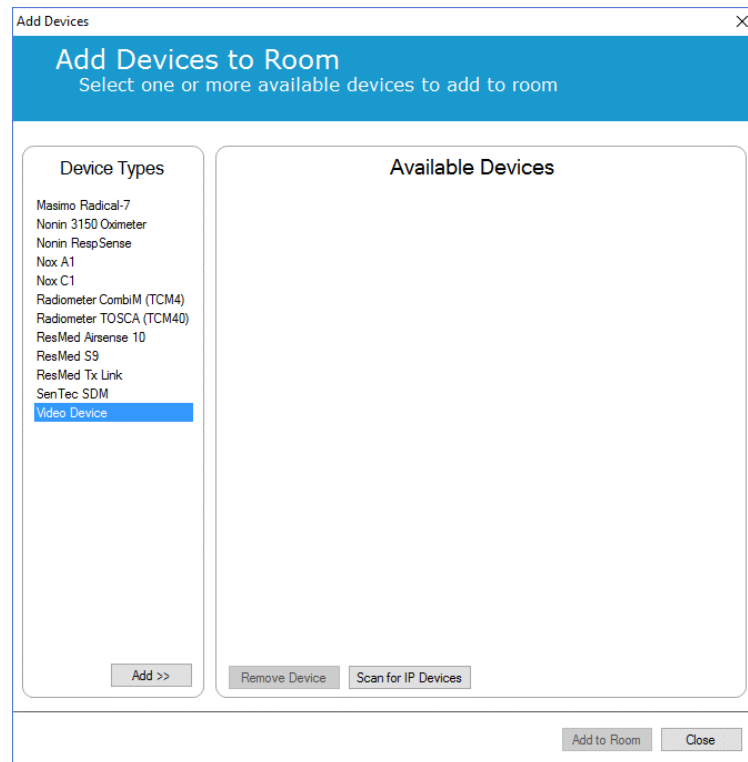
VIDEO CODECS

Noxturnal's support for video is governed by the video codecs that are installed on your computer system. These video codecs are specialized software that enables the compression and decompression of digital video. Noxturnal does not install any codecs but most computer systems have some types of codecs installed. You will require codecs to be installed on your computer system to use video with your Nox Sleep System. Noxturnal will then provide you with access to the features supported by these codecs. You can download the **K-Lite Codec Pack** from the Nox Medical support site: <http://support.noxmedical.com/hc/en-us/articles/207882176>

VIDEO CAMERA INTEGRATION

To setup an online recording including a video device follow the steps below.

1. Setup an Online Room in Noxturnal as explained in *Online Room* section (Devices > Online Rooms... from the Noxturnal toolbar).
2. Add a video device to your Online Room by clicking **Add Devices** and select **Video Device** from the **Device Types** list.



3. You will see the Device Properties dialog shown below. Check the applicable option, depending on the video device being used and click **Next**.

Device Properties

Select Video Input Source

1 Video Source 2 Video Properties 3 Device Settings

Select video input source type:

- ☒ IP Camera
- ☐ File or URL
- ☐ Media Capture Device
- ☐ Screen Recording

Next > Finish Cancel

To setup your IP camera click **Find...** and Noxturnal will scan your network and discover video cameras that are connected to your network if they have UPnP (networking protocol that permits IP camera to be discovered on a network) enabled. Noxturnal offers default connection options for some IP cameras (Axis, D-Link cameras, Vivotek and Hikvision). Make sure that when choosing the connection string available in Noxturnal to choose the connection string (URL) per the recording you are performing, if only video is to be recorded, or both video and audio are to be recorded.

If your camera is not automatically discovered by Noxturnal when using the **Find...** action you can always manually add your camera by entering the relevant connection string (URL) and the camera IP address into the **File or URL** field.


If you have a video device that is not supported by the default connection options mentioned above you can always manually add new connection strings (URL) to have them accessible in Noxturnal for future use. To do that browse to **Tools > Settings > Advanced** and select the **Default Settings**. Open the Video Profiles folder and open the *IPCameras* Excel sheet. You can add to the existing list of connection strings a new connection string for you video device and that will become available to use within Noxturnal.

When you have entered the User and Password information for your camera you can click **Start Preview** to see if your camera is correctly set up and working with Noxturnal. If a delay is observed during the preview a delay input can be added to correct the video replay during the analysis. Click **Next** and you can give the camera a unique name and then click **Finish**.

Device Properties

Video Device

1 Video Properties 2 Device Info



Device Name:
AXIS P3364 - 00408CF948CB

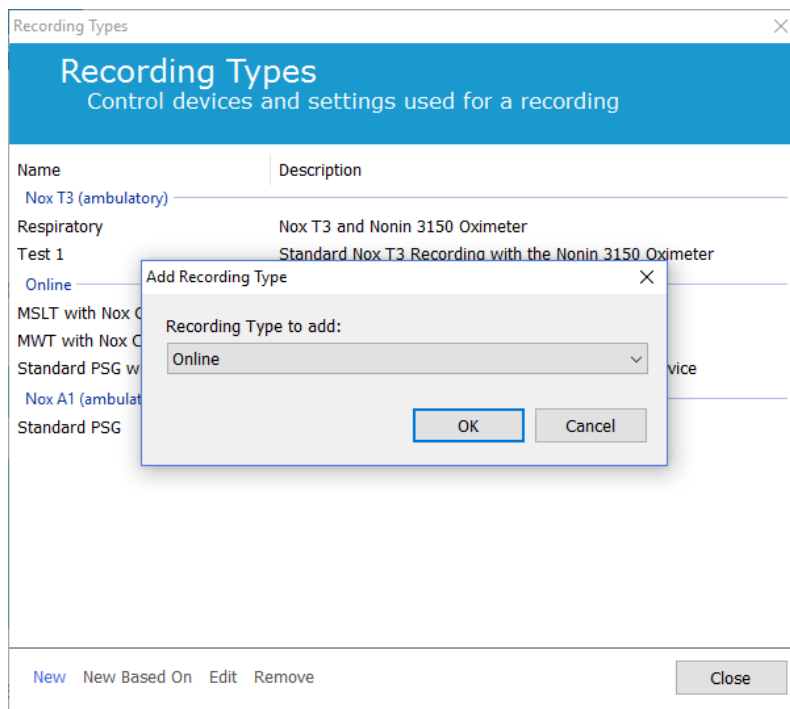
Device: Video Device
Device Type: Video Camera

< Previous Finish Cancel

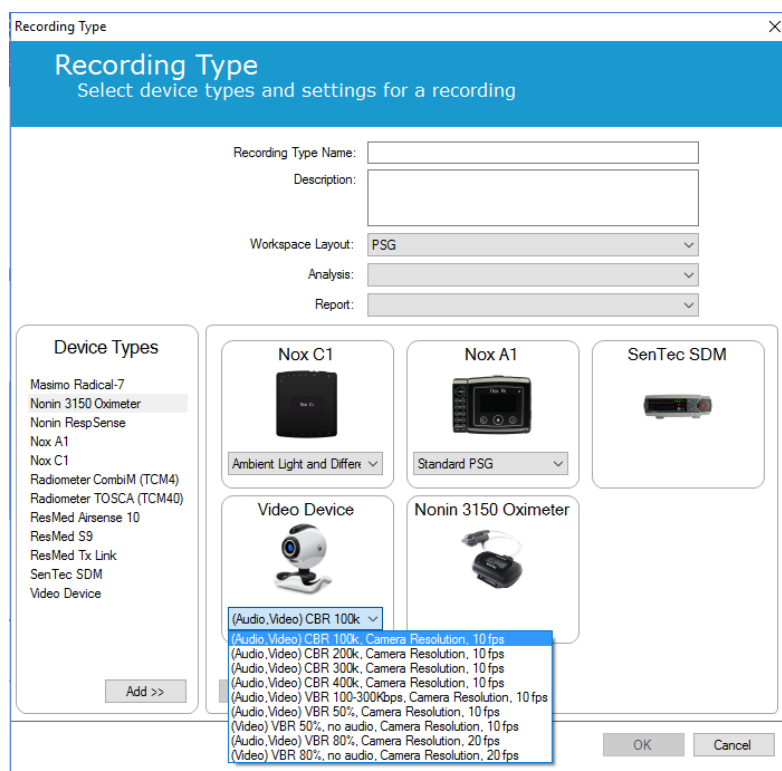
You have now added the video device to your online room.

Setup a Recording Type with a Video Device

Noxturnal offers default Recording Types for online recordings that include video device. You can select one of the default Recording Types and start directly an online recording which includes a video device. You can also set up a custom Recording Type and define the Windows Media Profile to use with Noxturnal when recording and compressing the online video. To do that navigate to **Devices > Recording Types...** from the Noxturnal toolbar. In the Recording Types wizard select **New** and **Online** from the **Recording Type** dropdown list.

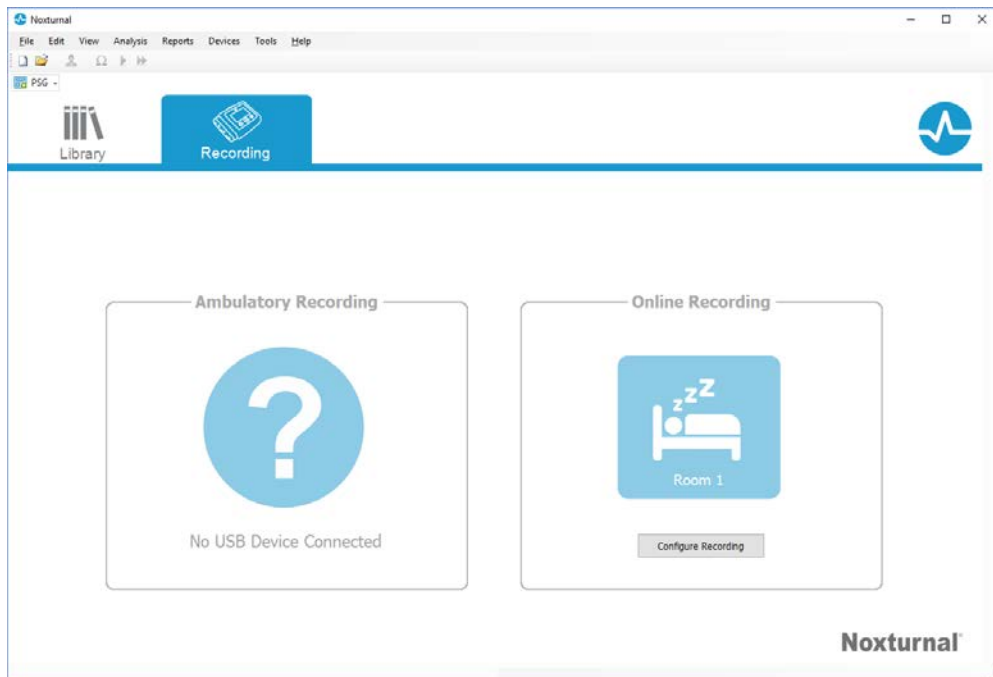


In the Online Recording Type wizard, you can add your video device as other devices. You can select the video profile to be used from the drop down list, see image below.



