



# Instruction Manual

USA

# DOMINO

VERSION 2.6.0



SOMNOmedics America Inc. – 815 Ponce de Leon Blvd., Suite P-209  
Coral Gables, FL 33134  
Toll free: 866 361 9937  
info@somnomedics-diagnostics.com  
www.somnomedics-diagnostics.com



Rev. 2



**SOMNO**  
*medics*

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## Preamble

We are pleased that you chose our product. We are constantly working on updates and improvements and new releases of the Domino Software are available free of charge for our customers.

Any comments and suggestions you wish to make regarding the improvement of this Instruction Manual will be much appreciated.



Our Service-Hotline is available 24 hours a day at:

**866 361 9937 (toll free)\***

\* If due to technical difficulties our staff is not available, you will be redirected to our mail box. If that is the case, please leave your name and telephone number so that we can call you back as soon as possible.

## 1 System Requirements

**Note:** Before the analysis with the software can be started, the registration code must be entered in order to unlock the software. Please contact SOMNOmedics by Fax, E-mail, or telephone.

### ***System requirements for running DOMINO Software without Video or wireless data transfer.***

**Minimum:**

Pentium IV / AMD XP  
1024 MB RAM  
160 GB HDD  
AGP graphics card 64 MB  
USB 2.0  
CD-RW  
19" TFT monitor (1280x1024)  
Windows 2000/XP  
Colour Printer

**Recommended:**

Intel Core2 Duo E-Series/ Recent AMD  
2048 MB RAM  
250 GB HDD 7200 rpm  
PCIe graphics card 128 MB  
USB 2.0  
DVD-RW or CD-RW  
20" TFT monitor (1680x1050)  
Windows XP  
Colour Printer

### ***System requirements for running DOMINO Software, with wireless data transfer (without Video).***

**Minimum:**

Pentium IV / AMD XP  
1024 MB RAM  
160 GB HDD  
AGP graphics card 64 MB  
USB 2.0  
CD- RW  
19" CRT/TFT monitor (1280x1024)  
Windows 2000/XP  
Colour Printer

**Recommended:**

Intel Core2 Duo E-Series / Recent AMD  
2048 MB RAM  
250 GB HDD 7200 rpm  
PCIe graphics card 128 MB  
USB 2.0  
DVD-RW or CD-RW  
20" TFT monitor (1680x1050)  
Windows XP  
Colour Printer

### ***System requirements for running DOMINO Software with data telemetry and Digital Video***

This is only possible with a specified PC from SOMNOmedics.

### ***System requirements for running DOMINO Software with data telemetry and with video (notebook)***

This is only possible with a specified Notebook from SOMNOmedics.

**A colour laser printer is generally recommended.**

The functionality of the DOMINO software, version 2.6.0, was tested and verified for Windows XP and Windows 7 Professional (64 Bit).

## 2 Installation of DOMINO

### 2.1 Installing DOMINO for the first time

Observe the following steps for installation of DOMINO.

1. Open the DOMINO installation file “Setup” on the DOMINO CD with a double click. Choose your language and click on “**Next**”:

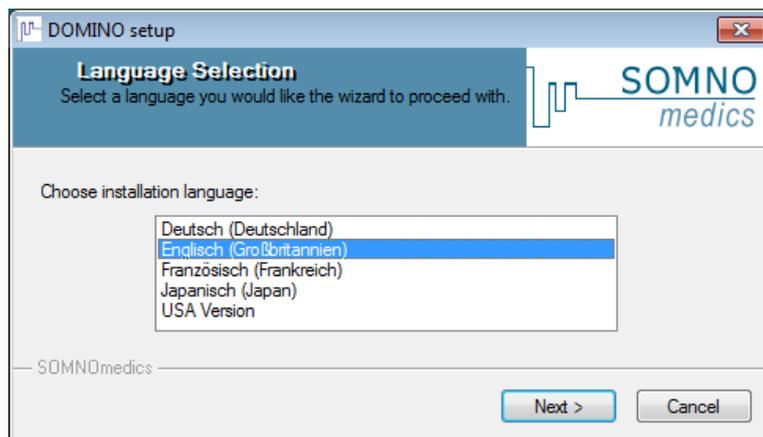


Fig. 2-1 Domino-Setup: Language Selection

2. Then choose the destination folder for the DOMINO software. The folder C:\SOMNOmedics\SomnoScreen is chosen by default. With “**Browse...**” you can choose a different folder. Then click on “**Next**”.

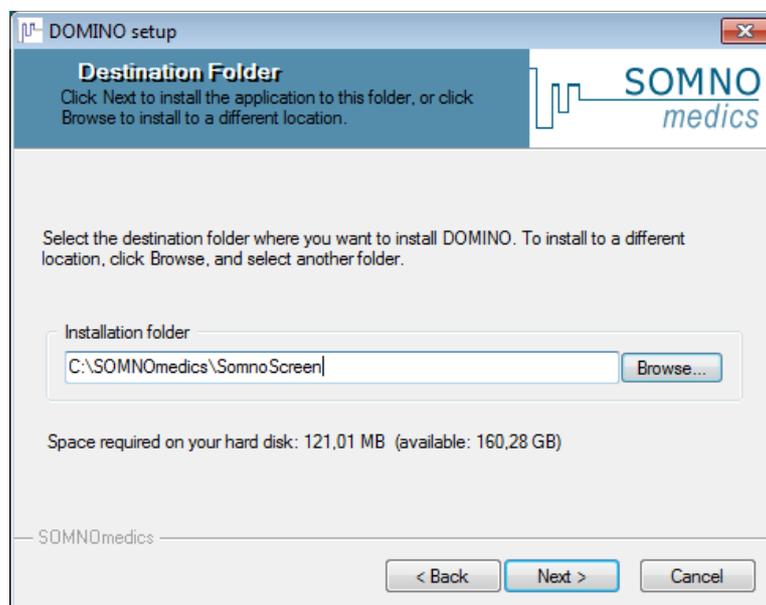


Fig. 2-2 Domino-Setup: Definition of destination folder

3. The following window will appear. Click on “Next”.

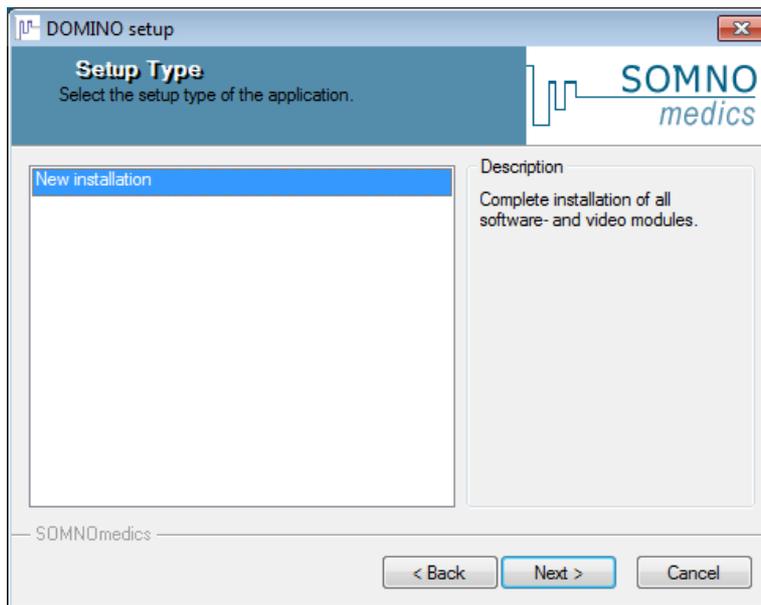


Fig. 2-3 Domino-Setup: Select type - New installation

4. Now select the components which shall be installed.

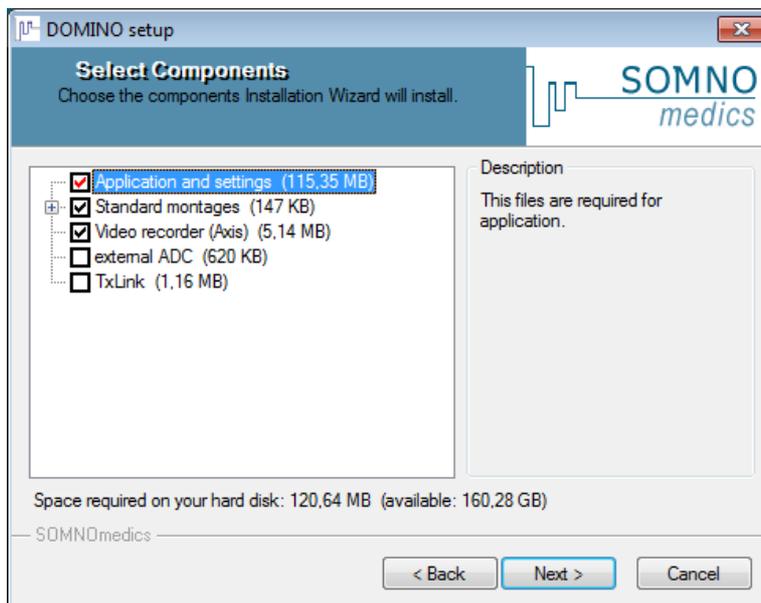
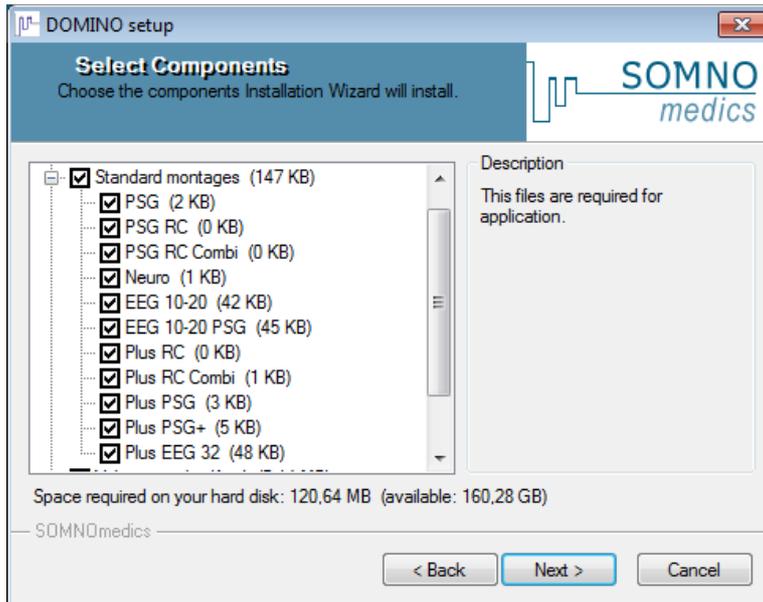


Fig. 2-4 Domino-Setup: Select components

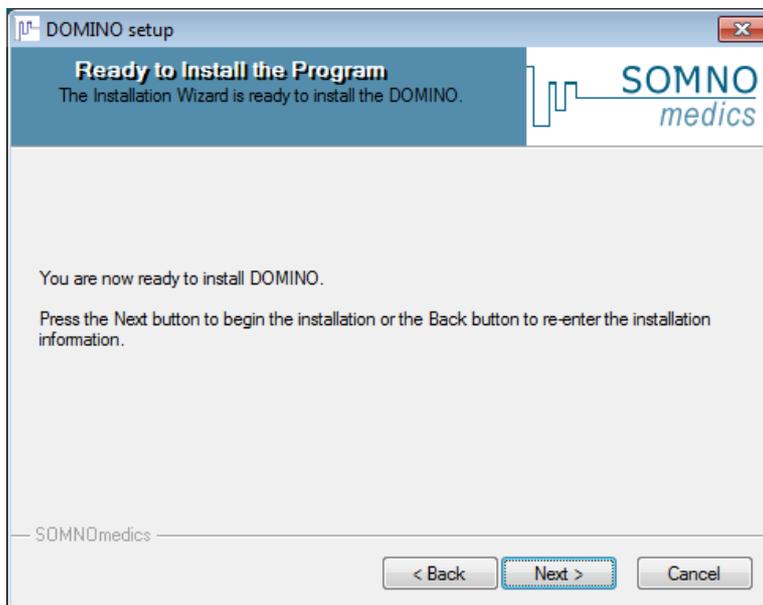
Opening the menu of “**Standard montages**” will show you a number of predefined montages (Fig. 2-5). Here you can select montages which are available for your type of device or ignore montages, which are not available for your type of device. We recommend only installing montages which are available for your type of device.



**Fig. 2-5 Domino-Setup: Select components - Montages**

Then click on “**Next**”.

5. You can now start the installation. Click on “**Next**” to continue, the software will now be installed.



**Fig. 2-6 Domino-Setup: Start Installation**

## 2.2 Software-Update

To update your version of DOMINO, please follow the following steps:

1. Open the DOMINO installation file “Setup” on the DOMINO CD with a double click. Choose your language and click on “**Next**”:

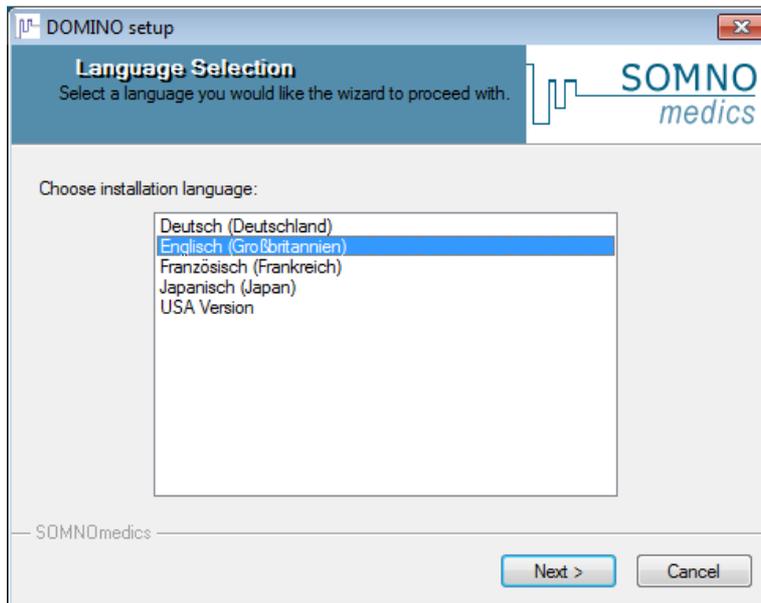


Fig. 2-7 Domino-Setup: Language selection

2. Then choose the destination folder for the DOMINO software. The folder C:\SOMNOmedics\SomnoScreen is chosen by default. With “**Browse...**” you can choose a different folder. Then click on “**Next**”.

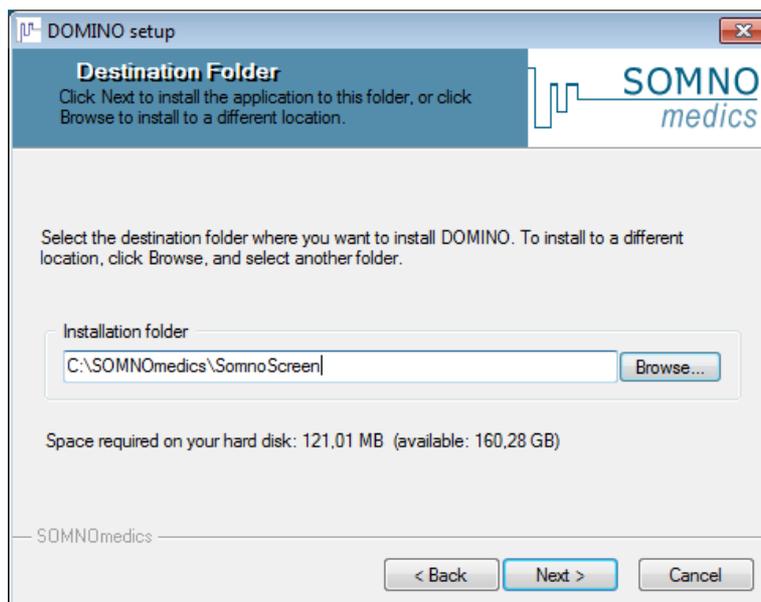


Fig. 2-8 Domino-Setup: Selection of destination folder

3. You will be asked to confirm the destination folder, if this folder already exists. Confirm with “Yes”.

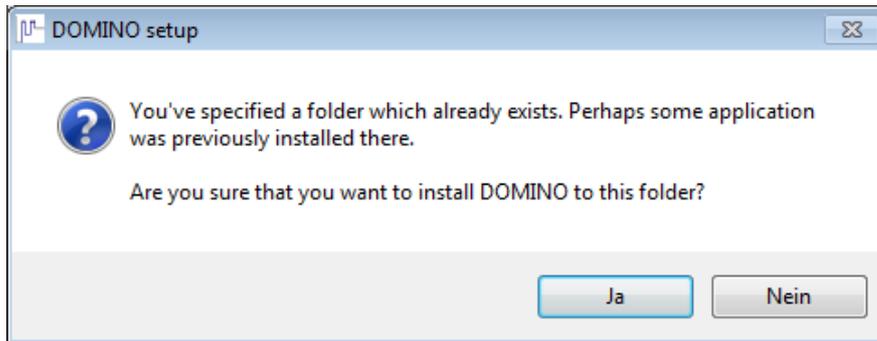


Fig. 2-9 Domino-Setup: Confirm folder

4. The following window will open, where you can choose between three different updating variants:
  - A) **Update news** (recommended): New analysis, channels and features of the software are updated. The settings of analysis and analysis templates remain as before.
  - B) **User defined update**: You can choose which components shall be installed (Fig. 2-11).
  - C) **Complete software update**: All settings are overwritten with the new standard settings of the software.

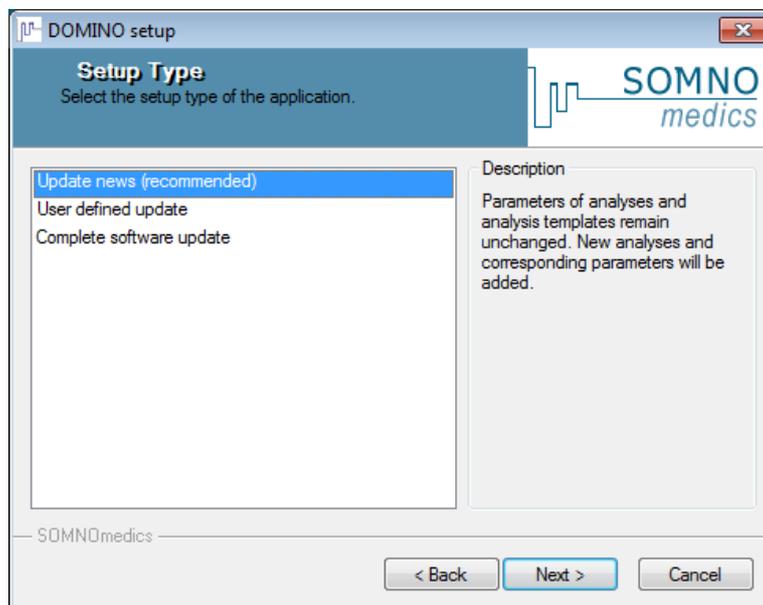


Fig. 2-10 Domino-Setup: Choose setup type

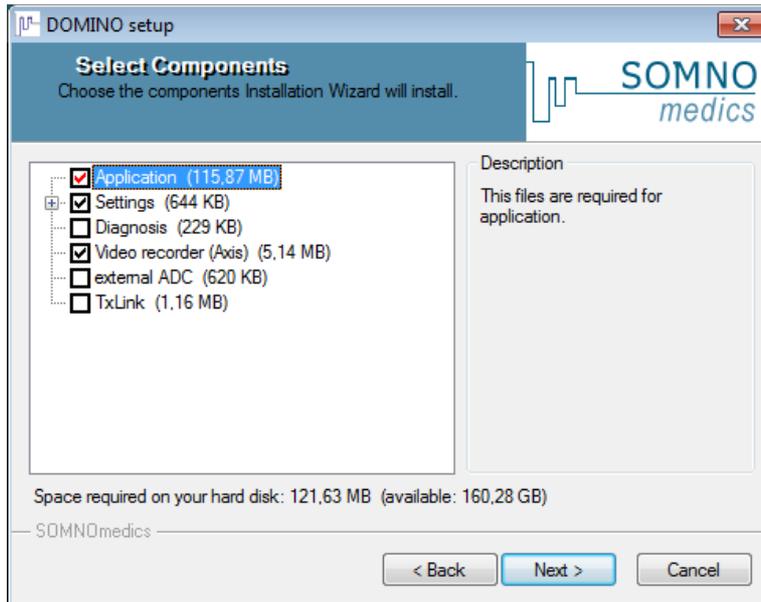


Fig. 2-11 Domino-Setup: User-defined update

Confirm with “**Next**”.

5. You can now start the installation. Click on “**Next**”. The software will be installed.

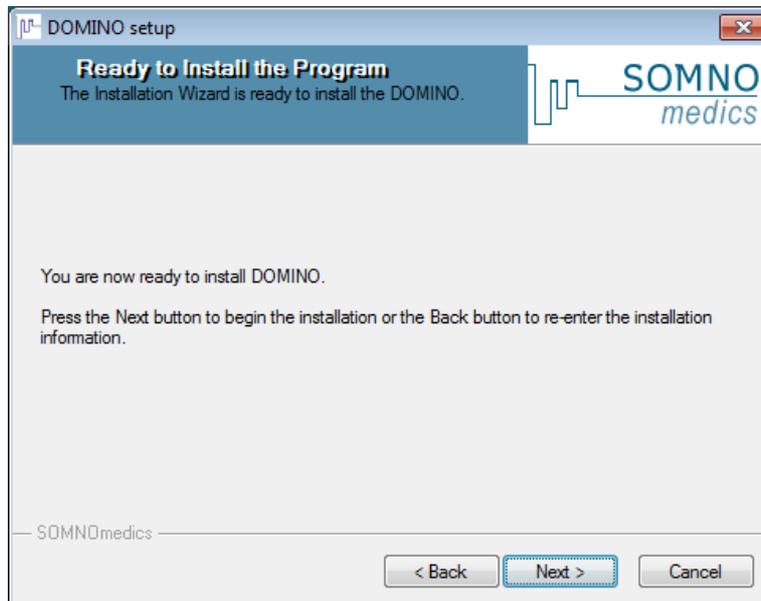


Fig. 2-12 Domino-Setup: Start installation

- The processing of the sleep FFT analysis and its parameter settings were improved in the 2.6.0 version of DOMINO. When updating versions of DOMINO 2.5.0 or earlier, an update of the parameter settings is strongly recommended. You will get the following notice:

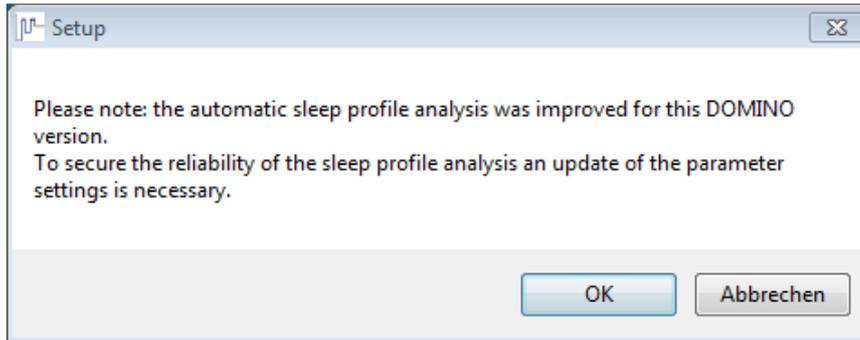


Fig. 2-13 Domino-Setup: Update-Info

Click on “**OK**” to continue the update of sleep profile parameters.

- A window will open (Fig. 2-14) where you can update the parameters of your analysis templates with the newest parameter settings. Select the corresponding standard templates in the drop-down menu. If you do not want to update your parameters settings, select “**Retain old parameters**”.

**Please note that the reliability of the automatic sleep profile analysis cannot be warranted with old parameter settings!**

If you did not update the parameter settings during installation, these can be updated later in the Global Preferences → Tab “**Analysis**” → “**Sleep profile**” by pressing the button “**Basic settings**”.

Confirm with “**Continue**”. The software will then be installed.

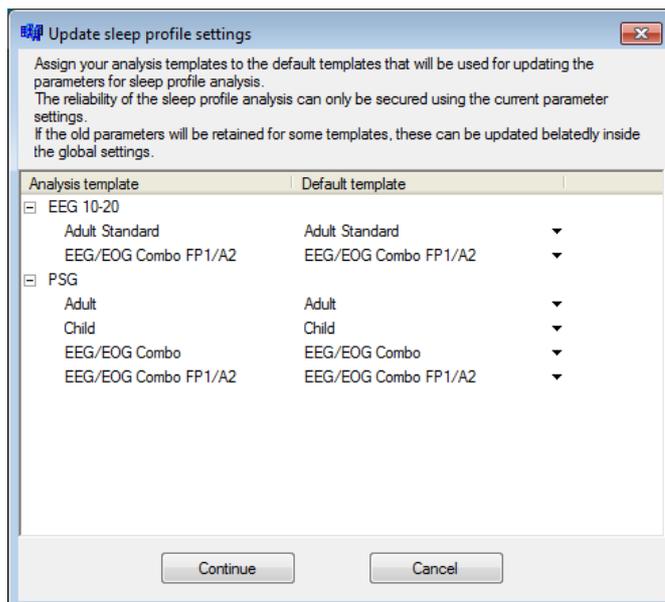


Fig. 2-14 Domino-Setup: Update sleep profile settings

### 3 DOMINO Panel



After starting the DOMINO panel, the analysis software symbol appears in the Tray Notification Area (TNA) on the bottom right hand side of the desktop window. The current mode is stated by a pop-up window. When you right click on the symbol, another pop-up menu appears.

When the “SOMNO Panel” is open, the menu looks like this:



When another mode is selected, the following menu is shown



- (1) Brings the “**DOMINO Panel**” to the foreground
- (2) Refreshes the service report and opens it.
- (3) Closes the DOMINO Software and the panel.
- (4) Opens the service report window without refreshing the log file.



The service report (Fig. 3-1) states the errors to be documented. This logs all specific system events and other occurrences from the DOMINO software.

In the main menu, you have the possibility of printing, refreshing, saving, and sending the service report per E-Mail. The E-Mail is directly sent to the SOMNOmedics support.

**Fig. 3-1 Service-Report Window**

In the main menu option “**Password**”, you can set a password for the “**SOMNO Panel**” (see Fig. 3-2).



Tick the box “**Password activated**” and enter the desired password twice. Confirm with “**OK**”.

**Note:**

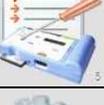
When you untick the box “**Password activated**” and confirm with “**OK**”, you will be asked for password authorisation.

**Fig. 3-2 Set Password**

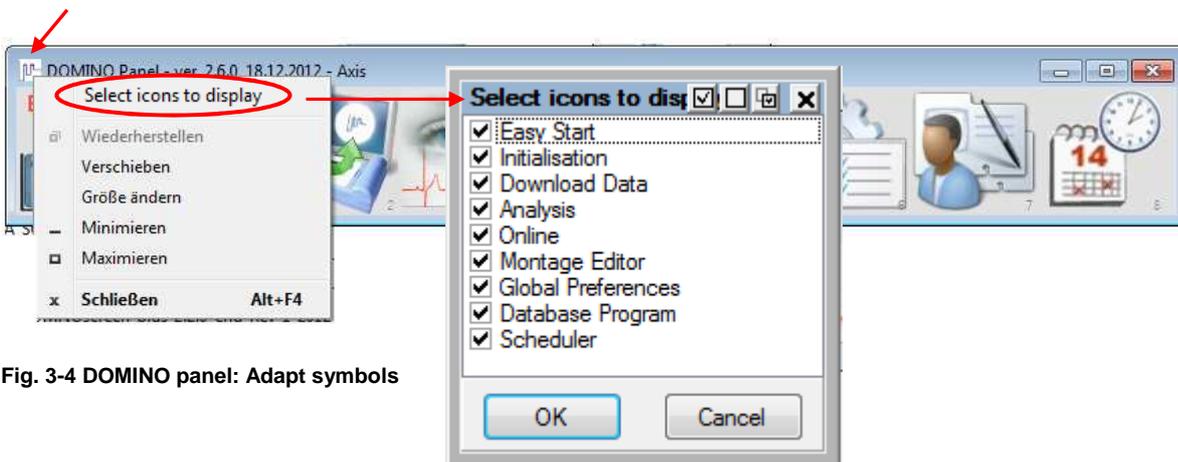


**Fig. 3-3 DOMINO Panel**

**Explanation of the DOMINO Panel icons:**

<b>Easy Start</b>		For a simplified operation of standard applications, Easy Start combines Initialization and Montage in a user-friendly overview.
<b>Initialisation</b>		Prepare the recording: Enter <b>Patient Data</b> , set <b>Start Options and Duration</b> and <b>Recording Montage</b> .
<b>Transfer</b>		Transfer the recording from the compact flash card to the PC, start automatic analysis and export EDF data.
<b>Analysis</b>		Analysing an existing recording or starting an on-line recording.
<b>Online</b>		Start of measurements with telemetric data transfer.
<b>Montage</b>		Create Montages (incl. EEG-Montages) and change channel configurations.
<b>Global Preferences</b>		Define all default settings including: Channel configurations, Analysis Parameters, Analysis Profiles, User Data and Report Outputs.
<b>Database</b>		The database provides effective organization of patient data even after recordings have been archived and deleted from the system.  The database is an optional feature in the DOMINO software.
<b>Scheduler</b>		Thanks to the calendar with a scheduler function, recordings can be planned and prepared a long time in advance.

The symbols of the DOMINO panel can be adapted by right click on the SOMNOmedics icon on the left of the panel. For example, customers who use SOMNOScreen for ambulatory applications can remove the symbol for Online mode.



**Fig. 3-4 DOMINO panel: Adapt symbols**

## 4 Easy Start

The interface of Easy Start can be activated in the DOMINO panel.

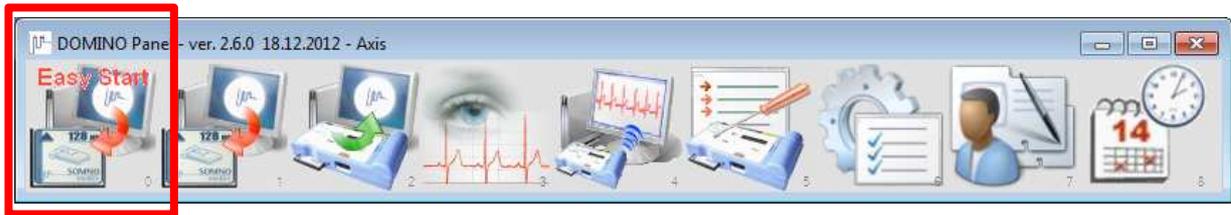


Fig. 4-1 “Easy Start” Menu Screen

Easy Start combines Initialisation and Montage in a user-friendly interface. The upper half of the Easy Start window contains input fields for the patient data. In the lower half of the window, you can configure montages.



With the buttons “DB” and “Add to DB”, patient data can be loaded from the database or be added to the database.

Programming the automatic start of a measurement can be done as usual. Alternatively, you can choose a manual start of the measurement.

In the lower half of the Easy Start window, you can define three montages. Click on one of the tabs Diagnostic, Therapie or Blood pressure. If you are creating a montage in one of the tabs for the first time, you will be asked to choose the appropriate SSC type of device in the scroll-down menu.

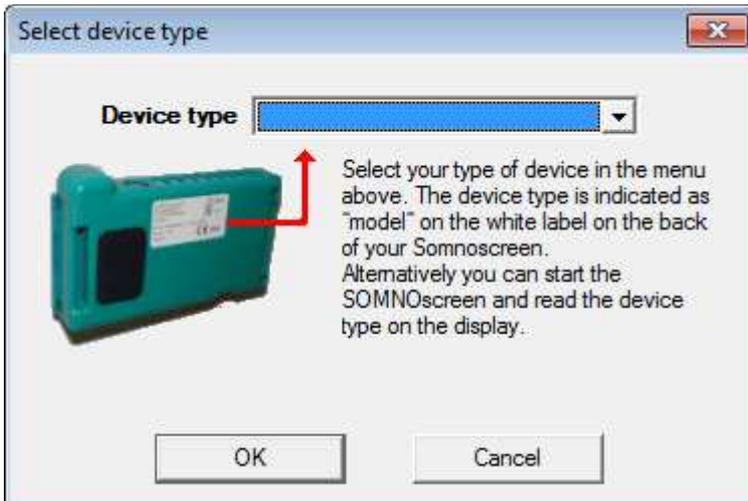


Fig. 4-2 Easy Start: Choose type of device

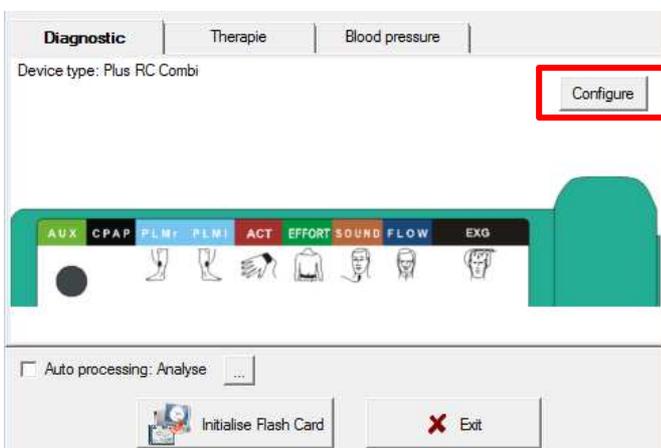


Fig. 4-3 Easy Start: Configure Montage I

To configure a montage, click on “Configure”.

A window will open, in which you can choose the appropriate sensors. The chosen type of device will be shown at the bottom of the window and can be changed there (1). By clicking on the arrow (2), the selection of sensors can be changed or extended. The chosen sensors are visualized on the corresponding plug-in position of the SOMNOscreen and the virtual patient. Data compression can be chosen selectively (3).

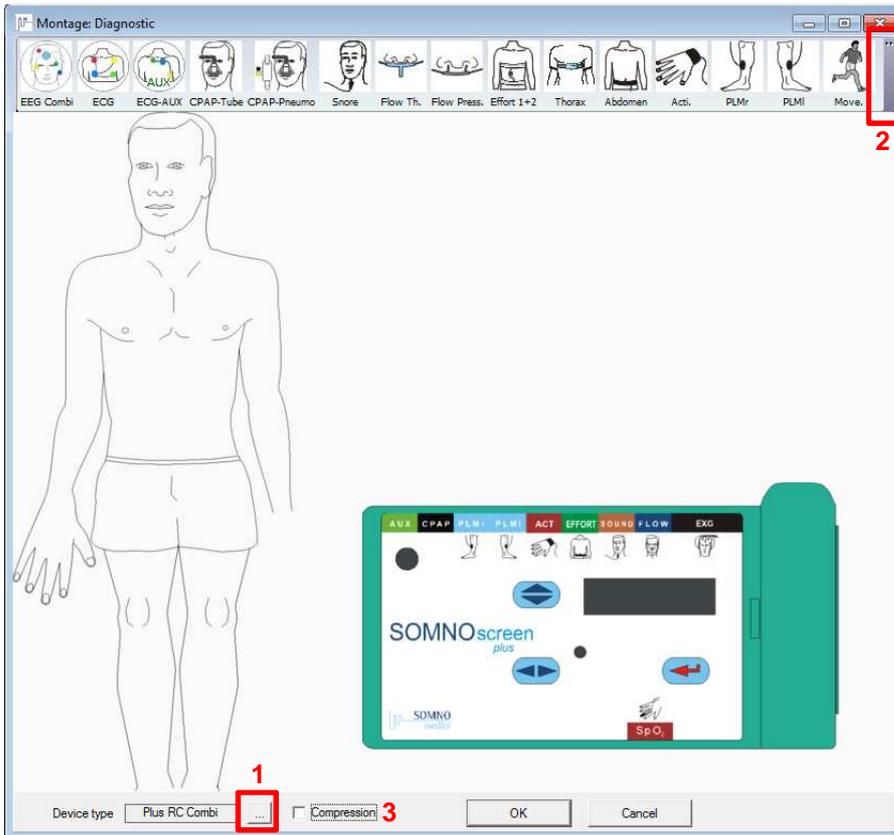


Fig. 4-4 Easy Start: Configure montage II

If you have created a montage, confirm with OK. The corresponding montage will now be chosen in the appropriate tab. If you want to rename the tab, make a right click on the tab. The “Tab name” will open (Fig. 4-5). Enter a new name and confirm with OK.

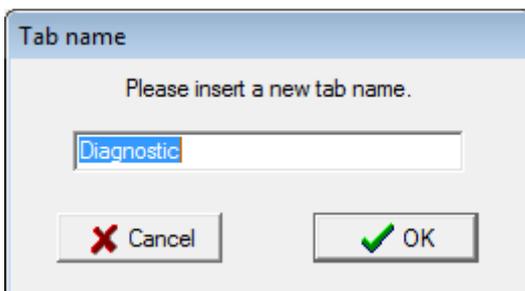


Fig. 4-5 Easy Start: Rename tab

When choosing the checkbox “Auto processing: Analyse”, you can program an automatic analysis of your measurement during transfer. You can choose further actions (e.g. Create a report).

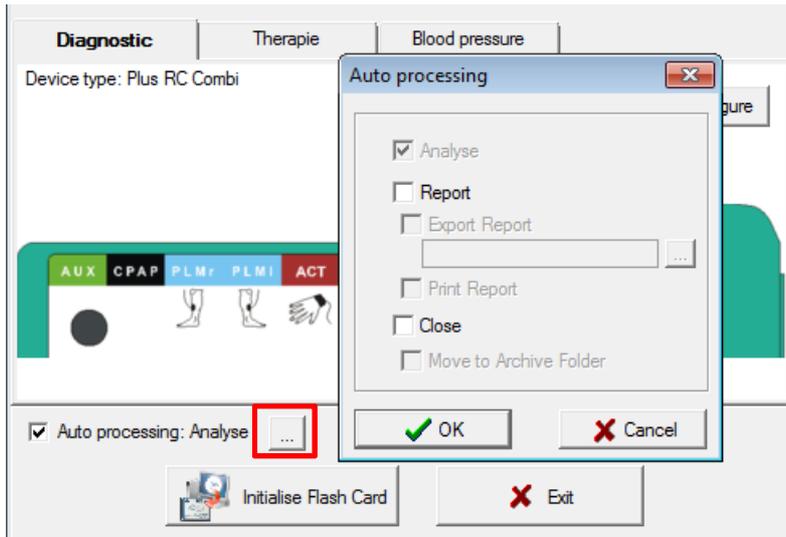


Fig. 4-6 Easy Start: Autoprocessing

Initialise the flashcard by clicking on “Initialise Flash Card”.

## 5 Global Preferences

In the Global Preferences, you can change settings for data display, filter settings, analysis settings etc. which are valid for all measurements. You can change these settings locally for single measurements (see chapter 8.3.3.1).

### Important Notices:

- Changes will only be saved, if you click on “Save” or “Save and Exit”.
- Be careful to choose the appropriate type of device (SOMNOscreen or SOMNOscreen plus / EEG 10-20).
- If you slide over the tabs of the Global Preferences, a yellow window will appear with more information on the functionality of the tab.

### 5.1 Choice of the type of device

When you change settings, make sure to choose the appropriate type of device. You can choose between two types of devices:

- a) SOMNOscreen (blue casing)

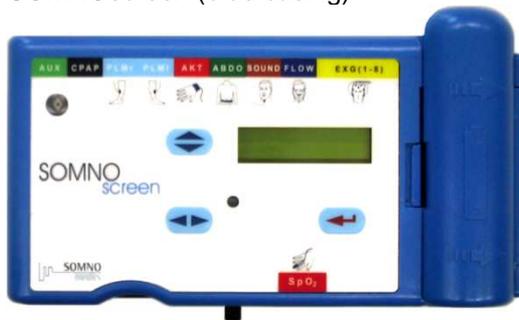


Fig. 5-1 SOMNOscreen

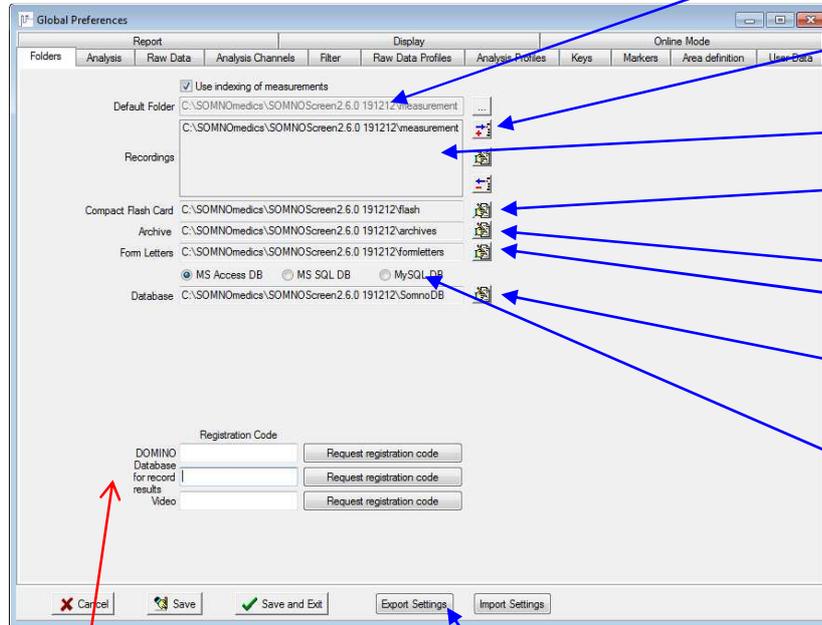
- b) SOMNOscreen plus (green or white casing)



Fig. 5-2 SOMNOscreen plus

## 5.2 Tab “Folders”

In the tab “**Folders**” (Fig. 5-3), you can define file path and enter the code you obtained from our service assistants for activation of analysis modules, database and/or video module after installation.



Default folder (recordings are saved to this folder – after data transfer or during On-line recording)

Add Folder

Directory(s) for recordings, e.g. for different rooms, analysis stations, etc.

Directory for Compact Flash Card

Directory for Archive

Directory for Form Letters

Directory for Patient Database

Convert to SQL database \*

The following preferences can be imported:

Fig. 5-3 Global Preferences, Tab “Folders”

Preferences will be saved to a file.



**Computer-ID** – phone SOMNOmedics™ support, quote this number and you will be given the Registration Code to enter here.

\* Please contact SOMNOmedics™ support, if it is necessary to convert to SQL data base.

Other symbols:



...The default folder can be chosen from the recordings directory using this symbol.



...Add folder



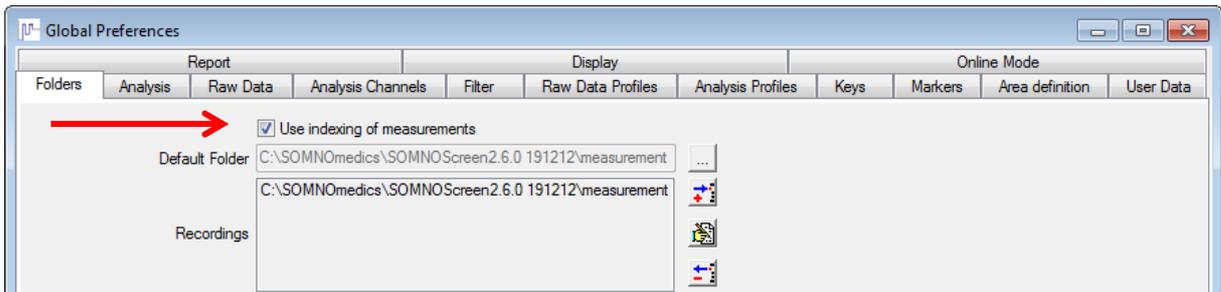
...Edit folder



...Delete folder.

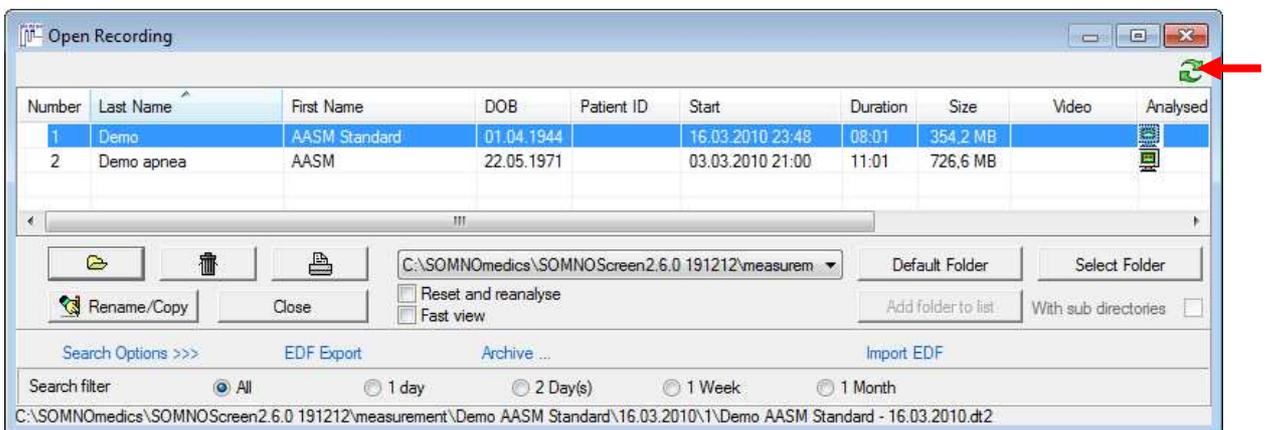
To speed up the upload of your registers with recordings, use the function “Use indexing of measurements”. If you activate the checkbox, a file “SomnoSearch.ini” will be created in the corresponding folder which contains data such as patient name, patient ID, date of birth etc. When

uploading your register with recordings, only these data will be loaded directly from the file, which leads to a short uploading time.



**Fig. 5-4 Indexing of measurements**

The activation of the indexing function will be displayed in the upper right corner of the opening dialogue with the symbol .



**Fig. 5-5 Opening dialogue and indexing symbol**

Notice: The indexing function is only available for folders which are listed in “Recordings” (folders can be added with the button “Add Folder”). Recordings that were copied manually into the folder will not be displayed automatically in the opening dialogue, unless you update with the indexing symbol  (see Fig. 5-5).

### 5.3 Tab “Analysis”

In this tab, the standard settings of e.g. analyses parameters, colour coding of graphs and events can be changed.

For changing the colour coding of graphs and events, make a left click into the corresponding field (fields are lined in red in the following illustrations).

Settings can be saved as a new template (“New Template” ). Templates can be deleted with “Delete Template” .

The following standard templates are pre-defined for SOMNOscreen: “**Adult**”, “**Child**”, “**EEG/EOG Combo FP1/A2**” and “**EEG/EOG Combo**”.



For SOMNOscreen plus / EEG 10-20, the options are: “**Adult Standard**”, “**EEG/EOG Combo FP1/A2**”, “**Child**” and “**Adult AASM**”.

In the local analysis settings (settings in an open recording) the following symbols appear:



= Analysis settings will be transferred from the global preferences.



= Analysis settings will be transferred to the global preferences.

**Please note: save your global settings to a file via the “export setting” function in the global settings.**

When you want to reset a local analysis setting (i.e. “Sleep Profile”), you can right click anywhere on the analysis area where the name appears and get a pop up called “**Reset Analysis**” (see Fig. 5-3).



Fig. 5-6 Reset analysis

#### 5.3.1 Sleep analysis

There are two possibilities available for the sleep analysis: the sleep-wake analysis and the sleep stage analysis using Fast Fourier Transformation (FFT).

##### 5.3.1.1 Sleep-Wake Analysis

The Sleep-Wake Analysis uses the activity signal and the body position analysis to determine the sleep and wake stages. If the body position is “**Upright**”, the epoch is scored as wake.