Noxturnal offers selection of default video profiles, however, you can create custom profiles and access them for use in Noxturnal. For further information and instructions on how to do that refer to Nox Medical support site, Windows Media Profiles in Noxturnal.

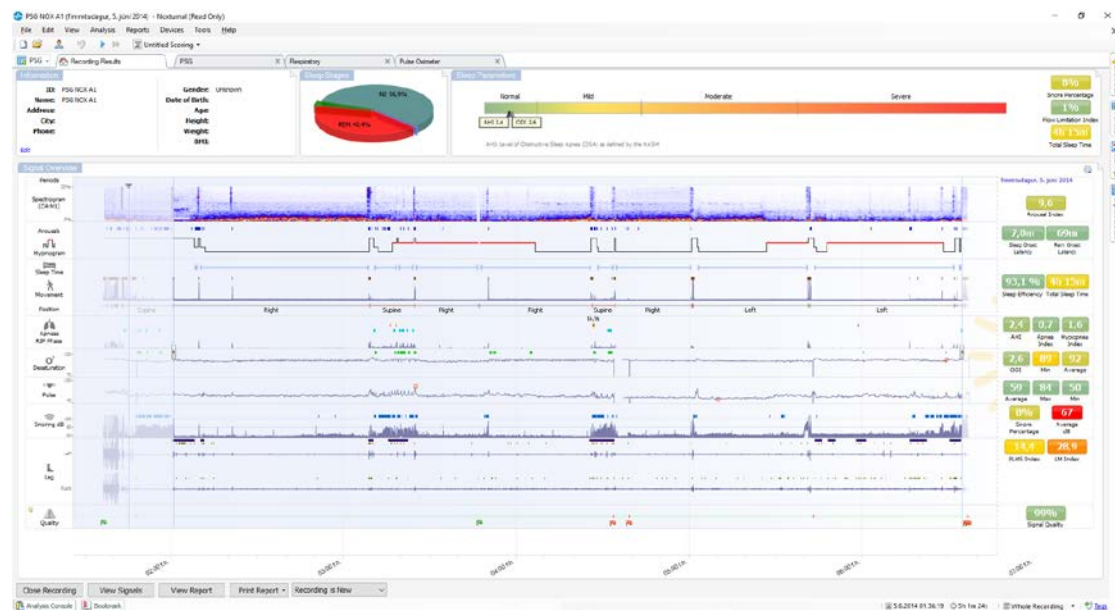
You have now configured your system to include a video device and you can start an online recording from the Noxturnal **Recording** page by double-clicking the room or click **Configure Recording**.



Working with recordings in Noxturnal

Recording Results Page

After downloading from a recording device or opening an existing recording in Noxturnal the **Recording Results** page is shown. This page contains an overview of the most common analysis parameters and the recorded signals. The result page is automatically updated when changes are made to the existing scoring or if the automatic analysis is run. When sleep stages are available, such as for recordings done with the Nox A1 Recorder, you will see graphs and information with that information. For the Nox T3 Recorder, you will only see parameters available with that device.



Result Page Commands

The **Recording Results** page has buttons for the following actions:

- **Close Recording:** This option closes the active recording and returns to either the Recording Library or the Recording page.
- **View Signals:** This option selects the first available signal sheet, allowing to browse through the recorded signals, view automatically scored events and manually edit scored events.
- **View Report:** This option creates the default report for the recording, the report defined within the Recording Type (for further information refer to the Recording Types section).
- **Print Report/Result Page:** This option prints the default Report or/and the Recording Results Page.
- **Recording Status:** This option allows to set the status of recordings. Downloaded recordings always have the status **New**. If a recording has failed for any reason, the status can be set to **Invalid**. If the recording has been diagnosed, the status can be set to **Scored**. If the recording and the scoring have been reviewed, the status can be set to **Reviewed**. If the recording has been interpreted, the status can be set to **Interpreted**. If a recording has been diagnosed and accepted, the status can be set to **Done**.

- **Play Audio:** If the recording contains audio, the play audio button allows to play the audio. Audio playback can also be played or paused by pressing the space bar key.

Patient Information

The **Information** panel shows information about the recorded patient. Edit the recording properties and patient information by selecting the **Edit** link or by pressing the **Ctrl+I** shortcut key.

Information

ID: 1234567890

Name: John Doe

Address:

City:

Phone:

[Edit](#)

Gender: Male

Date of Birth:

Age:

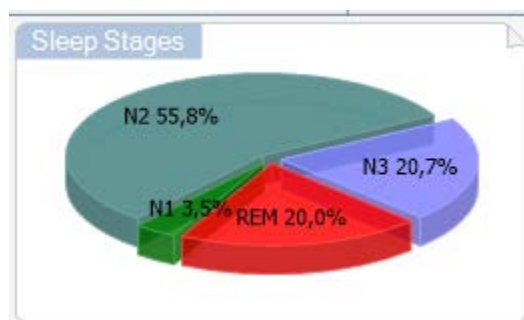
Height:

Weight:

BMI:

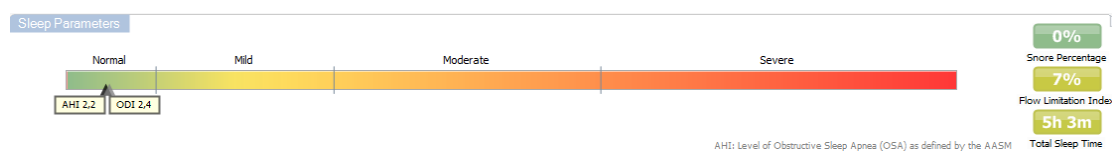
Sleep Stages

The **Sleep Stages** panel shows a pie chart of the four different sleep stages **if** sleep stage events have been scored.



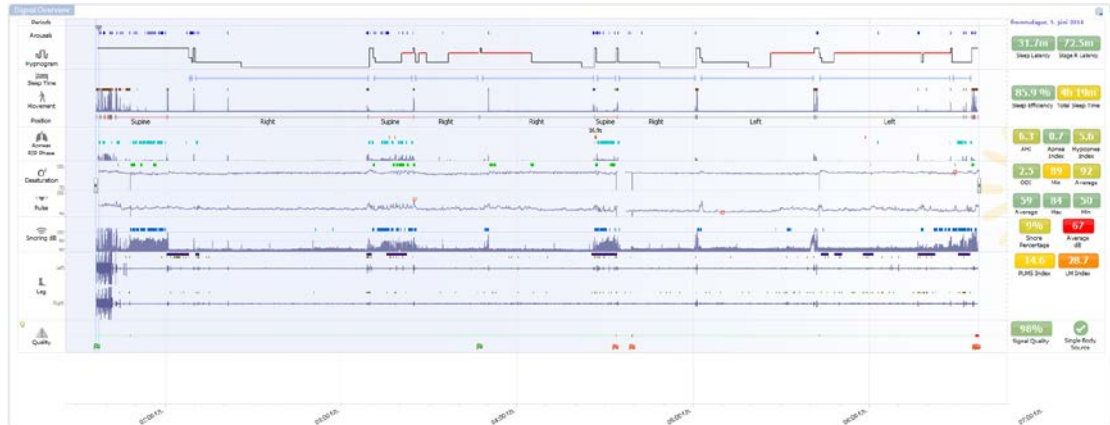
Sleep Parameters

The **Sleep Parameters** panel shows the main analysis parameters and their relation to severity. AHI, the Apnea Hypopnea Index, is the number of apneas and hypopneas per hour of sleep and Oxygen Desaturation Index (ODI) is the number of scored oxygen saturation drops per hour of sleep (default automatic analysis scores all desaturations of 3% or higher but this can be customized by the user). The "sleep" time is calculated based on Total Sleep Time in Polysomnography (PSG) recordings and Est. Total Sleep Time (same as American Academy of Sleep Medicine (AASM) term Monitoring Time) for Polygraphy (PG) recordings. Snore Percentage is the proportion of sleep time spent in snore episodes (marked as Snore Trains). The severity goes from *Normal* → *Mild* → *Moderate* → *Severe* and complies with the levels set forth by the AASM. If more than one night has been recorded, then these parameters will show the average values for all nights. Refer to the section *Analysis Protocols* for more information.



Signal Overview and Parameters

The **Signal Overview** panel is a top down reviewing tool where recording results can efficiently be reviewed and edited. The overview panel is split up into analysis parameters on the right and signal overview on the left.



The analysis parameters show a summary of the most common analysis parameters for a single night. If more than one night has been recorded, then each night is represented within its own panel. You can also select the period to view with the period menu located in the lower right corner of the application. Each parameter is color coded based on its severity ranging from green to red (*Normal* → *Mild* → *Moderate* → *Severe*).

- **Arousal Index** is the number of arousals per hour during sleep time.
- **Sleep Onset Latency** is the duration in minutes from Lights out (Analysis Start Time) until the first epoch of scored sleep
- **REM Onset Latency** is the duration in minutes from the first occurrence of sleep until the first occurrence of REM.
- **Sleep Efficiency** ranges from 0-100% where 0% means that the patient was awake the entire night and 100% means that he slept throughout the night. When sleep scoring is not available the software uses movement periods to estimate this parameter.
- **Total Sleep Time** is the time the patient spent asleep (based on Hypnogram).
- When **Total Sleep Time** is not available **Est. Total Sleep Time** (Same as AASM term Monitoring Time) is the parameter used. That is the time the patient is lying down during the recording. The green color code (normal) is shown when the Total Sleep Time or Est. Total Sleep Time is more than 6 hours.
- Respiration is represented by indices. Indices are a method to represent analysis parameters in a standardized way.
 - Apnea Hypopnea Index (**AHI**)
 - **Apnea Index** (AI)
 - **Hypopnea Index** (HI)

- Oxygen Desaturation Index (**ODI**) represents a number of oxygen desaturation events per hour of **Total Sleep Time** or alternatively **Est. Total Sleep Time**.
- **Snore Percentage** is the proportion of sleep time spent in snore episodes (marked as **Snore Trains**)
- **Average dB** is the average dB levels during snore train periods.
- Overall **Signal Quality** is determined from the monitoring of signal quality of the following signals: oximeter, airflow, abdominal or thoracic respiratory effort signals. The lowest signal quality of those signals is displayed for the overall **Signal Quality** on the Recording Results Page and is represented from 0-100%.
- The **Single Body Source** result indicates whether the oximeter and RIP belt signals are originated from the same subject. For further information about this result, refer to the section *Single Body Source*.

Signals and Events

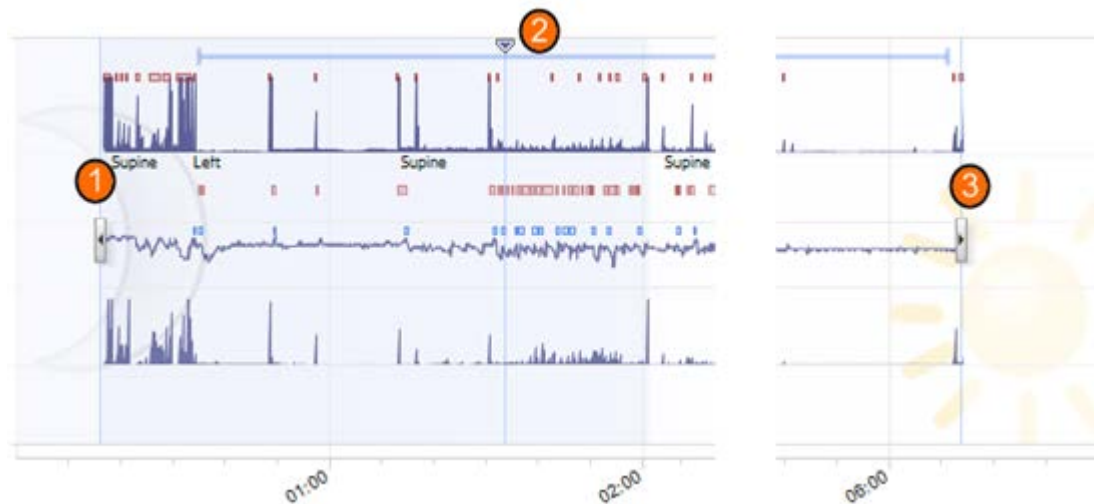
The signals and events plot in the signal overview panel give an overview of the whole night.

- Signals in the overview can include:
 - **Spectrogram** for the channel displayed on the screen (Right click the Spectrogram to change the channel)
 - **Arousals/Hypnogram** shows the arousals and sleep stages throughout the night
 - **Sleep Time**
 - **Movement**
 - **Position**
 - **Apneas/RIP Phase** (phase between abdomen and thoracic respiratory effort signals)
 - **Oxygen Desaturation** (SpO₂)
 - **Pulse**
 - Audio Volume (**Snoring dB**)
 - **Leg Movements** (optional)
- Events shown in the overview include apneas and hypopneas, oxygen saturation drops, snoring episodes and artifacts.

Moving the mouse cursor over the **Arousals/Hypnogram**, **Sleep time/Movement/Position**, **Apneas/RIP Phase** and **O₂ Desaturation** and **Pulse** icons will show more details for the related signal or events.

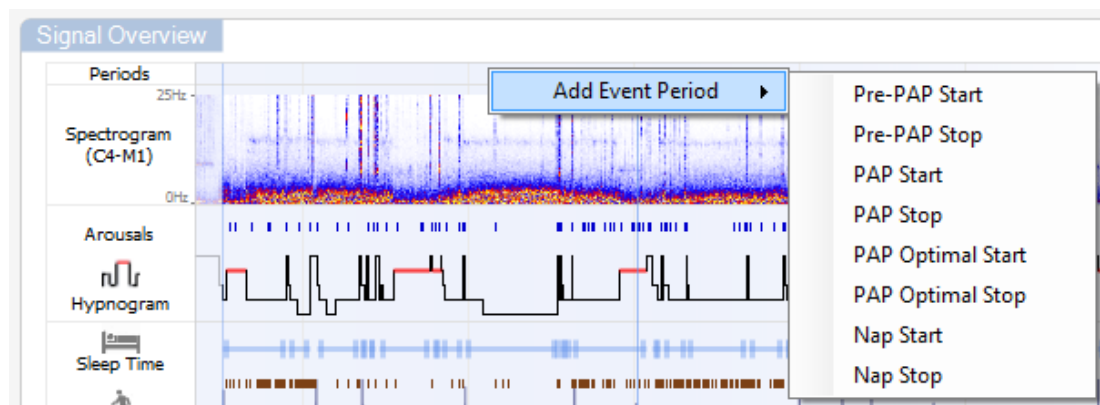
Changing the Analysis Periods

If a recording starts before all sensors have been attached or if the patient removes the sensors before the recording ends, it is possible to adjust the interval being analyzed by moving the Analysis Start **1** and Analysis Stop markers **3** to the appropriate location within the recording. All the analysis parameters are updated accordingly when these adjustments are made.

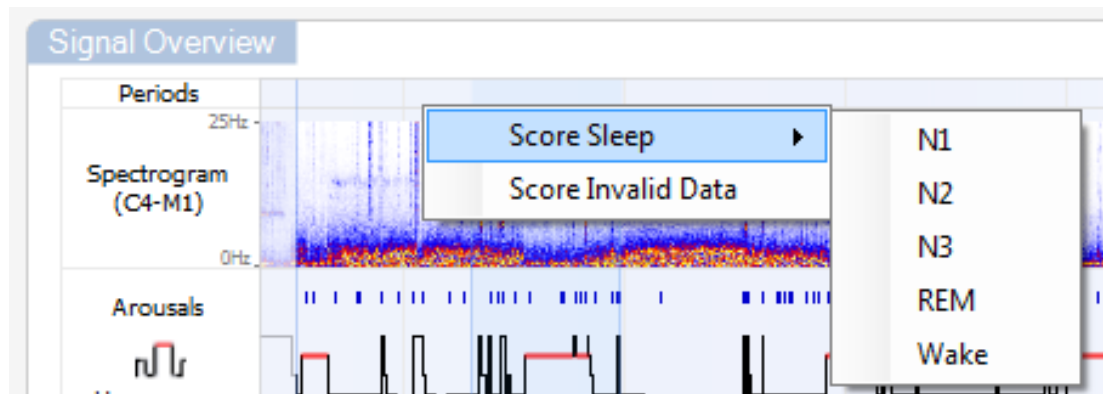


To navigate into the recording use the synchronization marker **2**. All signal sheets such as the **PSG**, **Respiratory** and **Pulse Oximeter** sheets are synchronized accordingly. If an interesting event is located in the overview, drag the synchronization marker over that area and browse into the relevant signal sheet to view the raw signals.

Event periods can be added directly from the **Signal Overview** panel. To add an event period, locate the mouse pointer to the **Periods** panel and mouse click. The **Event** period menu will be available as shown below.

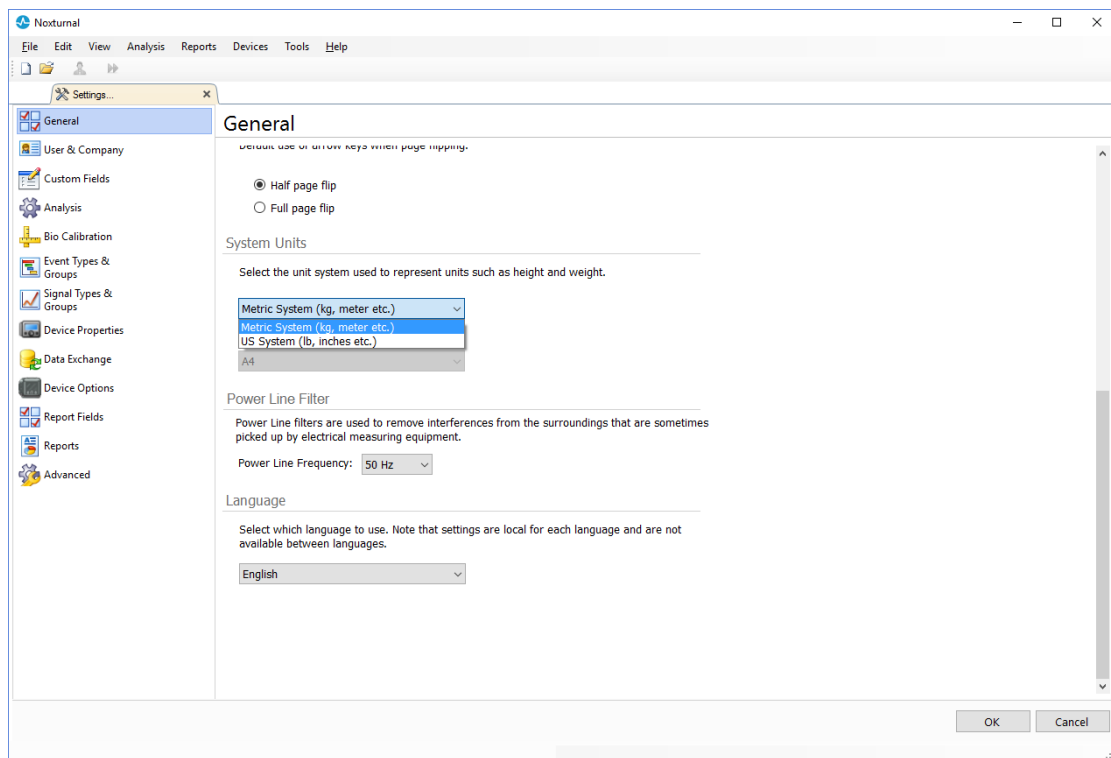


Sleep scoring and exclusion of invalid data can be performed in Signal Overview panel. To score sleep or exclude invalid data from the recording locate the mouse pointer to the **Periods** panel, left mouse click and select an area by dragging left/right. Release the mouse button and the menu showed below will be available. The 'Awake' events and 'Invalid Data' events will be excluded from the report calculations.