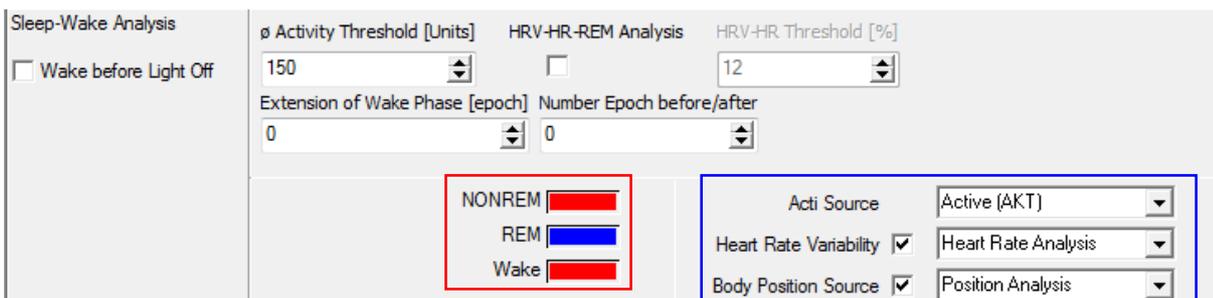


Fig. 5-7 Sleep-Wake Analysis

**“Activity Threshold [Units]”**

You can define the limit (threshold) a signal must exceed to be detected as activity.

If activity is detected within an epoch, the epoch will be defined as “Wake”. The threshold for activity is set once for the entire recording.

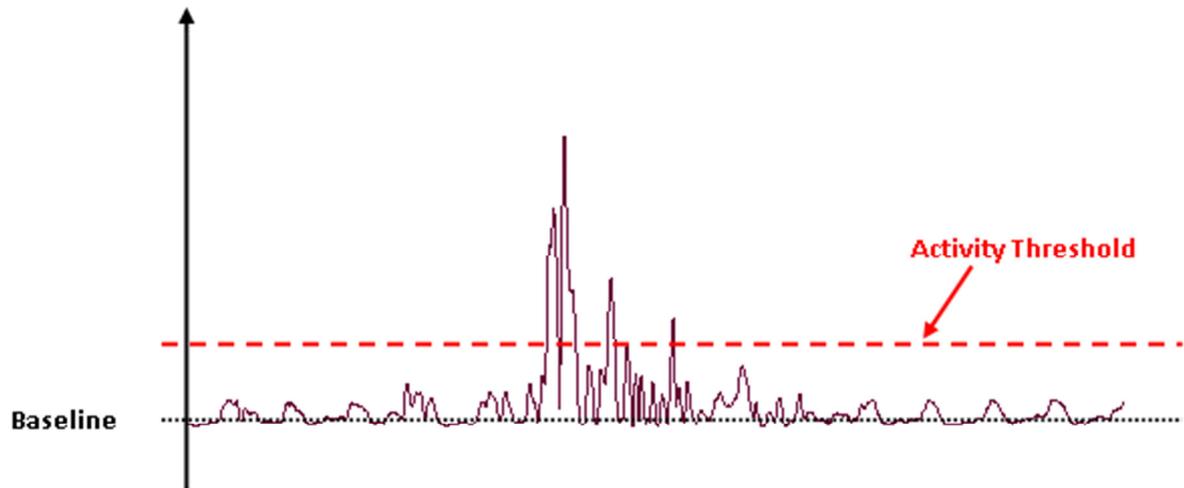


Fig. 5-8 Activity Threshold

**“Extension of Wake Phase [epoch]”**

If an epoch is scored as wake, the here defined number of consecutive epochs are scored as wake as well. This ensures that short phases with low activity during the day are not scored as sleep.

**“Number Epoch before/after”**

Defines the number of epochs before and after the current epoch for calculation of the mean activity of the current epoch. Calculating the mean activity for a longer time window than only the current epoch evens out short periods of activity during sleep (e.g. a shift of body position) and therefore these epochs are not scored as wake (as long as the activity level does not exceed the activity threshold).

**“HRV-HF-REM Analysis”**

Differentiation of REM-/Non-REM phases can be calculated based on HRV (heart rate variability). To use this function, activate the heart rate analysis (checkbox). If you do not choose the HRV-HF-REM-analysis, calculation of sleep and wake phases are based on data from the activity sensors or the body position sensor. When activating the HRV-HF-REM-analysis, a threshold (“HRV-HF-threshold [%]”) can be defined. All values between 0% and the defined value are scored as REM.

### 5.3.1.2 Sleep Profile

The sleep analysis includes pre-set profiles for adults, paediatric patients and in compliance with AASM-Standard (see the area marked green in Fig. 5-9). The Sleep Profile Analysis calculates the sleep profile from the results of the Sleep FFT analysis (Delta, Alpha + Beta, AFV, Sigma), EOG analysis (REM), EMG, Heart Rate Variability, Sympatho Vagal Balance, Spindle Analysis and Body Position. This analysis checks all possible sleep stages for correlating signals. When correlation occurs, the sleep stage is given a specific score (the quantifier) which is user defined. Subsequently, the software assumes the sleep stage which received the highest score. The reliability of this result will be calculated by the following formula:

$$\text{reliability} = 1 - (\text{second largest score} / \text{largest score}).$$

Results between 1 and 0.7 are shown in green, 0.35 – 0.7 in yellow and <0.35 in red unless the user defines other colours.

Additionally to the above criteria, the recorded impedances of Delta, Alpha + Beta or AFV channels allow the assessment of sleep staging. Depending on the critical impedance limit (see chapter 5.14), with at least 15 seconds of bad impedance, the epoch will be defined as uncertain.

The sleep Analysis stage algorithm requires two different sets of parameters:

- A) Settings for quantifiers - How many points will the sleep stage score if the signal occurs within a predefined value range?
- B) Settings for ranges in which the signals must lie in order to score points (= parameter).

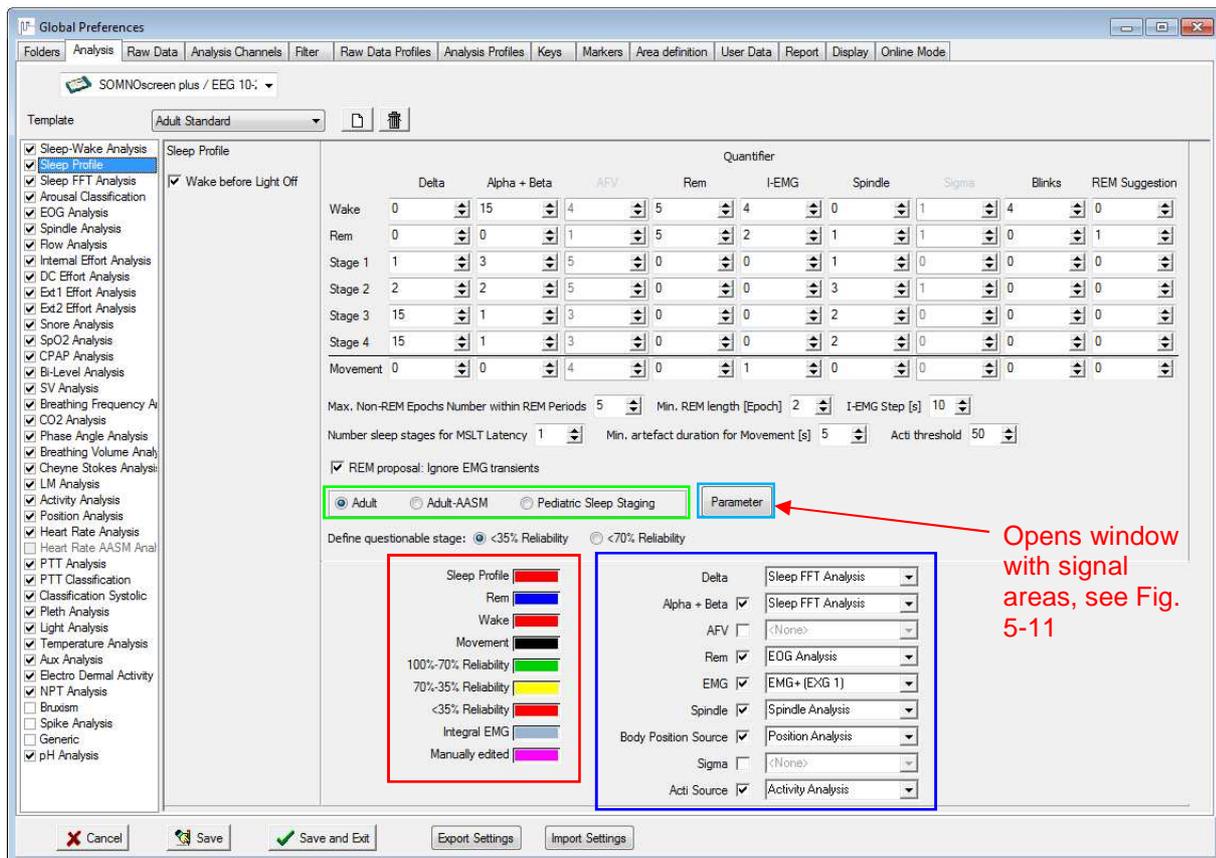


Fig. 5-9 Quantifiers

The value “**Max. Non-REM Epochs Number within REM Periods**” is needed for the detection of REM phases. If the period between two REM epochs does not exceed the set number of 5 Non-REM epochs, these epochs will be reclassified as REM (Note: Wake ≠ Non-REM).

“**Min. REM length [Epoch]**” avoids diagnosis of single REM epochs or very short, isolated REM periods. If the signal entered parameters are smaller than the epoch, it is directly assigned the most likely Non-REM sleep stage (e.g. a setting of 2 implies that at least two epochs classified as REM must follow each other in order for a period to be marked as REM)

“**I-EMG Step**” defines the length of the time window for the calculation of the I-EMG.

The value “**Number sleep stages for MSLT Latency**” states, how many epochs must be classified as sleep, for the sleep latency to be calculated.

The value “**Min artefact duration for movement [s]**” indicates how many seconds an artefact must have to be recognized by the sleep FFT analysis to classify the epoch as “movement”.

In “**define inaccurate stage**” you can specify with a percentile probability, when an epoch is to be declared as an uncertain sleep stage. When analysing the sleep stages manually you can directly jump to these uncertain sleep stages.

With “**Acti threshold**”, you can define an activity threshold (based on the activity sensor in the SOMNOscreen device) above which the epoch is automatically scored as Wake.

When activating the checkbox “**REM Proposal: Ignore EMG transients**”, very short changes in the EMG, which have no effect on the actual sleep stage, are neglected in the calculation of “REM Proposal”.

When activating the checkbox “**Wake before Light off**”, epochs before the “Light off” marker are automatically scored as Wake.

You can select the parameters for calculating the sleep profile by activating or deactivating the checkboxes. The source for each parameter is shown next to its checkbox (blue box in Fig. 5-9). The parameters can only be changed with a password. The required password is **parameter**.



Activating the checkbox “**Ask no more**” the first time you enter the password, will result in you not being asked to enter it again.

Fig. 5-10 Enter Password

Parameter	Wake		Rem		Stage 1		Stage 2		Stage 3		Stage 4		Movement	
	min	max	min	max	min	max	min	max	min	max	min	max	min	max
Delta	N/A	N/A	N/A	N/A	10	15	16	25	26	40	41	80	N/A	N/A
Alpha + Beta	84	100	N/A	N/A	71	83	45	70	36	44	10	35	N/A	N/A
AFV	11	14	8	9	6	10	6	9	5	7	2	6	20	100
Rem	1	10	1	10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
I-EMG	10	20	0	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	20	100
Spindle	N/A	N/A	0	0	0	0	1	10	1	10	1	10	N/A	N/A
Sigma	5	N/A	0	2	N/A	N/A	4	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Blinks	1	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
REM Suggest	N/A	N/A	0	100	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Delta: Absolute    Alpha+Beta: Relative    AFV: Absolute    REM: Number per Epoch    I-EMG: Relative    Spindle: Number per Epoch  
 Sigma: Absolute    Blinks: Number per Epoch

Fig. 5-11 Signal setting section

The table (Fig. 5-11) shows the minimum and maximum values of the different parameters for all stages (wake to artefact). To set parameters, please note the following information:

- **Delta:** absolute values (%) – as shown in the analysis
- **Alpha + Beta:** absolute values (%) – as shown in the analysis
- **AFV:** absolute values (Hz)
- **REM:** number of REM events per epoch
- **I-EMG:** absolute value (dB)
- **HRV:** relative values (correlating to the difference between the minimum and maximum value of the recording)
- **SVB:** relative values (with respect to the maximum value of SVB within the recording).
- **Spindle:** number of spindles per epoch
- **Sigma:** absolute values ( $\mu V$ )
- **Blinks:** number of blinks per epoch
- **REM Proposal:** logarithmic display of the product of parameter Sigma FFT and I-EMG

The setting **N/A** means that the limit is not considered. If both limits for a certain sleep stage are set to N/A, the stage will not score any points, whatever the signal.

### 5.3.1.3 Sleep FFT Analysis

Fig. 5-12 Sleep FFT Analysis



The EEG source for sleep FFT analysis can be set separately for the different parameters (e.g. for AASM recordings).

Likewise the limits for the frequency bands can be changed:

Fig. 5-13 Frequency bands

You can further adapt the following settings:

#### 1) “Artefact Amplitude $\mu V$ ”

Defines the maximum amplitude of the EEG signal, above which the signal is scored as artefact.

2) **“Sweat artefact”**

Defines the maximum power of frequencies < 0.5 Hz above which the signal is scored as sweat artefact.

3) **“Delta/A+B smoothing”**

This value determines the intensity of smoothing with wavelet of the delta- and alpha/beta graph. A higher value results in stronger smoothing characteristics of the algorithm.

4) **“AFV smoothing”**

Defines the intensity of smoothing of the AFV-graph. A higher value results in stronger smoothing characteristics of the algorithm.

5) **“A+B 100% duration [min]”**

Defines the sum of time intervals for which the maximum alpha/beta value must be present to be set as the maximum value of alpha/beta.

6) **“A+B absolute”**

If you activate this checkbox, the absolute values of alpha/beta are taken as basis for the sleep FFT analysis.

7) **“Impedance Source”**

With **“Impedance Source”** activated (see green mark in Fig. 5-12), the continuous impedance recording is used to determine sections in the EEG raw data channels with too high impedances. These sections are represented in red in the analysis window. The function is helpful for direct recognition of artefacts in the sleep profile (see Fig. 5-14).

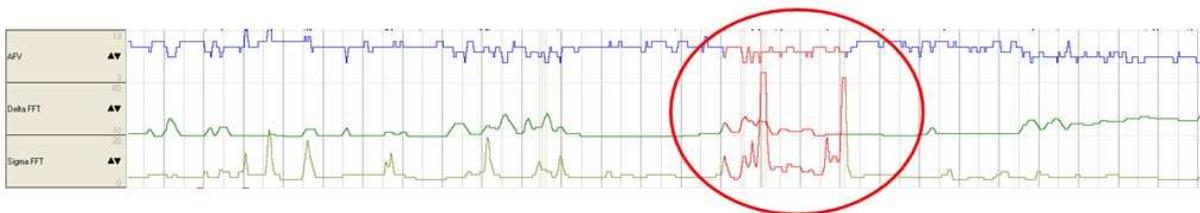


Fig. 5-14 High Impedance from the EEG electrode

Please, make sure that in the montage the following points are activated in order to be able to use this function:



The sleep FFT analysis also helps to determine arousals.

There are three ways to determine arousals:

- a) Detection of frequency increases in the EEG (cortical arousal) based on increase in **AFV** (Average Frequency Value).
- b) Detection of frequency increases in the EEG (cortical arousal) based on increase in **Sigma**.
- c) Detection of **EMG bursts**.

All methods can be activated individually (cortical arousal **OR** EMG burst) or together (cortical arousal **AND** EMG burst). If an arousal event is detected in both EEG and EMG simultaneously, the event will be marked as a cortical event in the EEG.

### 5.3.1.4 Arousal

#### Cortical Arousal AFV (see Fig. 5-12)

1) **“Min. Duration [s]”**

Minimum duration of an increase in the AFV curve to determine an arousal.

2) **“Increase [Hz]”**

Minimum increase of the amplitude of the AFV curve to determine an arousal.

3) **“Threshold”**

Threshold for the beginning of an increase. Increases that start above this threshold are not included in the calculation.

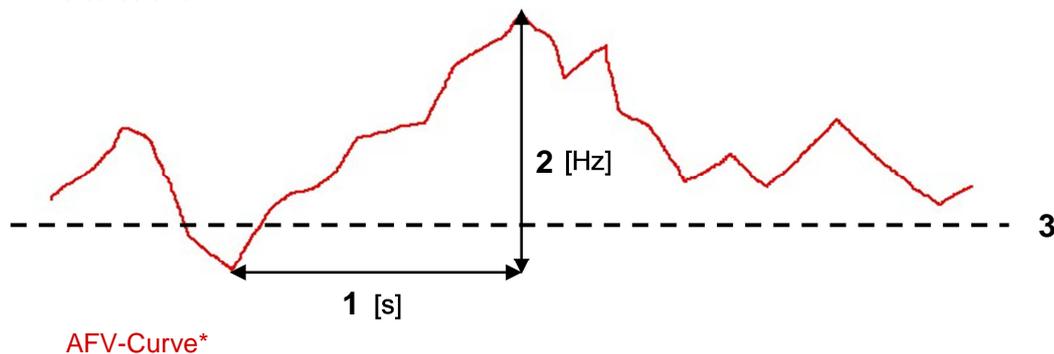


Fig. 5-15 AFV Curve determined by Sleep FFT Analysis

\* Note: The AFV Curve in the analysis window is displayed smoothed.

4) **“BL Min. Duration [s]”**

Before the AFV curve increases, it must be constant for a time (attention to the Max AFV variation), for an arousal to be present.

5) **“BL Variation [Hz]”**

If the fluctuations of the AVF curve are smaller than this value, this part of the curve is evaluated as an area with constant AFV.

#### Cortical Arousal Sigma (see Fig. 5-12)

Alternatively to the determination of cortical arousals based on AFV, arousals can be determined based on the Sigma FFT.

6) **“Increase [ $\mu$ V]”**

Minimum increase of the Sigma frequency band to determine an arousal.

#### EMG bursts (see Fig. 5-12)

7) **“Ratio [%]”**

Change of EMG baseline in % during minimum duration (see “Cortical Arousal AFV” 1)).

### 5.3.1.5 CAP (Cyclic Alternating Pattern)

CAP describes a periodic EEG activity during Non-REM sleep. Characteristic are sequences of temporary EEG events which differ significantly from the basic EEG activity, and return in intervals.

A CAP cycle consists of a **phase A** and a directly following **phase B**. If several CAP cycles follow each other, one speaks of a CAP sequence.

The CAP recognition uses the unsmoothed AFV curve.

#### 1) “Threshold [Hz]”

This serves for the calculation of the phases and the data must fall below or exceed this value, respectively.

#### 2) “Min Phase offset [Hz]”

Gives the minimal frequency change within a phase, and serves as a threshold for the detection of the possibly following phase.

#### 3) “Min Phase dur. [s]”

Minimum duration of a phase to be considered.

#### 4) “Max Phase dur. [s]”

Maximum duration of a phase to be considered.

#### 5) “Min Cycles”

Gives the minimum number of consecutive cycles for a CAP to be recognized.

### 5.3.1.6 Classification of Arousals

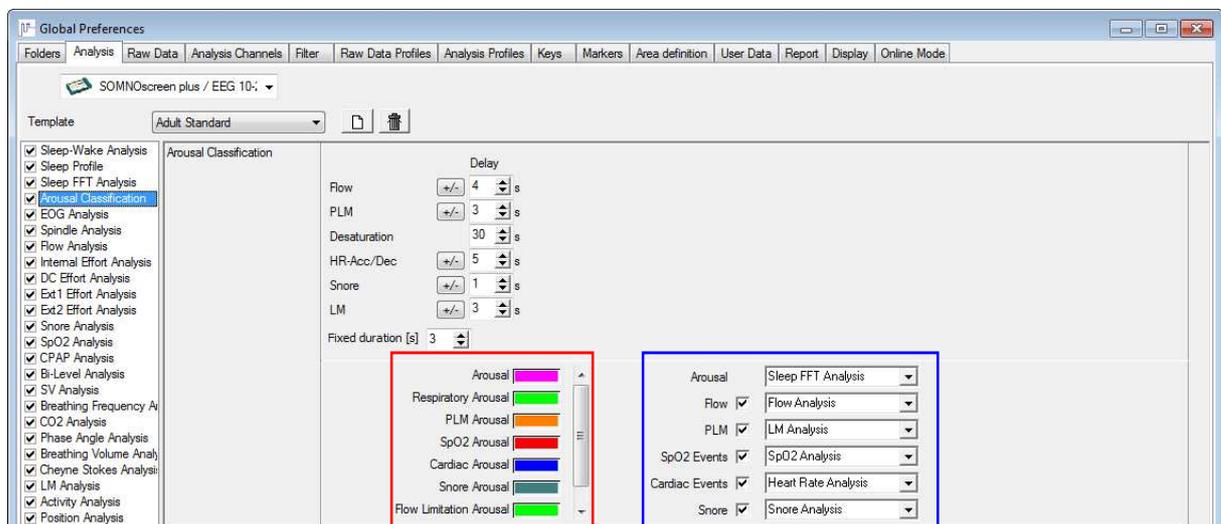


Fig. 5-16 Classification of arousals

Arousals are labelled in the selected source channel. As soon as an arousal is detected, the analysis “**Arousal Classification**” will check if an event occurred in any of the other channels within the delay time set here. The delay time can be adjusted as required and can be set separately for each of the following events: Flow, PLM, Desaturation, HF-Acc/Dec. and Snore. Depending on their priority the arousals will be correlated to these events. Using the drag & drop function, the order within the list can be changed and by these means the priority of classification is altered.

**“Fixed Duration [s]”**

In the **“Keys”** tab you can set the duration of an arousal for quicker manual editing. Define a key for the event **“Arousal fixed duration”**.

40		Arousal Classification : Flow Limitation Arousal	
41		Arousal Classification : Arousal fixed duration	
42		Arousal Classification : Spontaneous Arousal	

Fig. 5-17 Key for arousal duration

**5.3.1.7 EOG Analysis**

The EOG analysis is used to determine rapid, conjugated eye movements, which occur during REM (Rapid Eye Movement) periods.

Fig. 5-18 EOG Analysis

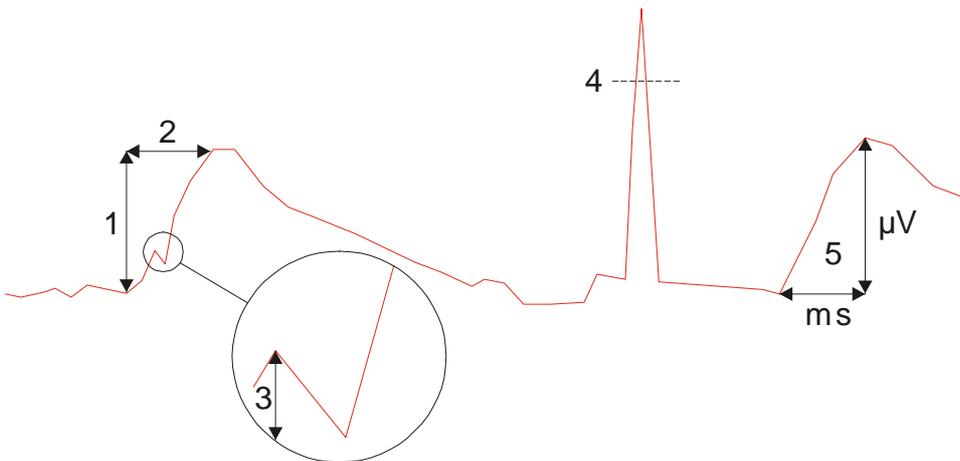


Fig. 5-19 EOG Analysis Details

1) **“Min. Amplitude Diff. [µV]”**

Minimum increase in the EOG signal for the detection of eye movements.

2) **“Min. Duration [ms]”**

Minimum duration of the increase in EOG signal to detect an eye movement.

3) **“Oscillation Range [µV]”**

Maximum fluctuation of the EOG-signal. When this value is exceeded, the eye movement will not be included in the analysis.

4) “Artefact Ampl. [ $\mu\text{V}$ ]”

This value indicates the threshold for an artefact. All values above this limit will be detected as artefact.

5) “Min. Rise Time [ $\mu\text{V}$  per ms]”

If the rise time is shorter than defined here, it will not be detected as Rapid Eye Movement.

6) “Symmetry [%]” (only if two EOG-Sources are selected)

You can set this value to define the percentage by which the two curves (EOG I and EOG r) need to synchronise for a Rapid Eye Movement to be detected.

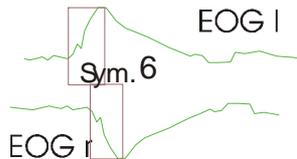


Fig. 5-20 EOG Symmetry (sym.)

7) “Averaging [ms]”

The bigger this value, the more the EOG channel used for the EOG analysis gets smoothed.

8) “Min. Ampl. for Blink [ $\mu\text{V}$ ]”

Minimal amplitude in the EOG signal for a blink.

9) “Don’t allow Events when Delta is above [%]”

In the areas in which the fraction of delta waves exceeds the given number, no EOG events (REM, Blink) are scored.

### 5.3.1.8 Spindle and K-Complex Analysis

The spindle analysis is used to determine spindles and K-complexes in an EEG channel.

Spindle Analysis			
Min. Spindle [Hz]	Max. Spindle [Hz]	Baseline window [s]	
12.0	14.0	8	
Spindle ratio [%]	Min. Ampl. [ $\mu\text{V}$ ]	Min. Duration [s]	Max. Duration [s] Max. Amplitude [ $\mu\text{V}$ ]
250	5	0.5	5.0 300
<b>K-Complex:</b>			
Min. Amplitude [ $\mu\text{V}$ ]	Amplitude SS [ $\mu\text{V}$ ]	tmin SS [s]	tmax SS [s] Max. Amplitude [ $\mu\text{V}$ ]
50	90	0.1	0.6 500
Max K-Rise duration [s]		Min K duration [s]	
0.25		0.5	
<input type="checkbox"/> Spindle <input type="checkbox"/> K-Complex <input type="checkbox"/> Spindle frequency		Spindle Source: C4:A1 Arousal check: <input checked="" type="checkbox"/> Sleep FFT Analysis	

Fig. 5-21 Spindle Analysis

1) “Min. Spindle [Hz]”

Minimum frequency of the EEG signal (to determine Spindle).

2) “Max. Spindle [Hz]”

Maximum frequency of the EEG signal (to determine Spindle).

3) “Baseline Window [s]”

Time period used by the analysis to determine the baseline.

4) **“Spindle ratio [%]”**

The relative change of the signal in % in relation to the baseline. This value must be exceeded for a spindle to be detected.

5) **“Min. Ampl. [ $\mu$ V]”**

Minimum amplitude of the Spindle EEG signal (to determine Spindle).

6) **“Min. Duration [s]”**

Minimum duration of a Spindle.

7) **“Max. Duration [s]”**

Maximal duration of a Spindle.

8) **“Max. Amplitude [ $\mu$ V]”**

All amplitudes above this threshold will not be detected as Spindle.

**K-Complex:**

9) **“Min. Amplitude [ $\mu$ V]”**

Minimum amplitude of a K-Complex in the EEG signal.

10) **“Amplitude SS [ $\mu$ V]”**

Minimum spike to spike amplitude of a K-complex in the EEG signal.

11) **“tmin SS [s]”**

Minimum duration of a spike to spike decrease in amplitude of a K-complex.

12) **“tmax SS [s]”**

Maximum duration of a spike to spike decrease in amplitude to determine a K-complex.

13) **“Max. Amplitude [ $\mu$ V]”**

Maximum amplitude in the EEG to determine a K-complex.

14) **“Max K-Rise Duration [s]”**

Maximum duration of the increase to determine a K-complex.

15) **“Min K-Duration [s]”**

Minimum duration of a K-complex in the EEG signal.

**“Arousal Check”**

When activated, the sleep FFT analysis checks whether there is an arousal. In this case, the pattern is not counted as a spindle.

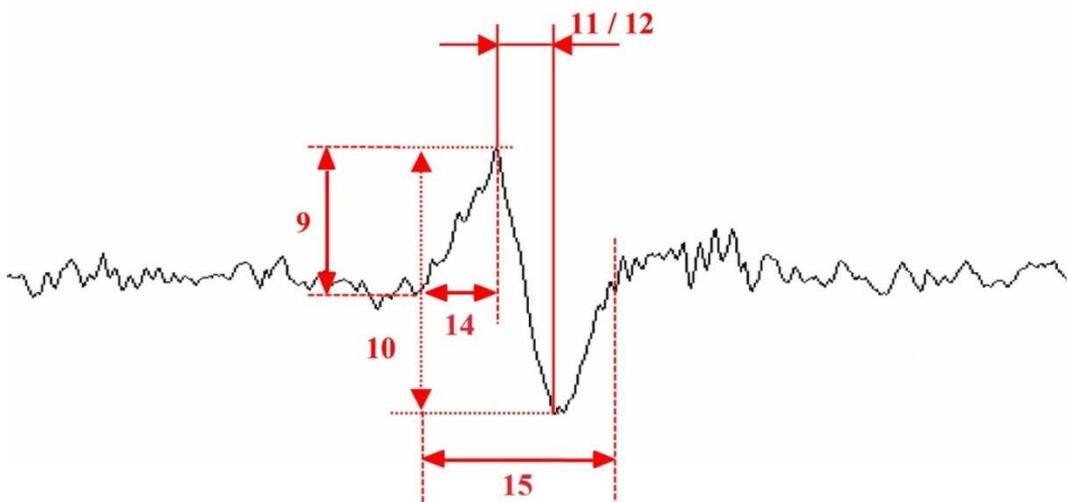
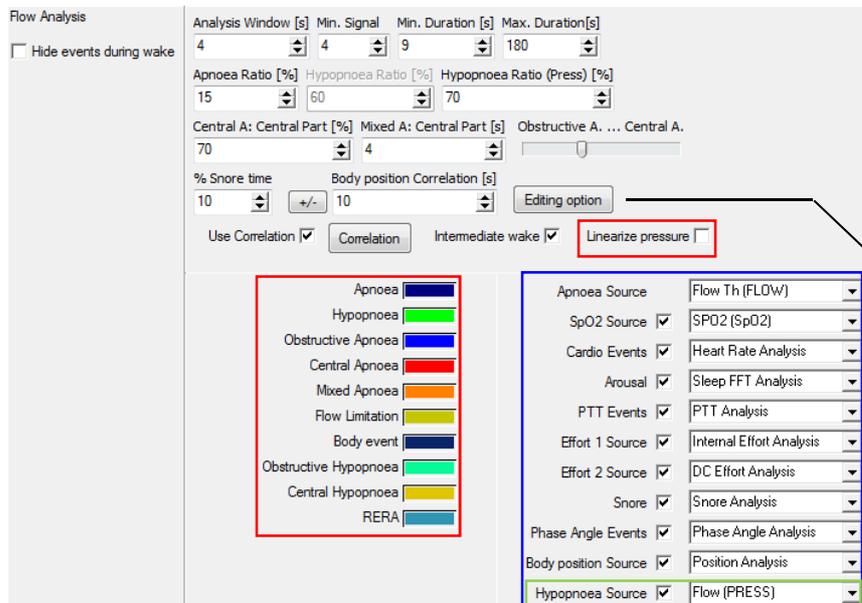


Fig. 5-22 EEG curve with K-complex

### 5.3.2 Respiratory Analysis

Below, the settings for different respiratory analyses are described, as e.g. flow analysis, or evaluation of effort signals and snoring.

#### 5.3.2.1 Flow Analysis



With “Editing-Option”, you can define for which manually edited event arousals should be displayed automatically.

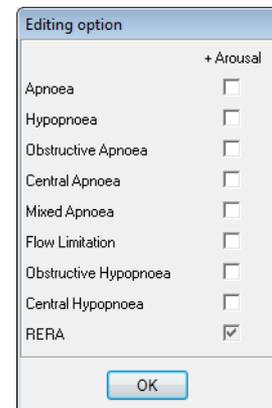


Fig. 5-23 Flow Analysis

Note that obstructive and central hypopneas can only be defined manually (see chapter 5.9) and can only be included in the user-defined report.



Fig. 5-24 Hide events during wake

#### “Hide events during wake”

If you activate this checkbox, automatically scored flow events during wake are not displayed. Manually edited events during wake are still shown. When you edit events manually, automatic events that are hidden, are overwritten by the manual scoring.

Note that only events during sleep are included in the analysis for the report. Results shown in the report are therefore not affected by choosing “Hide events during wake”.

#### 1) “Analysis Window [s]”

Timeframe used by the analysis

#### 2) “Min. Signal”

Minimum value of the signal. An artefact will be detected as soon as the signal falls below this value.

#### 3) “Min. Duration [s]”

Minimum duration for an Apnoea or Hypopnoea.

4) **“Max. Duration [s]”**

Maximum acceptable duration for an Apnoea or Hypopnoea.

5) **“Apnoea Ratio [%]”**

The Apnoea ratio states the fractional flow relative to the baseline. All values below this ratio are detected as Apnoea.

6) **“Hypopnoea Ratio [%]”**

The Hypopnoea ratio states the fractional flow relative to the baseline. All values below this ratio and above the Apnoea ratio will be detected as Hypopnoea (please also refer to section 12 on Correlation).

7) **“Hypopnoea Ratio (Pressure) [%]”**

The Hypopnoea ratio gives the fractional flow relative to the baseline. All values below this threshold and above the Apnoea ratio are classified as Hypopnoea.

For the recordings with nasal cannulas (dynamic pressure recording) a separate Hypopnoea Ratio can be set. Choose this by selecting “Flow (Press)” under “Flow Source”.



The AASM standard demands a thermistor for the recognition of apnoea and a nasal cannula for the recognition of hypopnoea. Therefore, there is the possibility to activate the “Hypopnoea Source” (see green mark), and therefore running the recognition of Hypopnoea and Apnoea on two different raw data channels. For the recognition of Apnoea select “Flow Source: Thermistor” and for the recognition of hypopnoea select “Hypopnoea Source: Nasal Cannula”.

8) **“Central A: central part [%]”** (A: Apnoea)

This value indicates to what extend effort and flow events have to overlap in order to be identified as a Central Apnoea. For example: If more than 50 % of an Apnoea in the flow channel is overlapped by an effort event it will be scored as a Central Apnoea.

9) **“Mixed A: central part [s]”** (A: Apnoea)

Where no central apnoea is detected but an Apnoea and an effort event overlap for at least 4 seconds, a mixed apnoea will be scored.

10) **“% Snore time”**

If the percentage of snoring during an apnoea phase exceeds this value, a hypopnoea will be detected.

11) **“Body position correlation [s]”**

With this function the correlation of a flow event is checked with body position change. The adjustable delay gives the maximum time between a Flow event and a body position change.

12) **“Correlation”**

This function checks the correlation of the Apnoea and Hypopnoea events to desaturation, heart rate acceleration/deceleration, arousal and PTT. It is used as additional criterion to detect Apnoea and Hypopnoea. You can define the **“Delay”** for the correlation for each parameter separately.

	Apnoea	<input checked="" type="checkbox"/> Hypopnoea	<input type="checkbox"/> Hypopnoea2	Flow Limitation	Delay
Ratio	15 %	70 %	50 %		
Desaturation	anc N/A %	4 %	N/A %	N/A %	10 . 40 s
HR-Acc/Dec	or N/A bpm	N/A bpm	N/A bpm	N/A bpm	+/- 6 s
Arousal	or N/A Hz	N/A Hz	N/A Hz	3 Hz	+/- 3 s
PTT	or N/A ms	N/A ms	N/A ms	N/A ms	+/- 4 s

Fig. 5-25 Correlations of the flow analysis

This delay will indicate the maximum time interval between the end of one Apnoea/Hypopnoea and the end of a correlating event (Desaturation, Heart Rate Acceleration/Deceleration, Arousal, and PTT) (1).

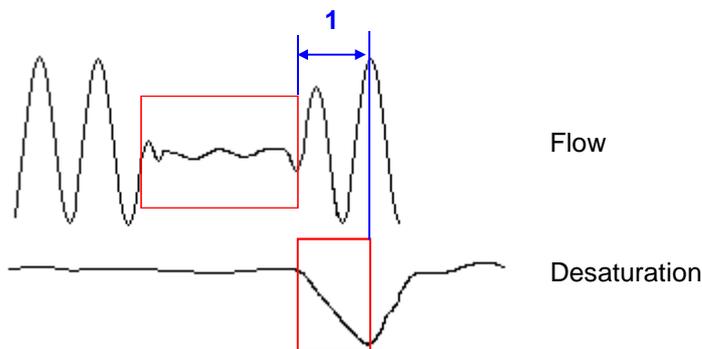


Fig. 5-26 Correlation of flow analysis



In the **Correlation** Menu, the parameter values for **Apnoea** and **Hypopnoea** can be defined (see Fig. 5-26). For analysis according to AASM there is an alternative possibility to set criteria for Hypopnea (see the green frame in Fig. 5-26).

It is possible to link multiple parameters using the “**and**”, “**or**” or “**N/A**” function for each parameter: The link “**and**” means that the correlating event (desaturation, heart rate acceleration/deceleration, arousal and PTT) **must** occur within the set delay time for an apnoea or hypopnoea to be detected. This criterion is essential for the detection of an apnoea, hypopnoea or flow limitation. The link “**or**” means that the correlating events may or may not occur at the same time as an apnoea or hypopnoea but it is not required. When detected, events will be marked in the flow analysis channel. When “**N/A**” is selected, the criterion is fulfilled automatically. If several criteria are linked by “**or**” but only one is not automatically fulfilled by “**N/A**” this criterion has to be fulfilled to define the event.

The checkboxes “Hypopnoea” and “Hypopnoea 2” (see green box in Fig. 5-25) allow for separate criteria for hypopnoea and to check for one or both criteria.

13) “**Intermediate Wake**”

Activating this function will count an Apnoea/Hypopnoea event as sleep during the first wake stage after a respiratory event. The event however must start in a sleep stage.

14) “**Linearize Pressure**”

The most accurate method of measuring the flow signal, is to use two sensors: nasal cannula and thermistor, as recommended by the AASM guideline. Simple screenings, which do not have to satisfy the recommendations of the AASM, can be done with only the nasal cannula. For this purpose, we have implemented the option to linearize the characteristics of the flow signal when measured with only the nasal cannula. This improves the detection of apnoea from the cannula so that apnoea and hypopnoea are detected precisely without having to apply a second sensor.

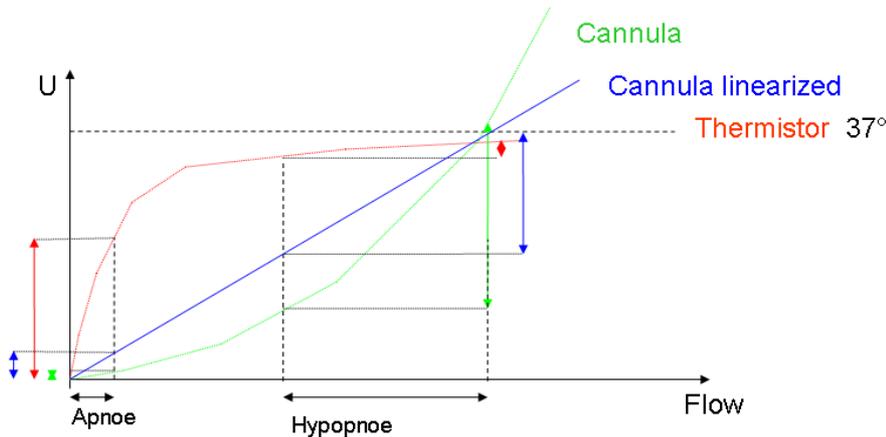


Fig. 5-27 Characteristics of cannula and thermistor

### 5.3.2.2 Effort Analysis

This analysis is used to quantify effort signals (Thorax, Abdomen) and to determine central, obstructive or mixed respiratory events.

Internal Effort Analysis			
Analysis Window [s]	Min. Signal	Min. Duration [s]	Max. Duration[s]
4	6	8	120
Apnoea Ratio [%]	Hypopnoea Ratio [%]		
18	60		
Apnoea	Effort Source		
Hypopnoea	Thorax (Internal)		

Fig. 5-28 Internal effort analysis (integrated in SSC)

DC Effort Analysis			
Analysis Window [s]	Min. Signal	Min. Duration [s]	Max. Duration[s]
4	6	8	120
Apnoea Ratio [%]	Hypopnoea Ratio [%]		
18	60		
Apnoea	Effort Source		
Hypopnoea	Abdom (ABDO)		

Fig. 5-29 DC Effort Analysis (Ext. Effort Sensor - SOMNOmedics Sensor)

Ext1 Effort Analysis			
Analysis Window [s]	Min. Signal	Min. Duration [s]	Max. Duration[s]
4	6	8	120
Apnoea Ratio [%]	Hypopnoea Ratio [%]		
18	60		
Apnoea	Effort Source		
Hypopnoea	Press Effort2 (AKT)		

Fig. 5-30 Ext1 Effort Analysis (AUX-AC)

Ext2 Effort Analysis			
Analysis Window [s]	Min. Signal	Min. Duration [s]	Max. Duration[s]
4	6	8	120
Apnoea Ratio [%]	Hypopnoea Ratio [%]		
18	60		
Apnoea	Effort Source		
Hypopnoea	Press Effort3 (PRESS)		

Fig. 5-31 Ext2 Effort Analysis (AUX-DC)

The channels for internal effort, DC effort, Ext1 effort and Ext2 effort offer the same set of settings as the flow analysis (Chapter 5.3.2.1).

### 5.3.2.3 Snore Analysis

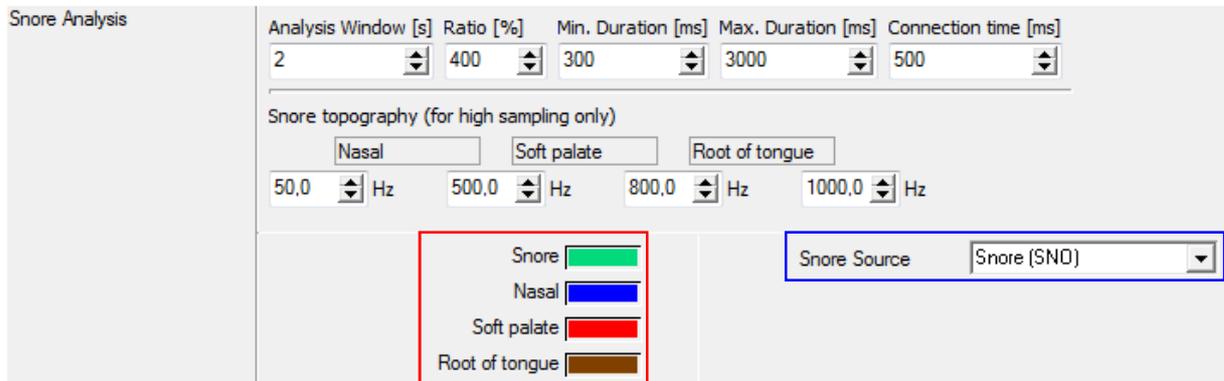


Fig. 5-32 Snore Analysis

1) **“Analysis Window [s]”**

Time period used for the analysis.

2) **“Ratio [%]”**

This ratio shows the percentage increase by which the signal needs to exceed the baseline. All values above this ratio are detected as snore.

3) **“Min. Duration [ms]”**

Minimum duration of a snore event.

4) **“Max. Duration [ms]”**

Maximum duration of a snore event.

5) **“Connection Time [ms]”**

If two snore events follow in this defined time interval, they are counted as one.

#### Snore Topography (high-sampling only)

Using the Research-Firmware and a sampling rate of the snore signal of at least 2kHz, “Snore Topography” can be used as additional analysis. It allows a differentiation of the snore types according to their individual frequencies. As the frequency depends of the point of origin the Snore topography helps to identify the anatomic source of snore and allows for an optimization of therapy.

You can define 3 different frequency bands. As default values, nasal snore is set to 50-500 Hz, snore with source in the soft palate is set to 500-800 Hz and snore with the source root of tongue is set to 800-1000 Hz. These settings can be changed individually (Fig. 5-32).

**Notice: prerequisite for the snore topography is the firmware “Research” and a high sampling microphone with a sampling rate of at least 2 kHz.**

### 5.3.2.4 SpO<sub>2</sub> Analysis

SpO<sub>2</sub> analysis detects decreases in the SpO<sub>2</sub> curve (desaturations).

Fig. 5-33 SpO<sub>2</sub> Analysis

1) **“Max. Desaturation Time [s]”**

Maximum duration of a desaturation event.

2) **“Min. Desaturation Time [s]”**

Minimum duration of a desaturation event.

3) **“Desaturation [%]”**

The minimum decrease in SpO<sub>2</sub> for a desaturation event to be detected.

4) **“Max. Drop (Artefact) [% SpO<sub>2</sub> per s]”**

An artefact will be detected if the saturation decreases faster than this predefined value.

5) **“Oscillation Range [% SpO<sub>2</sub>]”**

A new desaturation will be scored if this predefined value is exceeded.

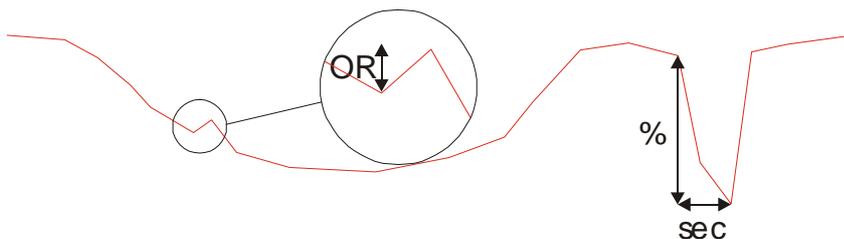


Fig. 5-34: SpO<sub>2</sub> Analysis Oscillation Range (OR)

6) **“Min. SpO<sub>2</sub> (Artefact) [%]”**

If SpO<sub>2</sub> is smaller than this defined value, an artefact is detected.

7) **“Body Position Correlation [s]”**

A desaturation will be defined separately as a desaturation caused by a body position change, whenever it occurs within the predefined time period after a body position change.

**“Artefact Source”**

The pleth signal can be defined as artefact source which prevents wrong calculation of the SpO<sub>2</sub> value when there’s a pleth-artefact on hand.

### 5.3.2.5 CPAP-/BIPAP-/SV- Analysis

#### CPAP-Analysis

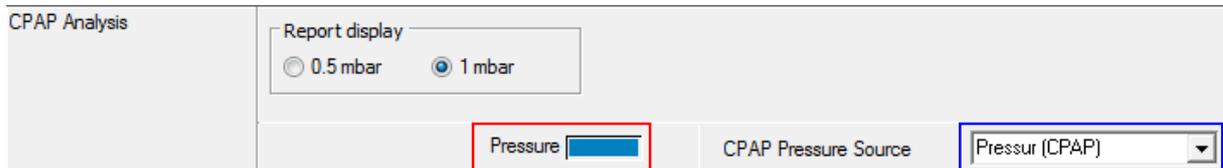


Fig. 5-35 CPAP Analysis

The trend of the CPAP pressure is calculated and displayed in 15-second intervals. The CPAP pressure will also be displayed as a numeric value (mbar) in the online mode.

Manual calibration is possible in the Edit Mode, in case the values from the software and the CPAP device differ. For this, add the command button “**CPAP**” to the quick start toolbar (see chapter 8.5). Position the cursor at the relevant point of time in the analysis window and click “**CPAP**” in the quick start toolbar.