Setting Units

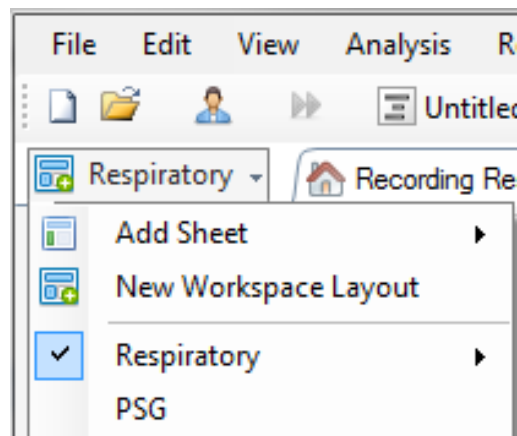
To change the unit system used to represent units such as height and weight navigate to **Tools > Settings...** from the Noxturnal toolbar. On the **General** property page locate the **System Units** drop-down list and select the applicable field to be edited.



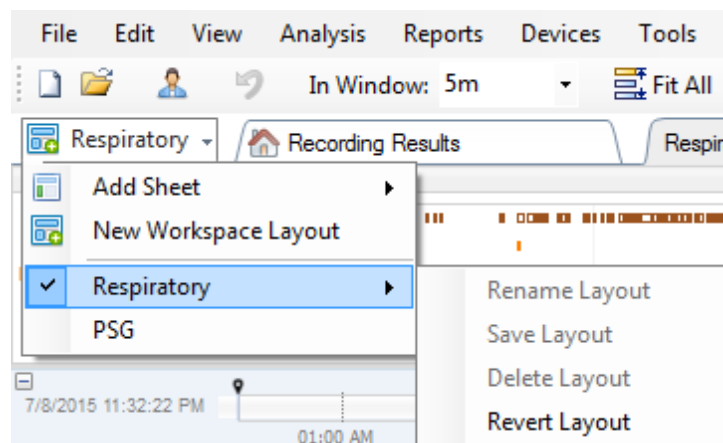
Viewing Signals

Workspace Menu Button

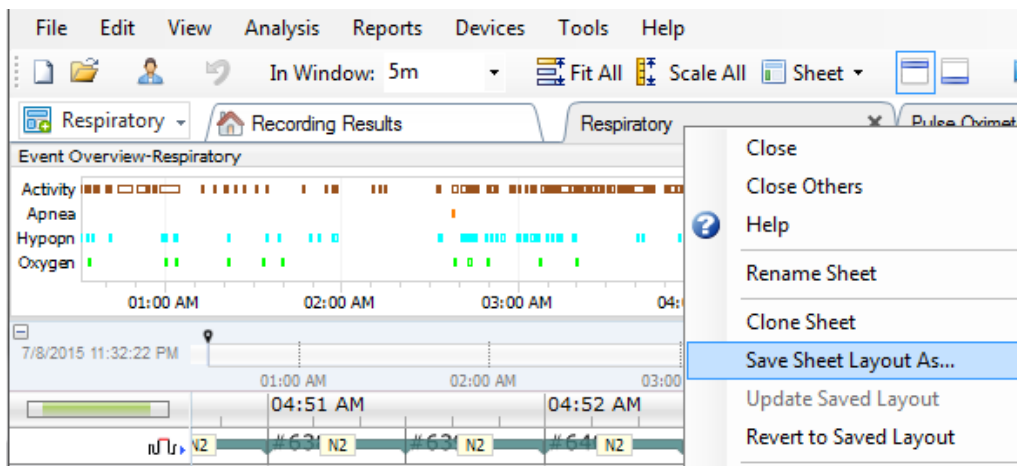
The **Workspace Menu Button**  allows you to apply different Workspace Layouts and signal sheets to manage the way you want to see your recordings. The Workspace Layouts include a selection of signal sheets and signal sheet properties. Noxturnal offers a range of default Workspace Layouts (Respiratory and PSG layouts) and signal sheets. You can also setup custom Workspace Layouts and Signal Sheets. You can save all changes to your workspace layout for future use. This means that you can change settings on traces and setup your work environment as you see fit.



You can use the Workspace Menu button to **Add Sheet**, Create a **New Workspace Layout**, using a default layout to base it from or even **Revert Layout** after making changes.



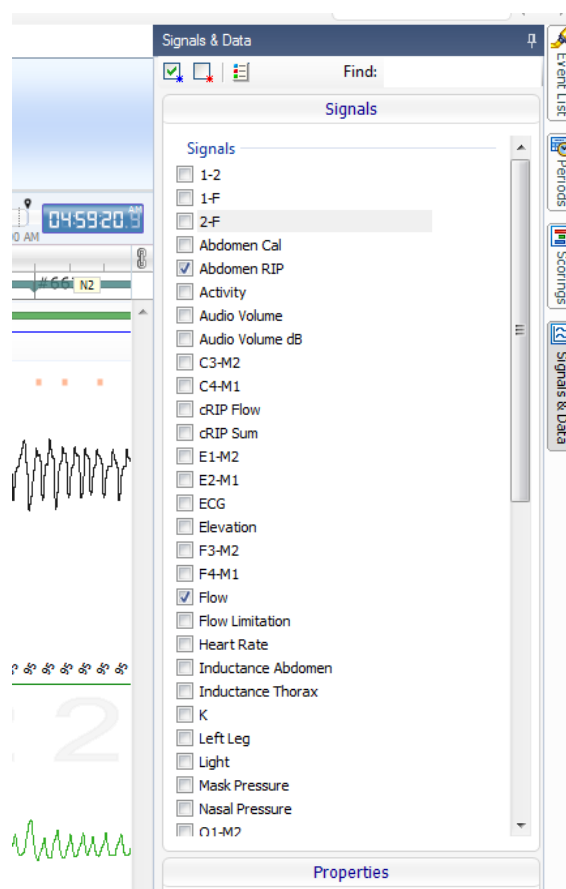
To save a customized signal sheet you right click on the signal sheet tab and select **Save Sheet Layout As...** When you have saved the customized signal sheet you can always **Update Saved Layout** if additional changes are made. For further information on signal sheets refer to the *Signal Sheets* section.



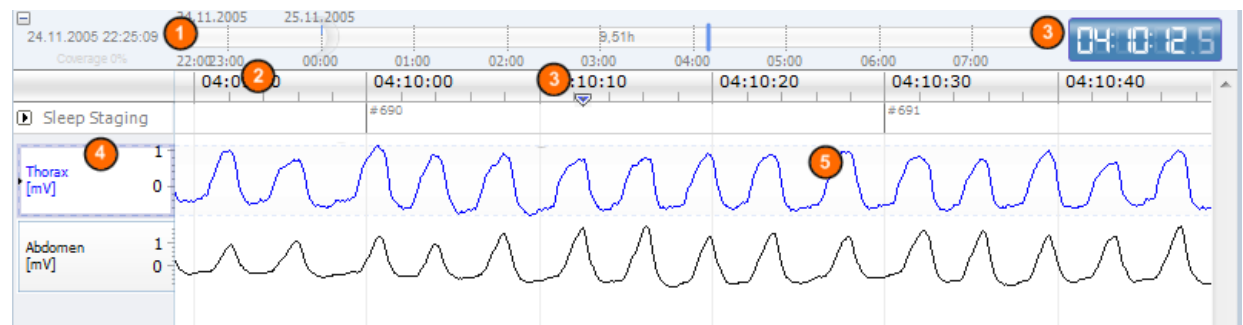
Signal Sheets

A signal sheet shows one or more signals in a tab window in the workspace. Noxturnal comes with predefined signal sheets such as the **Respiratory** sheet, **PSG** sheet, and the **Pulse Oximeter** sheet.

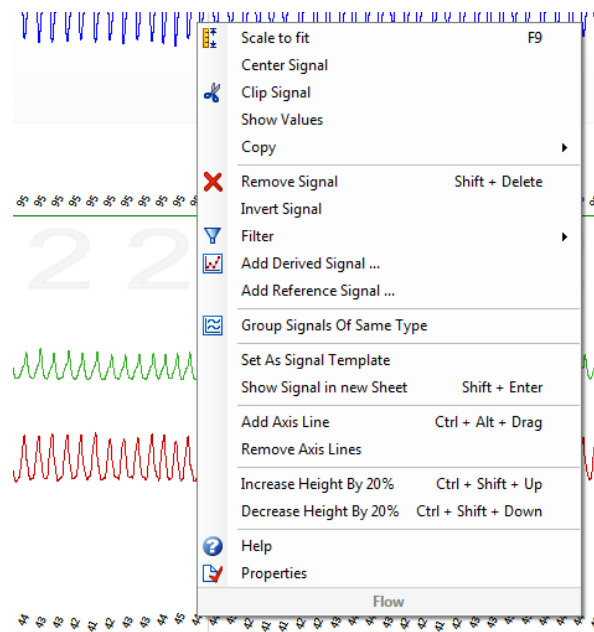
To add or remove signals in a signal sheet navigate the mouse to the **Signals and Data** task window located to the right of the workspace. When the mouse cursor is over this tab the **Signals and Data** task window will slide out. A list of all signals available is listed in this task window. A checkbox next to the signal determines if the signal is displayed in the sheet or not. Check/Uncheck the box to add or remove the signal from the sheet. See the **Signals & Data** tab here below.



Working with Signals



- 1 The navigation bar allows to quickly navigate to any time in the recording. The blue line indicates where the user is located in the recording. Click on any location in the bar to jump to that time.
- 2 Time axis displays the recording time and the time period in the window. Right-click on the time axis to change the interval in the window. Stretch/compress the time axis with the mouse to change time interval in the window.
- 3 The synchronization marker located on the time axis is used to synchronize with other signal sheets and views. The clock on the right side of the navigation bar shows the time of the marker position. The synchronization marker can be dragged and moved in time.
- 4 Signal value axis shows the name of the corresponding plotted signal and the value axis scale. The axis can be stretched/compressed with the mouse. To change the properties of the value axis, double-click on the axis and a dialog will appear where the properties can be changed.
- 5 Signal plot in a pane. Signals can be adjusted in many ways. Resize the signal pane or move the signal pane around by using the mouse. To change the properties of the signal, double-click on the signal and a dialog will appear where the signal properties can be changed. To access all actions for an individual signal trace right click the signal trace and the following menu will be available.



Keyboard Navigation

Navigate and manipulate the signal sheet by pressing the following shortcut keys:

Navigation:

- Right key = By default - Half page flip forward, user configurable
- Left key = By default - Half page flip backward, user configurable
- Ctrl + Right key = By default - Full page flip forward, user configurable
- Ctrl + Left key = By default - Full page flip backward, user configurable
- Page Down key = Page flip forward
- Page Up key = Page flip backward
- Home key = Start of recording
- End key = End of recording
- Shift + Right key = Increases time span in window
- Shift + Left key = Decreases Time span in window
- Shift + Ctrl + Left key = Jump to previous data session
- Shift + Ctrl + Right key = Jump to next data session
- - key = Zoom out of selection
- + key = Zoom into selection
- Mouse wheel = Scroll forward/backward
- Mouse wheel + Ctrl key = Scroll up and down

Active Signal:

- Shift + Up = Increase signal scaling
- Shift + Down = Decrease signal scaling
- Ctrl + Up = Shift signal up
- Ctrl + Down = Shift signal down
- Shift + Return = Show active signal in new sheet
- Shift + Delete = Remove active signal from sheet
- Up key = Select signal above
- Down key = Select signal below
- Ctrl + F = Find events
- F9 = Auto scale signal

Signal Sheet:

- Space = Play/Pause recording playback
- Ctrl + W = Auto scale signals
- Ctrl + A = Arrange signals

Events:

- Tab = Next event, if searching then next search result
- Shift + Tab = Previous event, if searching then previous search result
- Delete = Delete selected events, or delete events overlapping selection
- Return = Deselect all events
- Esc = Clear all selections

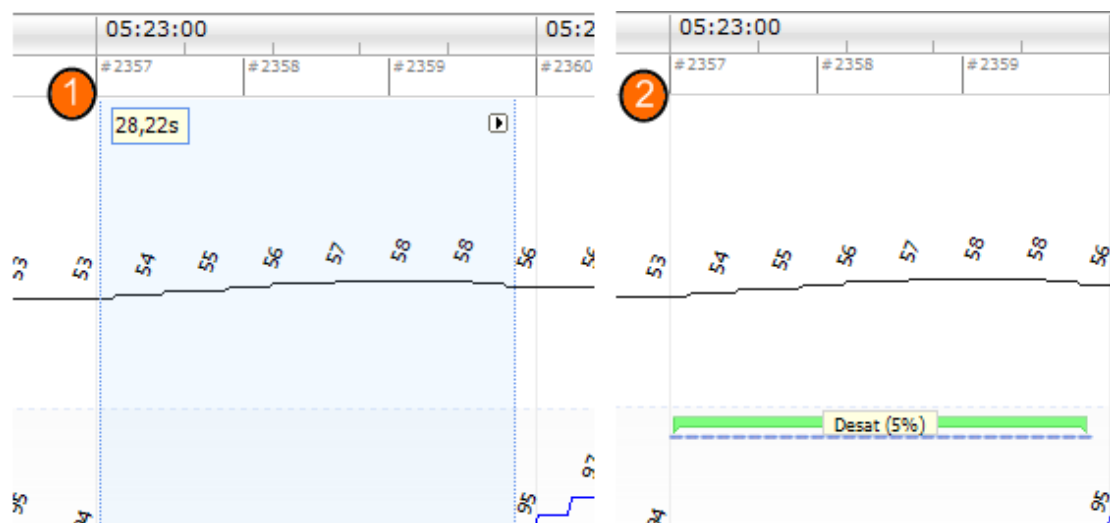
Working with Events

Events are used to identify areas of interest in a signal. An event has a start and stop time and a type used to classify it. Events can either be manually added to a signal or scored by the automatic analysis to flag areas of interest. Events can be modified or removed.

Scoring an Event


To score an event go to a sheet containing signals; locate an area on a signal of interest.

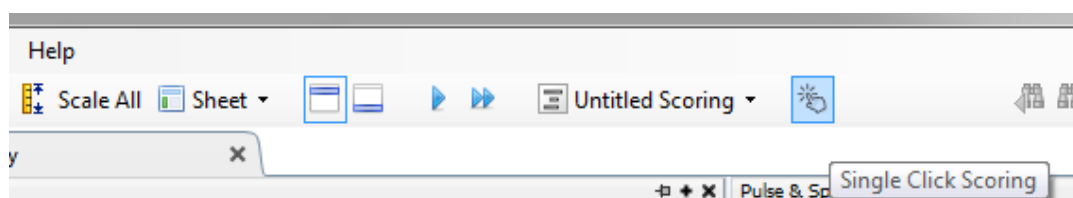
- 1 With the left mouse button, highlight an area to score the event on.
- 2 Press the shortcut key for that event. For a list of scoring shortcut keys go to **Edit > Configuration > Scoring Shortcut Keys...** from the Noxturnal toolbar.



An alternative method for scoring an event is to highlight an area with the left mouse button, as before, but then right-click on the area and select an event from the list.

Single Click Scoring

Noxturnal offers the option to use **Single Click Scoring**. To activate the single click scoring action click the  icon located in the Noxturnal toolbar.



Within the applicable signal sheet manually score an event on the relevant signal trace, for instructions on how to manually score an event refer to the *Scoring an Event* section above. When you have scored the first event the single click scoring feature will enable you to continue scoring the same event type with only single mouse click as you browse through the recording.

Deleting an Event

There are several ways to delete existing events:

- Select an event by left-clicking it and then press the **Delete** key.
- Right-click on an event and select **Remove Event**.
- Select an area with the mouse that intersects with the events to delete and press the **Delete** key.

Moving an Event

To move an event to a different location, select the event by holding down the left mouse button and then drag the event to the desired location. Events can be dragged between signals as well as to a different time period.

Resizing an Event

To resize an event, move the mouse cursor over the left or right boundary of an event. The mouse cursor should change to an icon of an arrow pointing right and left. Once the icon has changed to an arrow, left-click and drag the event to the desired duration.

Navigating Events

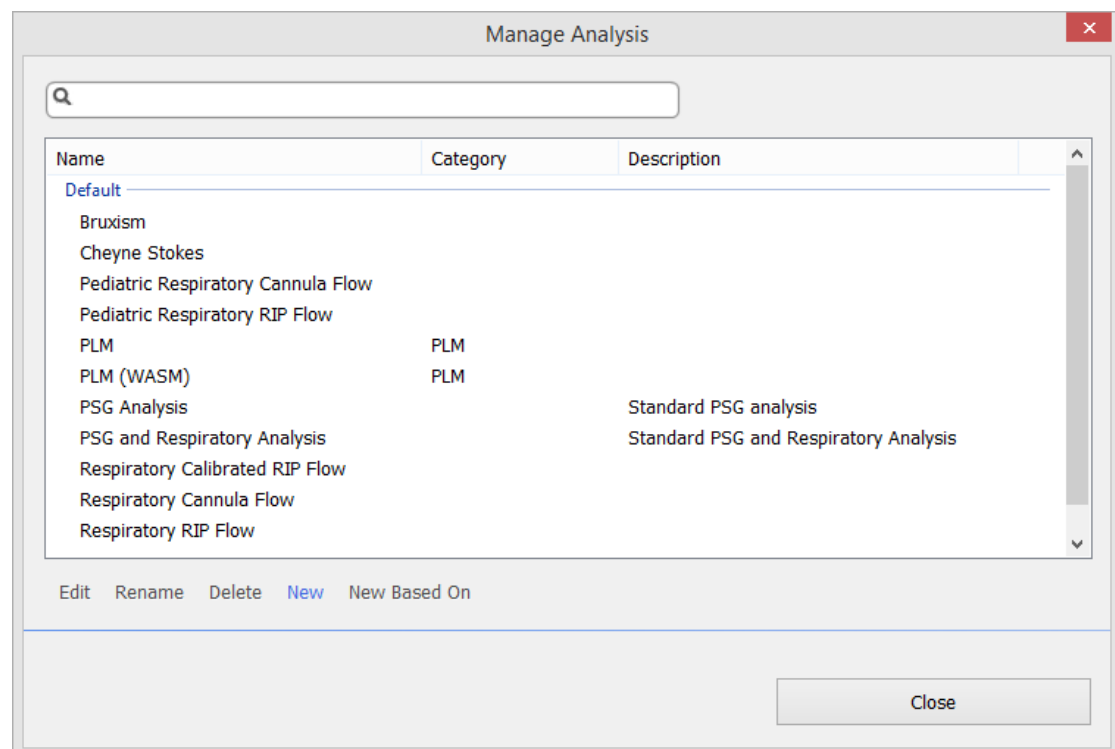
There are several ways to navigate scored events in the recording:

- Jump between the events that have been scored on a signal by clicking on the signal and pressing the **Tab** key which jumps to the next event in time. To jump to the previous event in time press the **Shift + Tab** key.
- In the top right corner of the workspace there is a search text box which allows you to search for any events that have been scored. Clicking on the textbox shows a dropdown list of all event types that have been scored. To search for events of some type click on the event type in the list. This shows the next event in time with that type. Click on the navigation buttons in the drop-down list to navigate the events.
- Select **View > Event Overview** from the Noxturnal toolbar to bring up an overview window that shows all the events in a plot that have been scored in the recording. To navigate to a specific event click on it in the overview plot.