Fig. 5-36 Enter CPAP Value

Fill in the value indicated by the CPAP device, and confirm with .

#### BiLevel Analysis



Fig. 5-37 BiLevel Analysis

This analysis uses the pressure signal to generate an inspiration and an expiration curve (EPAP / IPAP). Manual calibration is possible in the Edit Mode, in case the values from the software and the BiLevel device differ. For this, add the command button “**BiLevel**” to the quick start toolbar (see chapter 8.5).

Position the cursor at the relevant point of time in the analysis window and click “**BiLevel**” in the quick start toolbar.

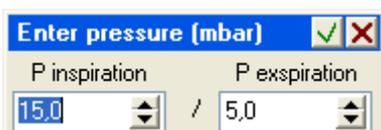


Fig. 5-38 Enter BiLevel Values

Fill in the values of IPAP and EPAP, and confirm with .

## SV Analysis

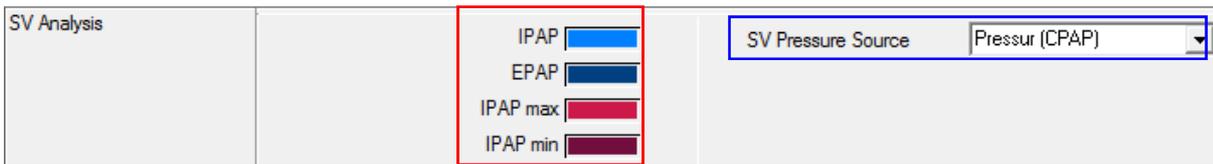


Fig. 5-39 SV Analysis

With SV respirators (SV = Servo Ventilation) two pressure levels can be set for the inspiratory ventilation pressure (IPAP = inspiratory positive airway pressure; IPAPmax / IPAPmin). SV respiratory devices reduce the ventilation pressure during periods with normal respiration or periods with hypopnoea and therefore stabilize the breathing pattern.

The SV analysis determines the maximum IPAP and the minimum IPAP based on the IPAP curve.

Manual calibration is possible in the Edit Mode, in case the values from the software and the SV device differ. For this, add the command button “**SV**” to the quick start toolbar (see chapter 8.5). Position the cursor at the relevant point of time in the analysis window and click “**SV**” in the quick start toolbar.



Fig. 5-40 Enter SV values

Enter the values of **IPAPmax**, **IPAPmin** and **EPAP** and confirm with .

### 5.3.2.6 Breathing Frequency Analysis

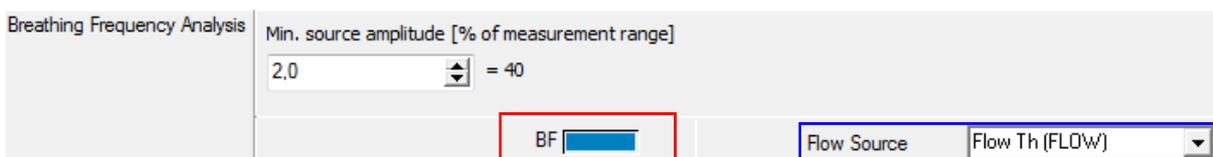


Fig. 5-41 Breathing Frequency Analysis

This channel calculates the number of breaths per minute from the flow channel.

1) “**Min. source amplitude [% of measurement range]**”

Defines the minimum amplitude of the flow signal to be determined as a breath.

### 5.3.2.7 CO<sub>2</sub> Analysis

Fig. 5-42 CO<sub>2</sub> Analysis

1) **“Min. threshold [%]”**

Value must exceed this sidestream threshold, so that a CO<sub>2</sub> value is taken into account for the analysis.

2) **“Min. Signal [%]”**

Value must exceed this transcutaneous threshold, so that the CO<sub>2</sub> value is included in the analysis.

3) **“Artefact Amplitude [%]”**

Minimum threshold for artefact detection.

4) **“Hypocapnia [%]”**

If the percentage of exhaled CO<sub>2</sub> falls below this value, a Hypocapnia is detected.

5) **“Hypercapnia [%]”**

If the percentage of exhaled CO<sub>2</sub> rises above this value, a Hypercapnia is detected.

**“Max. value for report chart”**

You can user-define the scaling of the CO<sub>2</sub> chart in the report. **“Automatic”** scales the x-axis automatically depending on the values of the recording. To get an even visual impression for the charts of different recordings, a maximum value for the x-axis can be set at **“User-defined”**.

**Notice:** the chosen unit during the calibration of the CO<sub>2</sub> signal will be saved in the Global Preferences. If you choose a different unit from %, you have to change the thresholds for hypercapnia and hypocapnia and if necessary the artefact amplitude manually. The threshold will be displayed in the report.

### 5.3.2.8 Phase Angle Analysis

The Phase Angle Analysis determines the phase shift between the 2 effort signals. From the resulting phase angle curve, the degree of obstruction is obtained via smoothing and sudden increases (phase-angle events) are detected.

Phase Angle Analysis		
Ending Threshold [grad]	Min. Increase [deg]	Min. artefact duration [s]
70	50	120
Min. Duration [s]	Max. Duration [s]	Min. Amplitude Diff.
8,00	120,00	30
Phase Angle	Obstruction	Effort 1 Source
Obstructive Apnoea	Central Apnoea	Effort 2 Source
		Thorax (Internal)
		Abdom (ABDO)

Fig. 5-43 Phase angle analysis

1) **“Ending Threshold [deg]”**

Start of the fluctuative increase has to be above this threshold value in order to be considered in the analysis.

2) **“Min. Increase [deg]”**

Minimal increase of the phase angle chart, in order to classify a phase angle event.

3) **“Min. artefact duration [s]”**

Minimum duration for classification of artefact.

4) **“Min. Duration [s]”**

Minimal duration of the increase, in order to classify a phase angle event.

5) **“Max. Duration [s]”**

Maximal duration of the increase, in order to classify a phase angle event.

6) **“Min. Amplitude Diff.”**

Minimum amplitude threshold for artefacts.

### 5.3.2.9 Breathing Volume Analysis

Breathing volume is analysed based on the pneumotachograph- signal.

Fig. 5-44 Breathing Volume Analysis

#### 1) “Breath Threshold”

The area between the Flow Curve and the Leakage Flow Curve is calculated. The Breath Threshold represents a limit for calculation and will define the beginning and end of a breath. A starting breath is defined when the Flow Curves cross the Breath Threshold for the first time. Passing the Threshold a second time will mark the end of a breath.

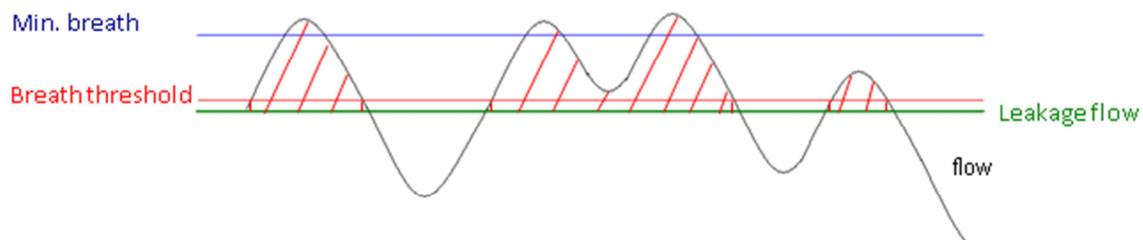


Fig. 5-45 Breathing Volume Analysis - Parameters

#### 2) “Min. Breath Strength”

Minimum respiratory signal to be detected as a breath.

#### 3) “Average Window [breathing]”

Set the time frame for the analysis window.

#### 4) “Hypoventilation (L/min)”

All values below this defined value will detect as a Hypoventilation.

#### 5) “Hyperventilation (L/min)”

All values above this defined value will detect as a Hyperventilation.

**The following values are needed for the CPAP-Report:**

#### 6) “Max. Leak [ml/s]”

This value will indicate the maximum divergence level of the Leakage Flow. Values above will be displayed as “leaky”.

#### 7) “Mask”

Different types of masks can be selected:

For an optimal calculation of leakage, it is necessary to choose the mask in use and to save the calibrated values of the patient. These can be set by “Edit” (see Fig. 5-44). If you choose “Standard Mask”, the leakage is calculated based on the mean value of all defined masks.

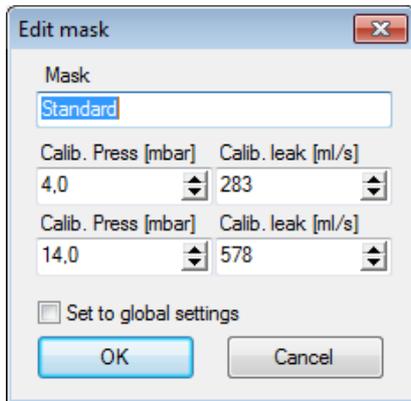


Fig. 5-46 Edit mask settings

### 5.3.2.10 Cheyne-Stokes Analysis

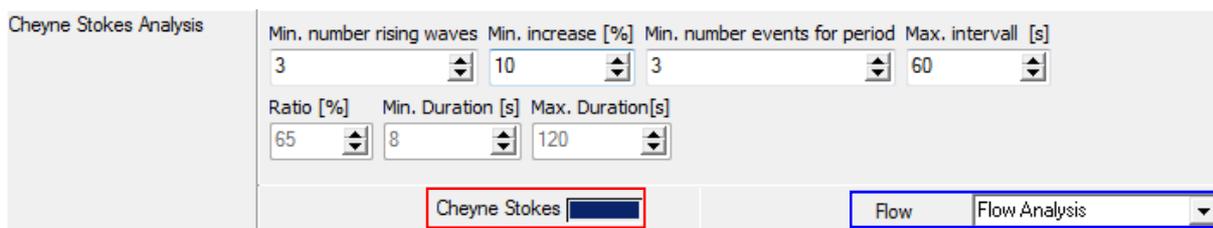


Fig. 5-47 Cheyne-Stokes Analysis

1) **“Min. number rising waves”**

This value defines how many waves minimum have to be counted before a Cheyne Stokes breathing pattern is recognized.

2) **“Min. increase [%]”**

Minimum increase in breathing amplitude from one breath to the next one

3) **“Min. number events for period”**

Only periods of Cheyne-Stokes are shown in the analysis. This value defines the minimum required number of events to be scored as a period.

4) **“Max. intervall [s]”**

Two events count for one period if the time in-between is shorter than the time given in this menu.

5) **“Ratio [%]”**

This ratio reflects the change in % compared to the baseline. All values under this ratio are defined as event.

6) **“Min. Duration [s]”**

Minimum duration of a respiratory event.

7) **“Max. Duration [s]”**

Maximum duration of a respiratory event.

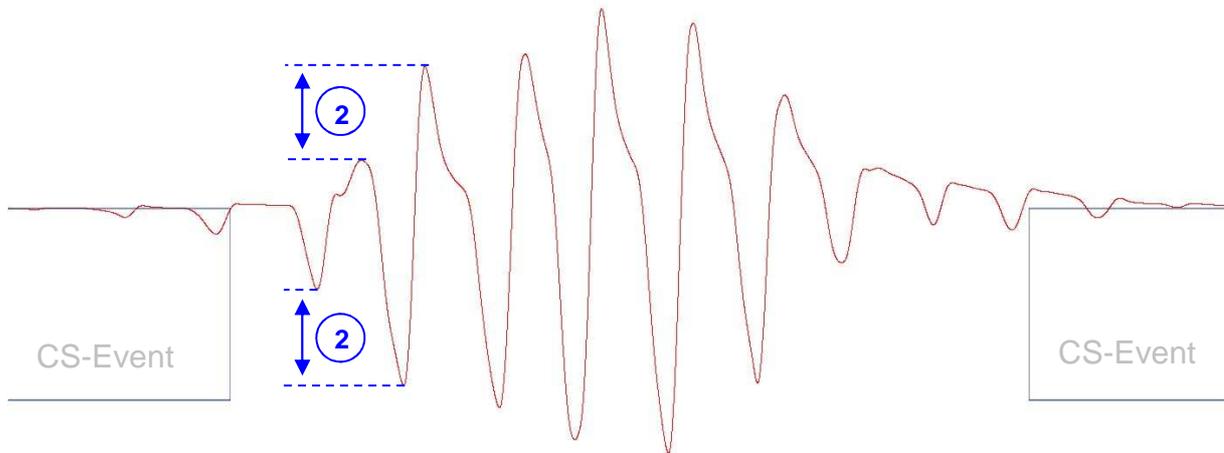


Fig. 5-48 Cheyne-Stokes: parameter definition

If the flow analysis is selected as source, the event recognition is only done via the flow analysis and the values for “**Ratio [%]**”, “**Min. Duration [s]**” and “**Max. Duration [s]**” are deactivated.

If another raw data channel is selected as source an event recognition independent from the flow analysis is done.

### 5.3.3 Motor/ Movement Analyses

#### 5.3.3.1 LM-Analysis (LM: Leg Movements)

Analysis Window [s]	Ratio [%]	Connection time [ms]	Min. Amplitude Diff. [ $\mu$ V]
30	400	1000	20
Min. Duration [ms]	Max. Duration [ms]	Synchronisation [ms]	
500	10000	2000	
Min. Distance [s]	Max. Distance [s]	Min. Number	
5	90	4	
Flow Correlation [s]	Body Position Correlation [s]		
-3 - 3	3 <input type="checkbox"/> separated analysis for PLM l/r ?		
<div style="border: 1px solid red; padding: 2px;">                     I-Marker <span style="display: inline-block; width: 15px; height: 10px; background-color: #ccccff; border: 1px solid #000;"></span>                      P-Marker <span style="display: inline-block; width: 15px; height: 10px; background-color: #ff0000; border: 1px solid #000;"></span>                      LM Resp <span style="display: inline-block; width: 15px; height: 10px; background-color: #0000ff; border: 1px solid #000;"></span>                      LM Body Position <span style="display: inline-block; width: 15px; height: 10px; background-color: #000080; border: 1px solid #000;"></span> </div>		<div style="border: 1px solid blue; padding: 2px;">                     PLM 1 Source <span style="float: right;">PLM l (PLMl)</span>                      PLM 2 Source <input checked="" type="checkbox"/> <span style="float: right;">PLM r (PLMr)</span>                      Flow Source <input checked="" type="checkbox"/> <span style="float: right;">Flow Analysis</span>                      Body Position Source <input checked="" type="checkbox"/> <span style="float: right;">Position Analysis</span> </div>	

Fig. 5-49 LM Analysis

1) “**Analysis Window [s]**”

Length of time window for the calculation of the baseline

2) “**Ratio [%]**”

This threshold defines the change in % compared to the baseline. Values above this threshold are marked as LM.

3) “**Connection time [ms]**”

If two PLM events follow within this defined time window, they are counted as one.

4) “**Min. Amplitude Diff. [ $\mu$ V]**”

The change of the signal has to meet the defined amplitude criterion. The change is calculated as the standard deviation of amplitude during the LM event.

5) “**Min. Duration [ms]**”

Minimum duration of a LM event.

6) “**Max. Duration [ms]**”

Maximum duration of a LM event.

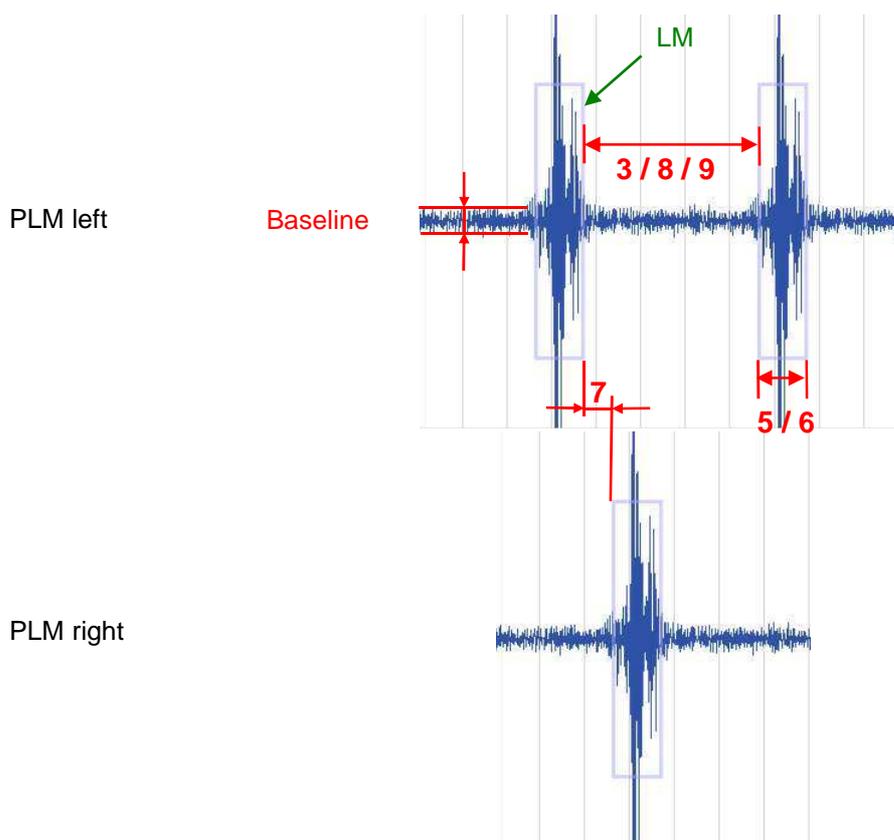


Fig. 5-50 LM parameters

7) “**Synchronisation [ms]**”

Maximum time frame between two LM events on both channels (PLM r and PLM l) to be scored as one LM event.

8) “**Min. Distance [s]**”

Minimum time frame between two LMs on one channel, to be scored as a PLM (Periodic Leg Movement) event.

9) “**Max. Distance [s]**”

Maximum time frame between two LMs on one channel, to be scored as a PLM (Periodic Leg Movement) event.

10) “**Min. Number**”

Minimum number of consecutive LMs to classify a PLM event.

11) **“Flow Correlation [s]”**

The correlation between a LM event and a Flow Event can be checked. The delay between the two events can be set here. The report will show the maximum time interval between the end of the LM event and the end of the correlating Flow event.

The LM event will not be detected as a PLM but as a resulting Arousal if the end of an Apnoea/Hypopnoea is detected within the predefined time frame.

12) **“Body Position Correlation [s]”**

The correlation between a LM event and a Body Position Change can be checked. The delay between the two events can be set here. It will indicate the maximum time interval between the LM event and the correlating Body Position Change.

**“Separated Analysis for PLM l/r”**

Activation of this checkbox enables you to analyse PLMs separately for the right and left leg. You get an additional analysis channel where the events for left and right leg can be displayed and edited separately.

A click on  opens a help window with an explanation of the input fields.

**5.3.3.2 Activity Analysis**



Fig. 5-51 Activity Analysis

The signal of the internal (or external) activity sensor is selected for the motor activity. A bar chart is shown in the analysis window.

**5.3.3.3 Position Analysis**

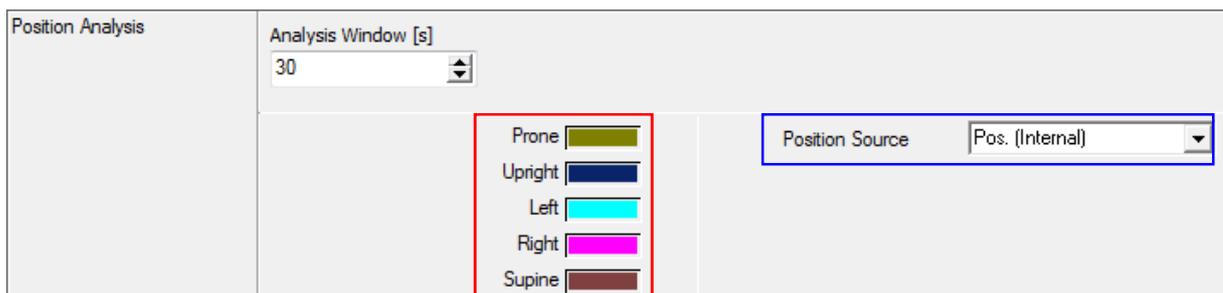


Fig. 5-52 Position Analysis

**“Analysis Window [s]”**

Sets the time frame for the determination of the dominant body position.



### 5.3.4 Cardio / Circulatory Analysis

This analysis offers a standard heart rate analysis and a heart rate analysis according to AASM. We also offer a blood pressure analysis as an option (with costs).

#### 5.3.4.1 Heart Rate Analysis

Fig. 5-53 Heart Rate Analysis

1) **“Artefact Variation [bpm]”**

Maximum change in consecutive heart beats. An artefact will be detected if the difference is larger than this value.

2) **“Body Artefact [s]”**

An artefact is determined when there is a body position change for the given duration. Therefore no HR-Event is determined in this area. For this **“Artefact Source”** must be activated.

3) **“HRV Averaging”**

Number of beats for the smoothing of the signal for the HRV and SVB analysis.

4) **“Asystole [ms]”**

Minimum RR distance for the detection of an asystole.

5) **“Tachycardia [bpm]”**

If the heart rate exceeds the defined value, the heart rate curve is colour coded as tachycardia. The criterion **“Min. beats count”** has to be met simultaneously.

6) **“Bradycardia [bpm]”**

If the heart frequency is below the defined value, the heart rate curve is colour coded as bradycardia. The criterion **“Min. beats count”** has to be met simultaneously.

7) **“Min. beats count”**

Minimum number of consecutive beats of a bradycardia or tachycardia which meets the criteria.

Additionally, tachycardia with wide or narrow QRS-complexes are determined following these criteria:

8) **“Tachycardia [bpm]”**

If the determined heart frequency is above this value, a tachycardia is detected. The criterion **“Min. beats count”** has to be met simultaneously.

9) **“Min. beats count”**

A tachycardia which meets the criteria has to stop for this number of heart beats to be valued.

10) **“Wide QRS complex min [ms]”**

A tachycardia with wide QRS complex is marked in the raw data channel if the QRS complex lasts longer than the defined time.

11) **“Narrow QRS complex max [ms]”**

A tachycardia with narrow QRS complex is marked in the raw data channel if the QRS complex lasts less than the defined time.

Additionally, Acceleration and Deceleration are defined by the following criteria:

12) **“Arrhythmia Variation [%]”**

If the beat-to-beat variation (distance between two R-waves) is larger than this defined value, an arrhythmia is detected.

13) **“Min. Duration [s]”**

Minimum duration of a continuous period of heart rate increase or decrease.

14) **“Min. Change [1/min]”**

Minimum increase or decrease in the number of heart beats for an event to be detected.

15) **“Max. Duration [s]”**

Maximum duration for a continuous heart rate increase or decrease.

Pulse rate thresholds for the extended BP report can be set via **“Limit Tachycardia”**.

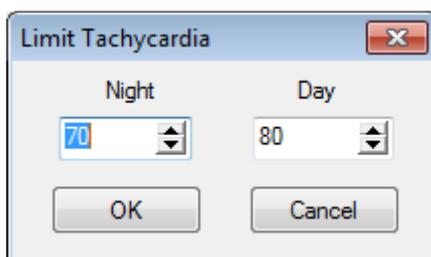


Fig. 5-54 Limit Tachycardia

### **Sympatho Vagal Balance**

The heart rate variability (HRV) is an integrating measurement reflecting, above all, the current dominant Sympathetic and Vagal innervations on the bodies Central Control System. Information on the Sympatho-Vagal-balance of the organism can be given (“fight or flight reaction”) and on this basis an objective indexing of stress conditions can take place. For example a close correlation between Sympatho Vagal Balance and the Sleep Profile can be seen.

For further information on this topic please refer to the following literature:

**«Dynamic heart rate variability as a tool for exploring the sympatho-vagal balance»**

*Laboratoire des Régulations Physiologiques et des Rythmes Biologiques chez l'Homme, Institut de Physiologie, 4 Rue Kirschleger, 67085 Strasbourg Cedex, France, 1998*

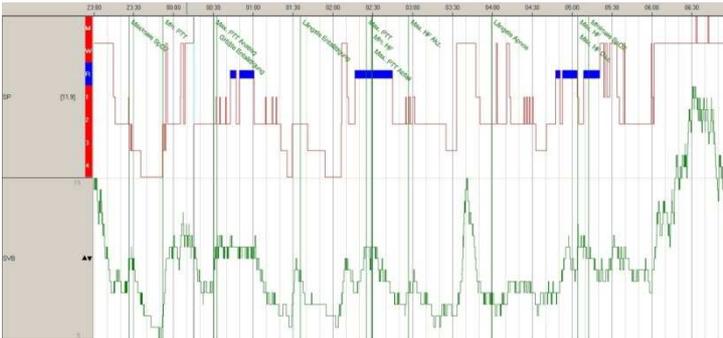


Fig. 5-55 Sympatho-vagal balance – correlation to sleep profile



### 5.3.4.2 Heart Rate AASM Analysis

Heart Rate AASM Analysis

Artefact Variation [bpm]	Body Artefact [s]	Asystole [ms]	Arrhythmia Variation [%]
46	1.0	3000	20
Tachycardia [bpm]	Bradycardia [bpm]	Min. beats count	
90	40	2	
Wide/Narrow complex tachycardia			
Tachycardia [bpm]	Min. beats count		
100	3		
Wide complex QRS min. [ms]	Narrow complex QRS max. [ms]		
120	120		
Limit Tachycardia			

Heart Rate	<span style="color: green;">█</span>
Tachycardia (wide QRS complex)	<span style="color: purple;">█</span>
Tachycardia (narrow QRS complex)	<span style="color: blue;">█</span>
Asystole	<span style="color: red;">█</span>
Tachycardia	<span style="color: magenta;">█</span>
Bradycardia	<span style="color: cyan;">█</span>

Cardiac Source	ECG II
Artefact Source	<input checked="" type="checkbox"/> Position Analysis

Fig. 5-56 Heart Rate AASM Analysis

1) “**Artefact variation [bpm]**”

This is the maximum difference of consecutive heart frequencies. If the change of the heart frequency is bigger than the previous value, an artefact is recognized.

2) “**Body artefact [s]**”

An artefact is determined when there is a body position change for the given duration. Therefore no HR-Event is determined in this area (for this “**Artefact Source**” must be activated).

3) “**Asystole [ms]**”

It is determined by the distance between two R points following each other. If this distance is longer than the given value, an Asystole is recognized.

4) “**Arrhythmia Variation [%]**”

An arrhythmia is scored if the beat-to-beat variation (RR distance) is higher than the defined value.

5) “**Tachycardia [bpm]**”

If the determined heart frequency is above the entered value, the heart frequency curve is marked in colour as a Tachycardia. In addition, the criterion “**Min beats count**” has to be fulfilled.

6) **“Bradycardia [bpm]”**

If the determined heart frequency is below the entered value, the heart frequency curve is marked in colour as a Bradycardia. In addition, the criterion **“Min. beats count”** has to be fulfilled.

7) **“Min. beats count”**

Minimum number of consecutive beats of a bradycardia or tachycardia which meets the criteria.

**According to the following criteria, Tachycardias with wide and narrow QRS complexes are determined:**

8) **“Tachycardia [bpm]”**

If the determined heart frequency is above this value, a tachycardia is detected. The criterion **“Min. beats count”** has to be met simultaneously.

9) **“Min. beats count”**

Minimum number of consecutive beats of a tachycardia which meets the criteria.

10) **“Wide complex QRS min. [ms]”**

If the QRS complex lasts less than the registered value, a tachycardia with wide QRS complexes is recognised from the raw data channel.

11) **“Narrow complex QRS max. [ms]”**

If the QRS complex lasts longer than the registered value, a tachycardia with narrow QRS complexes is recognised from the raw data channel.

**“Limit Tachycardia”**

Pulse rate thresholds can be set by pressing the button **“Limit Tachycardia”** (see Fig. 5-54).

### 5.3.4.3 PTT Analysis (PTT: Pulse Transit Time)

The pulse transit time is calculated from the ECG signals and the plethysmographic wave from the Pulse Oximeter. In our application the PTT is the time it takes for the arterial pulse to propagate from the heart to the pulse oximeter site (finger or toe).

**Please note:**

For this analysis it is essential to enter the patient’s body weight and height correctly. Otherwise the values you get might not be reliable.

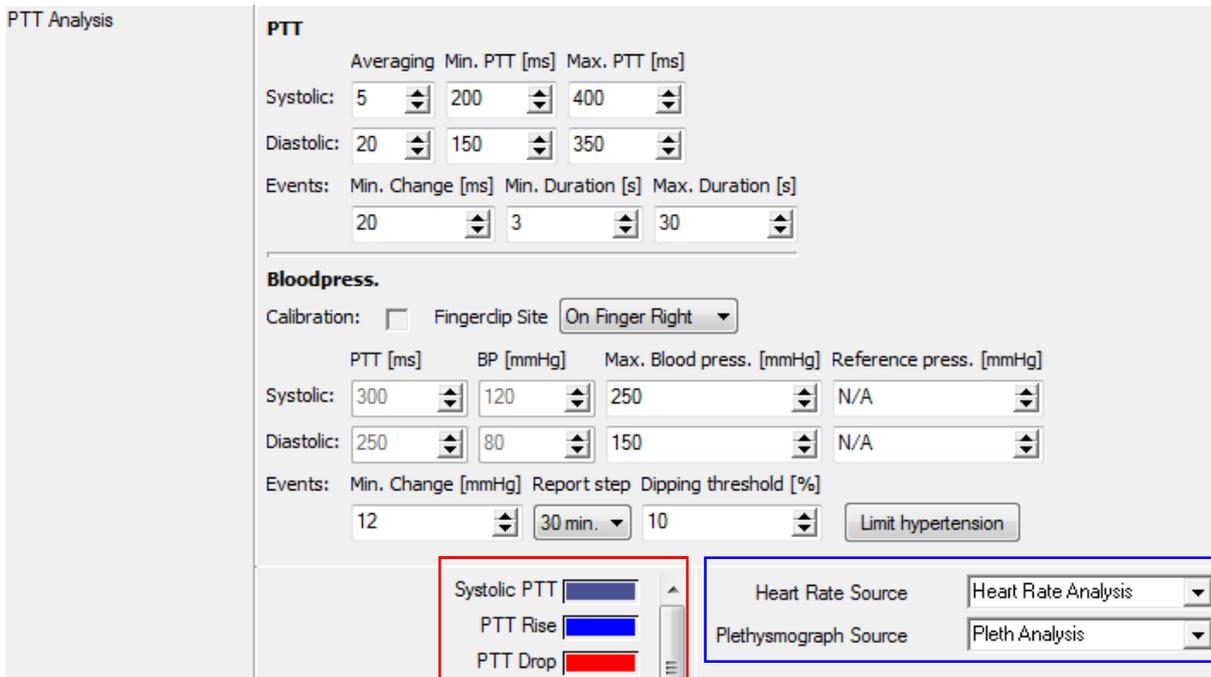


Fig. 5-57 PTT Analysis

1) **“Averaging”**

This value serves for smoothing the PTT curve. If the value 5 is given, 5 values are averaged and represented as one value in the PTT curve.

2) **“Min. PTT [ms]”**

Minimum PTT value.

3) **“Max. PTT [ms]”**

Maximum PTT value.

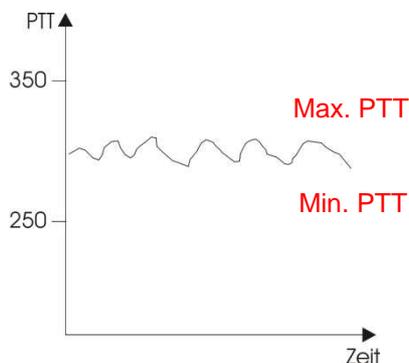


Fig. 5-58 Determining artefact limits

If the PTT curve exceeds the maximum or falls below minimum level, an artefact will be detected. Adjust both values to each individual patient (child, adult) and to the measurement site (finger, toe).

4) **“Min. Change [s]”**

Required change of the PTT to detect an event.

5) **“Min. Duration [s]”**

Minimum duration of an increase or decrease of the PTT curve.

6) **“Max. Duration [s]”**

Maximum duration of an increase or decrease of the PTT curve.

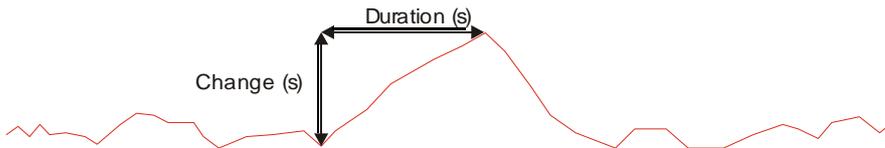


Fig. 5-59 PTT Analysis

7) **“PTT Syst./Diastol. [ms]”**

Determines the PTT Value at the moment of the manual measurement of blood pressure.

8) **“BP Syst./Diastol. [mmHg]”**

Manually measured blood pressure values.

9) **“Max. Blood Press. Syst./Diastol. [mmHg]”**

If the determined blood pressure values cross this threshold, an artefact is recognized.

10) **“Reference Pressure Syst./Diastol. [mmHg]”**

The report gives the percentage difference to the reference blood pressure (normal BP). If N/A is selected, the reference pressure is automatically determined during the first three minutes after “light off”.

11) **“Min. change [mmHg]”**

Min. increase of the blood pressure for an event to be recognized

12) **“Report step”**

Time window for the curve smoothing for the graphic in the blood pressure report.

13) **“Dipping threshold”**

Minimum percentage decrease of the nocturnal blood pressure in comparison to the blood pressure during the day, to classify the patient as dipper.

**Settings for the Advanced Blood Pressure Report**

To have a higher flexibility in the report module “Advanced Blood Pressure Report”, you can set the thresholds for systolic and diastolic blood pressure, the mean arterial pressure (MAP) and the pulse power (PP) for night and day. Press the button **“Limit Hypertension”** in order to do so. The stored values are shown in the advanced BP report.

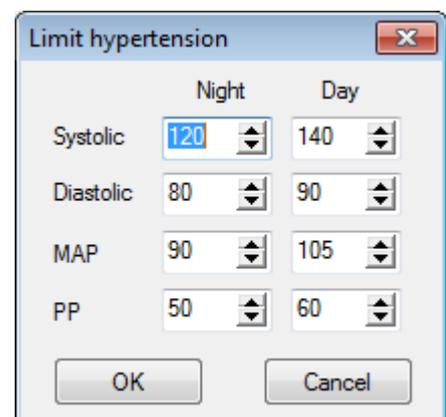


Fig. 5-60 Limit hypertension

### 5.3.4.4 Classification of PTT and Systolic Blood Pressure Events

Fluctuating decreases in PTT or raising systolic blood pressure values are correlated to other events which occur at the same time.

PTT Classification

	Delay
Flow	<input type="text" value="6"/> s
Limitation	<input type="text" value="3"/> s
PLM	<input type="text" value="3"/> s
HR-Acc/Dec	<input type="text" value="10"/> s
Snore	<input type="text" value="5"/> s
Body Position	<input type="text" value="3"/> s

Spontaneous PTT	<input type="checkbox"/>
Respiratory PTT	<input type="checkbox"/>
PLM PTT	<input type="checkbox"/>
Cardiac PTT	<input type="checkbox"/>
Snore PTT	<input type="checkbox"/>
Body Position PTT	<input type="checkbox"/>
Limitation PTT	<input type="checkbox"/>

PTT Events	PTT Analysis
Flow	<input checked="" type="checkbox"/> Flow Analysis
PLM	<input checked="" type="checkbox"/> LM Analysis
Cardiac Events	<input checked="" type="checkbox"/> Heart Rate Analysis
Snore	<input checked="" type="checkbox"/> Snore Analysis
Body Position	<input checked="" type="checkbox"/> Position Analysis
Limitation	<input checked="" type="checkbox"/> Flow Analysis

Fig. 5-61 Classification of PTT events

Classification Systolic

	Delay
Flow	<input type="text" value="6"/> s
Limitation	<input type="text" value="3"/> s
PLM	<input type="text" value="3"/> s
HR-Acc/Dec	<input type="text" value="10"/> s
Snore	<input type="text" value="5"/> s
Body Position	<input type="text" value="3"/> s

Spontaneous Systolic	<input type="checkbox"/>
Respiratory Systolic	<input type="checkbox"/>
PLM Systolic	<input type="checkbox"/>
Cardiac Systolic	<input type="checkbox"/>
Snore Systolic	<input type="checkbox"/>
Body position Systolic	<input type="checkbox"/>
Limitation Systolic	<input type="checkbox"/>

Systolic Events	PTT Analysis
Flow	<input checked="" type="checkbox"/> Flow Analysis
PLM	<input checked="" type="checkbox"/> LM Analysis
Cardiac Events	<input checked="" type="checkbox"/> Heart Rate Analysis
Snore	<input checked="" type="checkbox"/> Snore Analysis
Body Position	<input checked="" type="checkbox"/> Position Analysis
Limitation	<input checked="" type="checkbox"/> Flow Analysis

Fig. 5-62 Classification of systolic blood pressure events

The required delay times can be set separately for each of the following events: Flow, PLM, HF-Acc./Dec., Snore, Body Position. Depending on priority, the PTT or Blood Pressure events will be correlated to the events. Thanks to Drag and Drop the order of the list can be changed, and so can the priority for the classification. If a correlation is not possible, the event will be scored as “spontaneous”.

### 5.3.4.5 Pleth Analysis

Fig. 5-63 Pleth Analysis

The pleth analysis is part of the calculation of PTT. The signal must meet the following criteria to be included in the analysis:

- 1) **“Min. Amplitude Diff.”**  
Minimum amplitude of the pleth signal.
- 2) **“Min. Plateau-Artefact dur. [ms]”**  
Minimum length of the plateau of the pleth signal amplitude.

#### “Artefact Source”

Choose a raw data channel as artefact source here. If an artefact is detected in that channel, the signal of the pleth channel is also classified as artefact.

## 5.3.5 Further Analysis

### 5.3.5.1 Light Analysis

Fig. 5-64 Light Analysis

This analysis smoothes the raw data signal.

### 5.3.5.2 Temperature analysis

Fig. 5-65 Temperature analysis

This analysis shows the Body Temperature between 34°C and 39°C.

- 1) **“Min. Gradient [°C/h]”**  
The Temperature Report will display “insufficient decrease”, if the determined gradient falls below this value.

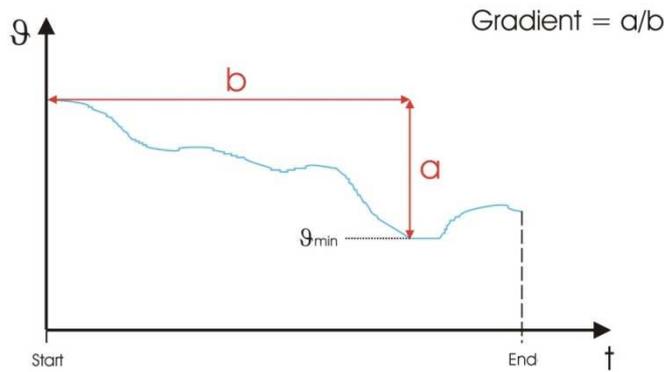


Fig. 5-66 Calculation of the temperature gradient

### 5.3.5.3 AUX Analysis



Fig. 5-67 AUX Analysis

This Parameter smoothes the raw data by calculating an average value every 250 ms.

### 5.3.5.4 EDA Analysis (EDA: Electro Dermal Activity)

The electro dermal activity is a term for the characterisation of the electrical phenomena of the skin.



Fig. 5-68 EDA-Analysis

The EDA analysis smoothes the raw data signal by averaging the value (every 250ms a new average value is formed). The determined values are used as conductance values (unit: Siemens [S]) in a curve.

The electro dermal activity is influenced by the rise of the sympathetic tone which comes with emotional reactions. These also coincide with increased sweating which causes a drop in the electrical resistance of the skin.

### 5.3.5.5 NPT Analysis (Nocturnal Penile Tumescence)

Here an erectile dysfunction of men can be detected. There are two sensors to be placed, one at the distal end and one at the proximal end.



Fig. 5-69 NPT Analysis

The NPT-Analysis smoothes the raw-data signal.

### 5.3.5.6 Bruxism

Phases with tonic and / or phasic jaw muscle activity are determined by jaw movements and teeth-grindings (or similar rhythmic jaw chewing movements).

Max. Amplitude [µV]	Ratio [%]	Synchronisation [ms]
300	30	1000

Phasic

Min. Duration [ms]	Max. Duration [ms]	Connection time [ms]	Min. count
50	2000	3000	3

Tonic

Min. Duration [ms]	Max. Duration [ms]
2000	30000

Bruxism phasic

Bruxism tonic

EMG Source  EMG

EMG Source  <None>

Fig. 5-70 Bruxism

1) **“Max. Amplitude [µV]”**

Maximum amplitude for Bruxism to be recognized.

2) **“Ratio [%]”**

This threshold indicates the change in %, relative to the baseline. All values above this threshold are marked as Bruxism.

3) **“Synchronisation [ms]”** (a second EMG channel must be selected for this)

Maximum time between detected events in both channels for an event to be scored.

**If the settings above lead to an event to be recognised, the software performs a test for phasic Bruxism:**

4) **“Min duration [ms]”**

Minimal duration of a phasic Bruxism Event.

5) **“Max. Duration [ms]”**

Maximum duration of a phasic Bruxism Event.

6) **“Connection time [ms]”**

Two following Bruxism Events in a short interval are marked as one, if the event interval time is shorter than the given connection time.

7) **“Min. count”**

Minimal number of Bruxism events to be evaluated as phasic Bruxism.

**If the recognized events do not correspond to phasic Bruxism, they are checked for tonic Bruxism:**

8) **“Min duration [ms]”**

Minimal duration of a tonic event.

9) **“Max. Duration [ms]”**

Maximum duration of a tonic Bruxism event.

### 5.3.5.7 Spike Analysis

Min. Spike Amplitude [ $\mu\text{V}$ ]	Max. Spike Amplitude [ $\mu\text{V}$ ]	Max. Spike duration [ms]	Artefact Amplitude [ $\mu\text{V}$ ]
150	300	95	350
Min. No. of Episodes	Max. Episode Interval [s]		
1	100		
Spike <input type="checkbox"/> <span style="background-color: purple; border: 1px solid red; padding: 2px;">Spike</span> SW Complex <input type="checkbox"/> <span style="background-color: red; border: 1px solid red; padding: 2px;">SW Complex</span>		Fp1 <input checked="" type="checkbox"/> Fp1 (Fp1) Fp2 <input checked="" type="checkbox"/> Fp2 (Fp2)	

Fig. 5-71 Spike Analysis

1) **“Min. Spike Amplitude [ $\mu\text{V}$ ]”**

Minimal amplitude of a Spike in the EEG-Signal.

2) **“Max. Spike Amplitude [ $\mu\text{V}$ ]”**

Maximal amplitude of a Spike in the EEG-Signal.

3) **“Max. Spike Duration [ms]”**

Maximal duration of a Spike in the EEG-Signal.

4) **“Artefact Amplitude [ $\mu\text{V}$ ]”**

The maximum curve increase is determined. For all values above this limit the Spike Analysis will detect an artefact.

5) **“Min. No. of Episodes”**

The minimal number of successive spikes to be assessed in the report as episodic spikes.

6) **“Max. Episode Interval [s]”**

The maximal duration for an interval of successive spikes to be assessed in the report as episodic spikes.

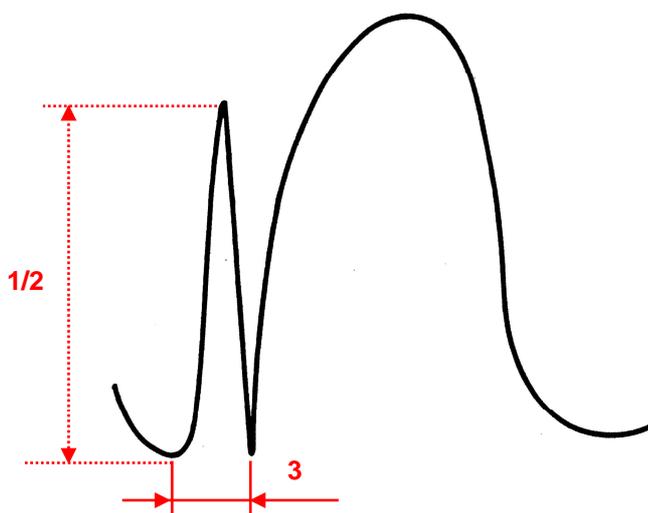


Fig. 5-72 EEG-curve with a spike wave complex

If a slow wave follows a spike within 300 ms, a spike wave complex will be determined.

### 5.3.5.8 Generic

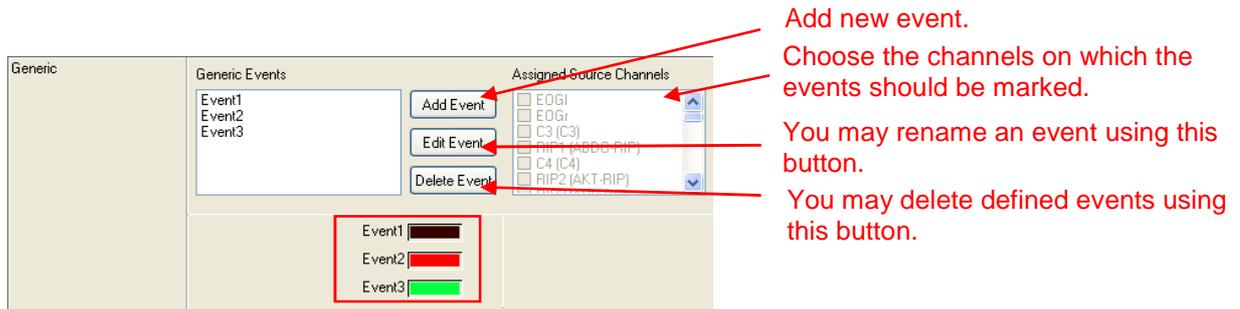


Fig. 5-73 Generic

This Parameter allows you to create a user-defined event on a selected channel.

### 5.3.5.9 pH Analysis

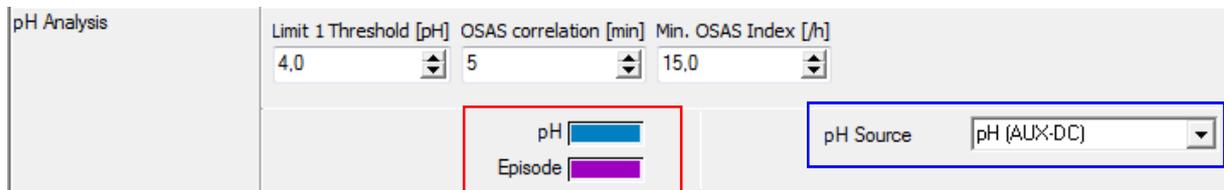


Fig. 5-74 pH Analysis

1) **“Limit 1 Threshold [pH]”**

Threshold under which the pH value has to fall for at least 30s to detect a pH event.

2) **“OSAS correlation [min]”**

Time frame for which occurring obstructive apnoea are marked as correlating with the following pH event.

3) **“Min. OSAS Index [h]”**

Minimum index of obstructive apnoea for the correlation with pH events in the time frame defined in 2).

### 5.4 Tab “Raw Data”

In the tab “Raw Data” (Fig. 5-75), changes in signal characteristics of all raw data channels can be made, e.g. colour and signal size in the display. The sequence of channels can be changed by drag & drop. Additionally, you can add or delete references.