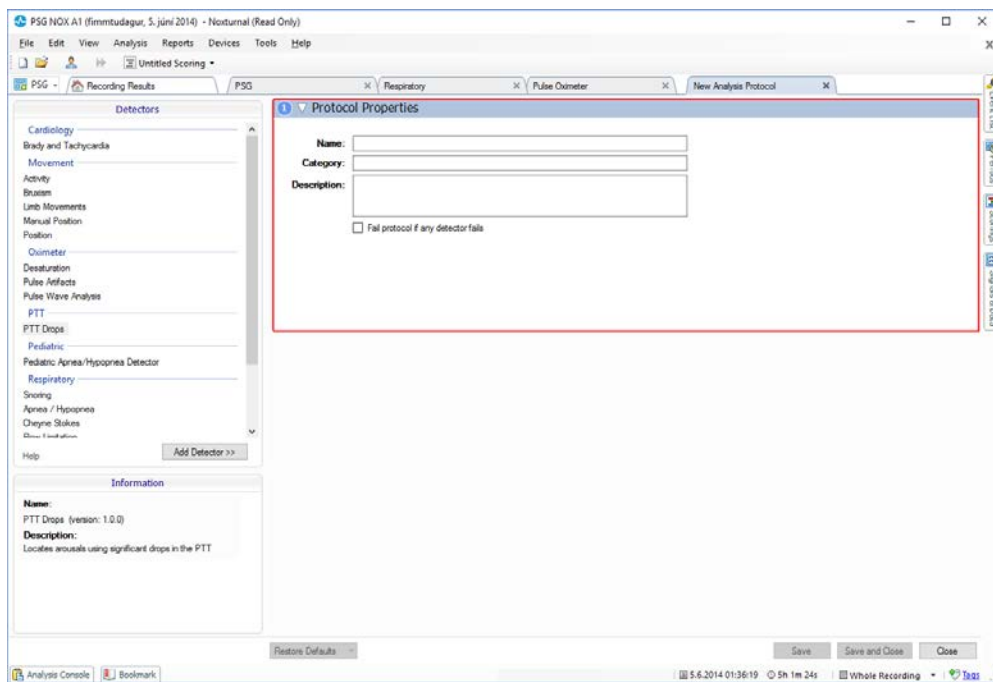
Analysis Protocols

An **Analysis Protocol** is a set of detectors that can be run on the recording to detect and mark various events within the recorded signals. The available analysis protocols, including the default protocols, are listed under the **Analysis** menu. To run an analysis protocol on the recording, select the applicable analysis from the **Analysis** menu and click on it.

Noxturnal offers a range of default analysis protocols and you can also create a new analysis protocol which uses customized settings and/or detectors. To setup a customized analysis protocol go to **Analysis > Manage Protocols** from the Noxturnal toolbar. You can **Edit** and **Rename** an existing protocol, or create a **New based on** an existing protocol.



For this example we will create a new analysis protocol. Select **New** in the **Manage Analysis** dialog. A new **Analysis Protocol** sheet will open up where the new protocol can be defined. A protocol is a collection of detectors and the function of a detector is to locate areas of interest within a signal and score the areas with events.

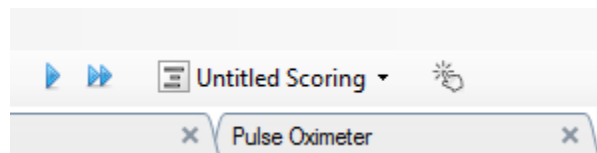


To add a detector to the protocol, choose detector from list of **Detectors** and select **Add Detector >>** **General Properties** and the **Input Signal** can be edited.

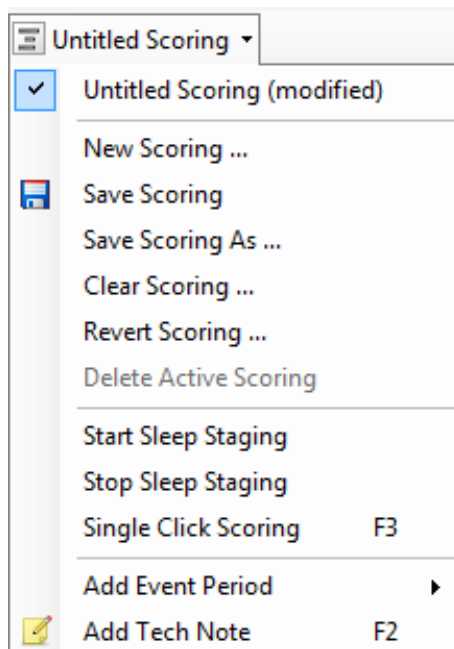
When you have setup your analysis protocol click **Save and Close** and the protocol will be added to the list of available analysis.

Working with Scorings

A scoring is a collection of events that are scored on signals in the recording. The actions for working with scorings are located in the **Scoring Button** in the Noxturnal toolbar. The actions taken while working with scorings are listed in the sections below.



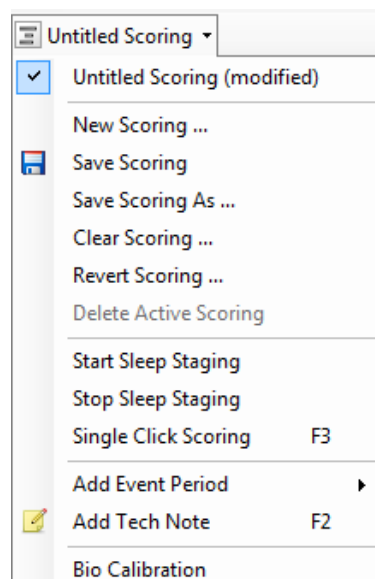
If you have included an **Analysis protocol** in the **Recording Type** configured for the recording then when downloading from a Nox recording device, Noxturnal automatically uses the default analysis protocol to analyze the recording. For online studies you need to close down the recording when completed and when reopened from the recording library the defined default analysis will analyze the data. The automatic analyzing of the data creates a new scoring called **Untitled Scoring**, see screenshot above. In the **Scoring Button** you always see the **Selected Scoring** which is used for the reporting and recording overview features. You may easily create new scorings by using the features of the **Scoring Button**, for example if you make modifications to the automatic scoring, you can easily save that as a new scoring with the applicable name.



From the **Scoring Button** you can also **Add Event Period** or **Add Tech Note** to the recording.

New Scoring

When using devices that record EEG, you can use the sleep staging features of Noxturnal. Noxturnal offers an automatic sleep stager with the system to assist the manual scorer. Also, a manual sleep staging without using the automatic sleep stager first, is possible. To perform manual sleep staging click the **Scoring Button** and select a **New Scoring**.



After that, to start sleep staging you can select the **Start Sleep Staging** action from the menu in the **Scoring Button**. The number pad on your keyboard is used for the default sleep staging hotkeys. You can change the scoring hotkeys as explained below.

The **Scoring Button** is also where you can start your **Bio Calibration**.

Select a Scoring

Multiple scorings can be associated with a single recording. All available scorings are listed in the scorings panel. Select the active scoring by clicking on it.

Save Scoring

Save the active scoring by clicking on the **Save Scoring** option. The user will be prompted for a name for the saved scoring. The saved scoring will be added to the list of scorings.

Clear Scoring

If a scoring is active, this action will clear it. If the active scoring has local modifications, the user will be prompted on whether he wants to save his local modifications.

Revert Scoring

If a scoring has local, unsaved modifications, these modifications can be reverted. This means that the scoring will be returned to the state it was in when it was loaded.

Delete Selected Scoring

A saved scoring can be deleted by selecting it from the scoring list and clicking on the **Delete Selected Scoring** option. A prompt will come up, asking whether it is OK to delete the scoring.

Scoring Keyboard Shortcuts

A shortcut key is used to score events quickly. For a list of existing keyboard scoring shortcut keys or to change shortcut keys go to **Edit > Configuration > Scoring Shortcut Keys...**

As a general rule events should only have a single keyboard character as a shortcut, but a combination of **Ctrl**, **Shift** and **Alt** plus a keyboard character is supported.

Noxturnal Reports



- ▶ Note: Report results are fixed and are not updated when the analysis of the recording changes.
- ▶ Note: If changes are made to the analysis another report can be generated or the existing report refreshed.

Noxturnal offers a range of default reports that can be accessed by clicking the **Reports** menu from the Noxturnal toolbar. The default reports available in Noxturnal are from two different sources, some are built-in the so called new report system (implemented in Noxturnal 4.x) and others are built-in an older Noxturnal report system and are called **Legacy** reports. We highly recommend users to use the new report system to easily edit and customize reports. For instructions on how to customize reports in the new report system refer to the Customizing Reports section below.

It is important for users to be aware that there are some differences in the mechanisms between the new Noxturnal report system and the legacy reports. Following are some explanations addressing the differences between the report systems.

- There is a difference in how the position and activity is calculated. The table below lists the different calculations for position and activity parameters within the legacy reports and the new report system.

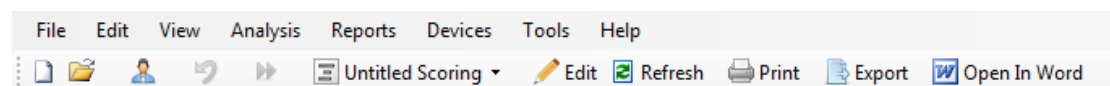
Noxturnal Reports	Calculation of Position and Activity
New Report System	Position and activity calculated from sleep period (in PSG study) or estimated sleep period (in PG study)
Legacy Reports	Position and activity calculated from the whole night

In the new report system the position and activity parameters are appended with the total sleep time (TST), e.g. "Supine Time (in TST)". Within the legacy reports the parameter would say "Supine Time".

- Within the legacy reports the quality index is calculated from the period chosen when reviewing recordings (selection available at the information bar bottom right of Noxturnal). If the period chosen is the "Whole Recording" the quality index is not affected within the reports when changing the analysis start and stop time for the recording. If the period chosen is "Analysis" the quality index is updated according to the analysis period selected. For the new report system, the quality index is always dependent on the analysis period.

Generating Reports

When you have generated a report in the new report system, you can easily modify the report by using the **Edit** button which is visible in the toolbar when viewing reports.

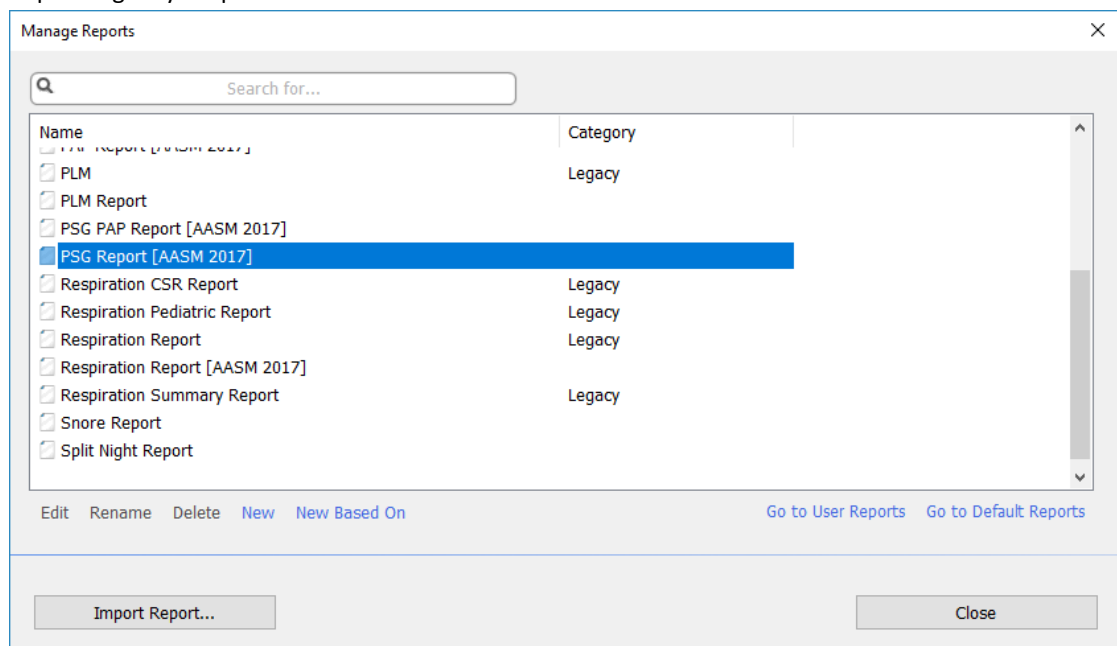


The Edit button launches the **Edit Mode** which allows you to edit the report in the same way as you would use Microsoft Word®. All changes that you make are immediately visible to you. You can also add new indices and even pre-defined report parts when interpreting a study. To stop **Edit Mode**, press the **Edit** button again. Changes that are made in the **Edit** mode are not saved as part of the report template.

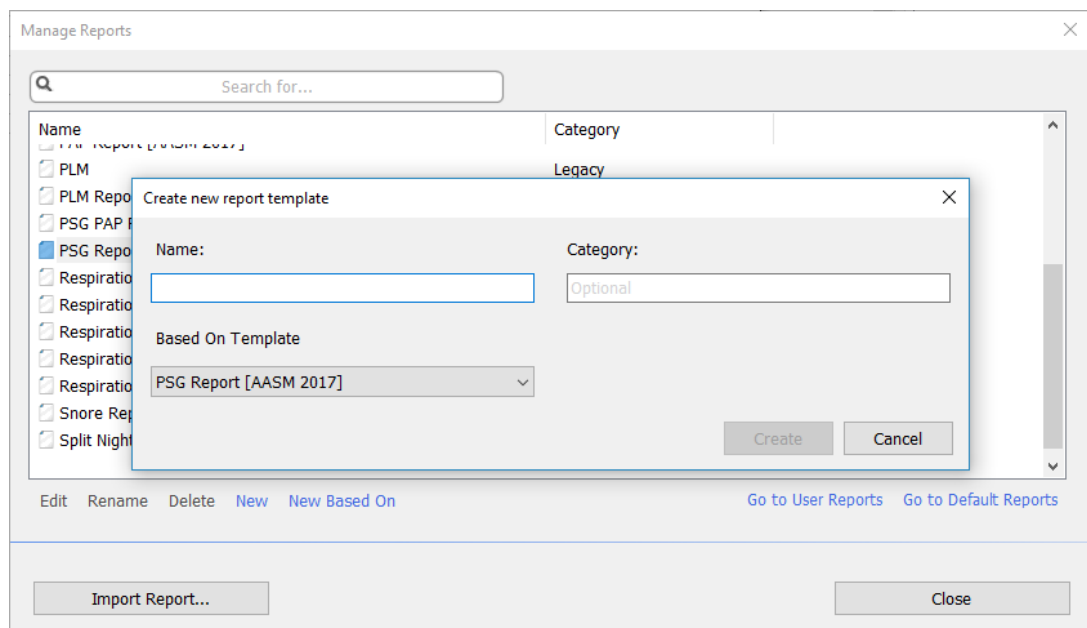
Customizing Reports

Noxturnal offers a powerful custom report system that includes Microsoft Word® like editing capabilities. Reports in Noxturnal can easily be customized. To create a custom report template, follow the steps below.

1. From the Noxturnal Toolbar select **Reports > Manage Reports...**
2. In the Manage Reports dialog select one of the options **Edit**, **New** or **New Based On** depending on your preferences.



3. For this example we will create a new custom report based on the default **PSG Report [AASM 2017]**. Select the **PSG Report [AASM 2017]** from the list of available reports and click **New Based On**.
4. You will see the following dialog where you can give the new report template a name and then select **Create**.



- A new sheet opens up with the default chosen report and in this window you can it. On the right side of the screen you can find a collection of **Fields** and **Report Parts** that you can use for your report. For further information on Report Parts and Fields refer to the *Report Parts and Report Fields* section below.

Note: In the report template you can hover over the fields (-) with the mouse to see the parameter's details. See figure below.

Sleep Stages	Duration	% of TST	% of TRT
N1:	-m	-%	-%
N2:	-m	-%	-%
N3:	-m	-%	-%
REM:	-m	-%	-%
Wake:	-m	-%	-%

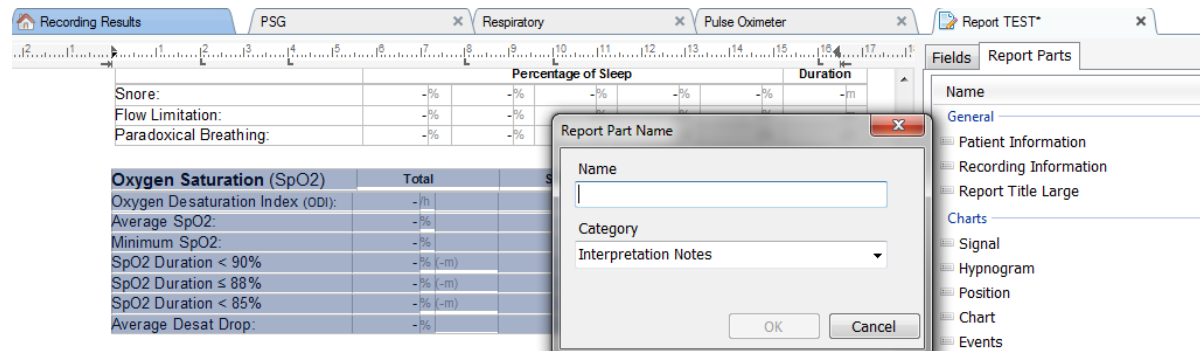
N1 Duration
Total duration of N1 events found in Sleep Onset to Wake as minutes

REPORT PARTS AND REPORT FIELDS

Each report part represents a section of your report such as Oximetry Saturation, PLM Details etc. Report parts and fields can be created in Noxturnal and you can save report parts from default reports to have available when creating reports from scratch.

CREATE A NEW REPORT PARTS

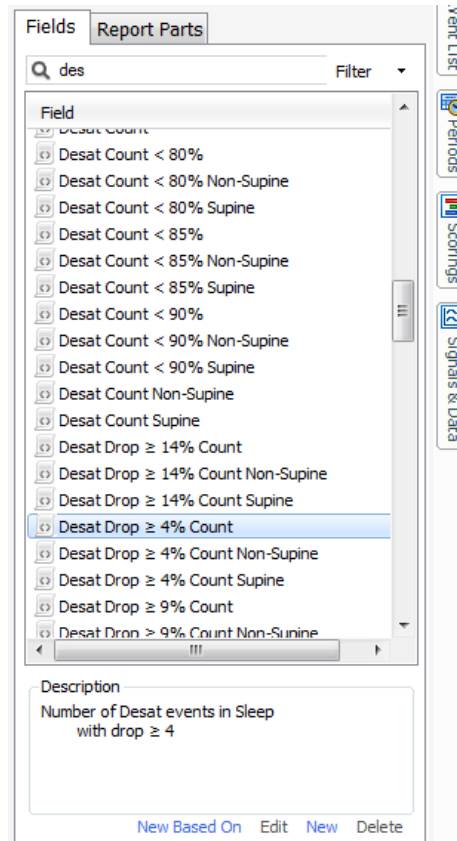
You can create new report parts and save for later use. To do that select the applicable report part in the report template (or any custom created text/table) and drag and drop it to the list of **Report Parts**. Give the report part a name and select the category. The new report part you created will be added to the list of **Report Parts**.