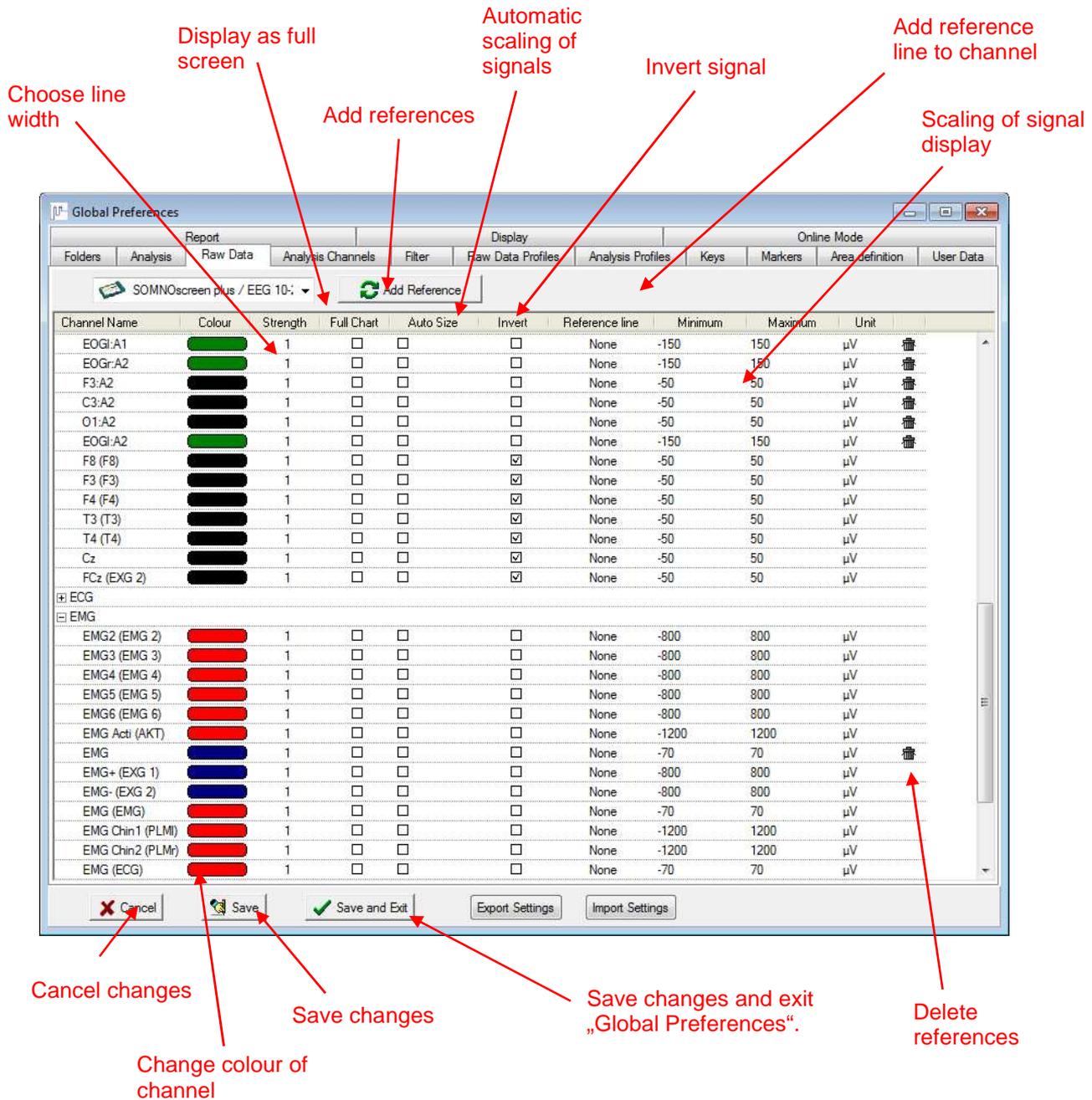
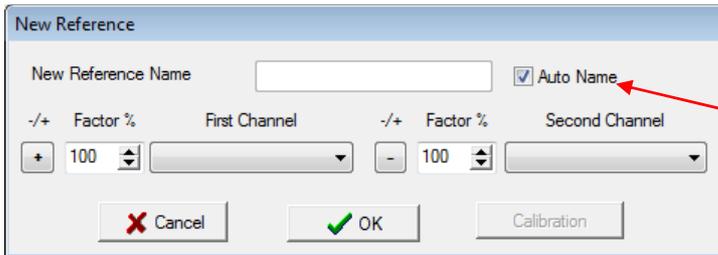


Fig. 5-75 Tab „Raw Data“

References are calculated as follows:

$$\text{Reference} = \pm (\text{Channel 1} * \text{Factor}) \pm (\text{Channel 2} * \text{Factor})$$

By pressing the button “+” or “-“ respectively, you can change between subtraction and addition.



Checkbox activates automatic naming of the channel. The name then consists of the two reference channels.

Fig. 5-76 Add reference

**Calibration:**

By double clicking the channel name, a window opens where you can calibrate the channels (see Fig. 5-77), rename references and change the mode of calculation for references (see Fig. 5-78).

**Temperature sensor as an example:**

Check the data sheet of the sensor for the minimum and maximum input voltage and for the minimum and maximum temperature the sensor can detect. Fill in the values in the tab “Voltage”. By clicking on “OK” calibration is completed.

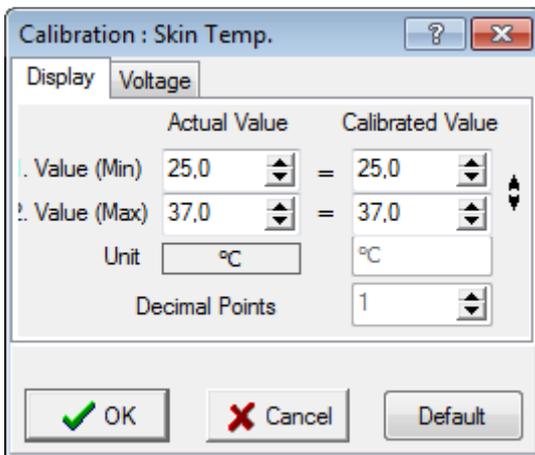


Fig. 5-77 Calibration of temperature sensor

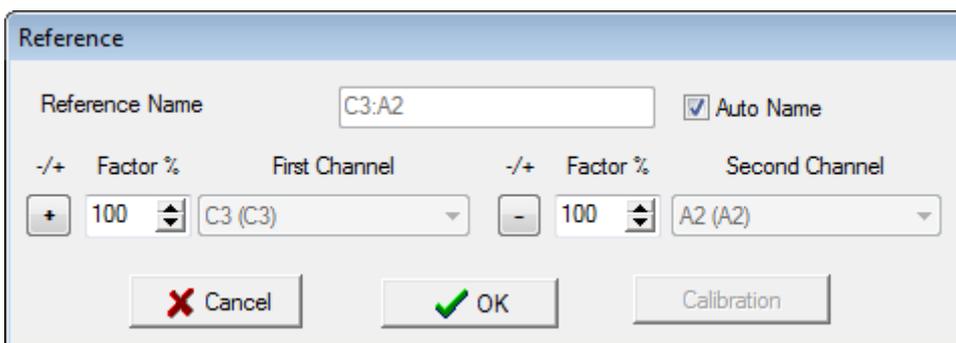


Fig. 5-78 Rename reference and change mode of calculation

## 5.5 Tab “Analysis Channels”

Within the Menu “Analysis Channels” the presentation of the analysis window can be changed.

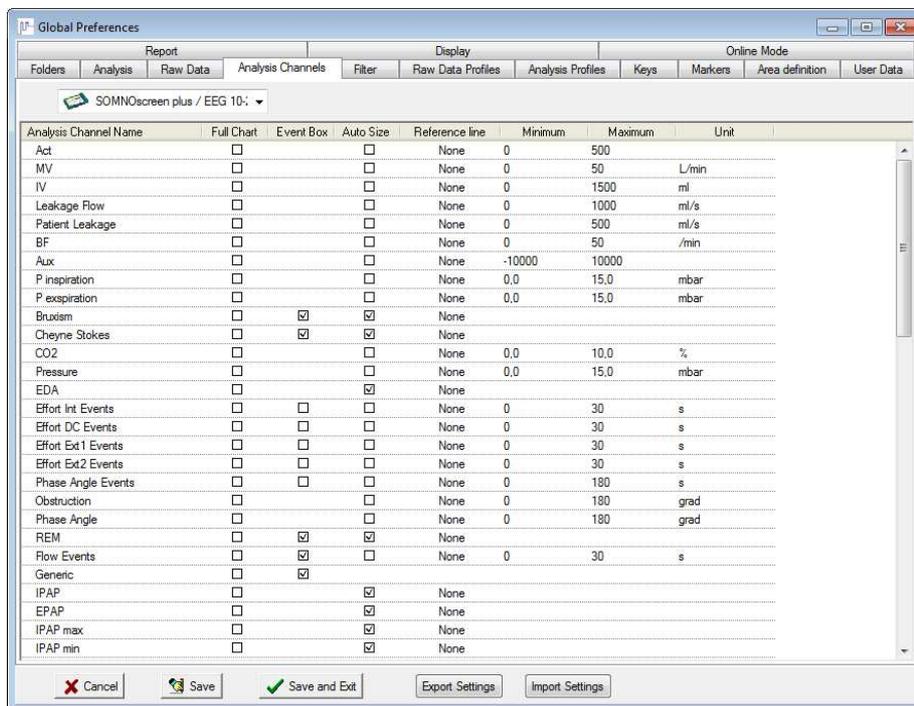


Fig. 5-79 Tab “Analysis Channels”

### Full Chart:

Upon activating this option the respective curve will be displayed in full chart mode.

### Event Box:

Upon activating this option coloured frames will mark the events of the respective signals in the Raw Data window.

### Auto Size:

This option will scale the amplitude of the curve automatically.

### Reference line:

With this function, reference lines can be constructed in the analysis channel. You have the choice between “absolute” and “delta”. “Absolute” draws a reference line with the registered distance above and below the zero line of the channel. “Delta” plots the area of the defined range around the zero line. This helps to evaluate the amplitudes of the EEG-signals.

### Minimum/Maximum:

Enter minimum/maximum values to scale the respective signal.

## 5.6 Tab “Filter”

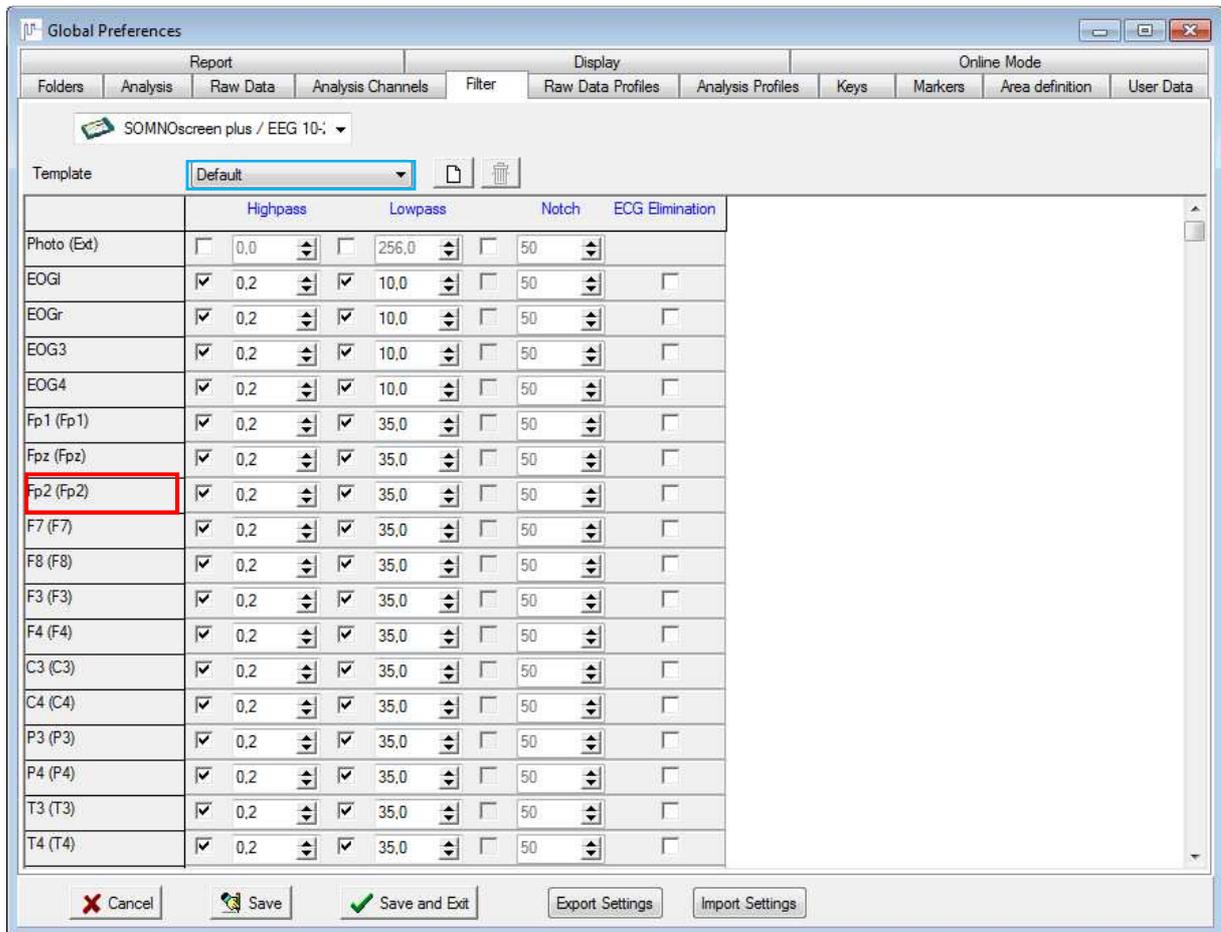


Fig. 5-80 Tag “Filter”

Mark the respective checkboxes  to filter a specific signal. Settings (in Hz) for Highpass, Lowpass and Notch can be selected individually. Right click the channel name field (marked red), to transfer the filter settings from one EOG/ EEG channel to all the other EOG/ EEG channels.

You can name and save your filter settings as a template (marked blue). Note that templates can only be defined in the Global Preferences. You can choose this template in the local settings later on. Changes made in the local settings are NOT saved to the template.

“ECG Elimination” filters unwanted ECG-signals from the EEG- and EMG channels using wavelet transformation.

## 5.7 Tab “Raw Data Profiles”

In the Raw Data Profiles, the display window can be configured to your own preferences. A Raw Data Profile is the collection of channels which are predefined for a specific recording. For example: If you want to select all relevant channels for an EEG recording, you can define a profile which contains the desired references.

Please note:

- You can set different time bases (display) for each profile (see Fig. 5-81)
- It is possible to change, delete or rename existing profiles.
- The Raw Data Profiles can be opened from the pop-up menu in the Analysis Window during Analysis or online acquisition (see chapter 8.7).
- You can change the order of the profile channels with Drag and Drop.
- If you would like to view your data online in dual time basis, choose the checkbox “Use dual time base for online” (marked orange).

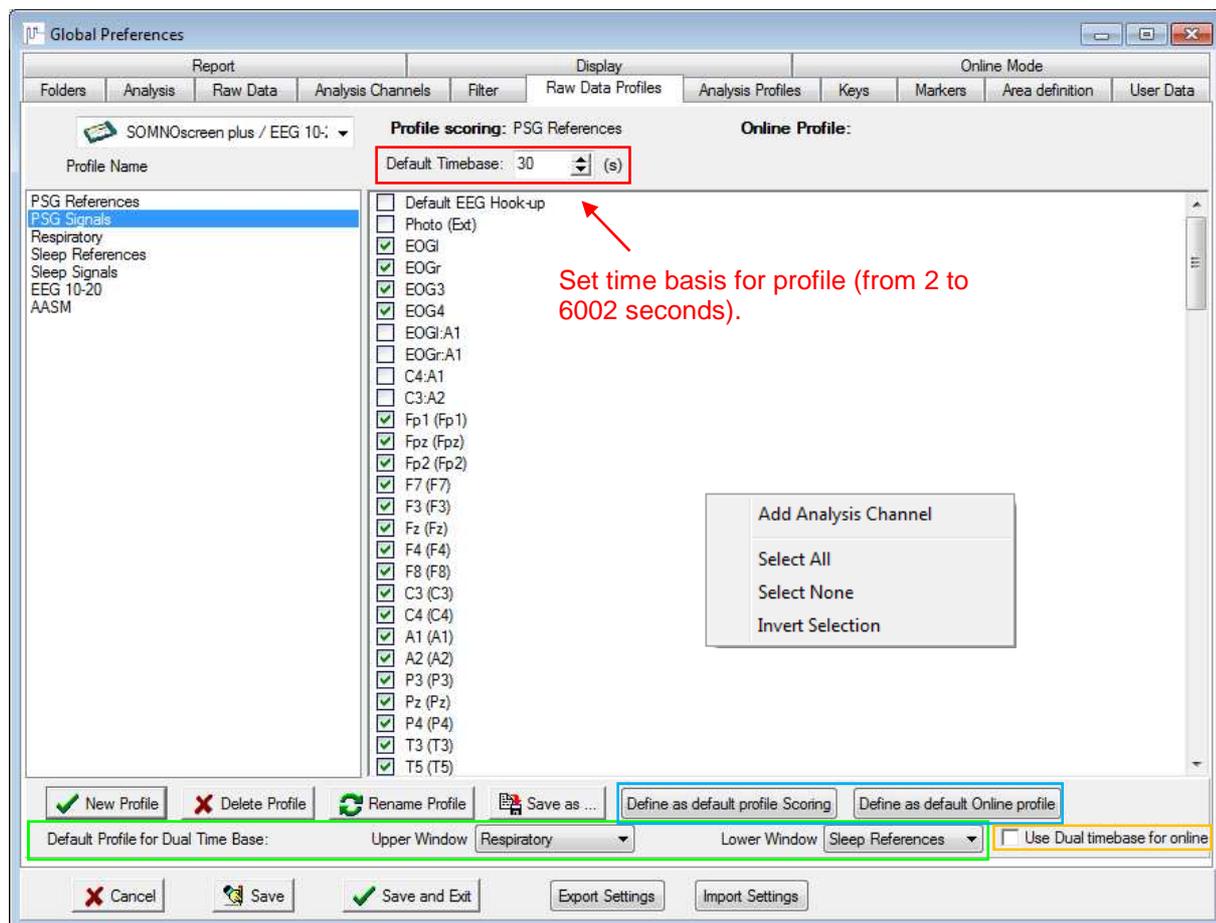


Fig. 5-81 Tab “Raw Data Profile”

### Creating a new profile:

Click “**New Profile**”, enter a name and confirm with “**OK**”. At first all channels will be activated. Unmark the channels which are not relevant for your profile.

Click right in the main window to open a pop-up menu where you can select all or none of the channels, invert the current selection or add further channels.

If you wish to rename a profile, please click “**Rename Profile**”.

**Defining a Default Profile:**

Select an existing profile from the list on the left; it will be highlighted in blue (see Fig. 5-81). Then click **“Define as default profile Scoring”** or **“Define as default Online profile”**.

When a recording is started or opened, the Raw Data signals will be displayed according to the selected Default Profile.

If **“Default EEG-Hook up”** is selected, all channels which are defined as default in the EEG Montage (in the Montage Editor) will be added to the profile.

**“Impedance (Headbox)”** adds the channel defined as the Continuous Impedance Recording Channel to the Raw Data Profile (see chapter 7.2.7.2).

**“Save as...”** saves the profile with a new name. It provides a quick and easy method to save a slightly modified version of an existing profile as a new profile.

For the **“Dual timebase”** (two raw data templates are displayed at the same time with a horizontal splitting line), two raw data profiles can be selected as default which are displayed in the higher and lower part of the window respectively (see green mark).

**5.8 Tab “Analysis Profiles”**

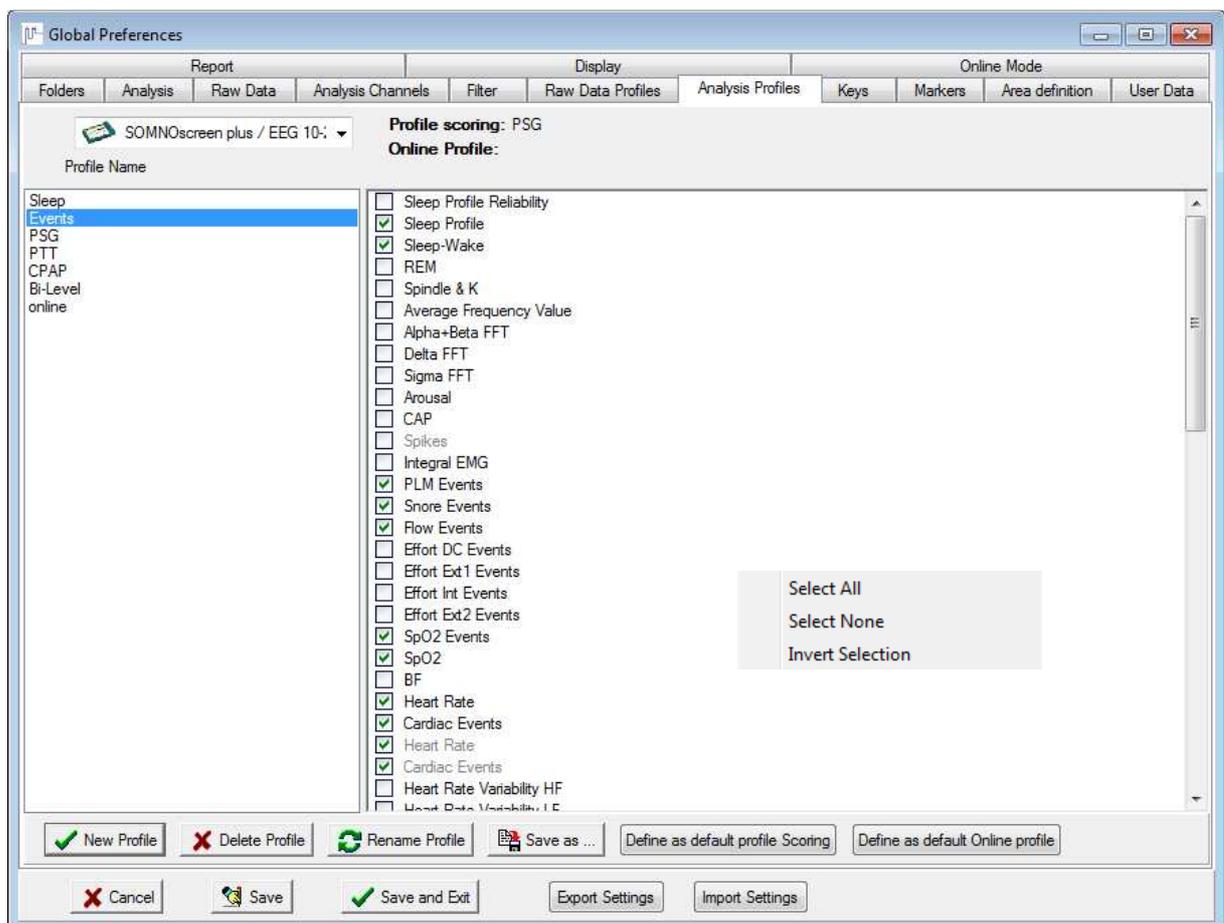


Fig. 5-82 Tab “Analysis Profiles”

The “**Analysis Profiles**” menu allows you to adapt the Analysis Display Screen to your needs. An analysis profile is the collection of analysis channels which can be predefined for different recordings and diagnosis protocols. For example: For a Sleep Stage Analysis, simply setup a profile to include the following Analysis channels:

Sleep Profile Reliability, Sleep Profile, Sleep Wake Analysis, REM, Average Frequency Value, Alpha + Beta FFT, Delta FFT, integral EMG, Position, Light and Activity.

**Please note:**

- **It is possible to change, delete or rename existing profiles.**
- **Analysis profiles can be called upon in the opened recording with a right click in the analysis window (chapter 8.7.1).**

**Creating a new profile:**

Click “**New Profile**”, enter a name and click “**OK**”. All channels will be activated at first. Unmark the channels which are not relevant for your profile.

Click right in the main window to open a pop-up menu where you can select all or none of the channels or invert the current selection.

If you wish to rename a profile, please click “**Rename Profile**”.

**Defining a Default Profile:**

Select an existing profile from the list on the left; it will be highlighted in blue (see Fig. 5-82). Then click “**Define as default profile Scoring**” or “**Define as default Online profile**”.

“**Save as...**” saves the profile under a new name. This allows you to quickly and easily save an existing profile in a slightly modified format.

## 5.9 Tab “Keys”

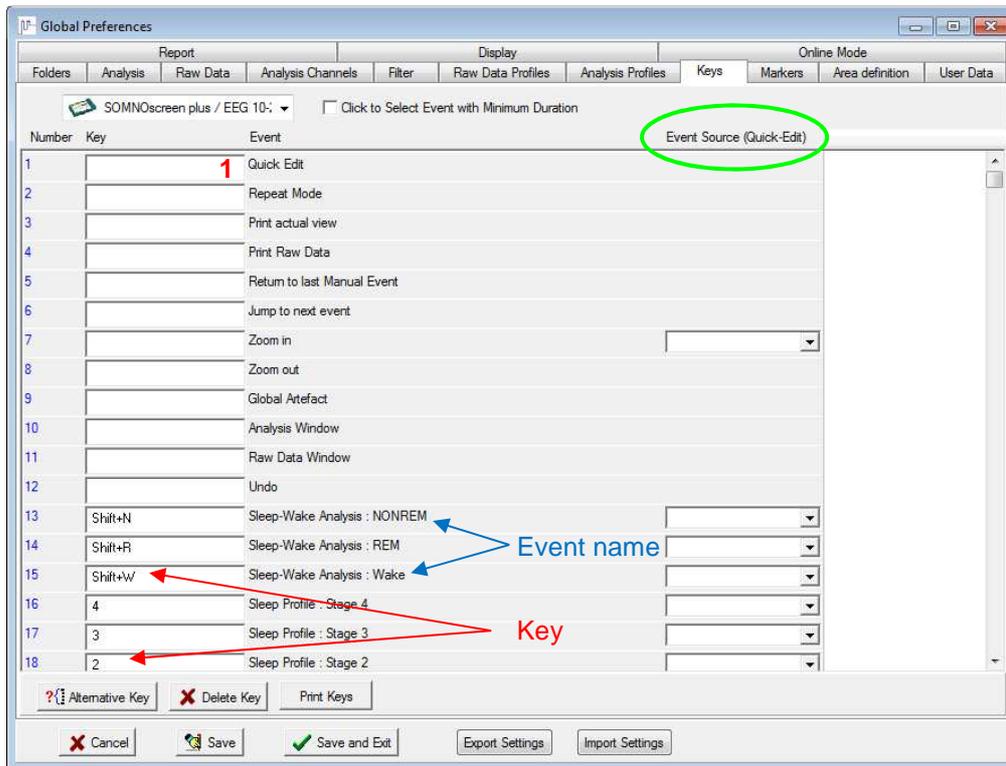


Fig. 5-83 Tab “Keys”

In the “Keys” menu you set the key functions to be used during manual editing.

### Define and add events:

Events can be assigned to shortcut keys. These defined keys are available in the Edit mode of the Raw Data display to edit, add or delete events.

With CapsLock, the same key can be used twice: For example, define the key R as REM, and then define R as RERA by first pressing CapsLock and then R. When manually editing events, you can switch between the two by pressing CapsLock.

### Note:

**Please ensure that you activate the “Edit Mode” before using the keys (menu “Mode” → “Edit Mode” of the open recording).**

You will need the Event Source (marked in green) in order to use the Quick Edit Mode (1) (see chapter 9.1.1.3). This mode allows for faster editing with the mouse. In this field, you may set the channel on which an event should be marked. Via “Alternative Key” additional sources can be selected for an event.

“Alternative Key” duplicates a type of event. Amongst others this is necessary if you analyse and edit the PLM for left and right leg separately. To do so you can select two different sources (PLM l and PLM r) for an event type (LM-Analysis: l-marker). Now you can mark LM-events for both analysis channels separately when you are in Quick Edit mode.

### Please note:

**Make sure you activate the “Quick Edit Mode” (menu “Mode” → “Quick Edit” or key F12) first.**

## 5.10 Tab “Markers”

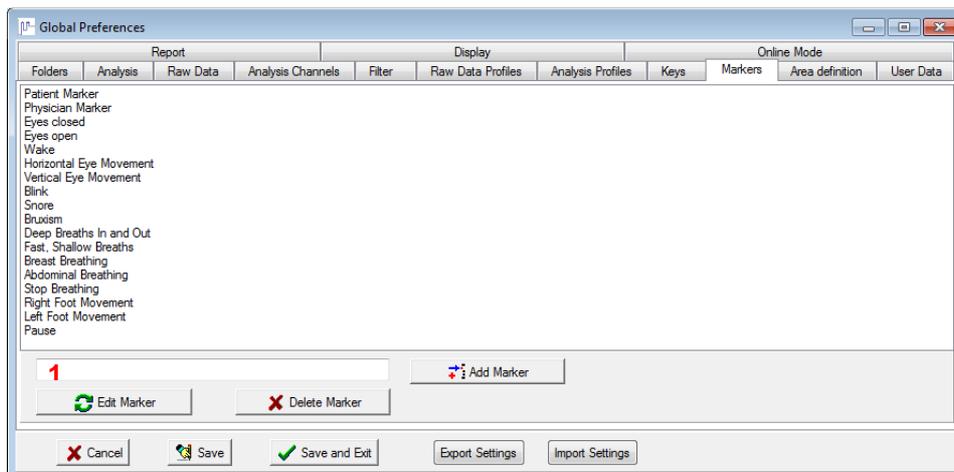


Fig. 5-84 Tab “Markers”

Markers can be set to indicate predefined events within a measurement. They are useful not only for editing the measurement but for biological calibration (see chapter 16). The default markers shown in Fig. 5-84 are predefined at program installation.

### Adding markers:

Enter the name of the marker in field (1) and click “**Add Marker**”.

### Renaming markers:

Select an existing marker from the list and click “**Edit Marker**”. Then it is possible to enter and save a new name for the current marker.

### Deleting Markers:

Select an existing marker from the box and click “**Delete Marker**”.

### 5.11 Tab “Area Definition”

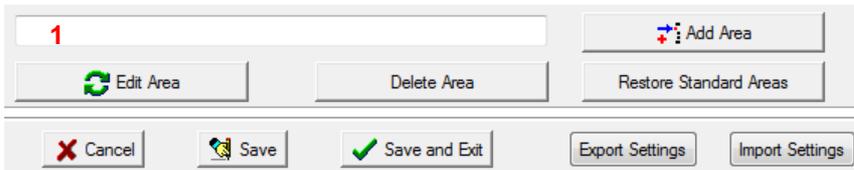


Fig. 5-85 Tab “Area Definition”

You can define parts of the recording as user defined areas. For results of sleep stages, respiratory, SpO<sub>2</sub> and PLM, these areas can be considered separately in the report. In these reports, there appears a point “**user-defined areas**”.

**Add Area:**

Write down the name of the new area in (1) and press “**Add area**”.

**Rename Area:**

Select an already existing area and press “**Edit Area**”. Then you can enter and save a new name for the current area.

**Delete Area:**

To delete an already existing area, select it and then press “**Delete area**”.

### 5.12 Tab “User Data”

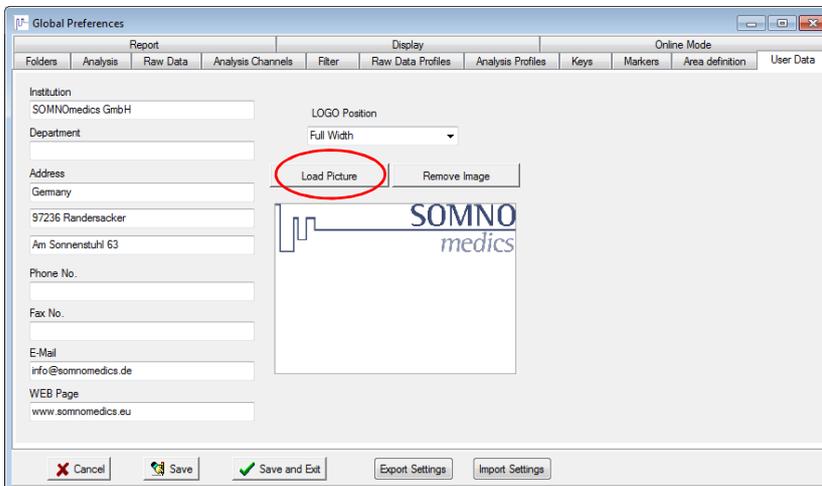


Fig. 5-86 Tab “User Data”

Enter this information carefully for it will be used as heading for all reports.

Should you wish to include your own logo on the report follow the instructions below:

Click on “**Remove Image**” to clear the screen. Now click “**Load Image**” and select the path where the logo is stored. Once the file has been found, select it and confirm by clicking “**OK**”.

**In order for the logo to print correctly, set the graphic file to the following specifications:**

- JPG or BMP format
- Optimum size:
  - Aligned left or right: 200 x 122 pixels
  - Aligned full page width: 660 x 122 pixels

### 5.13 Tab “Report”

In this tab, you can define settings for your report, e.g. create templates (see Fig. 5-87). These settings can only be defined in the Global Preferences – they cannot be changed in the analysis window.

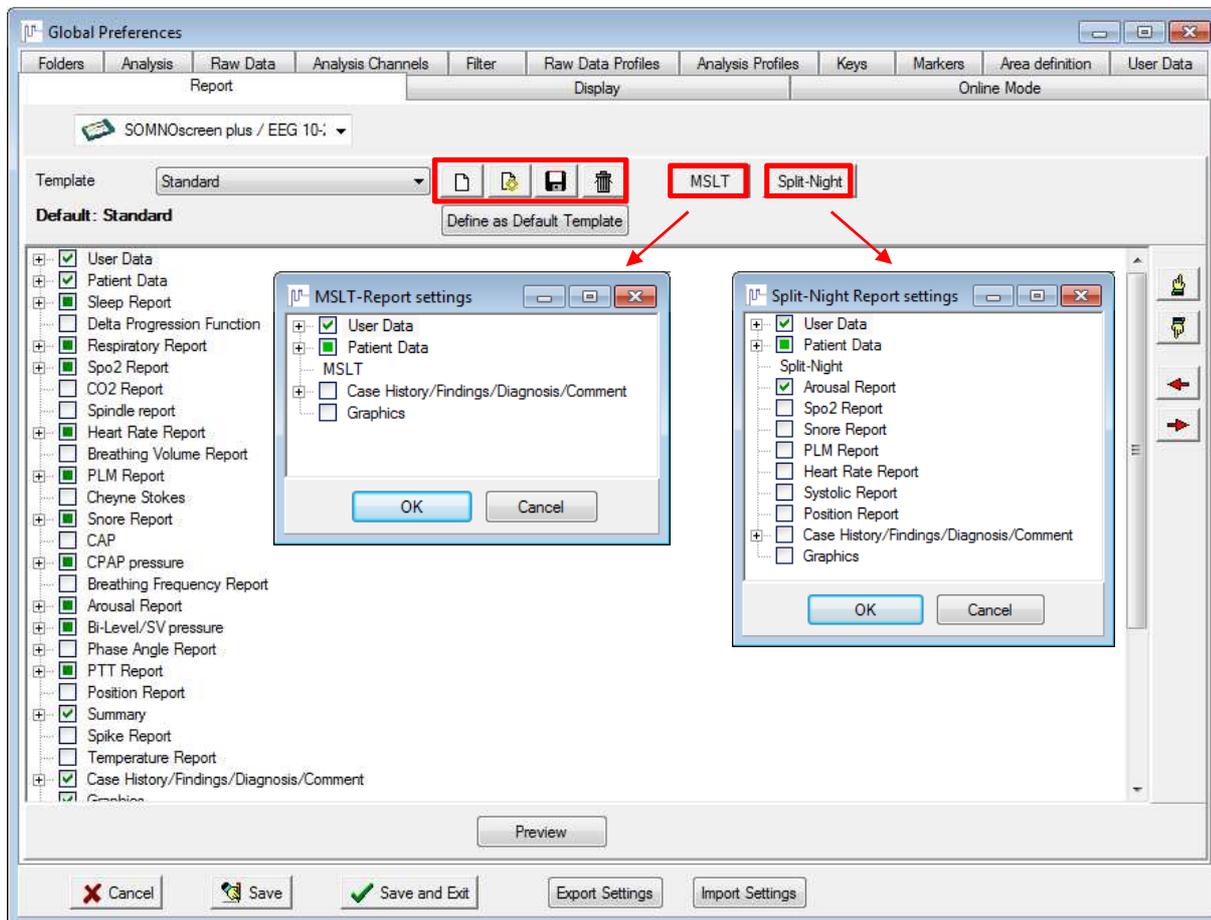


Fig. 5-87 Tab “Report”

Via “MSLT” or “Split-Night” you can define the settings for the MSLT- and Split-Night Report. For more information on creating an editing report templates see chapter 0.

## 5.14 Tab “Display”

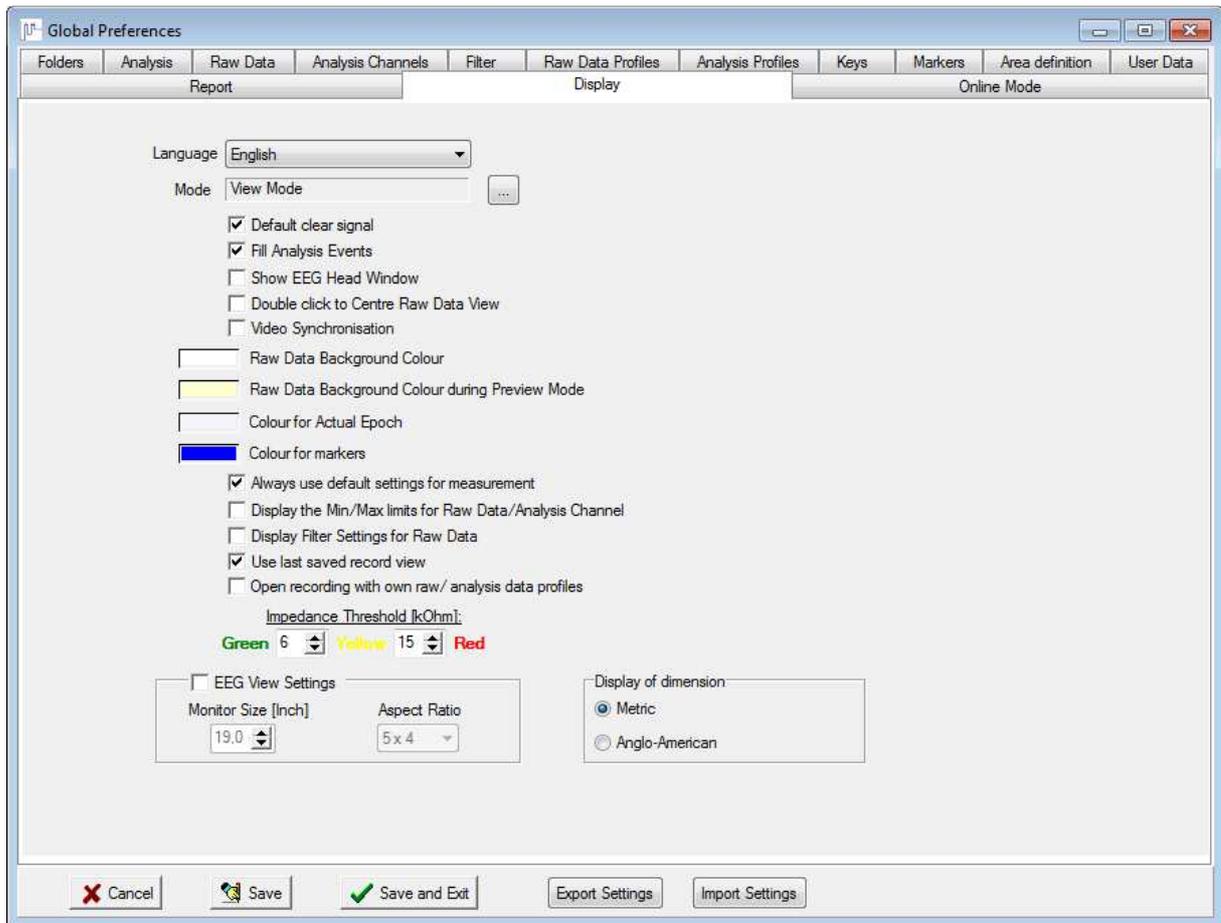


Fig. 5-88 Tab “Display”

Here you can select the menu language and the mode used as default when opening a recording.

The box “**Default clear signal**” should be activated to guarantee the best possible presentation of the signals.

If the box “**Fill analysis events**” is activated, recognized events are marked with a coloured rectangle.

If “**Show EEG Head Window**” is chosen, the EEG head appears when opening a recording.

With a double click in the analysis window, the appropriate place is displayed to the left of the raw data window as default. With “**Double click to centre raw data view**”, it is displayed in the middle of the screen instead.

“**Video Synchronisation**” displays the Video synchronously to the raw data in a recording with video.

In addition, you can choose the background colour of the raw data window for the preview mode and the started online mode as well as the colour of the current epoch and the colour of the markers.

When “**Always use default settings for measurement**” is activated, recordings that haven’t been analysed yet, are analysed by the default template when opened. The default template is selected for online recordings too.

When “**Display the Min/Max limits for Raw Data/Analysis Channel**” and/or “**Display Filter Settings for Raw Data**” is activated, the corresponding information is displayed in each raw data and analysis channel (see also chapter 8.3.5.2).

A recording can be opened again with its last selected settings (channels, channel settings, quick start bar...). Therefore activate “**Use last saved record view**”.

With “**Open recording with own raw/analysis data profiles**” the default profiles of the global preferences can be taken over for recordings with other analysis and raw data profiles. Therefore “**Use last saved record view**” has to be deactivated.

**Impedance threshold:**

Here the thresholds can be set for when the impedance colours are due to change.

“**EEG View Settings**” activates the option to display the raw data in a so called “EEG View”. Raw data are presented as defined display, resembling that of EEG recorders. To secure the according display, exact size and aspect ratio of the monitor have to be entered.

Additionally there’s the option to display dimensions in metric or Anglo-American units.

**5.15 Tab “Online-Mode”**



**Fig. 5-89 Tab “Online-Mode”**

In the tab “**Online-Mode**” a default recording time for online-recordings can be defined.

If the recording time had been reduced in a previous initialisation, this option secures the reset of the recording time for the next recording and prevents a shortened recording time.

If you have a multiple user licence of DOMINO (optional for an extra charge), you can start up to 4 online-recordings simultaneously on one PC (see Fig. 5-90 and Fig. 5-91).

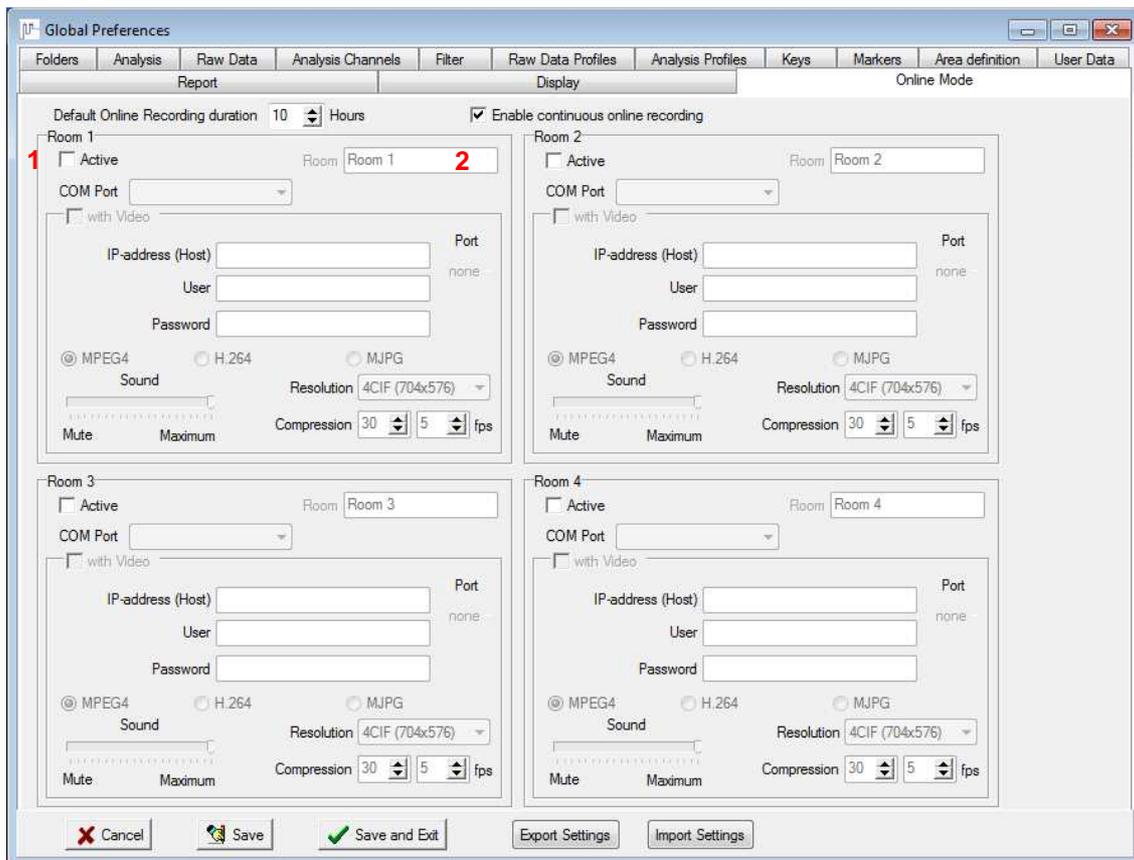


Fig. 5-90 Tab “Online Mode” for multiple user licences

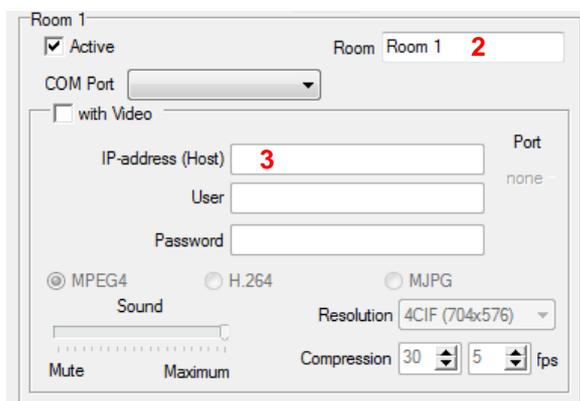


Fig. 5-91 Settings for Online-recordings

Using the checkbox (1), choose the rooms which you would like to record. You can then continue to define further settings. Using (2), you can rename a room. Also fill in the correct IP-address of the corresponding receiver (3).

If you would like to additionally record video, activate the checkbox “with Video”. You can then define further settings (see also chapter 7.2.3).

Be sure to confirm the settings with “Save” or “Save and exit”.

Initialization of an online-recording is described in chapter 7.2.1 and 7.2.4.



## 6 Montage Editor

### 6.1 General Information

The predefined montages are device-specific. Predefined montages must be selected according to the type of Hardware being used. Please see the Type Label on the back of your device or the display when starting it respectively.



**On patients with cardiac pacemakers, the active impedance analysis of all EXG channels may be affected and MUST be turned off in the Montage Editor Settings of the Domino software.**

Deactivate the checkbox “**Cont. Impedance**” to deactivate the active impedance analysis for all EXG channels (only hardware EEG 10-20, EEG 10-20 PSG, Plus PSG, Plus PSG+, Plus EEG32, EEG32 PSG).

#### ***Meaning of the command buttons in the montage editor:***

**New Montage:** Used to create a new montage.

**Delete:** Used to delete all the selected montage.

**Save as...:** An existing montage may be saved with a different name after modification.

**Print:** You will receive a printout in tabular form, including the chosen slots, hardware ID, name and number of the montage and online status.

**Save:** Stores the changes (**OK** also has this function).

**Cancel:** Here the changes are not stored.

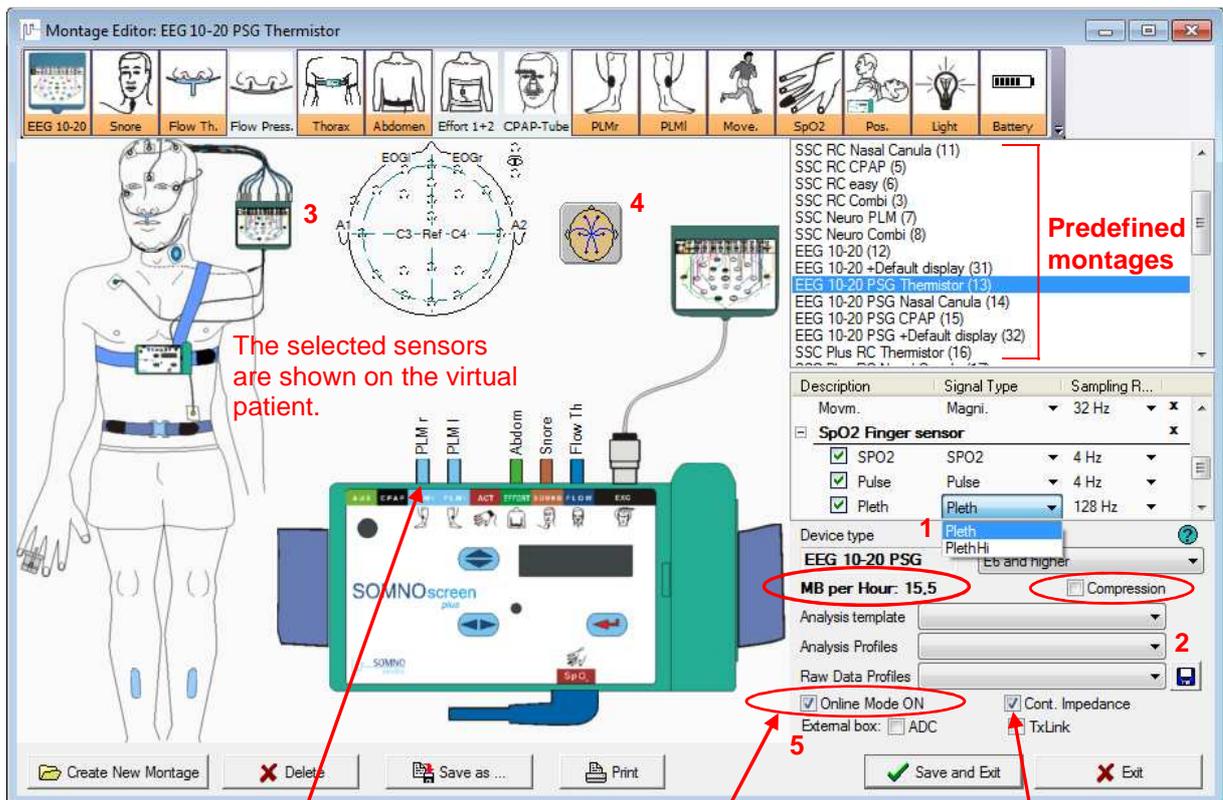


Fig. 6-1 Montage Editor

Assignment of slots is depicted here.

If you activate this checkbox, the montage is marked as suitable for online measurements by default.

Activate/ deactivate the continuous impedance measurement.

The sensor pack can be adapted to your needs (see Fig. 6-2). Open the window “**Customize sensor pack**” via → “**Customize**” → “**Add/Delete sensors**”. To the left you see the already “**Selected**” sensors and to the right you see all other “**Available**” sensors. Only those sensors in the “**Selected**” part are shown in the sensor pack!

The sensors can be switched from “**Selected**” to “**Available**” and vice versa via the buttons and . The order of the sensors can be changed by the arrow-buttons. Confirm your changes with “**OK**”.

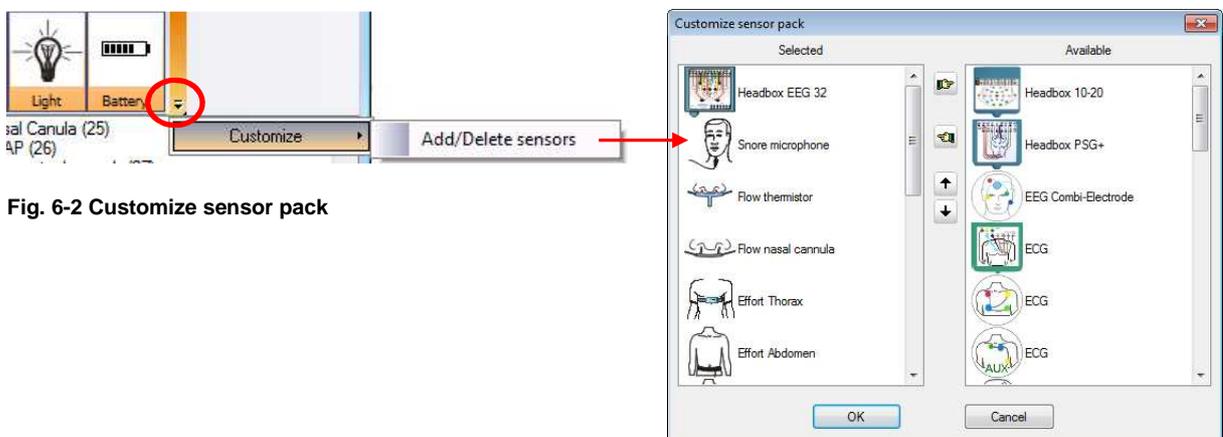


Fig. 6-2 Customize sensor pack

The order of the predefined montages can be changed by drag & drop.

Beneath the montage window all sensors of the selected montage are described in detail. There you can change the description, signal type or sampling rate of the channels.

With firmware E07 or higher you can choose between two different signal types for the recording of the pleth channel. Besides the conventional pleth-signal with 8-bit resolution, the pleth-signal can also be recorded with 16-bit. This offers the possibility to measure a larger signal range and reduces signals of low quality which can result from very weak or strong blood circulation.

For the recording of 16-bit pleth signals select firmware E07 upwards. Then choose your montage and “**PlethHi**” as signal type (see **1** in Fig. 6-1). Confirm the settings with “**Save and Exit**”.



**Notice:** If you have a device with an earlier serial number (SN) than SSP2573, the recording of a 16-bit pleth signal can only be conducted by soldering a new resistance and updating your firmware to at least E07. Please contact our service if you would like to use this option.

Beneath the montage description you see the type of device that can be used with this particular montage. Aside there’s a drop down menu to choose the appropriate firmware.

Right beneath the data volume of the selected montage is displayed in “**MB per hour**”.

**Note:** The more active channels, the higher the recording rate, the higher the rate of data transfer per hour (see red frame in Fig. 6-1).

$$\text{Maximum duration of recording (h)} = \text{Capacity of flash card (MB)} / \text{Recording rate (MB/h)}$$

If you activate the checkbox “**Compression**”, the volume of the raw data is compressed to 2/3 of the original volume. You can’t choose this option for montages with the sensor “**Effort 1+2**” (MUX-RIP-belts).

(**2**) Analysis and raw data profiles can be assigned to a montage via scroll-down menu. They will be used for the display of the channels in the analysis window.

If the montage is to be used for online recordings, the checkbox “**Online Mode ON**” has to be activated.

To activate the active impedance measurement for the EXG channels of the head box (only hardware EEG 10-20, EEG 10-20 PSG, Plus PSG, Plus PSG+, Plus EEG32, EEG32 PSG) activate the checkbox “**Cont. Impedance**”.

From the display of the virtual montage you get the following options:

Click the virtual head box (**3**) to open the window “**EEG Montage**” where you can define the positions of the electrodes of the montage.



Click the “**EEG Hook-up**” (**4**) to open a window where you can set the electrode- connections.

If the plug-ins for TxLink and/or ADC board were installed, the checkbox/es “**External box**” (**5**) are available. By activating the checkboxes, you can save the connection of TxLink or ADC board for your montage.

Preparing an online recording the appropriate device will be activated for the montage automatically. The IP address and chosen channels of the external device are saved and used again the next time.

**Note:**

Using the EEG32- head box there’s the option to record two additional EEG-channels (FT9 and FT10) besides the default ones. Activate the channels EMG5 and EMG6 in the description of the head box and change the signal type to FT9 and FT10 respectively (see Fig. 6-3). The additional EEG- channels are displayed in the EEG head of the virtual head box subsequently.

Please note that a bridging of the two EMG channels to the reference is necessary on the hardware.

Description	Signal Type	Sampling R...
<input checked="" type="checkbox"/> EMG4	EMG4	256 Hz
<input checked="" type="checkbox"/> EMG5	FT9	256 Hz
<input checked="" type="checkbox"/> EMG6	FT10	256 Hz
<input checked="" type="checkbox"/> ECG	ECG 2	512 Hz

Fig. 6-3 Selection of FT9 and FT10 for the EEG32 head box

## 6.2 Copy a Montage

The easiest way to create a custom-defined montage is to copy an existing montage, adjust it to your own criteria and save it.

First select a predefined montage. Click **“Save as”** (see Fig. 6-1) and label the montage:

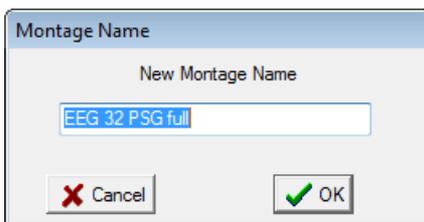


Fig. 6-4 Label montage

Now select the channels required for the recording and click **“Save”**.

### 6.3 Create a new montage

For creating a new montage, click on the button  (Fig. 6-1).

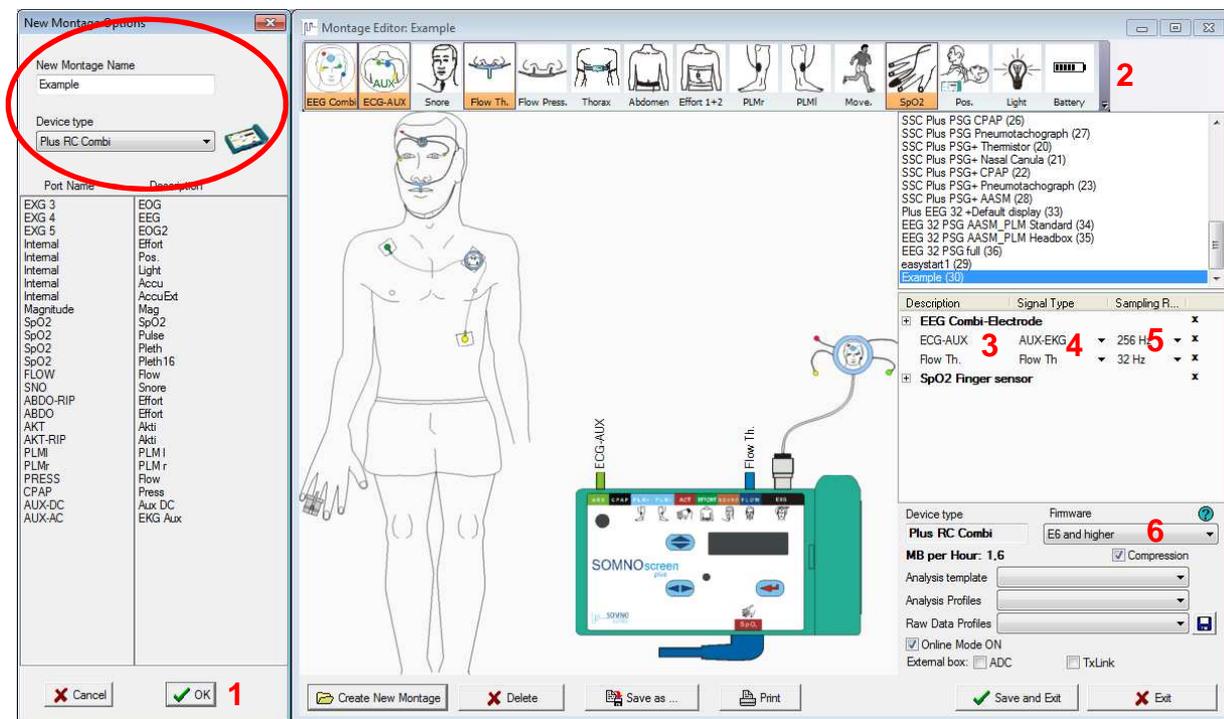


Fig. 6-5 Create new montage

Type in a montage name in the appearing window (Fig. 6-5), select the type of device (on the back of your device) and click “OK” (1).

Then select the channels (2) (orange = active). Channels can be renamed by left clicking the description field (3). Choose the signal type (4) and adapt the sampling rate (5). Then activate or deactivate the continuous impedance measurement and the option for online mode.

In the drop-down menu “Firmware” (6) you have to choose one of the research firmwares for devices with “Research Firmware”. For devices with hardware-IDs “EEG 10-20”, “EEG 10-20 PSG”, “Plus RC”, “Plus RC Combi”, “Plus PSG” und “Plus PSG+” firmwares can be selected that offer the possibility to process compressed data. You will be offered the checkbox “Compression” then. Clicking the question mark opens a window with information where you can find out about the firmware of your SOMNOscreen™.

In the drop-down menu “Analysis template” you can define a standard analysis template which is associated with your montage. This is important for the “Autoprocessing” function, since dedicated analysis templates are used automatically for the analysis of recordings. Additionally you can assign analysis and raw data profiles to the montage that are used for the recording and when opening a recording.

#### Defining and adding EEG montages

For defining a new EEG montage, press the button  (EEG Hook-up).

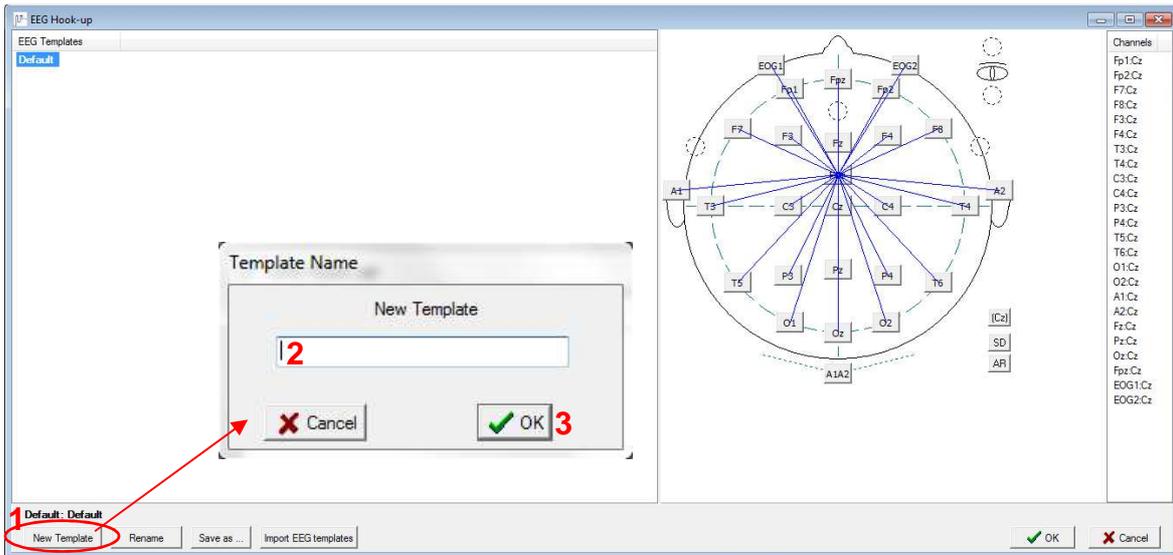
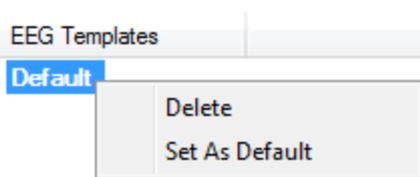


Fig. 6-6 Define an EEG montage

Click on “**New Template**” (1), label the montage (2) and click on “**OK**” (3).

If you define a template as default, recordings will be analysed with this template when opening the measurement.



Define template as default:

1. right-click the desired template
2. choose “**Set As Default**”

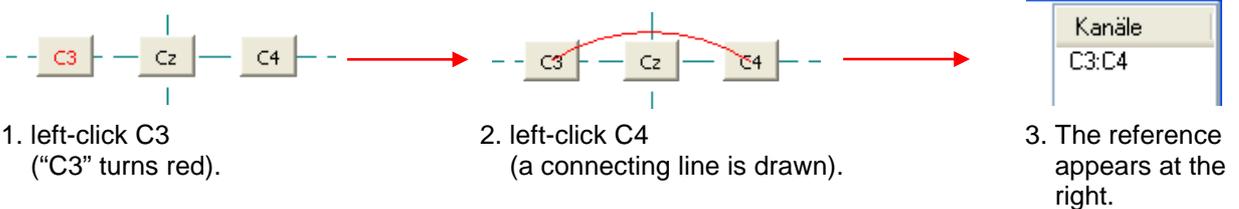
Delete template:

- 1) right-click the template
- 2) choose “**delete**”

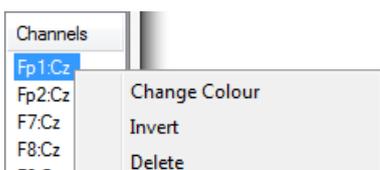
Fig. 6-7 Template-Menu

To create a new reference, you have to click at the two desired EEG-positions consecutively.

Example: Reference C3 to C4



The reference-order can be changed by drag & drop.



Right-click on a reference (channel) opens a menu to change its colour, invert or delete it.

Fig. 6-8 Reference- Menu

**!** Notice: Created EEG-montages and changes respectively are not saved before clicking **OK**!

## 7 Preparing a Recording

### 7.1 Recording without telemetric data transfer (Offline) and initialization of the flash card

#### 7.1.1 Initialization of the flash card

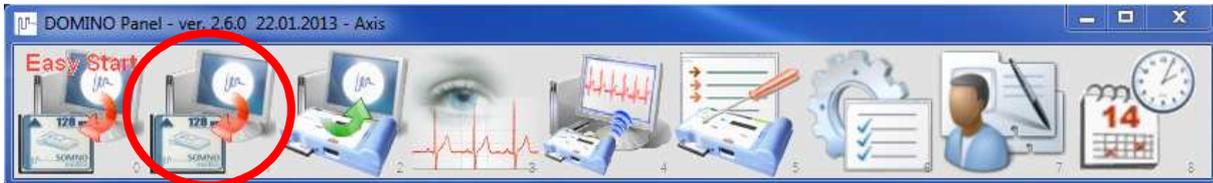


Fig. 7-1 DOMINO panel

Fig. 7-2 Patient data I

#### Patient data input:

- Enter the data carefully in the corresponding fields as this information is used for later analysis. Assign a Patient ID.
- You can import existing patient data clicking “DB”. Select your patient in the following window and confirm with “OK”. With a left-click you can sort the columns by ID, last name, first name or date of birth to speed up the search. Clicking “Delete” all data of the selected patient will be deleted.
- Clicking “Add to DB” will store the patient data in the database (optional, if bought).

You can also add further information (see Fig 7-3).

Fig. 7-3 Patient data II

Patient Data: edit the patient's data.

Questionnaire: add or edit questionnaires on Daytime Sleepiness (ESS), Restless Legs Syndrome (RLS-DI) or the risk of OSAS (STOP-Bang).

Notes: add additional information to the patient's record with date and time.

After entering the patient data, click “Next” or the register “Date”.

Now you have to decide for one of the Start options. They can be set in the registers “Date” or “Montage”. Below there’s a description of all Start options.

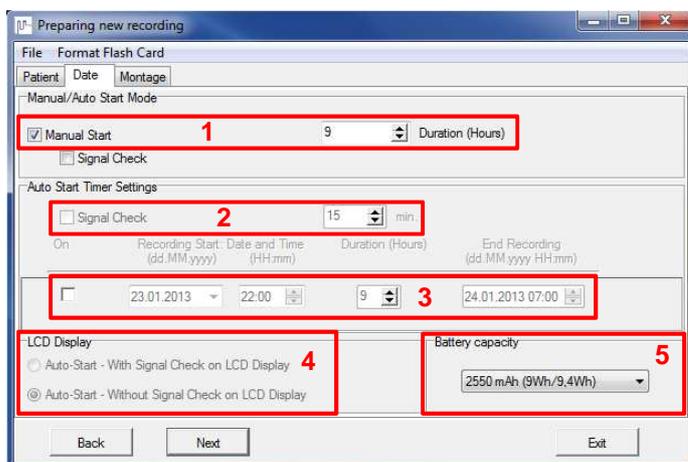


Fig. 7-4 Register “Date”

#### Start options for offline recordings:

- **Manual Start (1):**  
Recording is started manually. This option is used for attended recordings. The operator starts the recording prior to the patient going to sleep.
- **Signal Check (2):**  
A prerecording is started immediately after turning on the SOMNOscreen™. This can last maximum 30 minutes. The patient should be wired before starting the SOMNOscreen™. The signal control is used for recordings with an automatic start. During the signal control the blood pressure is measured manually (see chapter 0). In addition to the simultaneous representation on the PC, a digital Optocoupler (optional) can be connected.
- **Auto Start – without Signal Check on LCD Display (4):**  
This option is used when the patient uses the SOMNOscreen™ unattended. The operator switches the unit ON. The unit initialises itself and switches to the Standby Mode (green light flashes) until the programmed time (3) is reached. Recording will start automatically then. You can program a maximum of 30 recordings.
- **Auto Start – with Signal Check on LCD Display (4):**  
This option is used when the operator is able to check the signals prior to an automatic recording start (not recommended for recordings at the patient’s home). Once selected, it is necessary to manually confirm the signals on the SOMNOscreen™ display when the unit switches on. All signals are shown either as bar graphs (intensity) or numeric data (see chapter 7.1.4).

The information on the battery performance (5) can be used to determine the maximum recording time. The respective battery performance is marked on the label of the battery.



#### Attention:

**The programmable recording time is between 00:00 and 23:59. If a recording is to be started at 24:00, set the Start Date to the following day and set the Recording Start Time to 00:00!**

Click “Next” or the register “Montage”.

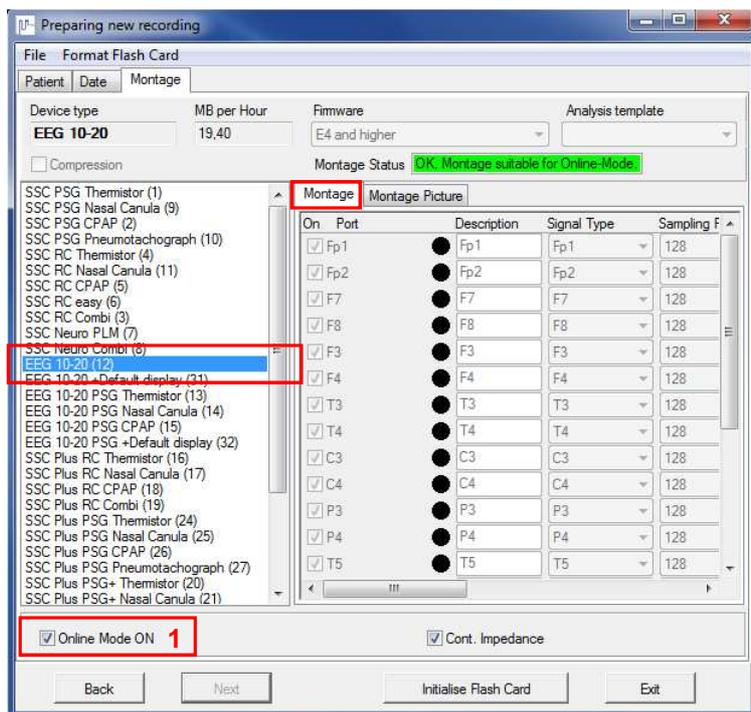


Fig. 7-5 Selecting a montage

Now select a previously created montage and deactivate the option for the online mode if necessary (1).

**Please note:**

For the signal control with display on the PC the online mode must be activated. With this set up, the maximum recording time is limited to 10 hours.

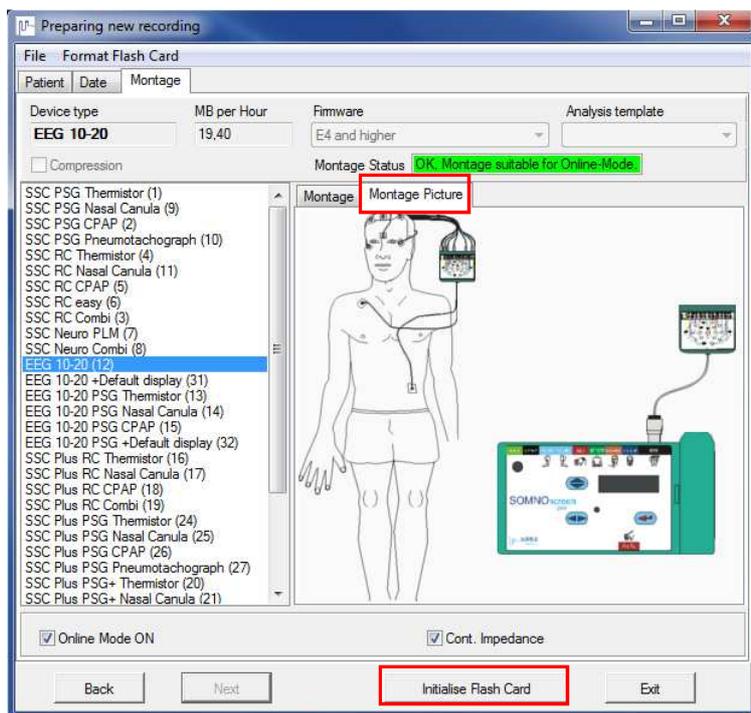


Fig. 7-6 Selecting a montage – Montage Picture

During initialization you can switch between “Montage” and “Montage Picture”.

“Montage Picture” helps you to identify the right montage for the recording more easily.

Furthermore, the needed sensors at the virtual patient and the plug-in configuration at the SOMNOscreen™ are shown.

Click “Initialise Flash Card” afterwards.

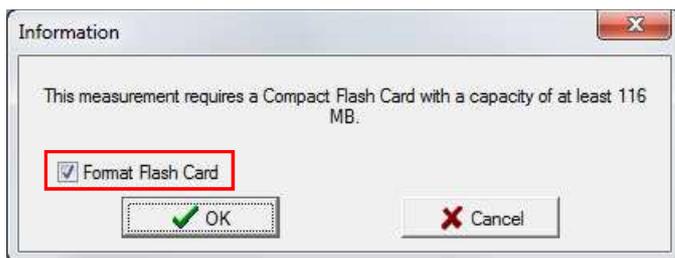


Fig. 7-7 Format Flash Card

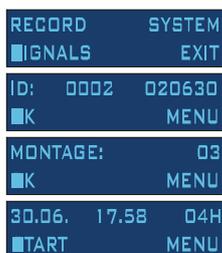
We recommend activating “**Format Flash Card**”. All old data is thereby deleted with the initialization of the Flash Card.

Click “**OK**” afterwards.

During the initialization DOMINO transfers the summer or winter time from your Windows settings to the Flash card. This only takes place if your operating system sets the time automatically. With the message “**Initialisation successful**” you can take the Flash Card from your Card reader, and place it in the SOMNOscreen™.

### 7.1.2 Manual Start of an Offline-Recording

The SOMNOscreen™ should only be turned on after the complete wiring of the patient. The power switch is directly under the second "O" of the word SOMNOscreen.



Press the red confirmation button four times to start the recording manually.

→ A successful start is indicated by “01. Recording...” on the display!

At the end of the recording the device automatically turns off.

### 7.1.3 Programmed Offline-Start without Signal Check on the Display

The SOMNOscreen™ should only be turned on after the complete wiring of the patient. The power switch is directly under the second "O" of the word SOMNOscreen.

On auto start without preliminary signal check on the display, the device switches to the waiting mode after being turned on and having checked the capacity of battery and storage capacity. This is indicated by the blinking green LED.

<p>SOMNO SCREEN PLUS PSG</p> <p>SYSTEM CHECK</p> <p>AUTOSTART START IN 04:25</p> <p>SHUTTING DOWN... PLEASE WAIT...</p> <p>...when start time is reached...</p> <p>01. RECORDING... SPD2 96% PR 67</p>	<p>The device executes a system check and checks the settings. Without sufficient battery capacity or flash card capacity a message is displayed (see chapter 7.1.6). You can then choose to start the recording nonetheless or cancel it. Now the waiting mode is automatically activated (green LED flashes), as long as the recording time is not yet reached. As long as the device is still in the waiting mode (green LED flashes), you can cancel the recording (see chapter 7.1.6). Reaching the recording time, the recording starts automatically.</p> <p>→ A successful start is indicated by “01 Recording...” on the display!</p>
<p>REC. COMPLETE! PLEASE WAIT...</p> <p>SHUTTING DOWN... PLEASE WAIT...</p>	<p>At the end of the recording the device turns off automatically.</p>

### 7.1.4 Programmed Offline-Start with Signal Check on the Display

The SOMNOscreen™ should only be turned on after the complete wiring of the patient. The power switch is directly under the second "O" of the word SOMNOscreen.

<p>SOMNO SCREEN PLUS PSG ID: Mustermann OK ENU</p>	<p>On the display an ID (surname of the patient) appears. Go to "MENU" using  and confirm with .</p>
<p>RECORD SYSTEM SIGNALS EXIT</p>	<p>Go to "SIGNALS" using  and confirm with .</p>
<p>20 ACT.CH 13MB/h DISPLAY BACK Headbox Resp. DISPLAY BACK A2 DISPLAY BACK</p>	<p>Here the number of activated channels as well as the required saving capacity per hour is indicated. To check the signals on the display, confirm "DISPLAY" with . To check the channels of the Headbox, select "Headbox" using  and confirm with . To check the respiratory channels, select "Resp." using  and confirm with . On the following display you can find the first signal with the name indicated top left. Confirm "DISPLAY" with  to display the values of this signal. Confirming with  takes you to the next channel. You can break off the signal at any time confirming "BACK" and afterwards "MENU" with .</p>
<p>RECORD SYSTEM SIGNALS EXIT</p>	<p>To prepare the Autostart, you have to confirm "RECORD" with .</p>
<p>ID: Mustermann OK MENU</p>	<p>Confirm "OK" with .</p>
<p>MONTAGE: 03 OK MENU</p>	<p>Confirm "OK" with .</p>
<p>30.06. 17.58 04H START MENU</p>	<p>Confirm "START" with .</p>
<p>SYSTEM CHECK</p>	<p>The device executes a system check and checks the settings.</p>
<p>AUTOSTART START IN 04:25 SHUTTING DOWN... PLEASE WAIT... ...after reaching starting time... 01. RECORDING... SPO2 96% PR 67</p>	<p>Now the waiting mode is automatically activated (green LED flashes), as long as the programmed recording time is not yet reached. As long as the device is still in the waiting mode (green LED flashes), you can cancel the recording (see chapter 7.1.6). Reaching the recording time, the recording starts automatically.  → A successful start is indicated by "01 Recording..." on the display!</p>
<p>REC. COMPLETE! PLEASE WAIT... SHUTTING DOWN... PLEASE WAIT...</p>	<p>At the end of the recording the device turns off automatically.</p>

### 7.1.5 Manual abort of a recording

You have the possibility to stop a running recording at any time. Follow thereto the steps below:

Display	What to do?
	Press  ,  and  together (for at least 1 second).
	Select "CANCEL" with  and confirm it with .
	Then select "SURE" with  and confirm it with .
	The device finishes the recording, closes the file created so far and turns off the device. The display goes out. Only when the device is off the flash card may be removed!



The procedure described above leads to a shorter recording duration. Premature ending of a recording creates the error code E08 in the bug log file!

### 7.1.6 Manual abort of the waiting mode

You have the possibility to stop the waiting mode at any time. Follow thereto the steps below:

Display	What to do?
	Press  (power switch) for at least 1 second.
	Select "CANCEL" with  and confirm afterwards with .
	Then select "YES" with  and confirm afterwards with .
	Now the device stops the waiting mode and you get back to the main menu.

### 7.1.7 Transfer of a recording from Flash Card to PC

As soon as one or several successful recordings are on the flash card, it is possible to transfer the data with the DOMINO software and the provided card reader.

**! Never pull the flash card out of the device as long as the recording is still running. Even if you have only turned on the device without a recording, the flash card is only to be extracted if the display tells you so.**

What to do?
If the recording is automatically finished, the device is already turned off. Otherwise the running recording can also be stopped manually (chapter 7.1.5).
Operate the black eject mechanism on the device and take out the card between thumb and forefinger.
Now insert the flash card in the flash card reader connected to the PC.
At insertion the software recognizes if there's a recording on the flash card and automatically opens the transfer window. If there's no recording (but at least a configuration file) on the flash card, the initialization window opens.
If the card reader is connected to a USB-connection not enlisted in the global preferences, the software recognizes the config-file as well and offers access to the device.
Select <b>"Data Transfer"</b> in the DOMINO control panel 

**Please Note:** Incorrect entries (e.g. date of birth) can be changed before the transfer in the input window.

Fig. 7-8 Data transfer

In the field **"Description"** you can write down a comment if necessary (1). This will be displayed later in the window "open recording".

If an additional EDF export is to take place (see chapter 0) the check box **"EDF Export"** should be activated (2).

The recording is automatically analysed after the transfer when the check box **"Auto processing: Analyse"** (3) is activated. In addition, other automatic steps, as for example automatic export of the report as pdf-, rtf-, xml- or emf- file, can be set by the command **"Configure"**.

Activating the checkbox **"send per Email"** (4) there's the possibility to send the raw data as E-Mail (depending on the file-size of the generated data). Before the transfer starts, the data are packed in a zip-file and your E-Mail assistant starts automatically. This option allows you to send ambiguous recordings (e.g. with many artefacts) to the SOMNOmedics Service and get them checked.

Click **"Download"** to start the data transfer.



## 7.2 Online Mode: Recording with telemetric data transfer (Online)

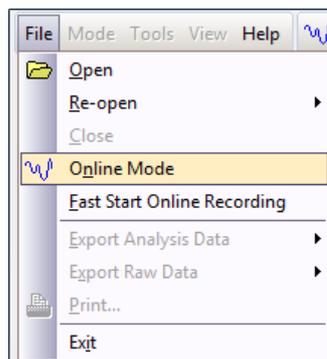
### 7.2.1 Preparing online recordings



The online mode is started with the button “Online” of the DOMINO panel.



Alternatively, you can start an online recording from the menu of the “Analyse” window. Select “File” and then “Online Mode”.



#### Please note:

If “Fast Start Online Recording” is selected, you directly go to the recording screen, with the settings and inputs of the last online recording.

Fig. 7-9 Open Online Mode

After starting the Online Mode, the window “New Recording” (see Fig. 7.9) pops up where you can enter the patient’s data in the according fields. Fill them out carefully because this information is stored for later analysis. Assign a patient ID. If “Add Patient to DB” is selected, the patient is stored in the database.

You can import existing patient data clicking “DB”. Select your patient in the following window and confirm with “OK”. With a left-click you can sort the columns by ID, last name, first name or date of birth to speed up the search. Clicking “Delete” all data of the selected patient will be deleted.

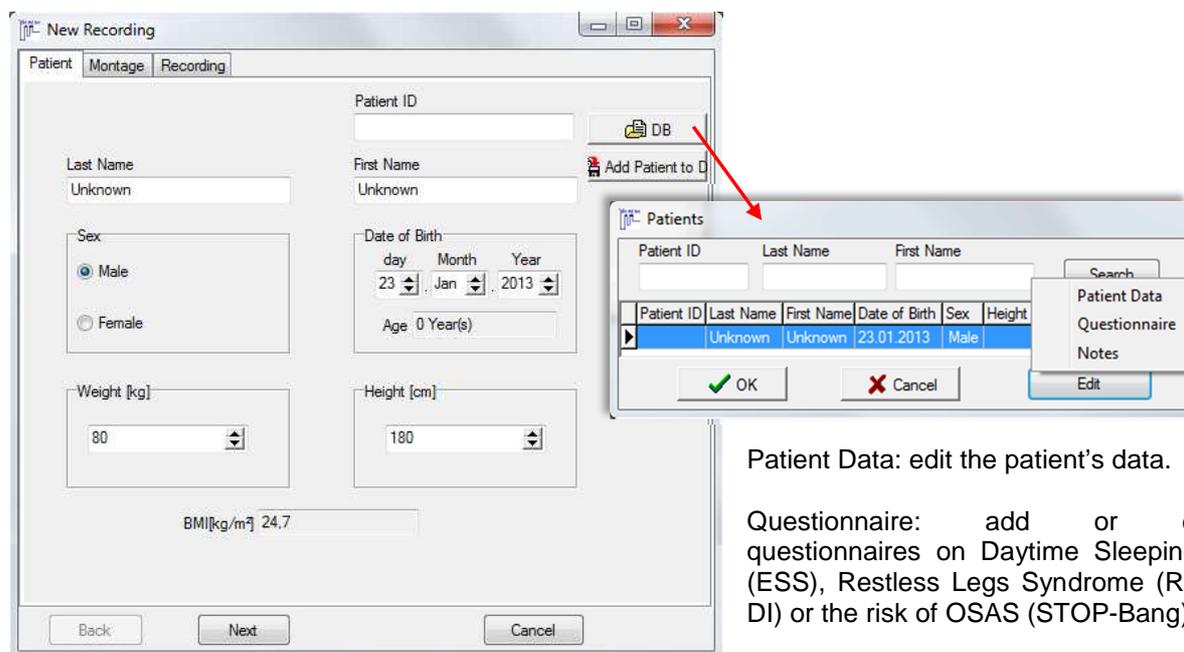


Fig. 7-10 Patient data for online recording

Patient Data: edit the patient’s data.

Questionnaire: add or edit questionnaires on Daytime Sleepiness (ESS), Restless Legs Syndrome (RLS-DI) or the risk of OSAS (STOP-Bang).

Notes: add additional information to the patient’s record with date and time.

After entering the patient data, click “Next” or the register “Montage”.

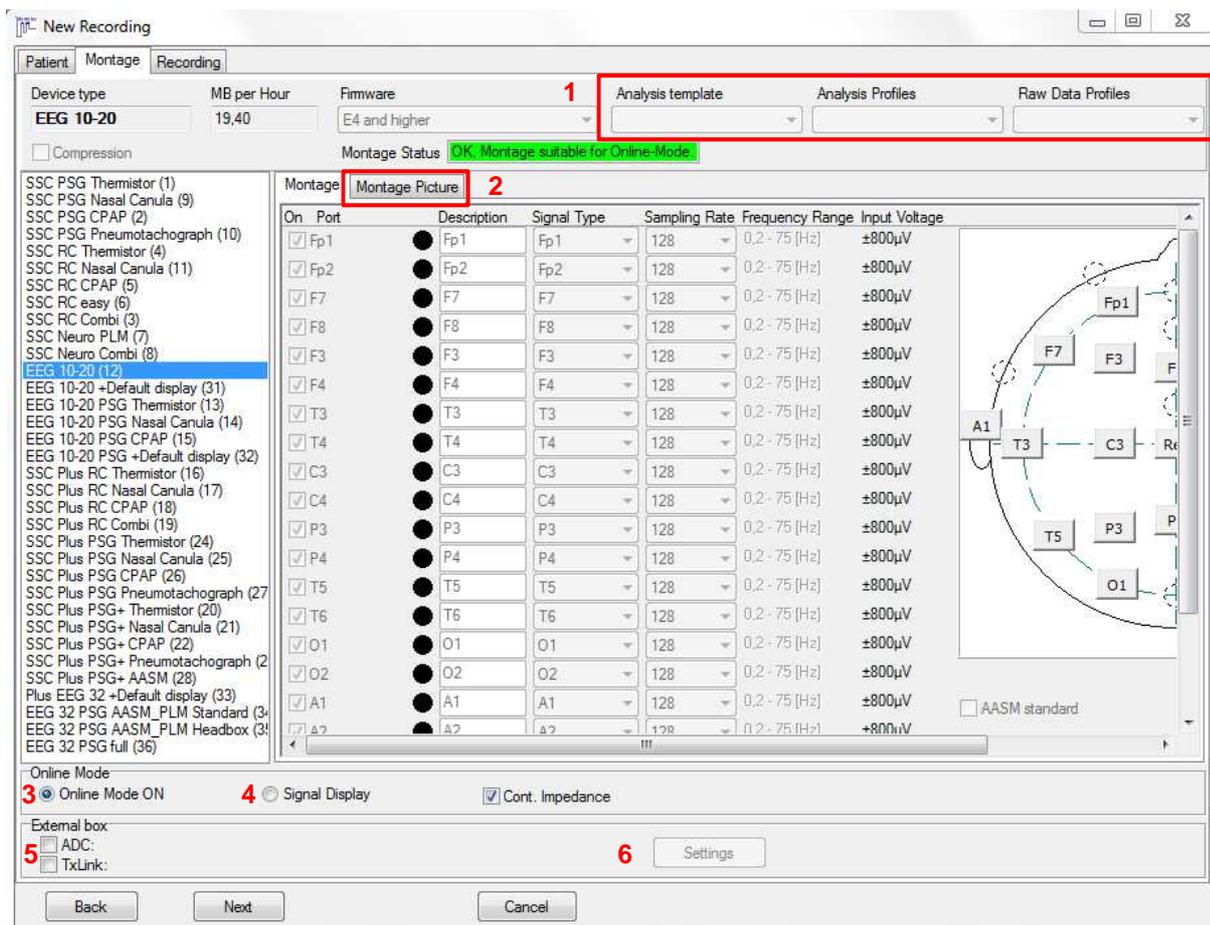


Fig. 7-11 Online-Mode: Register “Montage”

Select a previously created montage.

For each montage you get eventually existing analysis templates or analysis- / raw data profiles (1). “Montage Picture” shows the sensor application on a virtual patient. This may help you to find the desired montage more easily.

If not already done, activate “Online Mode ON” (3) for recordings up to 14 hours and “Signal Display” (4) for recordings longer than 14 hours.

With “ADC” and “TX Link” additional channels from external boxes can be selected for the recording. If there is already an external box in the selected montage, the corresponding checkbox is activated automatically. “Settings” (6) configures the channels of the external box (see Fig. 7-12 and 7-13).

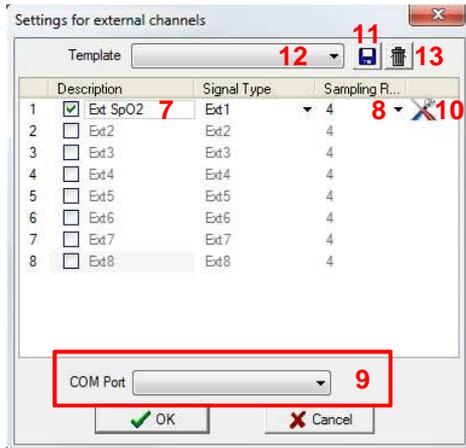


Fig. 7-12 Configuration ADC Board

Select the channels for the recording by activating the checkboxes. The description of the channels can be entered by a click in the field “**Description**” (7). The sampling rate can be changed clicking on ▼ (8).

For the right connection you need to enter the IP-Address/COM Port of the box at (9). If the box was already used in an earlier recording, the last IP-Address is used as default.

There are additional options for the ADC- channels:

A click on  (10) allows for the calibration and scaling of the external channels.

In addition to manually entering the IP-Address of the TxLink, “**Search**” (14) looks for available devices in the network. You can then select your device from the displayed list.

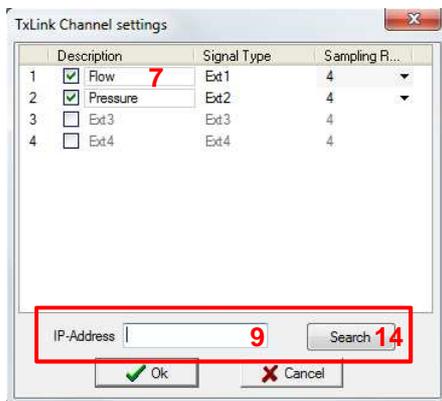


Fig. 7-13 Configuration TxLink

All settings for the external channels including calibration and scaling can be saved using the disc-button (11). Stored templates can be selected from the drop down menu (12). Storing different templates has the advantage that you can store different configurations for external channels which you can easily access when preparing for a new recording.

Stored templates can be deleted using the bin-button (13).

When you’ve adjusted the settings click “**Next**” or the register “**Recording**”.

In “**Recording**” you can set the recording time (1) at the PC. Maximum online recording time (2) depends on the capacity of the hard disk and the size of the RAM (random access memory) of your computer.

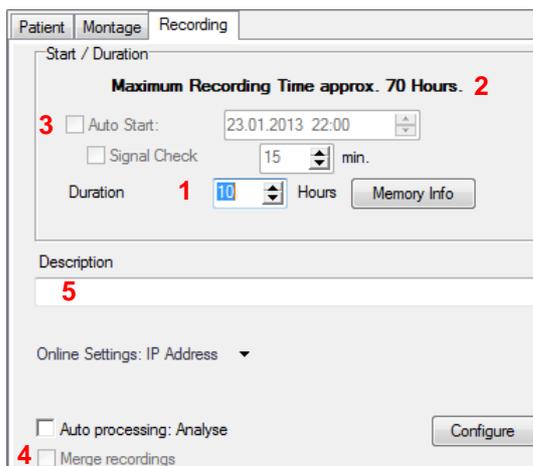


Fig. 7-14 Settings for the online recording

There’s the possibility to program an online recording with “**Auto Start**” (3) by activating the according checkbox. Enter start date and time.

For Auto Start you can also select “**Signal Check**”. During the check the signals can be controlled at the PC using a radio module or digital Optocoupler. Additionally the blood pressure can be calibrated (see chapter 16.3). Therefore “**Merge recordings**” (4) has to be activated!

In the field “**Description**” (5) a comment can be entered if necessary. It will be displayed in the “**Open recording**” window.

Select “**with Video**” to activate the video recording.

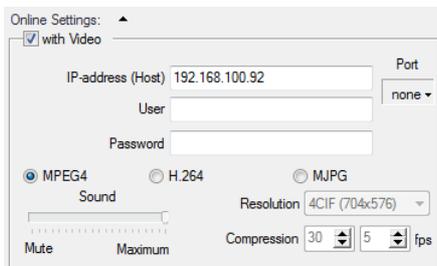


Fig. 7-15 Settings for the network camera

The IP-Address, user data and password have to be entered for access (if required).

You can choose between MPEG4, H.264 and MJPG.

A lower resolution, compression and the number of pictures per second can be set to reduce the data volume of the video. The video cannot be cut then!

**Note:** In MJPG-Mode the sound is not recorded.

Shows or hides the online settings so that only the IP-Address of the SOMNOscreen™ and the network camera are shown.

Turn the SOMNOscreen™ on and enter the right IP-Address or select the right port respectively (6). If a connection could be established, the current capacity of the rechargeable battery is shown and the checkbox “**Initialize Flash Card**” (7) can be activated.

**!** **Please note:** The correct IP address must be entered for the radio receiver or otherwise the communication with the SOMNOscreen™ isn't possible. Connecting attempts can be started by choosing the IP address again (6).



Fig. 7-16 IP-Address and link connection

If no connection to the SOMNOscreen™ can be established after entering the IP-Address, the note “**No Signal**” appears. Clicking on the question mark opens a list of potential failure causes. Sleep lab employees can thereby resolve the possible problem independently.