CREATE A NEW REPORT FIELD

You can create new report fields and save for later use. To do that follow the steps below.

1. For this example we will select the default field available in Nocturnal **Desat Drop \geq 4% Count** as a base for our custom field. Select the **Desat Drop \geq 4% Count** and click **New Based On**.



2. In the Edit Report Field dialog give the new field a name and edit the properties of the new field as required.

Dialog box titled "Edit Report Field".

Name: Desat Drop \geq 3% Count

Category: Oximetry

Number of events: Number of events

Number of Desat events in Sleep with drop \geq 3

An example of this type of field is the number of Desats

stats(named:Sleep).AsReference().Markers[Types(MarkerType:OxygenSaturation-Drop), Epoch:PeakToPeak:GreaterOrEqual(3)].Periods.Count

Conditions

Save Cancel

For this example we will change the desaturation drop to ≥ 3 and give the new field a descriptive name **Desat Drop \geq 3% Count**. If the conditions are to be changed click **Conditions** to see all available conditions.

ADD REPORT PARTS AND FIELDS TO REPORTS

To add **Report Parts** and **Fields** to your report set the mouse point to the preferred location in the report and double-click the desired report part from the list on the right side. Another way to add a Report Part and Field to a report is to drag and drop the desired report part/field into your report.

REPORT HEADER AND FOOTER

To customize the report header and footer follow the steps below.

1. From the Noxturnal toolbar select **Tools > Settings > User & Company** and you will see the following wizard where you can enter user and company information.

User & Company

User Information

User name, initials and email address are used to personalize reports and the user interface.

Name: Initials:

E-Mail:

Company Information

The company information is used in reports and in the user interface.

Name: Web Site:

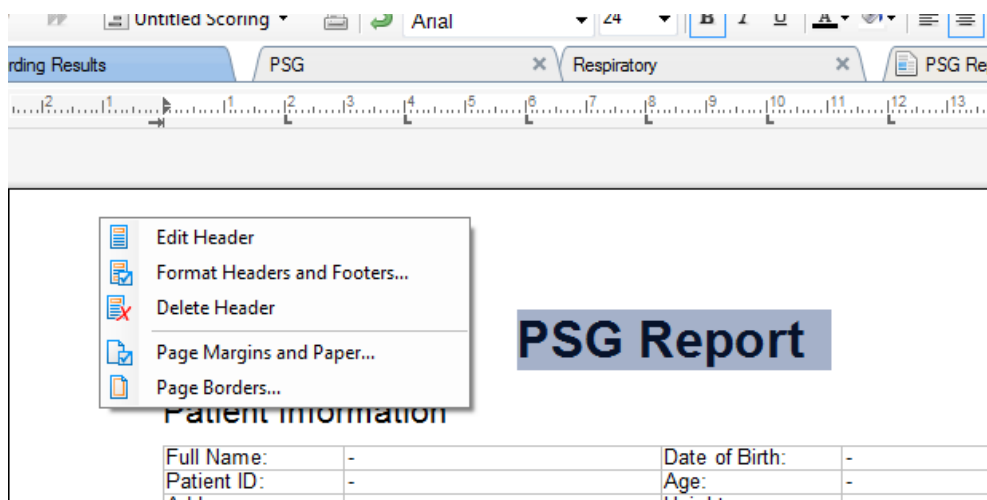
Address: E-Mail:

OK Cancel

Analysis Console | Bookmark | 5.6.2014 01:36:19 | 5h 1m 24s | Whole Recording | Data

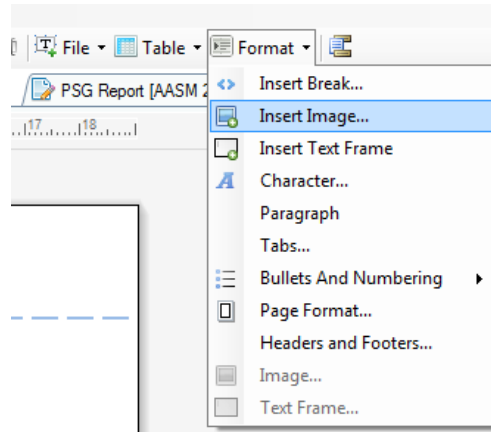
Fill in the fields shown above the applicable information. You can insert the information entered into your report using the corresponding Report Fields.

- To insert the information into the header/footer of your report place the mouse pointer within the upper part of the report, **right click** and select the option to **Edit Header/Footer**.



- Add the applicable fields from the list of available fields into the header section.

4. To add logo to your report header click **Format > Insert Image...** as shown below.

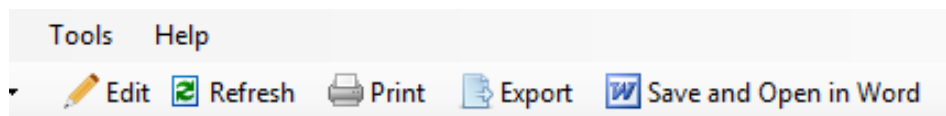


5. To add a page numbering to your report go the bottom of the report page **right click** and select **Edit Footer**. **Right click** within the **footer** area and select **Insert > Page Number**.

When you have completed setting up your report template select **Save**. Your report will be added to the **Report** list available from the Noxturnal toolbar.

Exporting Reports

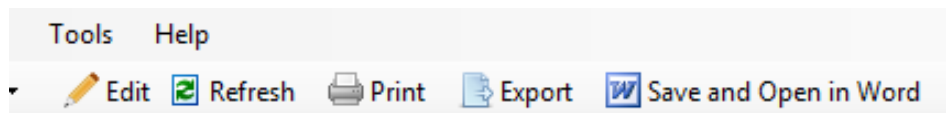
To export a report click **Export** from the report toolbar.



This will open a new dialog to specify the file format and the file name. Click the **Save** button when done and the report will be saved to the disk in the specified file format.

Printing Reports

After a report has been generated the user can print the report. To print a report select the **Print** option from the report toolbar.



A dialog will open where the printing options can be changed. Click the **Print** button when the settings have been adjusted.

The Recording Library

The recording library shows and manages all the recordings that have been downloaded from the Nox recording devices and online studies. When recordings are opened or downloaded in Noxturnal they are automatically added to the recording library. It is also possible to acquire licenses to open EDF files, EDF+ files, Embla files and Somnostar files in Noxturnal, and the corresponding recordings will be added automatically to the recording library.

To open a recording, select it from the recording library list and double-click.

Archiving Recordings

Recordings in the recording library can be archived to a different location or to a permanent storage. To archive a recording select one or more recordings in the library and click on the **Archive Recording...** button on the recording information panel. A dialog will appear guiding the user through the archiving process.

Single Body Source

The Single Body Source algorithm is a patent pending algorithm in Noxturnal that determines if the same subject wore the recording device and the associated sensors during the recording period.

The algorithm can return one of three results. The results and their meanings are listed below.

- **Not analyzed:** The algorithm has not been run for the recording.
- **Approved:** A single body source can be verified for the recording.
- **Inconclusive:** A single body source cannot be verified for the recording.

A variety of factors can result in an **Inconclusive** result, including the following:

- The recording does not contain the necessary signals (a pulse waveform signal from the oximeter and at least one RIP signal)
- The necessary signals are noisy or include prominent artifacts
- The sensors were not placed on the subject
- The sensors were placed incorrectly on the patient or were displaced during sleep
- The oximeter and the RIP belts were worn by separate subjects
- The recording is too short (at least 15 minutes of concurrently recorded pulse waveform and RIP signals are necessary)
- The cardiac artifact in the RIP signals (caused by the emission of blood from the heart to the arteries and the resulting torso movement) is too small

The Single Body Source algorithm can be run either as a tool (by clicking **Tools > Single Body Source**) or as an analysis detector, which can be included in a custom analysis protocol. The tool is run automatically after recordings are downloaded from a recording device.

The Single Body Source result is displayed on the **Recording Results** page under the **Signal Overview** section for each night and is also available as a report field for inclusion in custom reports. The result is indicated with one of the following symbols:

Not analyzed



A grey circle

Approved



A white check mark on a green circle

Inconclusive




A white question mark on a yellow circle

The automatic calculation of the Single Body Source algorithm for downloaded recordings and display of the Single Body Source result can be turned on and off in **Tools > Settings... > Advanced > Single Body Source**.

Regulatory Information

Description of Symbols and Abbreviations

PG	▶ Polygraphy
PSG	▶ Polysomnography
	▶ CE marking indicating conformance to EC directives 93/42/EEC and 2007/47/EC concerning medical devices
(01)15694311110255(8012)VVvrr (11)YYMMDD(10)ZZZZZ	▶ Unique Device Identifier (UDI): the Application Identifier (01) indicates the device identifier (DI) (i.e. "15694311110255"), the Application Identifier (8012) indicates the software version (i.e. "VVvrr"), the Application Identifier (11) indicates the production date/date of manufacture (i.e. "YYMMDD", with "YY" the last two digits of the production year, "MM" the production month and "DD" the production day), and the Application Identifier (10) indicates the lot number (i.e. "ZZZZZ")

About

This manual and associated translations are provided in electronic format according to Commission Regulation (EU) No 207/2012 of 9 March 2012 on electronic instructions for use of medical devices. They are also available in electronic format on Nox Medical's website: www.noxmedical.com.

Electronic versions are provided as PDF documents and a PDF reader is required to open the documents. PDF readers are commonly available at no cost for users. Refer to the applicable system and hardware requirements for the PDF reader that is used.

Hard copies can be requested at no additional cost by emailing support@noxmedical.com. The hard copy will be sent within 7 calendar days.