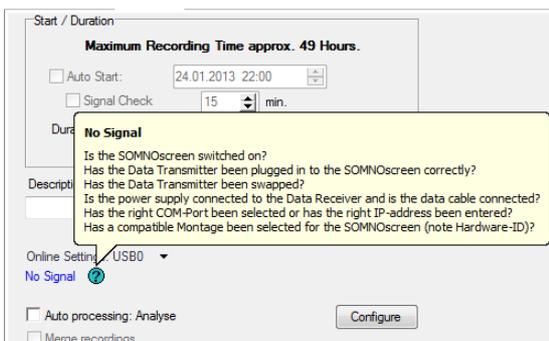


Fig. 7-17 Help for connection-failure

The recording is automatically analysed after the recording time is finished by activating the check box **“Auto processing: Analyse”** (8). In addition, other automatic steps can be set with the command button **“Configure”**, such as automatic export of the report as pdf-, rtf-, xml- or emf- file.

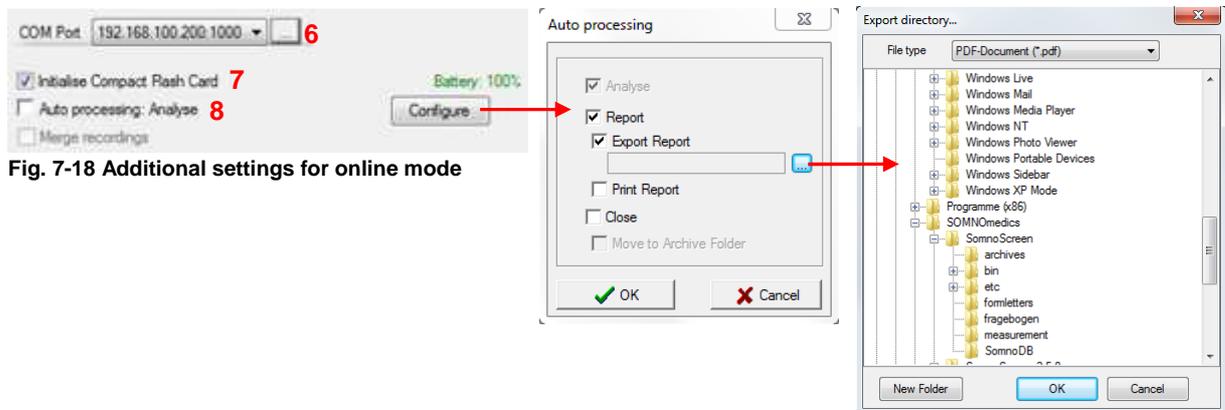


Fig. 7-18 Additional settings for online mode

Confirm the settings with the command button **“OK”**.

If you want to start an online recording always with the default template, you can activate the checkbox **“Always use default settings for measurement”** in the register **“Display”** of the global preferences (see chapter 5.14). In that case recordings always start with the stored default settings. If the according checkbox is not activated, the following window (Fig. 7-19) appears after clicking **“OK”** where the signals for the display can be modified.

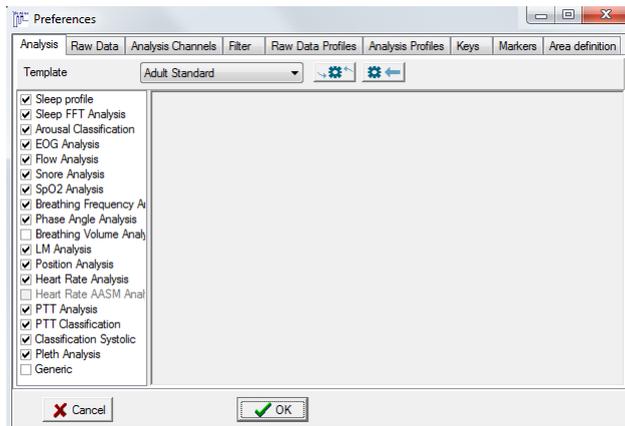


Fig. 7-19 Preferences for online mode

In this window (Fig. 7-19) you can modify the signals for the data display and define filters and/or raw data profiles or analysis if necessary.

You can choose amongst the default templates **“Adult Standard”**, **“EEG/EOG Combo Fp1/A2”**, **“Child”** and **“Adult AASM”**, depending on the patient and the settings you need for the recording.

Confirm the settings with **“OK”**. Date and time of the PC are transferred to the SOMNOscreen™ with initialization.

The online window appears with the defined settings.

**Please note:** Filter settings can be changed subsequently in the online mode.

## 7.2.2 Configuration of data transfer via Bluetooth

For data transfer via Bluetooth from devices of the series SOMNOscreen™ plus Tele (BT) the connections between radio receiver and sender can be configured with  (1). Generally this is only necessary if the SOMNOscreen™ plus Tele (BT) or the radio receiver is exchanged (e.g. a substitute in case of reparation).

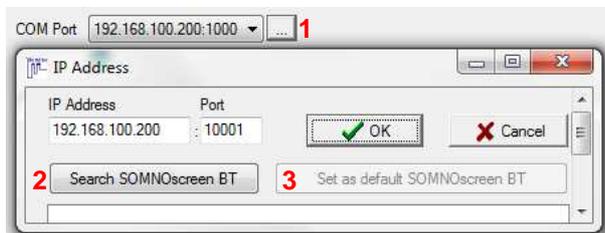


Fig. 7-20 Configure Bluetooth-Address

Click  and enter in the following window the IP-Address of the radio receiver. “**Search SOMNOscreen BT**” (2) checks for all available devices in range of the radio receiver. They are listed subsequently below with serial number and in brackets the MAC-Address of the according transmitter of the SOMNOscreen™ plus (BT). You can select the device to be connected and store it as default BT-device for the current receiver with “**Set as default SOMNOscreen BT**” (3). For all subsequent recordings with the according receiver, the selected device will be connected automatically.

## 7.2.3 Starting the online recording

After the online-window opened with the defined settings for recording, the Online Mode can be started with “**Start Recording**”.



Fig. 7-21 Start an online recording

With “**Wait for Signal**” the recording is automatically started as soon as data from the SOMNOscreen™ are transmitted (for online recordings with programmed Auto Start). As long as no signals are transmitted “**No Signal! Trying again...**” is displayed on the monitor.

**Note:** If you want to restart an already running recording, go to the main menu to “**File**” → “**Restart Online Recording**”.

## 7.2.4 Starting the video recording

When starting the online recording with video the video recording starts automatically.

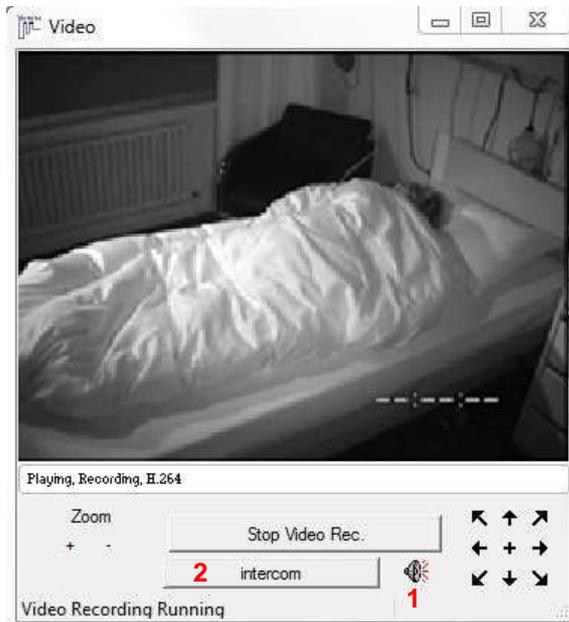


Fig. 7-22 Running recording

### Halting the video recording:

Click “**Stop Video Rec.**” to stop the recording.

**Halting the video only stops the recording on the hard disk drive. You can continue to watch the patient on the monitor.**

To start the recording again, click “**Start Video Rec.**”

### Sound playback:

Click on the speaker (1) to switch off the sound (muting).

### Option Intercom:

The optional function “**Intercom**” allows to give instructions via the speaker at the camera from the recording room to the patient (e.g. during bio calibration).

The cameras vid34 (Axis 214 PTZ) and vid65 (Axis P1346) support the intercom in full duplex (in both directions simultaneously). Simply once activate the button “**Intercom**” (2).

The camera vid56 (Axis M1031W) has an integrated speaker. During the intercom the button “**Intercom**” has to be pressed continuously for the time of speaking. To avoid acoustic feedback the sound of the video recording is disabled for the time of the intercom.



Fig. 7-23 Continue recording



Fig. 7-24 Active intercom

Depending on the type of camera, different video options are available during recording.

### 7.2.4.1 Functions of the high-end camera

The following options are available for the high-end camera vid34 (Axis 214 PTZ).

#### Zooming and slewing:

During the recording there's the possibility to zoom in video areas. Click with the left mouse button at the edge of the video window. Scrolling the mouse wheel up or down zooms the picture in or out respectively.

For slewing the camera move the cursor above the picture. You can see a red arrow. Pushing the left mouse button slews the picture in the direction of the arrow. The farther the arrow is from the centre, the faster is the slewing in the pointed direction.

Zooming and slewing can also be accomplished using the buttons (1) and (2).



Fig. 7-25 Zooming and slewing

#### Switching to defined camera positions (also for HD camera vid65):

Within the camera configuration you can store different camera positions (this can only be done on the camera server; it cannot be accomplished with DOMINO). Those defined positions (in the example "test" and "Home") are available during online recording. To switch between defined camera positions open the video menu with a right click on the video. In the context of "Go To" you can select the desired position. This option allows the night nurse or doctor to switch quickly between predefined camera positions.

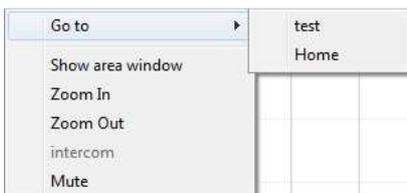


Fig. 7-26 Video context

### 7.2.4.2 Functions of the HD camera

The following options are available for the HD camera vid 65 (Axis P1346).

#### Display defined areas:

Using the HD camera for video recordings, there's the possibility to display predefined camera positions in a second video window. This option allows a detailed monitoring of the patient during a PSG (e.g. zooming in on the patient's head in the second window without loss of the information in the main window). To open the second video stream click **"Area"** (3). You can select one of the predefined positions of the camera configuration in the drop down menu (4).

**Please keep in mind that only the main window is recorded. We recommend using the zoom only in the area window.**

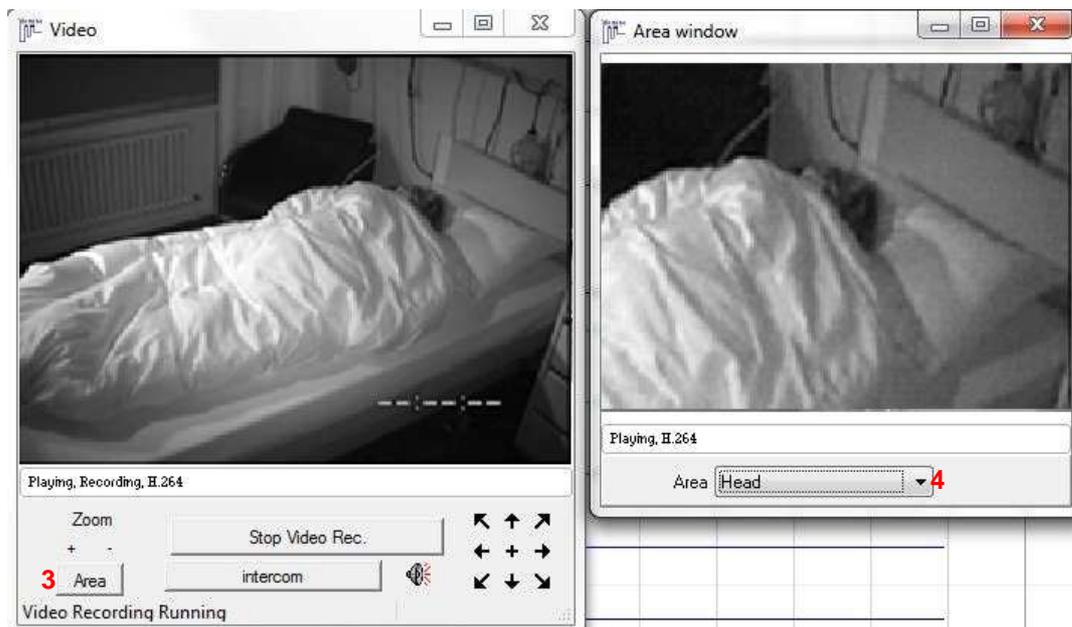


Fig. 7-27 HD option "Area"

The option "Switching to defined camera positions" is the same as for the high-end camera (see chapter 7.2.4.1)

### 7.2.5 Preparing and starting online recordings with multi-user licence

The preparing of online recordings with multi-user licence is carried out generally the same way as the preparing for single online recordings (see chapter 7.2.1). The only difference is that the choice of the room for the planned recording has to be made in the register “**Recording**”. The settings for the IP-Address of the radio receiver and the settings for the camera of the particular measurement stations have to be stored in the global preferences (see chapter 5.15) and are taken over automatically for the selected room.

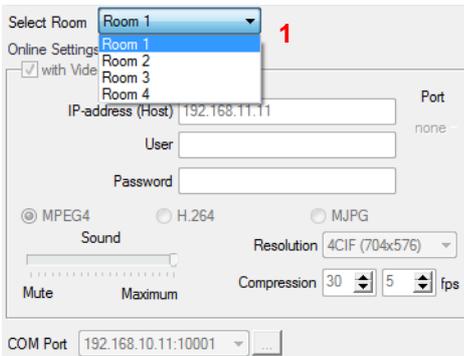


Fig. 7-28 Online recording with multi-user licence

As soon as the first recording of the multi-user licence is running, you can start additional recordings from the “**File**” menu of the recording. Select “**Start other online recording**”, the window for the preparing of the other recording opens and the recording can be started.

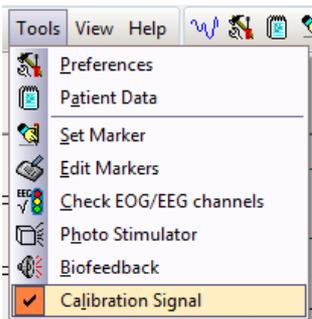


Fig. 7-29 Starting additional online recordings

## 7.2.6 Calibration signal

The filter settings for the SOMNOscreen™ can be checked ahead of the recording using a calibration signal. The output of a calibration signal and checking of hardware filters often is a component of study requirements.

The calibration signal can be selected in an active recording from the “Tools” menu. If the option “**Calibration Signal**” is activated, the output of a calibration signal of 50µV and 0.2 Hz is carried out for the channels EEG, EOG, EMG, ECG and PLM (Fig).



The active option “**Calibration Signal**” is marked with a check in the “Tools” menu.

The output of the calibration signal can be stopped by clicking “**Calibration Signal**” again.

Fig. 7-30 Active Calibration Signal

The time of start and end of the calibration signal are labelled in the recording with an according marker.

To avoid a recording of baselines for the whole time of the recording, the calibration signal ends automatically after five minutes.

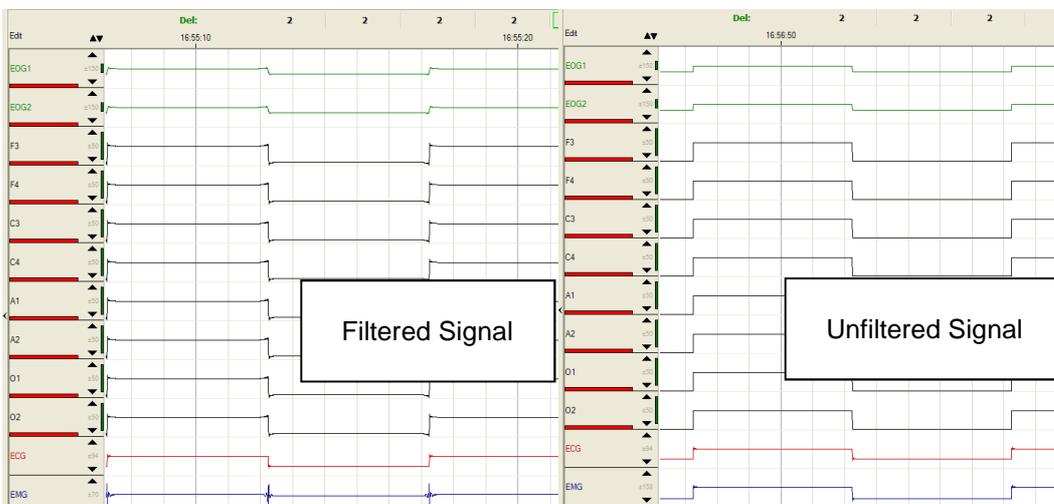


Fig. 7-31 Calibration Signal

**Note:** for the output of the calibration signal firmware-version E4/Y1 or higher is required.

## 7.2.7 Impedance Measurement

### 7.2.7.1 Control Survey

Preferably ahead of but also during an online recording you can check the impedances of the EOG- and EEG- channels. You start the impedance measurement from the “Tools” menu of the online display selecting “Check EEG/EOG channels”.

Alternatively the impedance check can be stored in and opened from the quick start bar using the symbol .

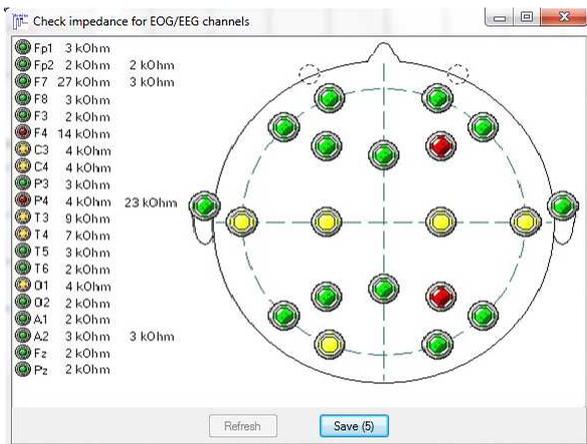


Fig. 7-32 Impedance-Check

The shown colour indicators represent the electrical contact between electrode and skin.

- Green indicator = good contact ( $R < 6k\Omega$ ),
- Yellow indicator = sufficient contact,
- Red indicator = deficient contact ( $R > 15k\Omega$ ), re-contacting necessary.

To document the impedance measurement in the report press “Save”. This is only possible for a running recording and for a maximum of 5 times.

### 7.2.7.2 Continual Impedance measurement



For patients with cardiac pacemakers or other implanted stimulators the active continual impedance measurement has to be deactivated.

Remove the check at “Cont. Impedance” (when choosing the montage) to deactivate the active impedance measurement for all EXG channels (only for hardware EEG 10-20, EEG 10-20 PSG, Plus PSG, Plus PSG+, EEG 32 PSG and Plus EEG 32+).

To use the continual impedance measurement the channel “Impedance” of the head box has to be activated in the montage.

During the online recording the impedances of all EEG channels are displayed consecutively in the channel “Impedance”.



Fig. 7-33 Impedance channel

Additionally the impedances are displayed in the according EEOG-/EEG-channels as coloured bar.



Fig. 7-34 Impedance bar

- Green indicator = good contact ( $R < 6k\Omega$ ),
- Yellow indicator = sufficient contact,
- Red indicator = deficient contact ( $R > 15k\Omega$ ), re-contacting necessary.

**Only in opened recordings:**

The channel **“Impedance”** can also be used for the display of a single channel impedance. Right click at the channel **“Impedance”** and select **“Impedance Display”**.



Fig. 7-35 Channel selection for impedance display

Activate **“Selection”** and select the channel for the single impedance display. **“All”** displays the impedances of all EEG-channels consecutively.

### 7.2.8 Performing the bio calibration

In online-mode you can select **“Set Marker”** from the **“Tools”** menu.

Tell the patient the command and double click the respective marker at the same time. The markers occur immediately in the raw data.

You can store own marker names and set the markers with . If **“Add marker to list”** is activated, the marker is added to the list automatically when set.

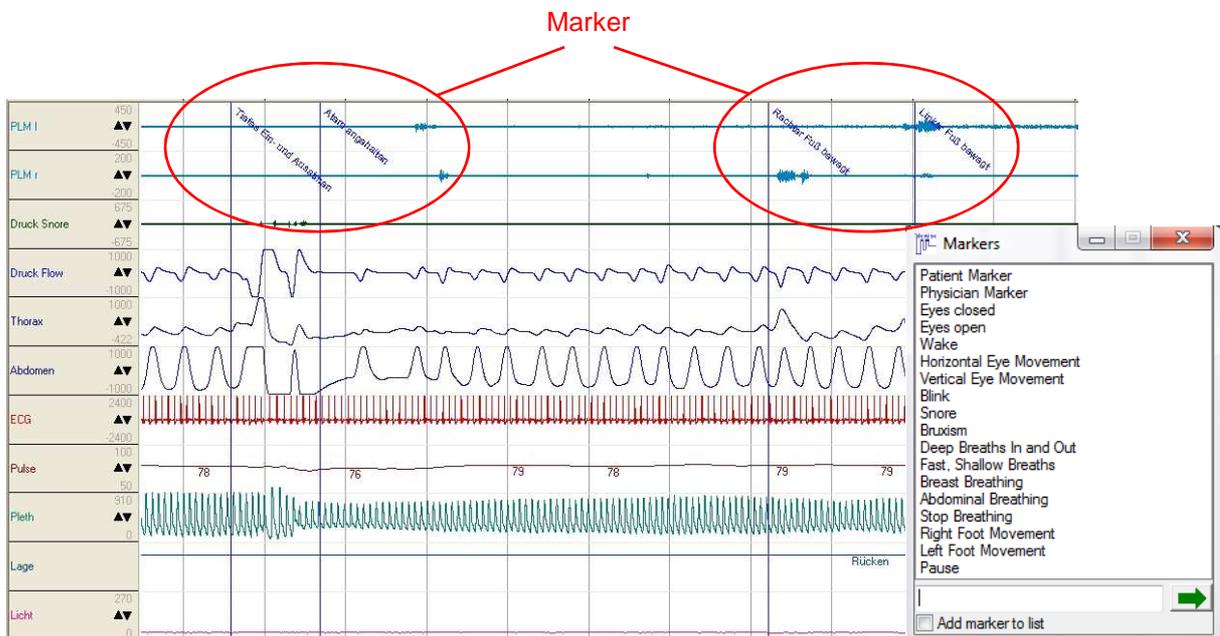


Fig. 7-36 Bio calibration with markers

Fig. 7-37 Marker list

**Note:** Only one marker per second permitted.

The bio calibration should take place at the beginning of the recording right after the start. After the bio calibration the marker **“Define Lights Off”** (right click on the raw data → **“Define Lights Off”**) should be set to define the start of TIB (Time In Bed).

Maker can be deleted or edited. See chapter 8.3.3.3.

## 7.2.9 Numerical Display

The numerical display of the online mode (see Fig. 7-38) shows the current values of oxygen saturation (SpO<sub>2</sub>), Pulse, Pressure, Breathing Frequency (BF), systolic and diastolic blood pressure, CO<sub>2</sub>- quotient of the exhalation air (CO<sub>2</sub>) and Leakage Flow.

### Note:

To get the display of Breathing Frequency, Leakage Flow, CO<sub>2</sub> and blood pressure, the following analysis have to be activated before starting the online mode (see Fig. 7-19):

Breathing Frequency → Breathing Frequency Analysis

Leakage Flow → Breathing Volume Analysis

CO<sub>2</sub> → CO<sub>2</sub>- Analysis

Systolic Blood Pressure → PTT Analysis (therefore the calibration has to be executed during the recording (see chapter 16.3))

“AF”, “CO<sub>2</sub>” and “Leakage Flow” are displayed for started recordings only!



Fig. 7-38 Numerical Display in Online Mode

To set the minimal and maximal values double click on the name of the according display. When the stored values are underrun or exceeded the background colour changes from green to red.

## 7.2.10 Online Analysis

During online display, live-scoring is possible. Sleep stages and marker can be edited and events can be added manually. This method saves time and costs as the scoring can be finished by morning.

For online analysis the following displays are available from the “View” menu:

- “Analysis” displays analysis channels only.
- “Raw Data” displays raw data channels only.
- “Analysis and Raw Data” divides the screen and displays analysis in the upper window and raw data in the lower window.
- “Dual Time Base (Raw Data)” divides the screen into two raw data windows with freely selectable time bases each.
- “Online Raw Data” shows the raw data channels as continuous display.
- “EEG View” displays the raw data channels in a defined window depending on monitor size. This setting allows for a steady visual impression when scoring the EEG signals.
- “Full Screen” displays the raw data channels in full screen mode.
- “Swap Window” swaps the windows in “Analysis and Raw Data” or “Dual Time Base” mode.
- “Second Display Window” opens the lower window of the “Analysis and Raw Data” or “Dual Time Base” view in an own window.
- “Display Profiles” allows you to store different display profiles and open them. A display profile involves layout, number, identity and scaling of the displayed channels as well as the settings of the quick start bar.

### Dual Time Base

The following figure displays the dual time base. Respiratory and sleep-raw data are displayed synchronously with different time bases. For changes of the display window see chapter 8.

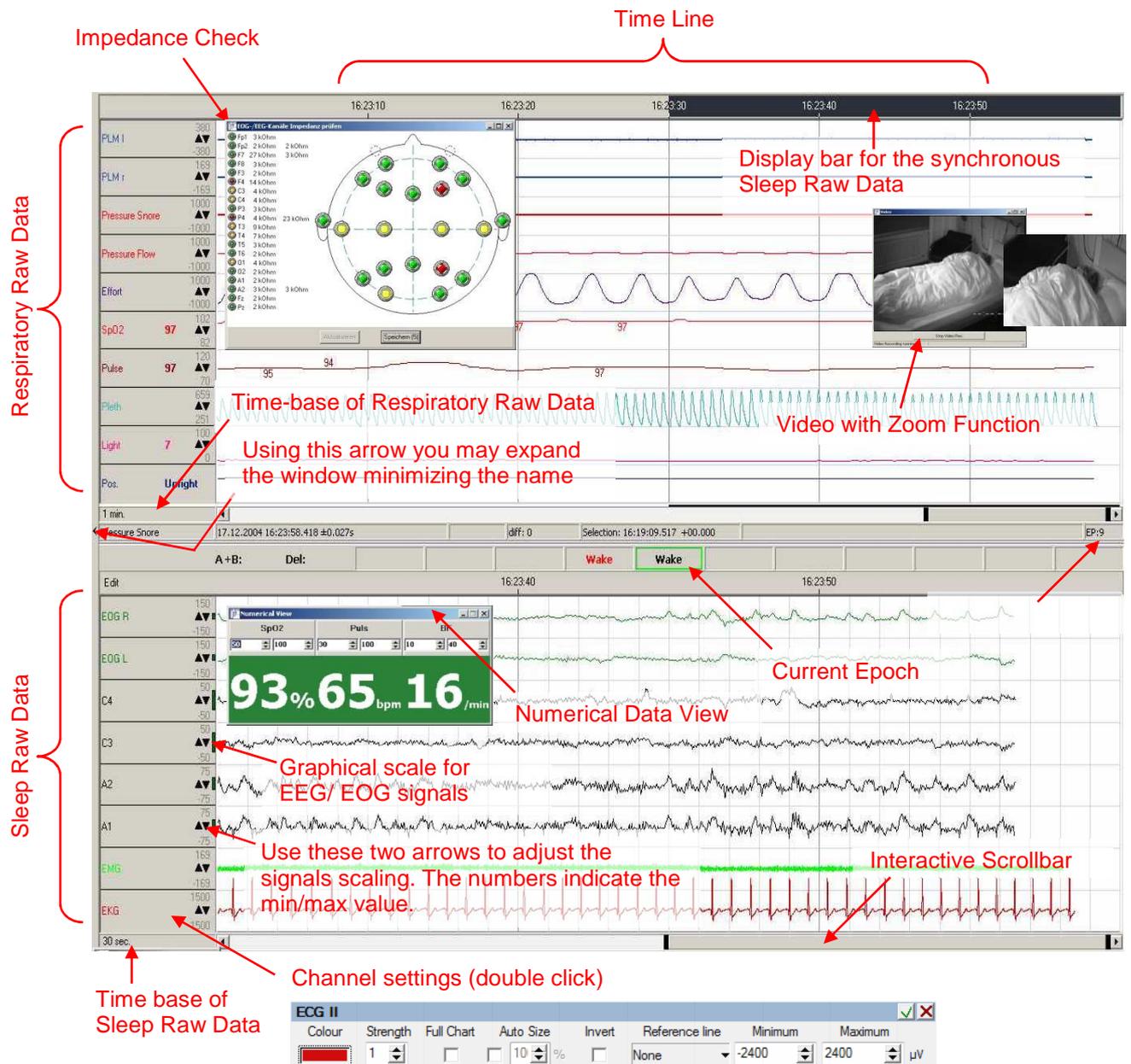
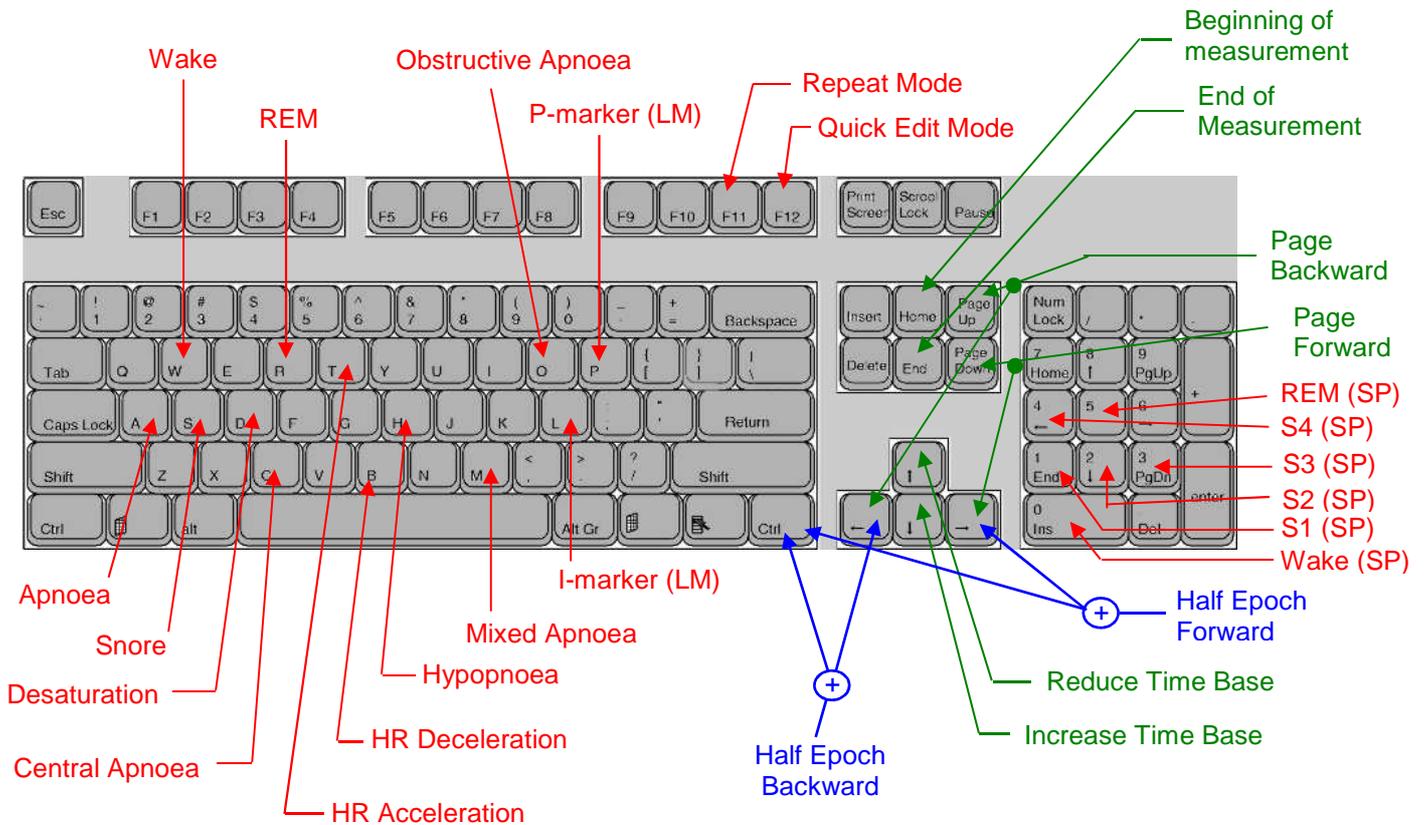


Fig. 7-39 Online display “Dual Time Base”

**Keyboard layout**

In order to manually edit sleep stages please activate the predefined keys 0, 1, 2, 3, 4, 5, R and W.



**Fig. 7-40** Keyboard layout for online scoring; SP: Sleep Profile, LM: Leg Movement

To manually add events mark the event and press the predefined key/s (see Fig. 7-40 and the table below). The key definitions can be edited in the global preferences register **“Keys”** or directly during the online recording via **“Tools”** → **“Preferences”** → **“Keys”**. Events can be deleted by right clicking the event box.

Further Keys:

Keys	Event
SHIFT+A	Arrhythmia
SHIFT+N	Non-REM
SHIFT+P	Pressure
SHIFT+R	REM
SHIFT+W	Wake
CTRL+A	Movement
CTRL+C	Phase Angle Analysis: Central Apnoea
CTRL+E	SpO2 Arousal
CTRL+G	Generic: Event1
CTRL+H	Generic: Event2
CTRL+J	Generic: Event3
CTRL+K	Cardiac Arousal
CTRL+M	Arousal
CTRL+O	Phase Angle Analysis: Obstructive Apnoea

CTRL+P	PLM Arousal
CTRL+R	Respiratory Arousal
CTRL+S	Snore Arousal
CTRL+ 	PTT Rise
CTRL+ 	PTT Drop
CTRL+ 	Half epoch backward
CTRL+ 	Half epoch forward
SHIFT+ 	Raw data Play-back function (backward) *
SHIFT+ 	Raw data Play-back function (forward) *

- \* The Play-back speed can be increased or decreased by pressing SHIFT+ the arrow key again. Press the arrow key in the opposite direction to stop the play-back mode.

### 7.2.11 Ending an Online Recording

Selecting “**File**” → “**Stop Online Mode**” will stop Online recording.

In the appearing window the recording of the SOMNOscreen™ can be stopped too by “**Yes, and stop device**”

The SOMNOscreen™ will stop recording automatically when the pre-programmed end time is reached. To stop the recording on the SOMNOscreen manually at any time before the pre-programmed end time, press all 3 keys (  ,  and  ) simultaneously. Follow the shutdown instructions on the LCD Display.

## 7.3 MSLT (Multiple Sleep Latency Test)

### 7.3.1 General Information

The SOMNOscreen™ is designed to perform Multiple Sleep Latency Tests.

A MSLT consists of several consecutive tests throughout the day (usually 4 to 5) to objectively measure and evaluate the Sleep Latency of the patients. Therefore the patient is instructed to try to sleep in a dark room.

The MSLT method is also used to measure Sleep-onset REM which is recognised as an effective tool for diagnosing narcolepsy.

### 7.3.2 Implementation

A MSLT can be carried out offline as well as in online mode.

Approach as follows:

- Attach the device with all sensors and electrodes to the patient.
- Start the offline or online recording (see chapter 7.1 and 7.2).
- Instruct the patient to sleep, switch off the lights, press the patient marker  and leave the room. In Online Mode, set the “**Lights off**” marker.
- Wait for 20-30 minutes and wake up the patient. Press the patient marker  as soon as possible. In Online Mode, set the “**Lights on**” marker.
- Instruct the patient to stay awake until the next test cycle is to be performed.
- After about 2 hours repeat steps c-e (4 to 5 times altogether)

Additionally for offline recordings:

It is important to observe the correlation of the individual patient markers to “**Lights on**” and “**Lights off**”. After the recording is completed and downloaded, select each marker in the Raw Data window and assign it as “**Lights Off**” or “**Lights On**” (right click aside to get the pop up menu). Areas between “**Lights off**” and “**Lights on**” are marked as recordings.

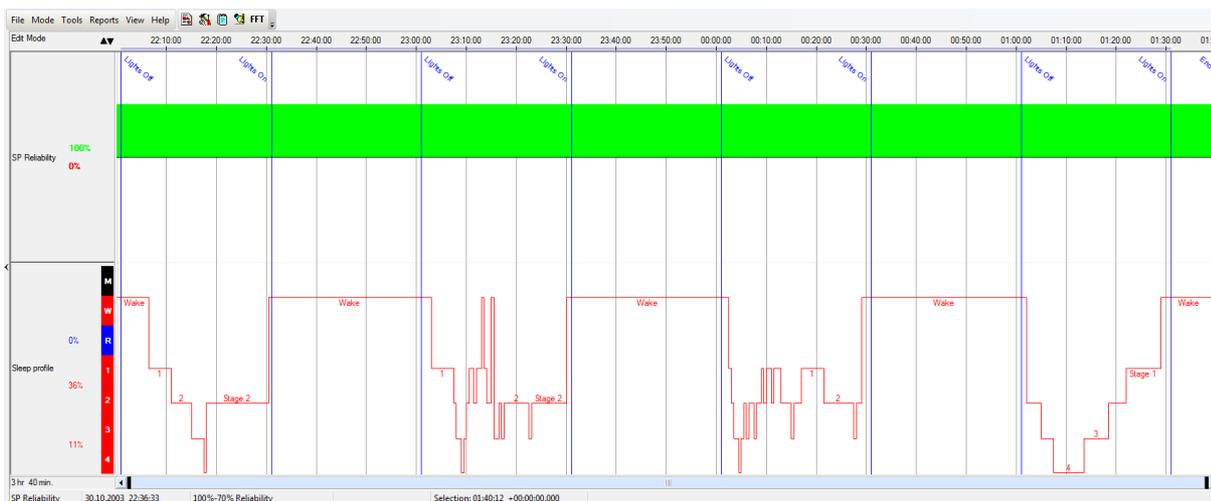


Fig. 7-41 Sleep Profile: MSLT

### 7.3.3 MSLT-Report

To create a MSLT report, click **“Report”** in the **“Report”** menu or click  in the quick start bar. The following window will open:

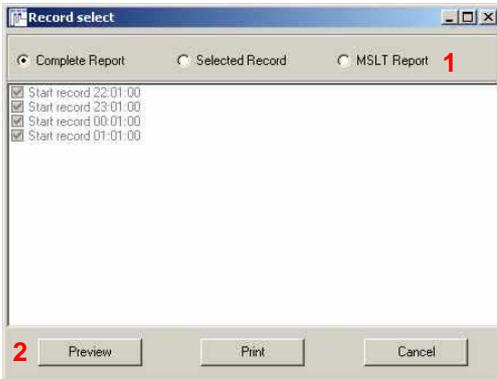


Fig. 7-42 Report window

Select **“MSLT Report”** (1) and click **“Preview”** (2).

The MSLT Report opens. It shows the hypnograms of the MSLT- recordings as well as the number of recordings. Additionally the beginning, TIB and sleep latency of each recording are displayed in a table.

#### Sleep Stages



MSLT	TIB	REM latency	Latency S1	Latency S2	Latency S3/S4	SOL
Record 1 - 22:01:00	00:30:00	-	00:05:30	00:10:00	00:14:00	00:05:30
Record 2 - 23:01:00	00:29:59	-	00:02:00	00:06:30	00:07:00	00:02:00
Record 3 - 00:01:00	00:29:59	-	00:01:29	00:01:59	00:02:29	00:01:29
Record 4 - 01:01:00	00:30:00	-	00:00:59	00:00:59	00:03:59	00:00:59
Average	00:29:59	-	00:02:29	00:04:52	00:06:52	00:02:29

Fig. 7-43 MSLT Report

The MSLT report can be configured in the global preferences in **“Report”**. Click **“MSLT”** to open the **“MSLT-Report settings”** window. There you can select the User Data, Patient Data and contents of the MSLT report.

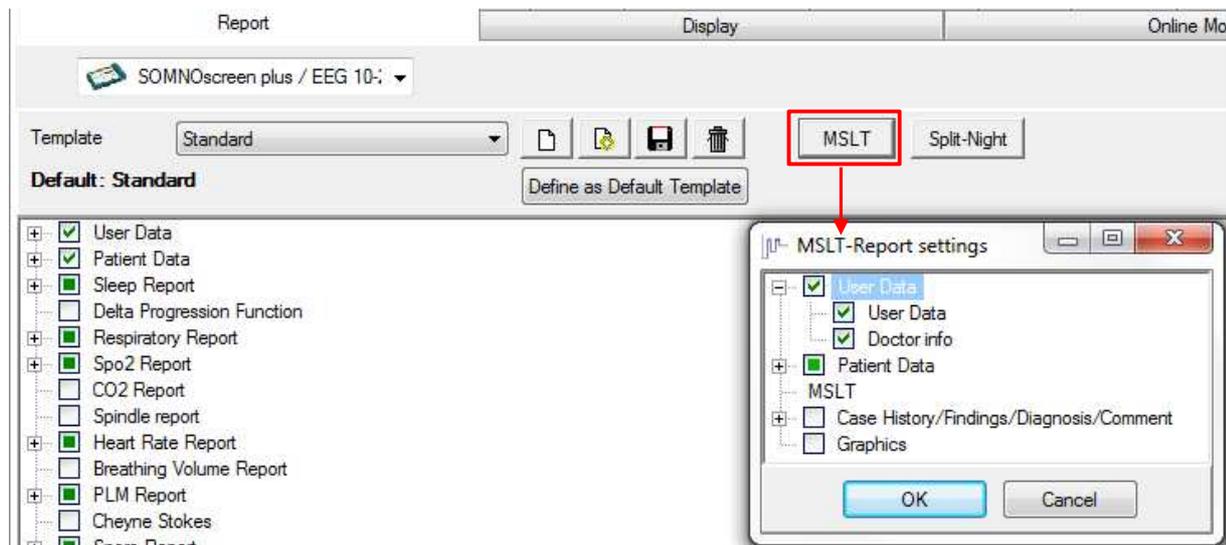


Fig. 7-44 MSLT-Report configuration in the global preferences

## 7.4 Split-Night-Function

### 7.4.1 General Information

Besides MSLTs you can also make Split-Night recordings with your SOMNOscreen™. Characteristically, in Split-Night recordings there's a diagnosis part and a therapy part. The diagnosis is carried out in the first half of the night followed by the therapy where the required pressure for the patient is determined. When changing from diagnosis to therapy, the thermistor/nasal cannula is replaced by a PAP-mask. The Split-Night function in DOMINO allows for a continual recording of both diagnosis and therapy.

### 7.4.2 Implementation

Prerequisite for the accomplishment of a Split-Night recording is the initialisation of the device with an appropriate montage that contains both sensors for the flow detection (thermistor/nasal cannula for diagnosis and CPAP-tube/-PT for therapy).

#### Start the recording:

Adjust the sensors to the patient that are necessary for the diagnosis part and start the online recording as usual. Set “Lights off” and “Lights On” to the start and end of the diagnosis part.

At the end of the diagnosis part wake the patient and exchange the thermistor/nasal cannula for the CPAP-tube/-PT. Attach the sensor to the according plug in position of the SOMNOscreen™.

To mark the change from diagnosis to therapy and change the analysis source of the flow analysis, place a marker in the raw data at the according point of time and open the popup menu (right-click).

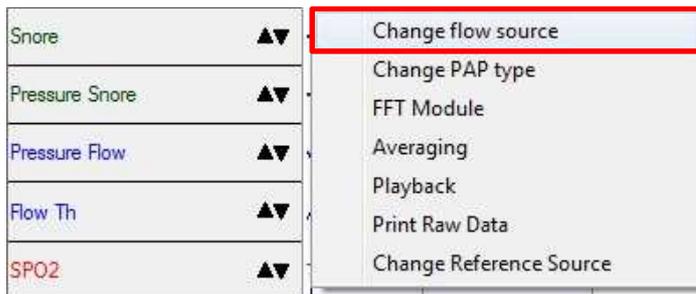


Fig. 7-45 Function Change Flow Source

Select “**Change flow source**” and the according window (Fig. 7-46) will open. There you can select the title of the marker from the drop down menu (1). Alternatively you can define own titles via (2).

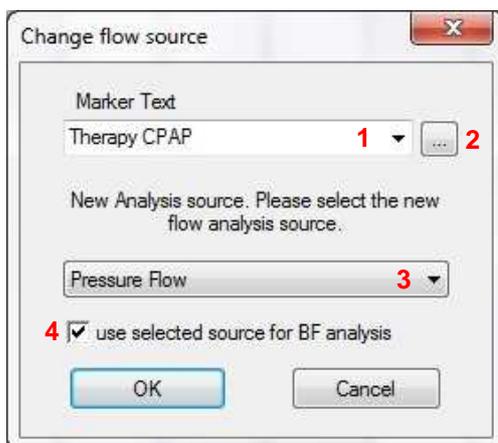


Fig. 7-46 Window Change Flow Source

Select the new source for the flow analysis of the therapy part from the lower drop down menu (3).

If the breathing frequency analysis is active, tick the checkbox “**use selected source for BF analysis**” (4) to use the source for that analysis as well.

Confirm with “**OK**”.

The moment of the change between diagnosis and therapy is now indicated by the according marker. Additionally the flow analysis is based on the selected flow source for the rest of the recording or until the next flow source change.

Set “Lights off” and “Lights On” to the start and end of the therapy part as well.

**Notice:**

The source change for the flow analysis can be carried out retrospectively in the opened recording! This function offers the possibility to get a flow analysis for the whole recording even if the flow sensor got out of place during the recording. In that case you can change the flow source to “Sum Effort” or another available source. Be sure to select “Complete Report” instead of “Split-Night Report” then (Fig. 7-47).

### 7.4.3 Split-Night-Report

After the end of the Split-Night recording the correspondent report can be created. It displays all relevant results of the sleep profile and respiratory analysis for diagnosis and therapy in a table.

To generate a Split-Night Report click the button  in the quick start bar or select “**Report**” → “**Report**”. The window “**Measurement Selection**” (Fig. 7-47) opens. Select “**Split-Night**”. Subsequently you can choose “**Diagnosis**” from the drop down menu as title for the first part of the night. If the title of the diagnosis part shall be displayed already during the recording, it is necessary to mark its beginning via “**Change flow source**”.

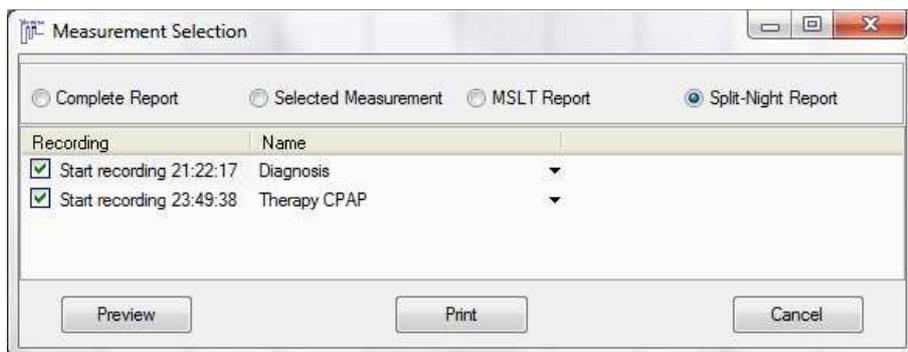
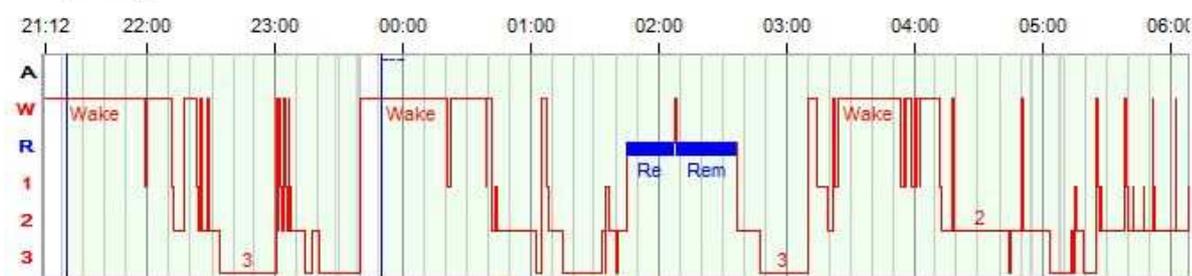


Fig. 7-47 Window Measurement Selection

Click **“Preview”** to open the report.

### Sleep Stages



Therapy CPAP		
Total Sleep Time (TST)	01:19:30	04:34:49
Sleep Efficiency [%]	57,4	72,5
Sustained Sleep Eff. [%]	78,4	79,0
Sleep Latency Stage 1	00:37:12	00:31:21
Sleep Latency Stage 2	00:50:12	00:52:21
Deep Sleep Latency	01:11:42	01:13:21
REM latency	-	01:23:30
Total Sleep Period (SPT)	01:27:30	05:26:49
Sleep Stage Change (Index)	32 (13,9)	73 (11,6)
# Wake (Index)	10 (7,5)	18 (3,9)

### Sleep Stages (% TIB)

Artefact	00:00:03 (0,0 %)	00:00:13 (0,1 %)
Movement	-	-
Wake	00:59:04 (42,6 %)	01:44:21 (27,5 %)
REM	-	00:52:00 (13,7 %)
Stage 1	00:06:00 (4,3 %)	00:22:30 (5,9 %)
Stage 2	00:24:00 (17,3 %)	02:20:49 (37,1 %)
Stage 3 + 4	00:49:30 (35,7 %)	00:59:30 (15,7 %)

### Respiratory Analysis

Therapy CPAP		
Obstructive	-	1 (0,2)
Mixed	-	-
Central	-	1 (0,2)
Undef A.	-	-
Total A.	-	2 (0,4)
Hypopnoea	25 (18,9)	38 (8,3)
A+H	25 (18,9)	40 (8,7)
Limitation	-	1 (0,2)

Hypopnoea-rules 1: Desaturation 4 %, Ratio 70 %. Hypopnoea-rules 2: Desaturation 3 %, Ratio 60 %

Fig. 7-48 Split Night Report

The Split-Night Report can be adjusted in the “Global Preferences” → “Report” → “Split-Night”. In the window “Split-Night Report settings” further analysis can be added to the report.

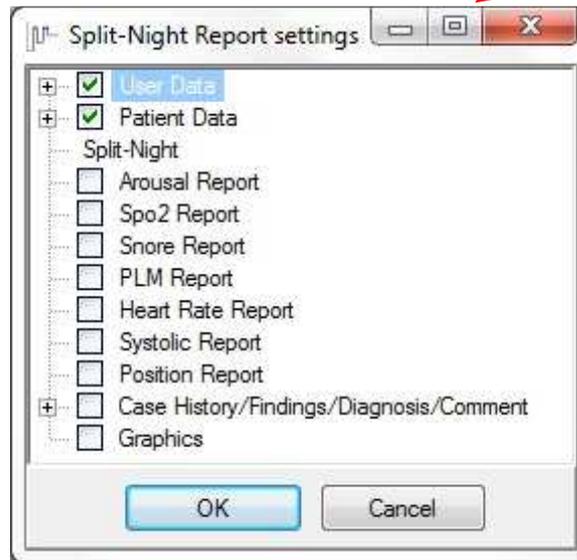
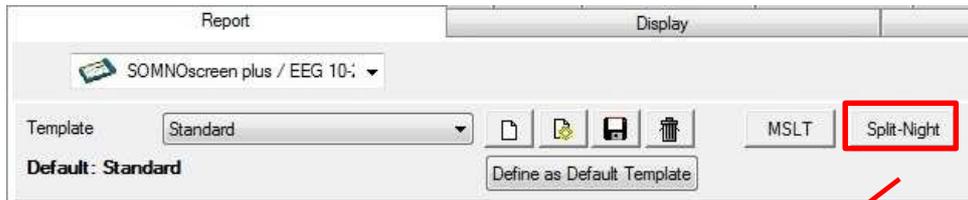


Fig. 7-49 Split-Night Report settings in the Global Preferences

## 8 Analysis

### 8.1 Opening a recording

To open a recording, click on the Analysis symbol  of the DOMINO panel. The following window will open:

A click on the column name sorts the recordings according to the column. They cannot be sorted by "Number" or "Source".

Video status  
(size and status  
of progress)

Archiving  
path

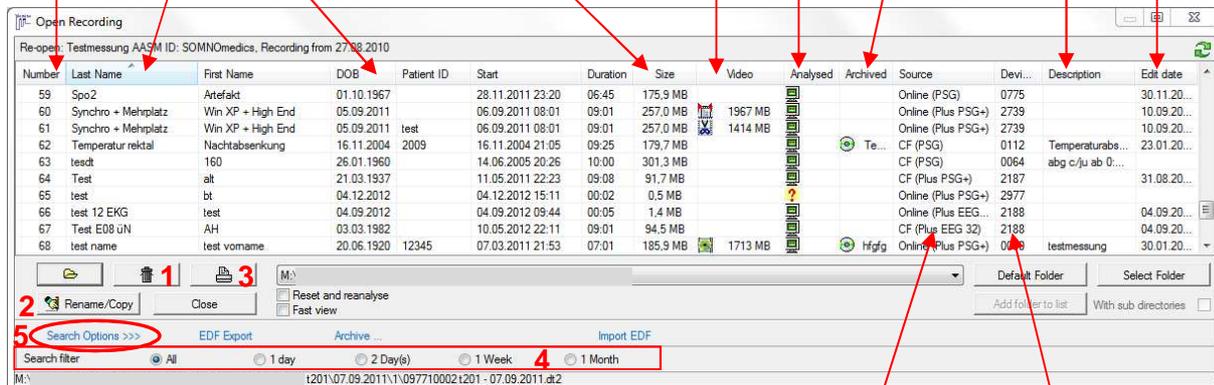
"Notes"  
information  
from the  
patient data

Saved  
recordings

Data volume of the  
recording

Status of  
progress

Edit date



Number	Last Name	First Name	DOB	Patient ID	Start	Duration	Size	Video	Analysed	Archived	Source	Devi...	Description	Edit date
59	Spo2	Artefakt	01.10.1967		28.11.2011 23:20	06:45	175.9 MB				Online (PSG)	0775		30.11.20...
60	Synchro + Mehrplatz	Win XP + High End	05.09.2011		06.09.2011 08:01	09:01	257.0 MB	1967 MB			Online (Plus PSG+)	2739		10.09.20...
61	Synchro + Mehrplatz	Win XP + High End	05.09.2011	test	06.09.2011 08:01	09:01	257.0 MB	1414 MB			Online (Plus PSG+)	2739		10.09.20...
62	Temperatur rektal	Nachtsabsenkung	16.11.2004	2009	16.11.2004 21:05	09:25	179.7 MB				Te...	0112	Temperaturabs...	23.01.20...
63	tesdt	160	26.01.1960		14.06.2005 20:26	10:00	301.3 MB				CF (PSG)	0064	abg c/ru ab 0...	
64	Test	alt	21.03.1937		11.05.2011 22:23	09:08	91.7 MB				CF (Plus PSG+)	2187		31.08.20...
65	test	bt	04.12.2012		04.12.2012 15:11	00:02	0.5 MB				Online (Plus PSG+)	2977		
66	test 12 EKG	test	04.09.2012		04.09.2012 09:44	00:05	1.4 MB				Online (Plus EEG...	2188		04.09.20...
67	Test E08 uN	AH	03.03.1982		10.05.2012 22:11	09:01	94.5 MB				CF (Plus EEG 32)	2188		04.09.20...
68	test name	test vorname	20.06.1920	12345	07.03.2011 21:53	07:01	185.9 MB	1713 MB			hfgrg Online (Plus PSG+)	0188	testmessung	30.01.20...

Fig. 8-1 Opening a recording

When the cursor is on this field an information window opens with a list of the recorded channels

ID of the used SOMNOscreen™

The dialogue of Fig. 8-1 shows all recordings of the directory you stored as default in the "Global Preferences". If you want to open a recording from another directory you have to select it by "Select Folder". It can be added to the select list by "Add folder to list".

You can select "With subdirectories" to search for recordings in every folder in the chosen directory. A right-click at a column name opens a menu where you can choose the columns to be displayed.

The status of progress is displayed by these symbols:

-  ...recording not opened yet (raw data)
-  ...recording automatically analysed
-  ...recording automatically and manually edited, marked as "complete" and approved for archiving
-  ...recording can't be opened

An archived recording is marked with the symbol  in the "Archived" column and the name of the CD/DVD or the directory of the archiving is displayed.

If there's a video to the recording, the column **"Video"** not only displays its size but also its state of progress. States are as follows:

-  ...Video available
-  ...trim marks are set
-  ...Video cut
-  ...Video archived with recording

The video can be deleted separately. Right-click the correspondent recording and select **"Delete only Video"** from the menu.

Furthermore, the opening dialogue allows for the following options:  
 You can delete (1) or rename (2) a recording and print a list of all recordings (3). When renaming a recording the original recording is kept, i.e. the data is copied and saved under a new name.

- By activating **"Reset and reanalyse"** you can undo all manual changes. The current settings from the global preferences are used for the reanalysis.
- ⓘ Activating **"Fast view"** allows a faster opening of already analysed recordings. Please note that a change of the settings and the editing of the recording are not possible then.

You can search the selected folder for recordings of the last one or two days, week or month respectively (4).

**"Search options"** (5) allows for a more specific search:  
 You can search for patient data, device ID, defined spaces of time or analysis results. By activating **"Search in all directories"** all stored directories are searched for recordings with the according criteria.

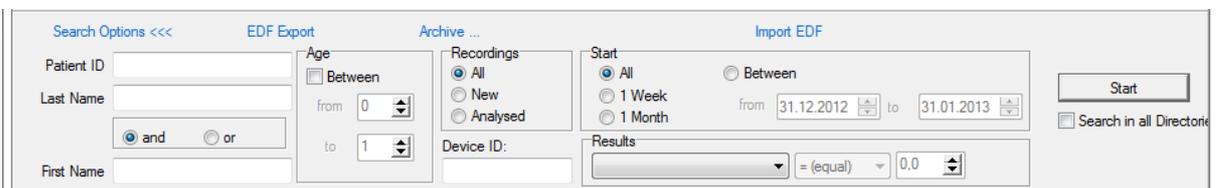


Fig. 8-2 Search options

By **"EDF Export"** or **"Import EDF"** you can export the raw data of the selected recording as edf file or import data from edf files to the DOMINO software (see chapter 12.3).

## 8.2 Signal control and merging of recordings

If signal control and main recording were transferred separately from the flash card, they can be merged afterwards from the opening dialogue. Mark the recordings to be merged and click right at one of them. Select “**Merge recordings**” from the menu. The signal control will be placed at the start of the main recording.

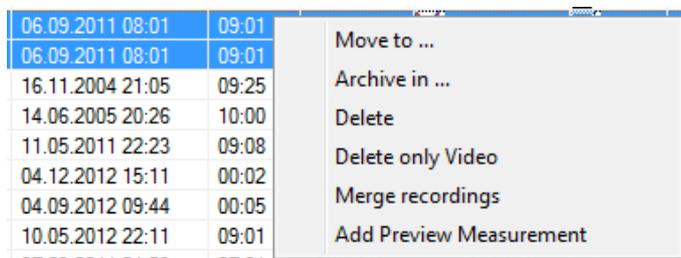


Fig. 8-3 Merge recordings

## 8.3 Main menu

The main menu of the analysis offers a multitude of options, e.g. to change the global settings for the current recording.

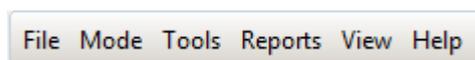


Fig. 8-4 Main menu of the analysis

### 8.3.1 “File”

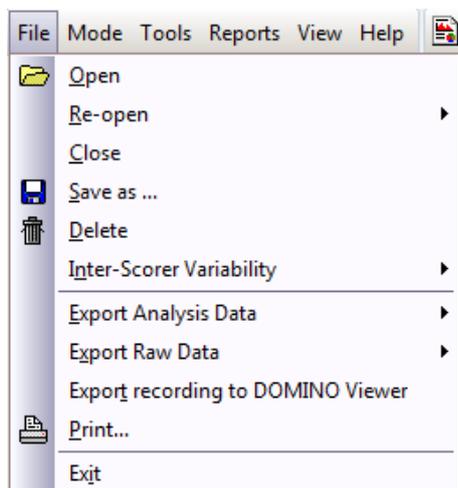


Fig. 8-5 “File” menu

#### 8.3.1.1 “Open”, “Save as” and “Delete” of an opened recording

“**Open**” allows for opening a new recording out of an opened one.

“**Re-open**” opens the last opened recording automatically.

“**Close**” closes the current recording.

“**Save as...**” and “**Delete**” allow for creating a backup of the current recording or directly deleting a failed recording.

### 8.3.1.2 “Inter-Scorer Variability”

“**Inter-scorer Variability**” allows for comparison of hypnograms and analysis results between multiple scorers.

“**Save Scorer**” saves hypnograms and analysis results of a particular scorer. During saving there’s the option to reset the sleep profile of the next recording to automatic analysis or entire wake and to delete events of the different analysis.

If there are multiple scorers, the hypnograms can be compared by “**Scorer Manager**”. For options (e.g. set as default or rename) simply click at the hypnogram of the according scorer which will then be highlighted in blue. As soon as one of the scorers is set as default (1) the checkbox “**Statistics**” (10) can be activated. A percentage comparison of the scored sleep stages of the scorers and the default scorer is carried out.

The hypnograms of the inter-scorer variability are directly linked to the raw data. This allows jumping from the hypnogram to the according raw data by double clicking at the relevant part of the hypnogram.

To manage the different scorers there are the following options:

- (2) saves an additional scorer.
- (3) loads the selected (blue highlighted) sleep profile to the analysis and raw data window.
- (4) deletes the selected scorer.
- (5) renames the selected scorer.
- (6) prints the “**Scorer manager**” window.
- (7) opens the direct epoch comparison; differential epochs are highlighted rose.  
As the epochs are linked to the raw data as well, you can jump to the according epoch in the raw data by double clicking an epoch in the list. By “**Print**” and “**Export**” the list of the epoch comparison can be printed or exported.
- (8) exports the analysis data as zip file; this aims to simplify the mobile scoring of recordings. The scorer can create an own recording file (e.g. on a laptop) and re-import it to the original file (9) without having to upload the whole data.
- (9) imports the analysis data of the scorer.
- (11) closes the “**Scorer Manager**”

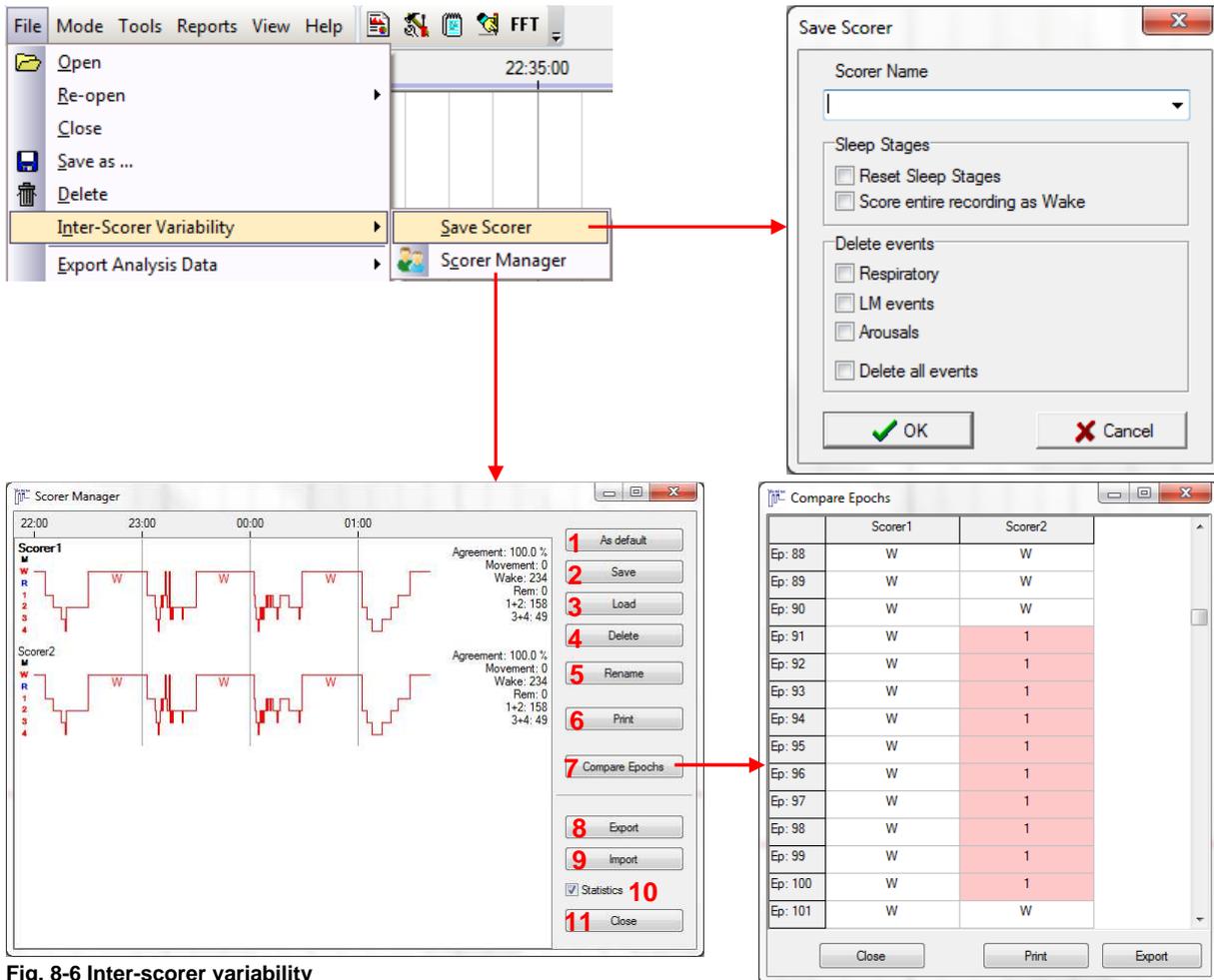


Fig. 8-6 Inter-scorer variability

### 8.3.1.3 Export of analysis- / raw data and export to DOMINO Viewer

For detailed information to data export please see chapter 13.

### 8.3.1.4 “Print” arrays

It is possible to comfortably print larger arrays of a recording. Via “Print” the following window opens, where you can decide to print analysis and/or raw data.

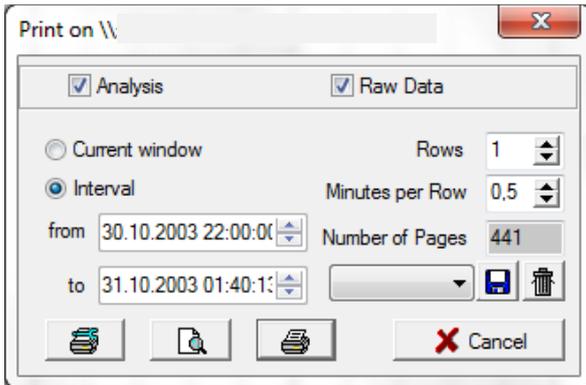


Fig. 8-7 Print settings

“**Current window**” prints the current screen display.

To print larger arrays “**Interval**” has to be selected. The time to be printed has to be defined by “**from/to**”.

“**Rows**” defines the number of rows printed on one sheet of paper.

“**Minutes per Row**” defines the displayed time range of the rows.

You can read the resulting amount of paper off the “**Number of pages**” field.

Via and the values for “**Rows**” and “**Minutes per Row**” can be stored in a template or rather an existing template can be deleted.

If necessary the printer can be changed or modified via . Printing is started via .

shows a preview.

## 8.3.2 “Mode”

### 8.3.2.1 Edit Modes

For more information about the different edit modes of the DOMINO software, please see chapter 9.1.

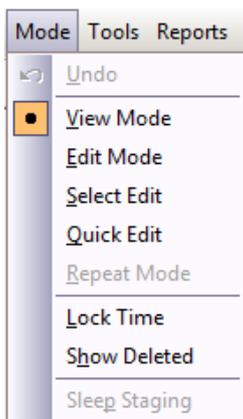


Fig. 8-8 “Mode” menu

### 8.3.2.2 Unlocking recordings

To avoid an uncontrolled editing of recordings, there's the so called restriction mode. It prevents the editing of recordings previously marked as **“complete”**. When an opened recording is locked, the **“Mode”** menu looks as follows. An editing of the recording is not possible while locked.



Fig. 8-9 Locked recording

To allow further editing nevertheless click **“Recording Locked”**. You're asked again if you're sure to allow further editing. Confirm with **“Yes”**. The recording can now be edited as usual.

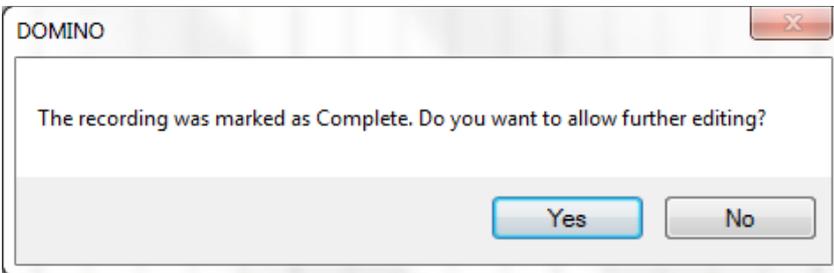


Fig. 8-10 Unlock a recording

When closing the recording it can be marked as complete again:

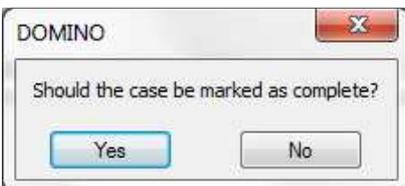


Fig. 8-11 Mark recording as complete

### 8.3.2.3 “Lock Time”

When you activate **“Lock Time”** the raw data is displayed in epochs. If an event is edited across epoch ranges, the software jumps back to the start epoch of the event afterwards. To use the following option **“Lock Time”** has to be deactivated.



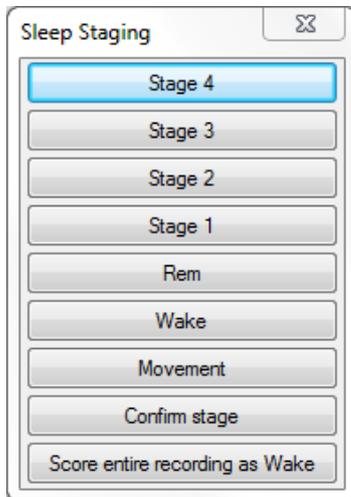
Keeping the Ctrl- key pressed you can scroll through the recording with the left mouse button.

Keep in mind that **“Lock Time”** has to be deactivated therefore.

Fig. 8-12 Scrolling

### 8.3.2.4 “Sleep Staging”

A click on “Sleep Staging” opens a panel for the scoring of the sleep stages (providing that you are in edit mode).



Clicking a field assigns the stage to the current epoch. Via “**Score entire recording as Wake**” all epochs are set to wake. This might be helpful to avoid a manipulation of the scorer by the automatic sleep staging of the software. Alternatively to the scoring via the sleep staging panel the sleep staging can be carried out via predefined keys (see chapter 5.9).

Fig. 8-13 Sleep staging

The sleep staging panel can be opened faster from the quick start bar (see chapter 8.5):

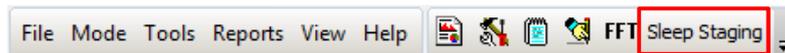


Fig. 8-14 Quick start bar with “Sleep Staging”

### 8.3.3 “Tools”

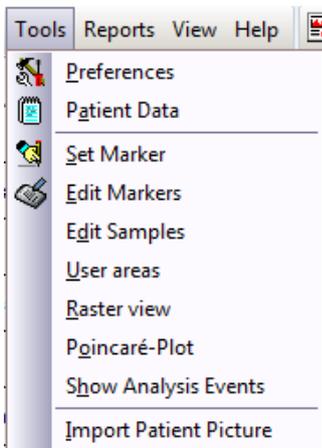


Fig. 8-15 Menu “Tools”

#### 8.3.3.1 “Preferences”

Here you can find an overview of all settings defined either global or local for the current recording (e.g. parameter settings of the analysis, channel display, channel referencing, filter settings, keyboard layout, marker names, definitions of raw data profiles etc.). Settings you change for example via right-click at the data channel → channel settings are applied here. Modifications made here are only used for the current recording.

Except for the settings of the analysis:

These settings can be transferred to the global preferences via .

If you wish to overwrite local changes with the global preferences use .

### 8.3.3.2 “Patient Data”

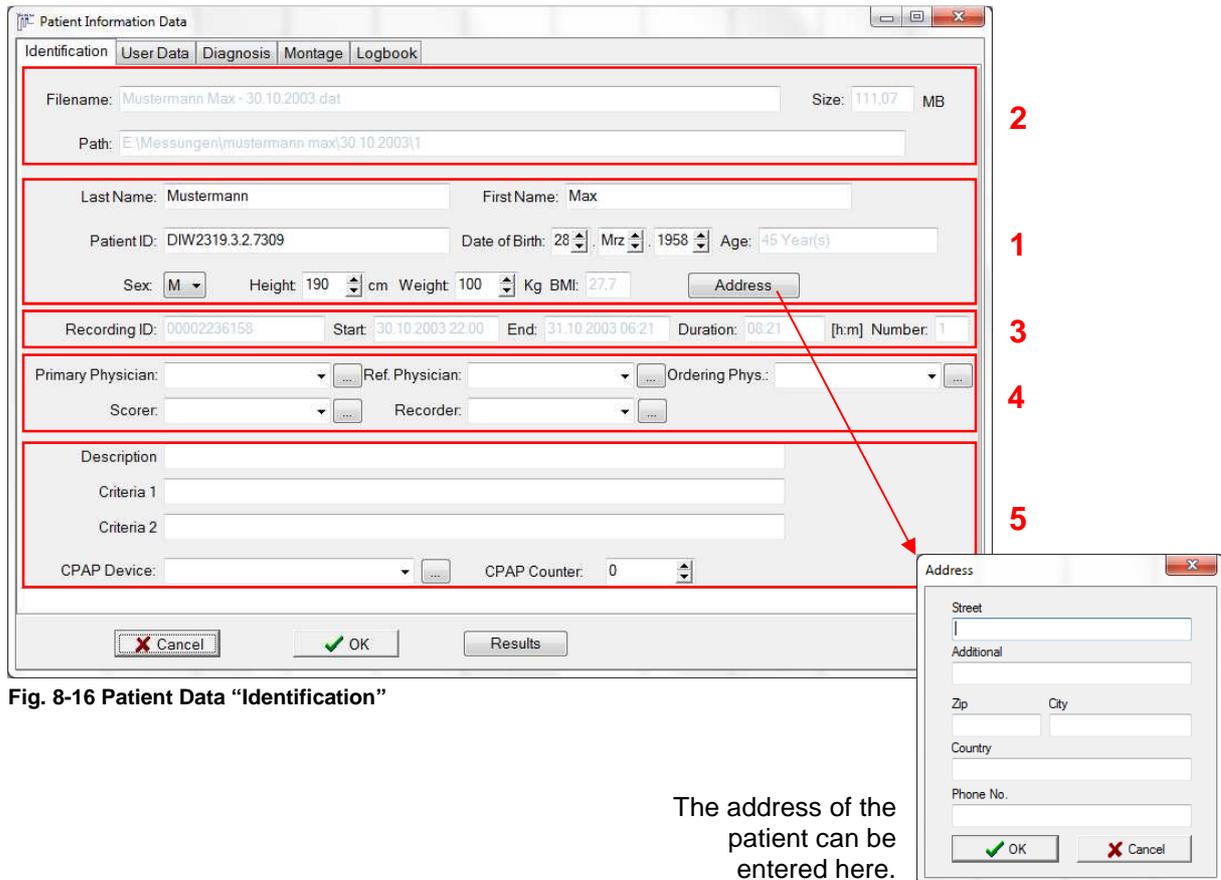


Fig. 8-16 Patient Data “Identification”

The address of the patient can be entered here.

In “**Identification**” the patient data you entered when preparing the recording are displayed (1) and can be edited. This is also possible for online recordings. In the upper field, name size and path of the recording are displayed (2). Furthermore recording ID, start, end and duration of the recording are shown (3). You can select or enter the physicians, scorer and night watch (recorder) (4). In the lower part you can enter a description and criteria of the recording as well as name and/or counter of a CPAP device (5).

In “**User Data**” the information from the global preferences are displayed and can be edited if necessary.

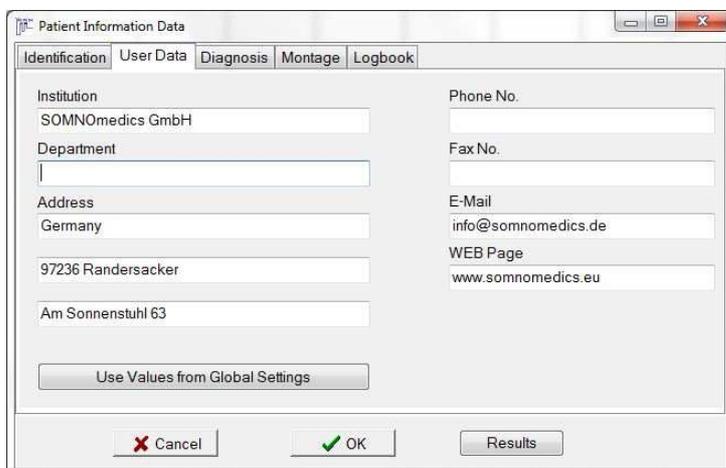


Fig. 8-17 Patient Data “User Data”

By default the user data are transferred from the global settings of the installation used for the recording.

If the address of your sleep laboratory should have changed, you can transfer the current user data from the global settings to the patient information via “Use Values from Global Settings”.

In “**Diagnosis**” you can add case histories, findings, diagnoses and comments which also appear in the report. Via “**Results**” you get an overview of the results of the recording which you can copy and paste to the findings. If you use the optional Patient Database you can also add or edit Questionnaire Data and/or notes or add the record to the database.

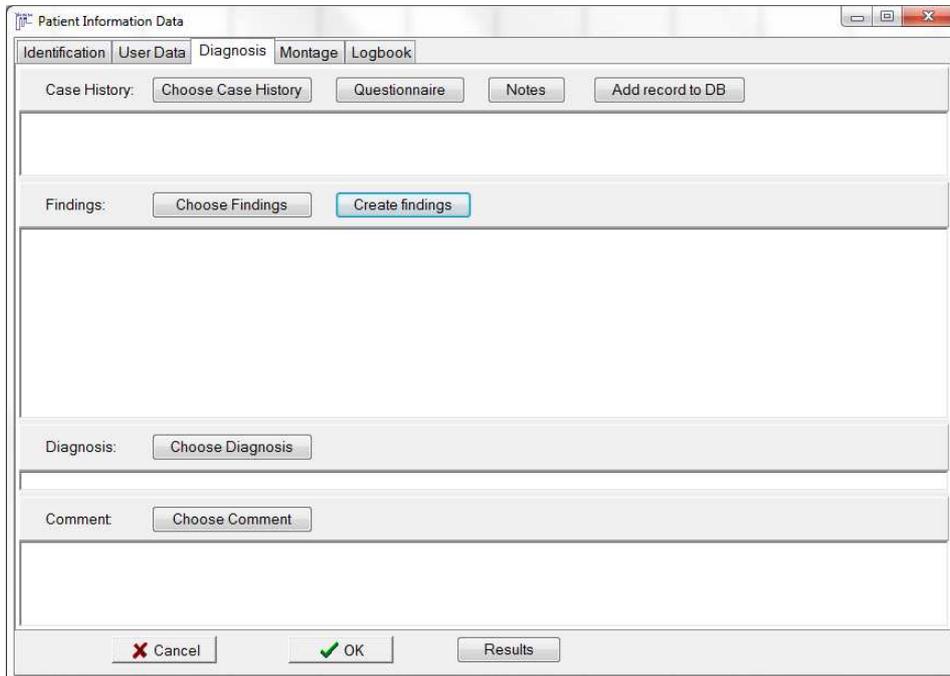


Fig. 8-18 Patient Data “Diagnosis”

Furthermore you can select findings and diagnoses from existing lists which can be amplified with own items (buttons “**Choose Findings/Diagnosis**”). For case histories and comments you can create own lists. The order of the list items can be changed by drag & drop. A right-click to one of the boxes opens a popup menu where a spell check is offered for the according entry.

Clicking “**Create findings**” gets you to the “**Findings Generator**”:

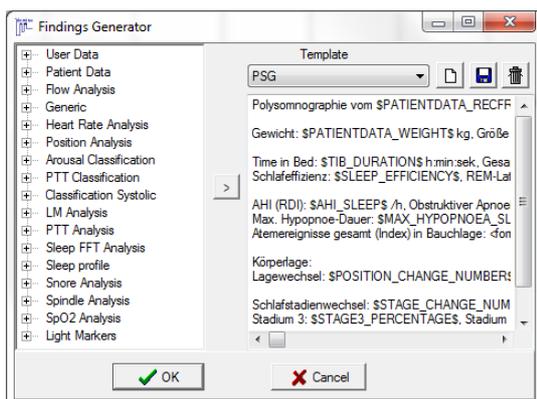


Fig. 8-19 Findings Generator

You can create templates with clozes and placeholders for results. For subsequent patients these templates can be selected and the text is automatically filled with the results of the current recording.

**Creating a template:** press  and enter a name for the template. Write your text in the box and select the according clozes for the results from the left (e.g. for AHI: Flow → Standard → AHI). Clozes are marked with a “\$” in front and at the end.

**Example:** “The patient’s name is \$PATIENTDATA\_FIRSTNAME\$ \$PATIENTDATA\_LASTNAME\$”

Additionally you can execute calculation processes by placeholders, provided the placeholders are valid numbers. Write the arithmetic operation between the formula command “<formula></formula>”.

**Example:**

“The double average breathing frequency was <formula>\$AF\_AVERAGE\_SLEEP\$\*2</formula>/min.”

Save the template via  or delete an existing template via .

Press “OK” to take over the text.

In “**Montage**” the hardware, montage name, device ID and software version of the analysis are displayed. Additionally the channels of the recording are shown.

You can define the position of the device. By default it's set to “Horizontal” but can be changed to “Horizontal (Back)” for example (if the patient is a belly sleeper and the device is mounted at the back). The body position is calculated according to the selected device position. After changing the device position the body position is reanalysed.

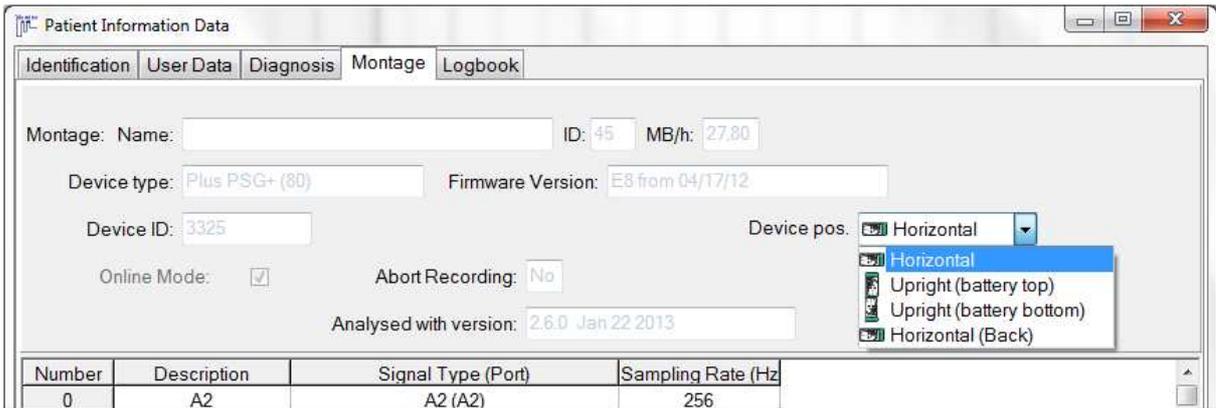


Fig. 8-20 Patient Data “Montage”

In “**Logbook**” all error messages that occurred during the recording are displayed. Please note that this is only the case for recordings that were transferred from the flash card.

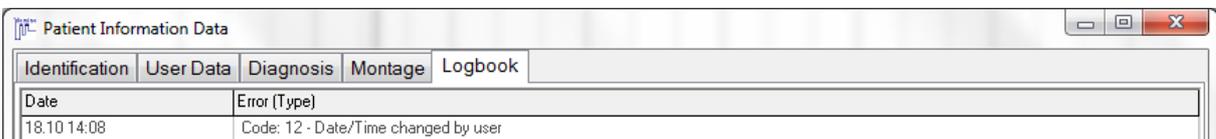


Fig. 8-21 Patient Data “Logbook”

### 8.3.3.3 Set and edit markers

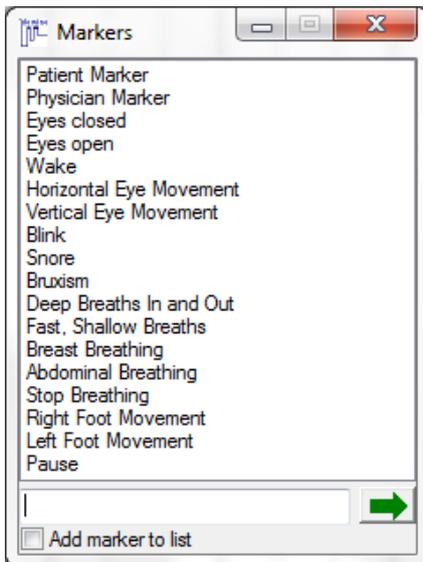


Fig. 8-22 Set marker

#### “Set Marker”

“Set Marker” opens a list of predefined markers. You can select a marker per click of the mouse and confirm it via . The marker is set at the current position in the raw data.

You can enter an individual marker text in the description field and add it to the list by activating the checkbox “Add marker to list”.

**Note:** You can only set one marker per second.

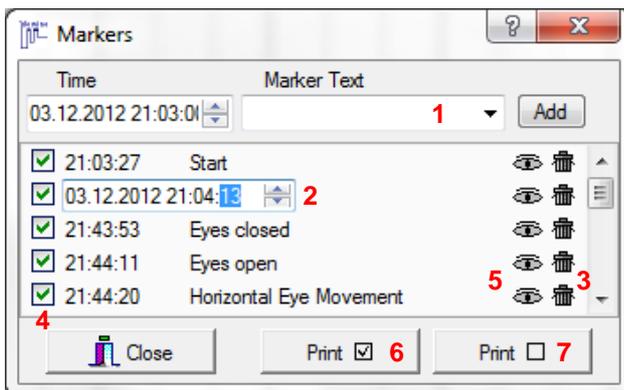


Fig. 8-23 Edit markers

#### “Edit Markers”

“Edit Markers” opens a list of all markers set in the current recording. You have the option to add new markers to the list (1), change time or name of existing markers (2), delete markers (3) or blank markers in the recording (no hook in the checkbox) (4). A click on an eye (5) gets you to the marker position in the raw data. You can also print all visible (6) or all blanked markers (7).

Alternatively you can adjust markers set online later in the raw data window. The time of the adjusted markers is updated in the list. Therefore keep the Shift- key pressed and navigate the cursor to the upper part of the marker. When the double arrow appears adjust the marker with pressed left mouse button to the desired moment.

### 8.3.3.4 “Edit Samples” and “User areas”

Via “Edit Samples” and “User areas” there’s the option to edit samples and areas stored in the recording. For detailed information on creating and editing samples and user areas see chapters 8.9 and 8.10).

### 8.3.3.5 “Raster view”

In “**Raster view**” a channel of the raw or analysis data (1) can be displayed separately. The selection of the channel is conducted via drop down (2) as well as the selection of the Time base (3). If “**Event Box**” (4) is checked for a raw data channel, event boxes are shown as well. Clicking the printer symbol opens the printer menu where you can choose to print (5) the actual window or the complete raster. You can also save the actual window as sample. Via “**Setup Printer**” you can e.g. select the printer and/or format.

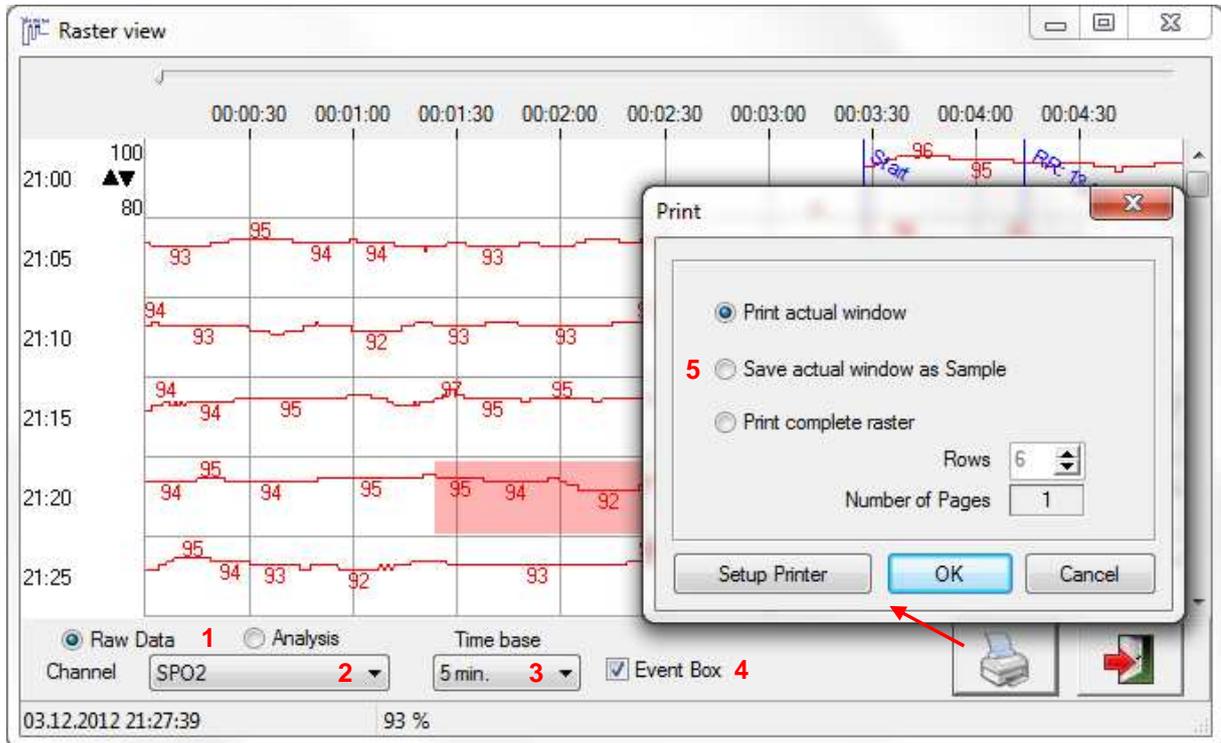


Fig. 8-24 Raster view

### 8.3.3.6 Poincaré-Plot

A common practice for the analysis of the heart rate variability is the display of subsequent RR-intervals in a Poincaré-Plot. The Poincaré-Plot is a standard tool for the detection of cardiac arrhythmia. In DOMINO the chart is linked to the raw data enabling the user to view interesting RR-intervals directly in the raw data. Simply click at the interval of the plot you wish to view in the raw data. It will be highlighted black there. If for the chosen interval there are several heartbeat intervals in the raw data, you can skip between the intervals via the arrow keys. The duration of the first (RR(n)) and the next (RR(n+1)) heartbeat interval are displayed in the footer of the Poincaré Plot.

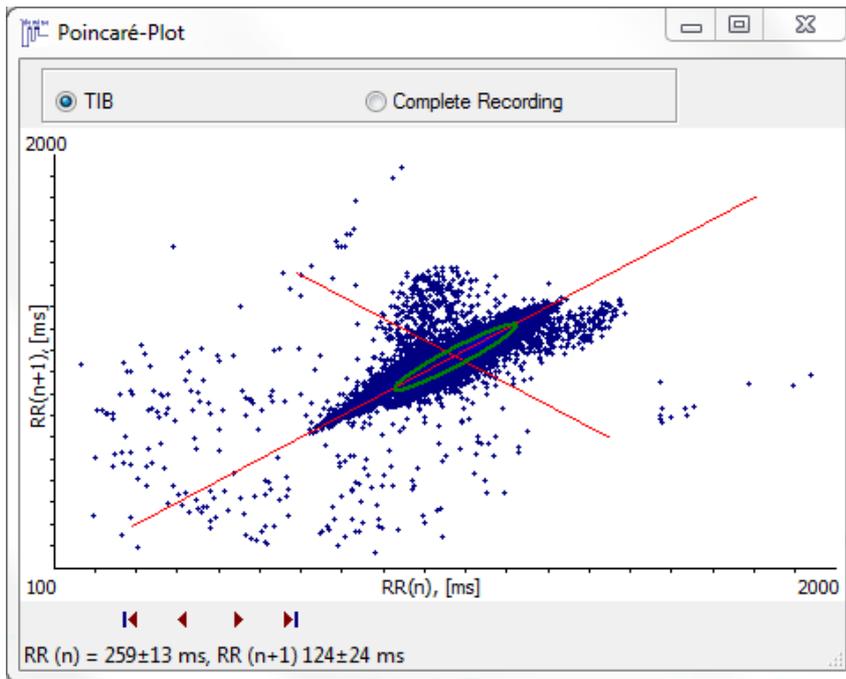


Fig. 8-25 Poincaré-Plot

### 8.3.3.7 “Show Analysis Events”

“Show Analysis Events” opens a list of all analysis results. The items are linked to the raw data, enabling to jump directly to the event in the raw data window when double-clicking an event on the list.

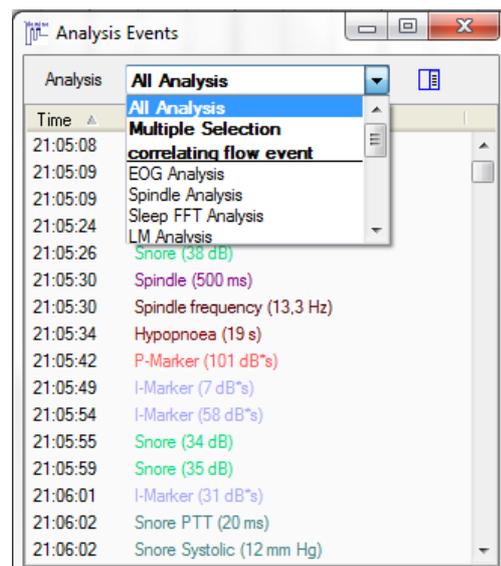


Fig. 8-26 Analysis Events I

To examine the influence of respiratory events on the circulatory system the list “correlating flow event” can be selected. All respiratory events are listed with blood pressure and cardiac events that occurred within 40 seconds after the respiratory event.

Time	Description
21:33:44	Hypopnoea (16 s) Desaturation (4 %; 17,8s) Deceleration (26 bpm; 4,6s)
21:41:14	Body event (13 s) Deceleration (64 bpm; 5,5s) PTT Rise (24 ms; 8,0s)
21:42:02	Body event (12 s) Arrhythmia (36 bpm; 0,9s) PTT Rise (24 ms; 4,8s)
21:42:33	Body event (17 s) PTT Rise (21 ms; 6,2s)
21:44:18	Obstructive Apnoea (11 s)
21:45:54	Mixed Apnoea (35 s) Respiratory Systolic (13 mm Hg; 4,3s) PTT Drop (22 ms; 5,1s)
21:54:12	Hypopnoea (17 s) Desaturation (4 %; 24,0s)
21:54:52	Hypopnoea (23 s) Desaturation (6 %; 31,0s) Spontaneous Systolic (15 mm Hg; 20,4s) PTT Drop (26 ms; 21,5s)
21:55:50	Obstructive Apnoea (12 s) Snore Systolic (12 mm Hg; 5,2s) PTT Drop (22 ms; 5,2s)

Fig. 8-27 Analysis Events II

Via the list-symbol  at the upper right corner of the “**Analysis Events**” window the list can be opened to the right of the main window.

### 8.3.4 “Report”

In “**Reports**” you find any option to create a report, export result lists to excel format (chapter 11.4 and 11.5) and to create and edit form letters (chapter 12) and SPSS files (chapter 13.1.3). For detailed information please see the according chapters.

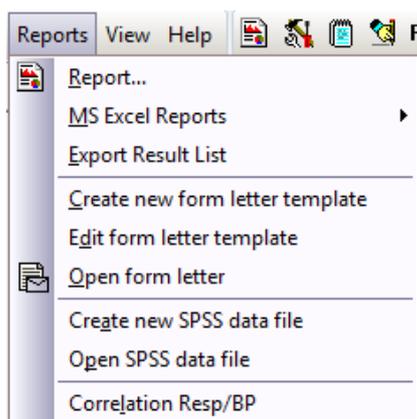


Fig. 8-28 Menu “Report”

### 8.3.5 “View”

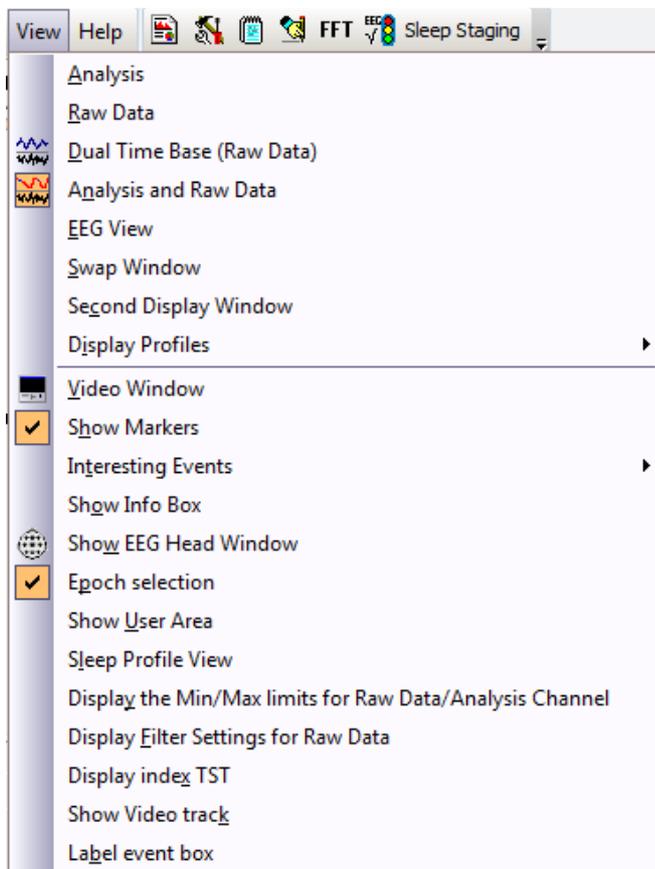


Fig. 8-29 Menu “View”

#### 8.3.5.1 Layouts for Data Display

Several different display layouts are available for efficient data processing:

- A) The Layout “**Analysis**” displays the Analysis window only.
- B) The Layout “**Raw Data**” displays the Raw Data window only.
- C) The Layout “**Dual Time Base**” splits the screen into two Raw Data windows providing individually selectable time bases in each window.
- D) The Layout “**Analysis and Raw Data**” splits the screen and displays both, the Analysis window on top and the Raw Data window at the bottom.
- E) With “**EEG View**” (chapter 8.3.5.2), the display size of raw data channels can be selected dependent on the monitor size. These settings guarantee a constant visual impression when analyzing EEG signals.
- F) “**Swap Window**” swaps windows of the standard view or the dual time base.
- G) If you chose “**Dual Time Base**” or “**Analysis and Raw Data**”, the window at the bottom can be displayed in an own window with “**Second Display Window**”.
- H) With “**Display Profiles**” you can save defined profiles or select profiles. Layout, number, identity and scaling of the chosen channels and the settings of the quick start bar.

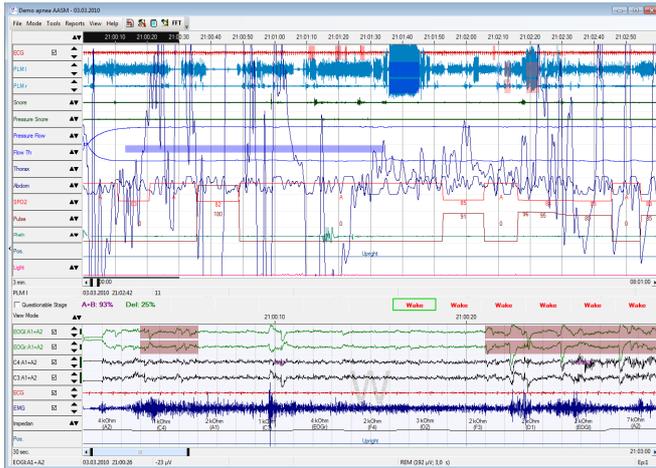


Fig. 8-30 Data Display: Dual Time Base

With the “Dual Time Base” you can edit data comfortably and efficiently, e.g. respiratory signals can be displayed in the upper window and sleep data can be displayed in the lower part and be edited simultaneously.

Please note that the time base of the lower window is not allowed to be longer than that for the upper window.

### 8.3.5.2 EEG View

“EEG View” offers a uniform display of EEG channels for a constant visual impression which is important for the manual analysis of EEG channels. Enter monitor size and aspect ratio of your monitor. If these settings are not yet defined in the global preferences, you will be asked to enter this information when choosing “EEG View” for the first time (see Fig. 8-31). The information will automatically be saved to the global preferences.

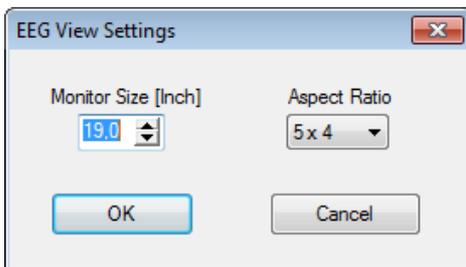


Fig. 8-31 Settings of EEG view

EEG view has a toolbar for settings and the scaling of signals (Fig. 8-32). Confirm your settings by clicking on the green arrow.

New recordings will be opened with your defined settings.

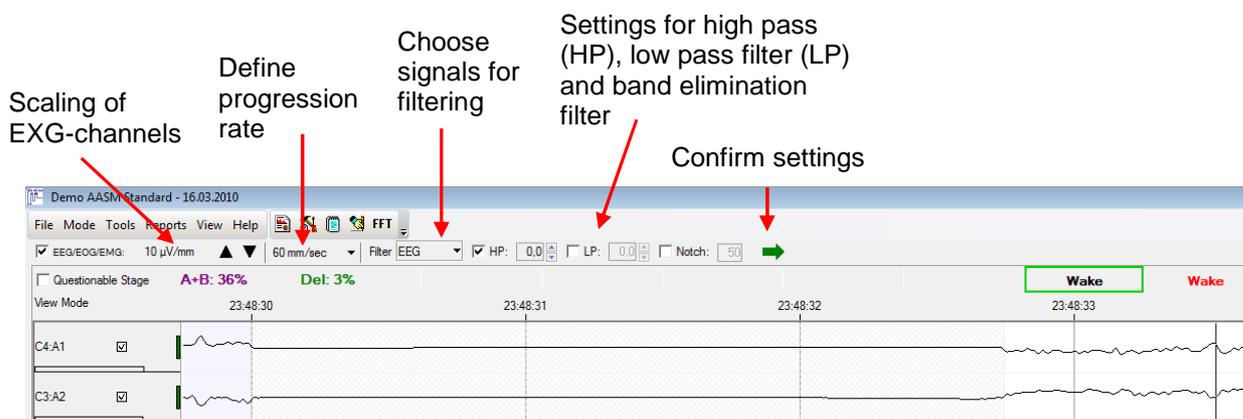


Fig. 8-32 Toolbar of EEG view

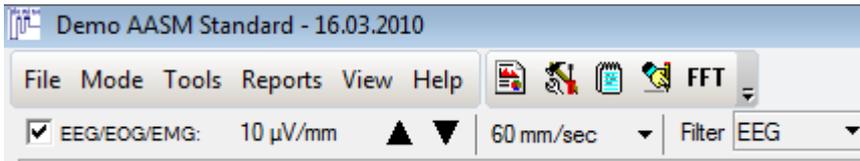


Fig. 8-33 Toolbar of EEG view

If you want to scale EEG channels independently from EOG and EMG channels, remove the check mark in the checkbox EEG/EOG/EMG (Fig. 8-32). Your defined scaling will then be applied to EEG channels only. The scaling of the other channels can be set individually for each channel with the arrow buttons in the channel. Please note: If EOGs are referenced to EEGs, they are scaled together with EEG channels.

### 8.3.5.3 Data display within the editing mode

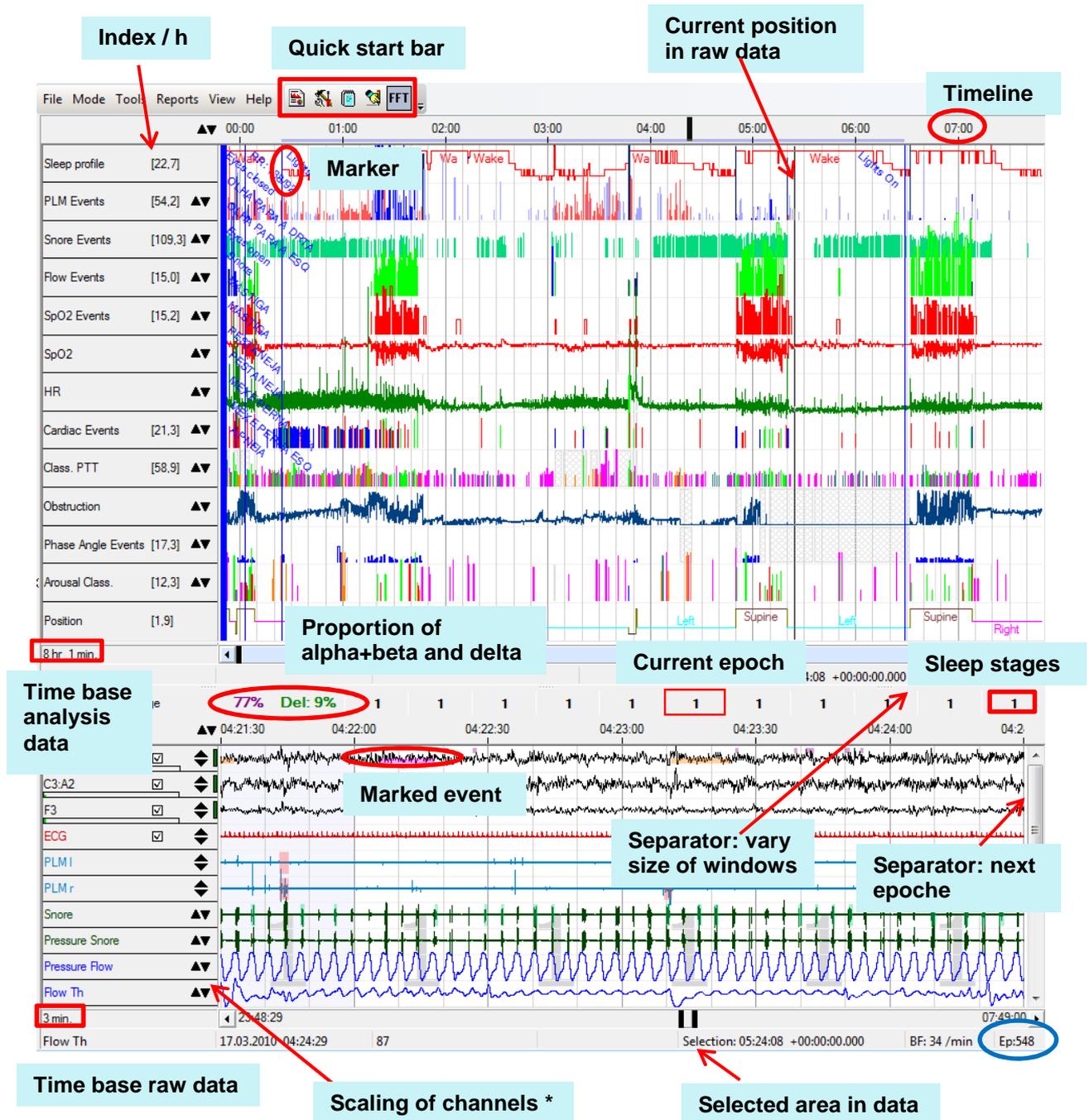


Fig. 8-34 Data Display

(\*) With right click on the scaling arrow of EEG/EOG channels, the scaling of all EEG/EOG channels are changed by the same factor.

Make a double click on “EP: #” at the bottom to jump to a certain epoch.

If you make a double click on a position in the analysis window, the corresponding raw data are shown at the bottom.

If you make a check on  Questionable Stage (in between the analysis and the raw data window), the software jumps to the epochs which had an uncertain sleep stage only while manually editing (see chapter 5.3.1.2).

To have a good view of EEG channels, you can blank out channels which overlap other signals (e.g. EMG bursts) by deactivating the checkbox of the channel (see Fig. 8-35).

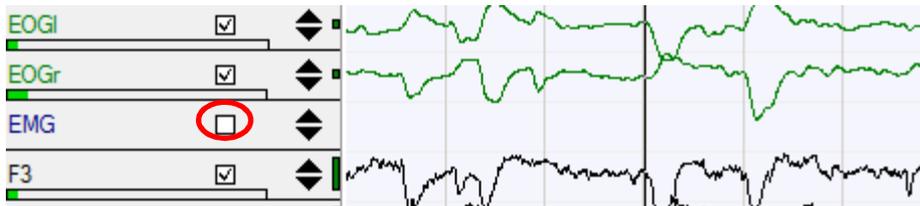


Fig. 8-35 Blank out channels

### Functions of the scrollbar



Fig. 8-36 a) Scroll

b) Change time base

You can scroll the scrollbar just like any other scrollbar in Windows programs. Move your cursor on the grey bar, so that it looks like in (Fig. 8-36 a), press the left mouse button and move the scrollbar to the point in time you wish.

The time base can be set on any value between 1 second and 30 minutes by making a left click on one of the black areas (see Fig. 8-36 b) and adapt the slider. Alternatively, the time base can be adapted by using the up and down arrows of your keyboard or by making a right click in the time base window and choosing a value.

### “Video Window”

If the recording contains a video, you can activate and deactivate the display of the video with “**Video Window**”.

### “Show Markers”

With “**Show Markers**” you can activate or deactivate the display of markers.

### “Interesting Events”

With this function, the display of several events in the analysis window can be activated (e.g. longest desaturation, biggest desaturation, Max HR acceleration, Max HR deceleration, Min. PTT, Max. PTT, minimal SpO<sub>2</sub>, maximal SpO<sub>2</sub>, longest apnoea, Max. PTT drop).

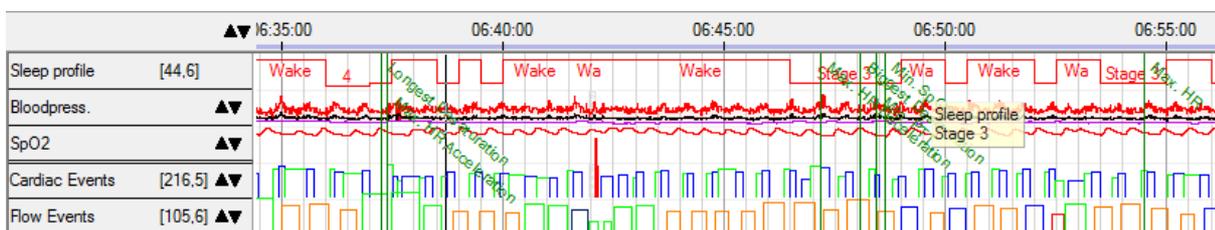


Fig. 8-37 Display of interesting events

**“Show Info Box”**

The info box gives a quick overview over data.

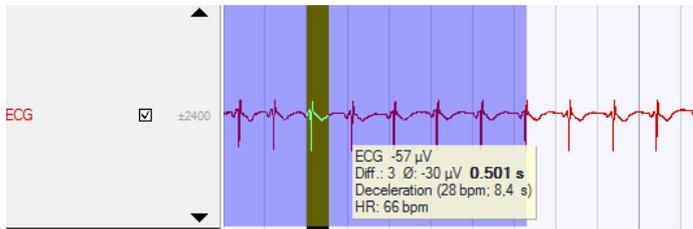


Fig. 8-38 Info Box

In the raw data window, the info box e.g. shows:

identity of channel, data value, events etc. If you mark an area, you will also be shown the difference in value between the first and the last data point of the selection.

If you point your cursor on the channel on the left, you will be shown e.g. minimum and maximum values of the scaling and, in some channels, the mean value of the displayed area.

**“Epoch selection”**

With this selection, the current epoch will be displayed in the background.

**“Show User Area”**

With this function, your own defined areas can be displayed. These are marked in a darker blue in the analysis window.

**“Sleep Profile View”**

The sleep profile can be displayed in an own window with this function.

**Display the Min / Max values for Raw Data / Analysis Channels**

The scaling of the channels can be displayed in the data, if the channel height is too narrow.

**Display filter settings for raw data**

The filter settings can be shown as well:

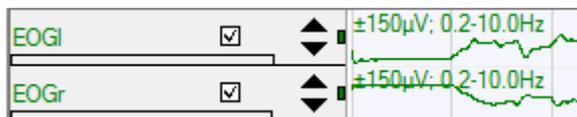


Fig. 8-39 Display of channel min and max and filter settings in the channel

**“Display Index TST”**

The index (number of events per hour of sleep) which is shown in the channel description of the analysis window is calculated in relation to the Time In Bed (TIB) by default. If you choose **“Display Index TST”**, the index will be calculated in relation to the Total Sleep Time (TST).

**“Show Video Track”**

With this function, the video track can be displayed as an analysis channel in the analysis window. Areas of the recording, for which the video is available, will be marked, as well as trim marks.

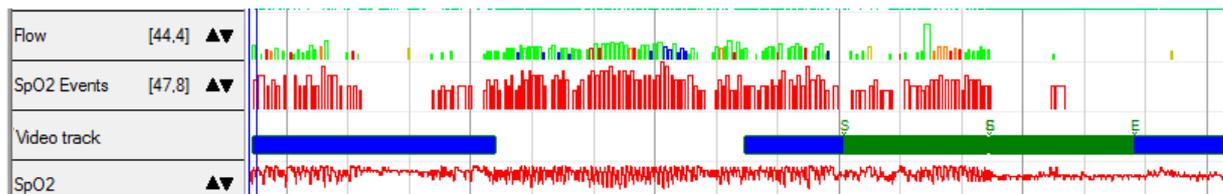


Fig. 8-40 Video track as analysis channel

After marking a period of the video recording with the mouse, you can select the function **“Select Video clip”** in the drop down menu (opens with right click on the video track). Here, you can enter a name for the clip and trim marks for start and end of the clip are set automatically.

With the cropping function of the video within the video window, the video recording can be trimmed at the set markers afterwards (chapter 8.11.2).

**“Label event box”**

If you activate this function, the event type will be displayed in the box of the marked event.

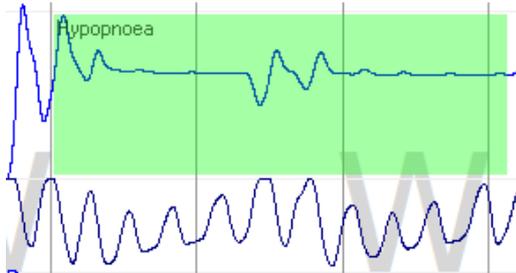


Fig. 8-41 Event box

**8.3.5.4 EEG Head**

If you are using a headbox for your recording (e.g. EEG 10-20, you can re-reference the channels within the analysis mode besides going back to the montage editor (chapter 6). Click on „View“ and „Show EEG Head Window“ in the main menu of DOMINO.

**8.3.5.4.1 EEG Hook-up**

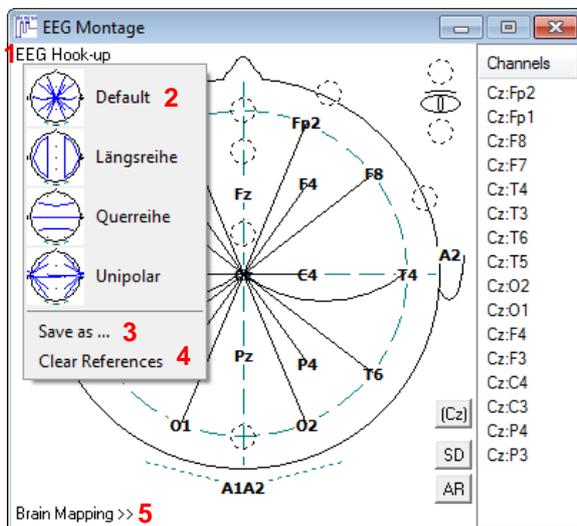


Fig. 8-42 EEG Hook-up

In the **Channels** column on the right you can see the current virtual references. You can add virtual references by connecting the reference nodes on the EEG Head graphically.

Right click on a channel to open a popup menu which allows you to change the display colour of the channel in the raw data window, to invert the reference or to delete the channel.

You can save the profile by clicking “EEG Hook-up” (1) and then on “Save as” (3). You will get the following window:

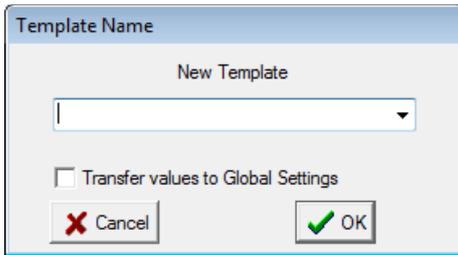


Fig. 8-43 Save profile as

You can either select an already existing template or create a new one. The template can be transferred to the global preferences by activating the checkbox **“Transfer values to Global Settings”**.

**“Clear References”** (4) deletes all defined references at once. The template will not be altered. This function can thus be used for starting new montages

The templates can be chosen in the menu (1 → 2), or by right click in the raw data window (**“EEG Hook-up”**).

**Notice:**

To manage EEG montages choose **“Tools”** → **“Preferences”** → tab **“Raw Data Profiles”** → **“EEG Montage”**.

### 8.3.5.4.2 Brain Mapping

The **“Brain Mapping”** function can be activated in the EEG Hook-up (Fig. 8-42) (5).

You can choose between **“Top”**, **“Left”** and **“Right”** (1).

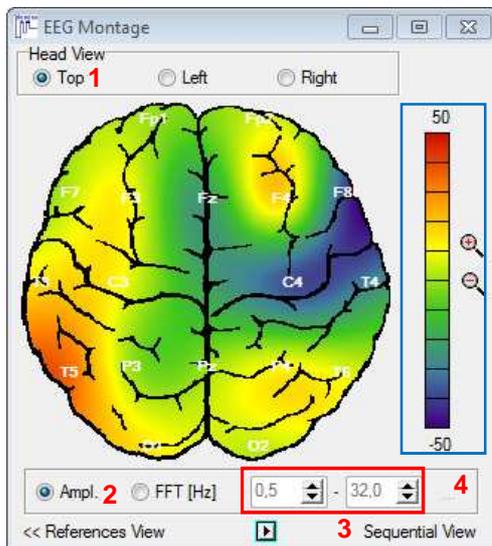


Fig. 8-44 Brain Mapping

For a colour-coded display of potentials, activate **“Ampl.”** (2).

If you marked an area in the raw data window, the first data points of your selection will be taken into account for the display of the brain mapping. A click into the raw data window at a certain time point will take these data into account for the display.

The unit of the scale (framed in blue) is  $\mu\text{V}$ . You can vary the scaling with and .

The distribution on the brain surface is calculated by interpolation algorithms and then colour-coded.

You can also display the values of the FFT analysis. Click on **“FFT (Hz)”** (2). A time frame of 1 second will be analysed. Starting point is the selected point in the raw data.

In the fields framed in red, you can define the frequency range which will be taken into account. Alternatively, you can select predefined frequency ranges with the button (4). Here, you can also save the selected frequency range and delete templates.

The unit of the scaling framed in blue for the FFT module is  $\frac{\mu\text{V}^2}{\text{Hz}}$  (see also chapter 8.7.2.1).

### 8.3.5.4.3 Sequential View

If you want to have a sequential display, click on “**Sequential View**” (3) in the “**Brain Mapping**” module (Fig. 8-44).

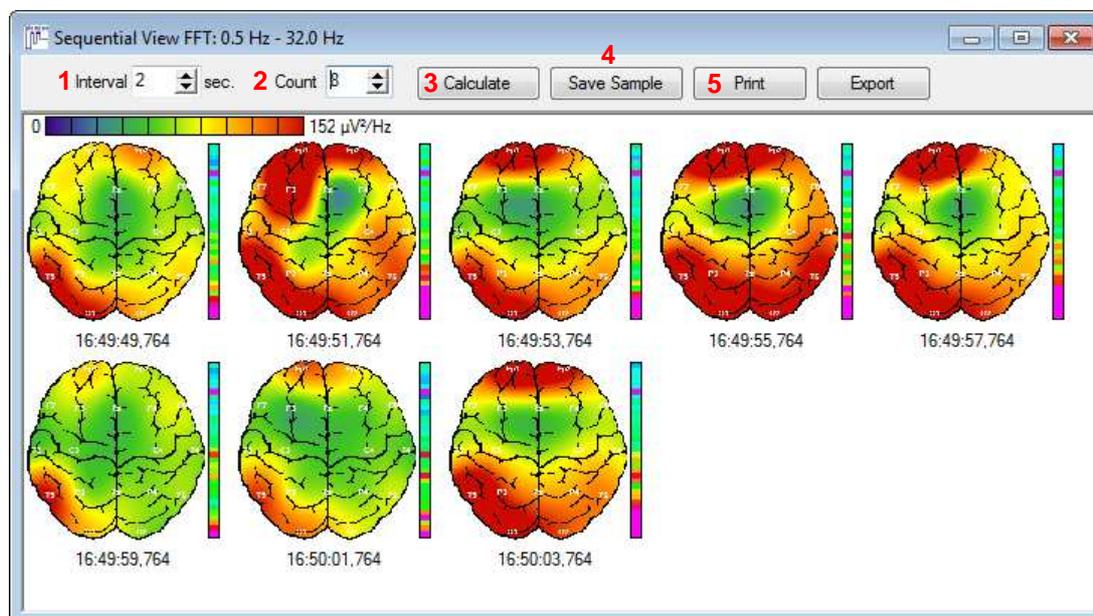


Fig. 8-45 Sequential View

The sequential view will take over the settings from the brain mapping module, like scaling and view of head etc., but these can be changed.

In the field “**Interval**” (1), a constant time increment can be defined. The field “**Count**” (2) defines how many samples will be calculated. Click on “**Calculate**” (3), to calculate samples with the new settings.

You can save the sequence as a Sample (4) (see also chapter 8.9) or print it (5).

### 8.3.6 “Help”

You will find the following menu in this tab:

“**User manual**” opens a file with information on important functions.

“**Contact Service**” will show the contact information of the SOMNOmedics service.

“**About ...**” will show information on the DOMINO version which is installed on your PC.

“**Error Report**” will send an error report to the SOMNOmedics service. This will help in analysing your problem. Chapter 17.3 gives more information on the bug report.

## 8.4 Customize the main menu

Click on the DOMINO symbol in the upper left corner of the DOMINO window (when a recording is open). Select "Customize menu" in the pop-up menu and choose the functions you need.

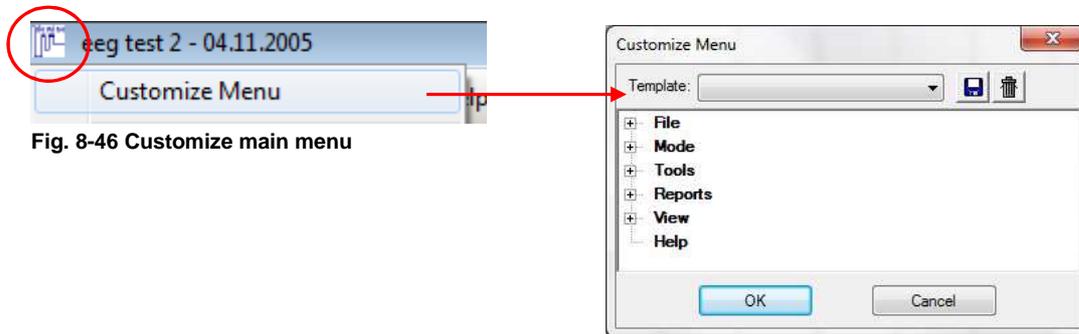


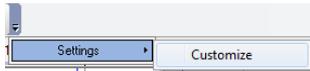
Fig. 8-46 Customize main menu

## 8.5 Toolbar

With the toolbar, standard functions of the software can be called up.



Fig. 8-47 Quick start bar

To customize the quick start bar, click on  and select . The window "Customize Toolbar" opens.

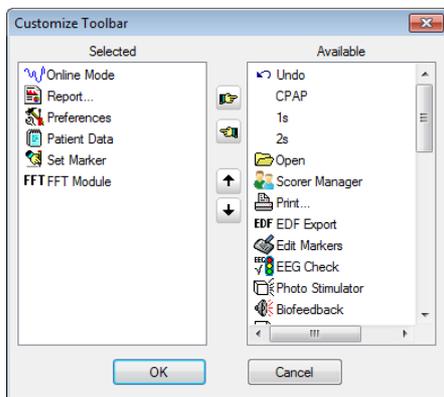


Fig. 8-48 Customize Toolbar

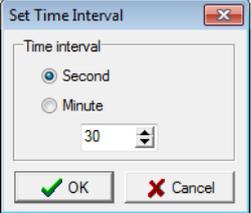
With the buttons functions can be deleted  or added  to the toolbar.



With these buttons, the order of functions can be altered.

Many of the toolbar functions can be activated in the main menu or the pop-up menus in the analysis or raw data window. The following list explains some of the functions.

**Explanations:**

 Report...	<p>Creates and opens a report with settings that were defined as standard in the Global Preferences.</p>
<p>Bi-Level SV CPAP</p>	<p>Opens a window for the manual input of pressure levels for recordings with CPAP-, Bi-Level or SV-devices.</p>
<p>Xs</p>	<p>Here you can select the time base for the display.</p> 
<p>1s .. 5m</p>	<p>Here you can define the time base for the display of data (1s, 2s, 5s, 10s, 30s, 1m, 3m, 5m).</p>
<p>Auto scroll</p>	<p>This function performs an automatic scroll forwards or backwards with a defined speed.</p>
	<p>Photostimulator: Here you can change settings for the photostimulator.</p>
	<p>Biofeedback: If you purchased the optional biofeedback module, you can select channels for the biofeedback here or activate an acoustic or graphic output</p>
	<p>Dependent on the cursor position, the light bulb signals the state (during TIB - grey or not – yellow). This function is also available online, which is especially helpful in MSLT recordings.</p>

## 8.6 Analysis- and Channel settings

### 8.6.1 Channel settings

Besides in the analysis and channel settings in the “**Global Preferences**” (see chapter 5), you can also change these settings when the recording is opened. Make a double click or right click on the name of the channel and choose “**Channel Settings**” (1) (see Fig. 8-49). Alternatively, you can adapt the settings in the menu of DOMINO (→ “Tools” → “Preferences” (see chapter 8.3.3.1).

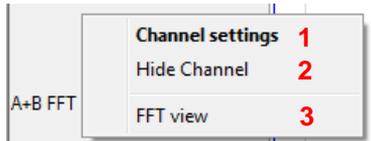


Fig. 8-49 Pop up menu for analysis channels

Settings which were changed in the opened recording are only valid for this recording. If you change parameter settings in the “**Global Preferences**”, these changes are used for recordings in the future.

If you want to reset settings, choose the option  **Reset and reanalyse** in the opening window of the analysis.

The following figures (Fig. 8-50 and Fig. 8-51) show examples of parameter settings.

#### Functions for analysis channels

Here you can change the following parameters:

- Show channel full screen (channel will be shown in the size of the analysis window)
- Show or hide event box in the channel
- Automatic scaling (scaling of channel will be adapted to the maximum value of the displayed time frame)
- Show reference lines in the channel
- Defined values for the scaling of the channel (minimum and maximum)

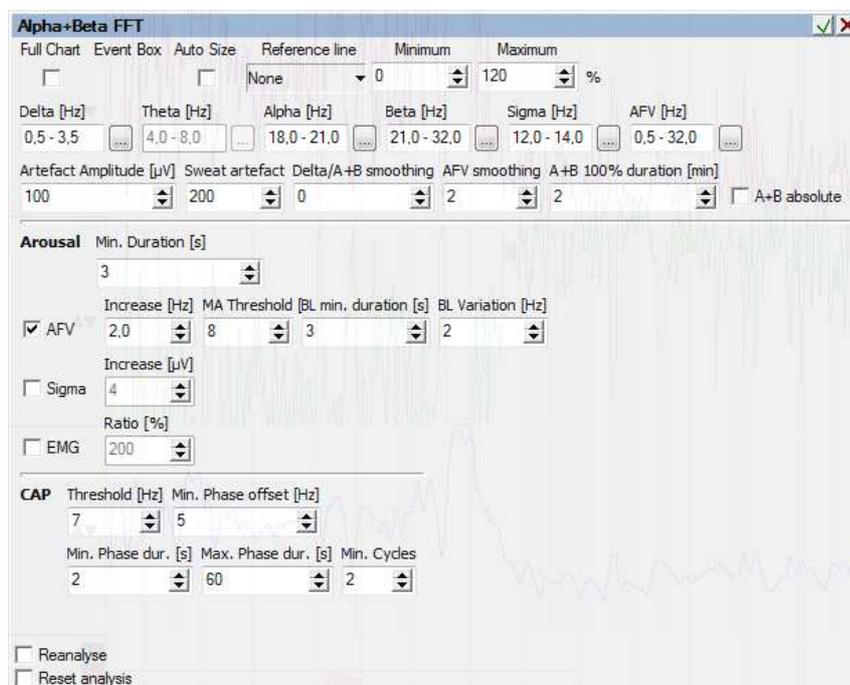


Fig. 8-50 Parameter settings for the analysis channel Alpha+Beta FFT

“**Reanalyse**”: performs a new analysis with new channel settings without deleting manual changes.

“**Reset analysis**”: the analysis will be performed with these settings, manual changes will be deleted.

Besides the channel settings, you can hide channels (2) or delete events in the channel (3) by using the popup-menu (Fig. 8-49).

### Functions of raw data channels

Here, you can define the following parameters:

- Colour-coding of the signals
- Show channel in full screen (channel will be displayed in the size of the raw data window)
- Automatic Scaling (scaling of the channel will be adapted to the maximum value of the time frame)
- Invert signal
- Show reference lines in the channel
- Defined values for the scaling of the channel (minimum and maximum)

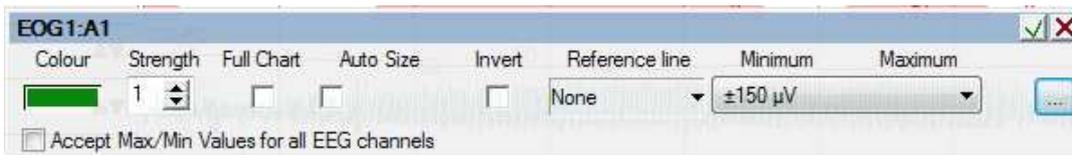


Fig. 8-51 Parameter settings for EOG1:A1, raw data

By activating the checkbox “**Accept Max/Min Values for all EEG channels**” the minimum and maximum values will be adopted for all EOG/EEG channels.

In the raw data, you can also change the display filter settings for the channels, activate the “**Clear Signal**” function and choose the “**Differential View**” (chapter 8.6.2). Make a right click on the name of the channel to see this menu:

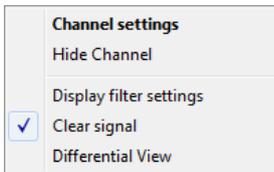


Fig. 8-52 Menu

You can also change the positioning of the raw data curve within the raw data channel. Press on CTRL and click on ▲ ▼. The signal curve will be shifted up or down in the raw data channel.

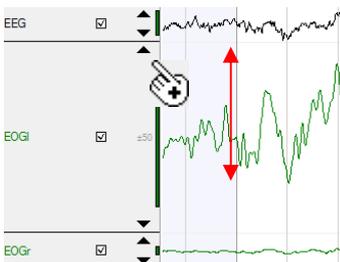


Fig. 8-53 Change positioning of raw data curve

### 8.6.2 Differential View

If a channel is displayed as differential view, you will get a different menu in the channel settings (see Fig. 8-54):

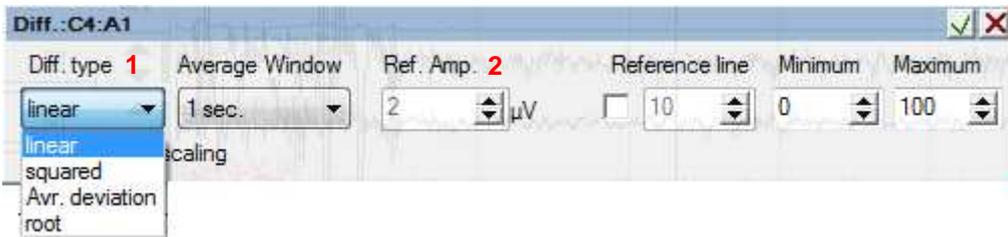


Fig. 8-54 Channel settings in the differential view

You can choose the differential type in the menu “**Diff. type**” (Fig. 8-54) (1):

In the linear mode, the absolute difference between two consecutive data points is calculated for pairs of data points in a time frame of 1 second. The mean of these calculated values will be plotted in the raw data window. This will be repeated for each second.

In the quadratic mode, the difference between two consecutive data points is calculated and divided by the value defined by “**Ref. Amp.**” (2). The result will be squared. Again, the mean of values for one second is calculated and plotted in the raw data window. This will be repeated for each second.

The average deviation (Avr. Deviation) is equal to the double standard deviation of recorded values of the channel for a time frame of 0.25 seconds each.

### 8.6.3 Display filter settings

“**Display filter settings**” opens the following window:

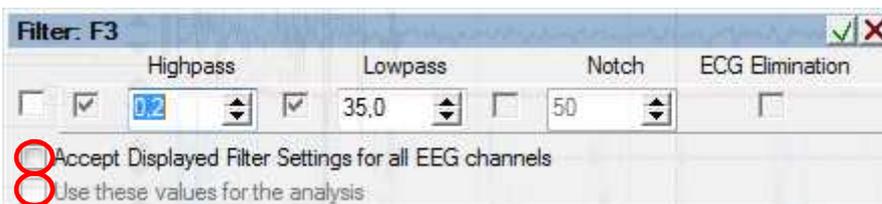


Fig. 8-55 Display filter settings

Activating the checkbox activates the display filters. When activated, you can select the type of filter, filter limits or activate the ECG elimination for the channel.

By activating the checkbox “**Accept Displayed Filter Settings for all EEG channels**” the filter settings will be adopted for the EEG channels.

If you activate “**Use these values for the analysis**”, all analyses which have this channel as source will be re-analysed. These settings will also be used for the re-analysis of the sleep profile.

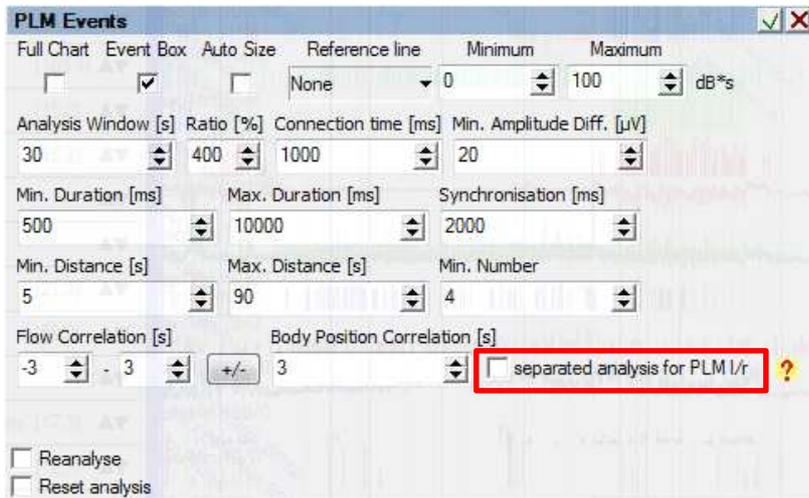
Confirm your changes with .

**Notice:** Changes in the display filter settings will be deleted when closing the recording.

### 8.6.4 Separate analysis for PLM left and right

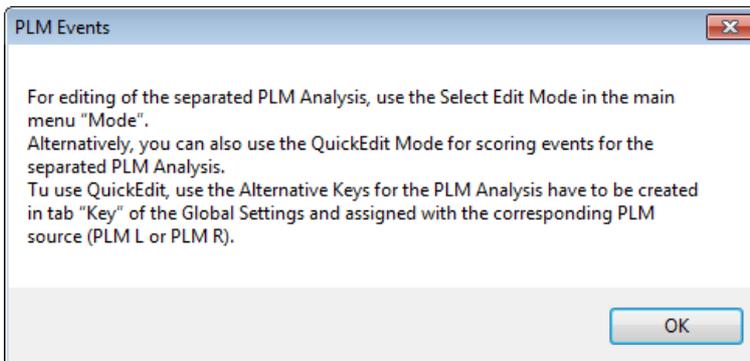
Additionally to the PLM analysis, PLMs can be analysed separately for the left and right leg.

The separate PLM analysis for right and left leg can be activated by clicking on the checkbox “Separated analysis for PLM l/r” in the channel settings of the analysis channel “PLM Events”.



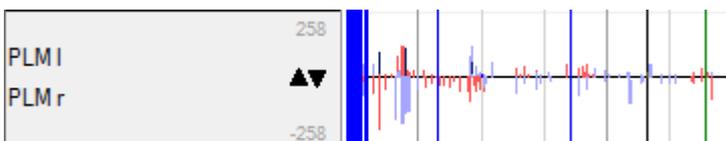
**Fig. 8-56 Separate PLM analysis for left and right leg**

You will get the following info box, which informs you how events for the differential PLM analysis can be edited manually.



**Fig. 8-57 Information on editing separate PLM events for left and right leg manually**

Afterwards, you can select the channels PLM l and PLM r for display in the analysis window.



**Fig. 8-58 Analysis channel PLM l/r**

The editing of events in the channel of the separated PLM analysis is easiest when you choose the select edit mode. Alternatively, events for the differential PLM analysis can be edited via the Quick edit mode. In order to do so, keys on your keyboard have to be defined (see chapter 5.9).

The results of the separated PLM analysis are available for the report (see chapter 11.3.9). Choose “PLM l/r” for the PLM report.

### 8.6.5 Zero Point Calibration

For the raw data channel “PT Flow” the popup menu offer two additional points: “Null Value Calibration” und “PT Calibration”. To perform a zero-point calibration, mark several seconds in the channel PT Flow and choose “Null Value Calibration”. A correction of the offset will be conducted subsequently. The Zero Point Calibration has to be performed in advance of any recording.

For calibration of the pneumotachograph, apply a defined volume with a pump at least 10 times with a calibration pump. Mark the applied blows with your mouse afterwards and choose “PT Calibration”. You will be asked to define the applied volume. The calculation of breath volume will then be performed with the calibrated values. The calibration of the pneumotachograph is necessary only once.

**Please note:** The Zero Point Calibration as well as the PT-Calibration must be performed without an applied PAP-pressure. For the Zero Point Calibration, do also not apply a breathing signal.

### 8.6.6 Unit for calculation of the leakage

When using a pneumotachograph, the leakage of the mask can be calculated. The leakage can be defined in [ml/s], in [l/min] or [l/s]. The unit can be defined in the Global Preferences, as well as in the channel settings of the breathing volume analysis.

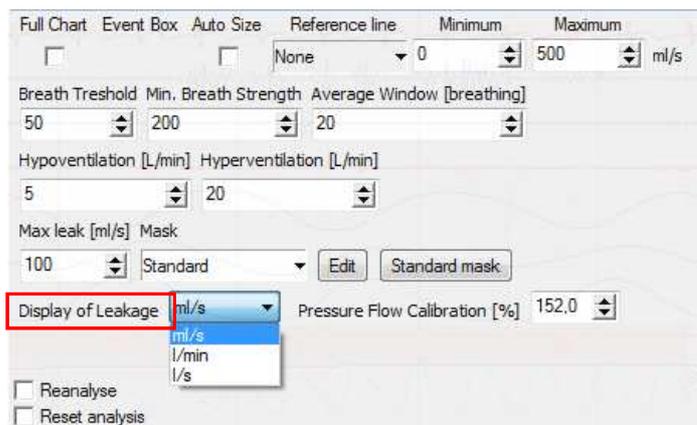


Fig. 8-59 Leakage

## 8.7 Functions of the popup windows

A right mouse click in the analysis or raw data window opens a popup menu.

### 8.7.1 Functions in the analysis window

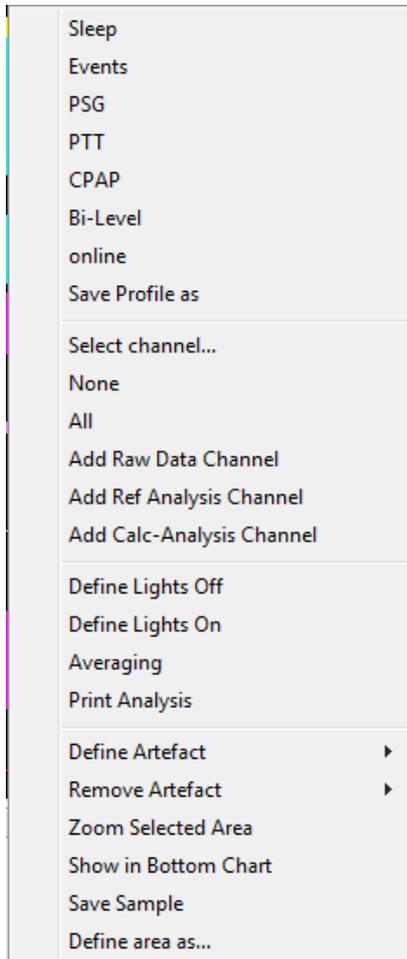


Fig. 8-60 Popup menu analysis window

- 1) “**Sleep**”, “**Events**”, “**PSG**”, “**PTT**”, “**CPAP**”, “**Bi-Level**” and “**online**” open the corresponding analysis profile, which was defined in the “**Global Preferences**” (see chapter 5.8).
- 2) “**Save Profile as**” saves the current analysis display as analysis profile.

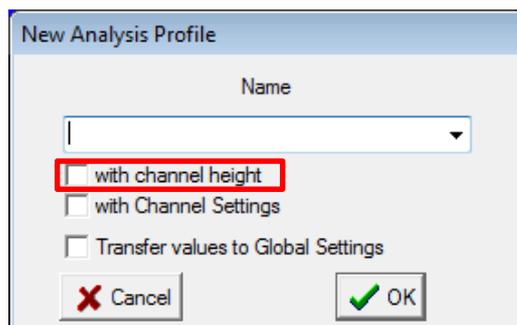


Fig. 8-61 Save analysis profile

Define the name of the analysis profile and click on “**OK**”. If you want the analysis profile to be saved in the Global Preferences, choose “**Transfer values to Global Settings**”. Additionally, you can save the information on channel height.

- 3) “**Select channel**” offers you a menu in which you can select channels for display:

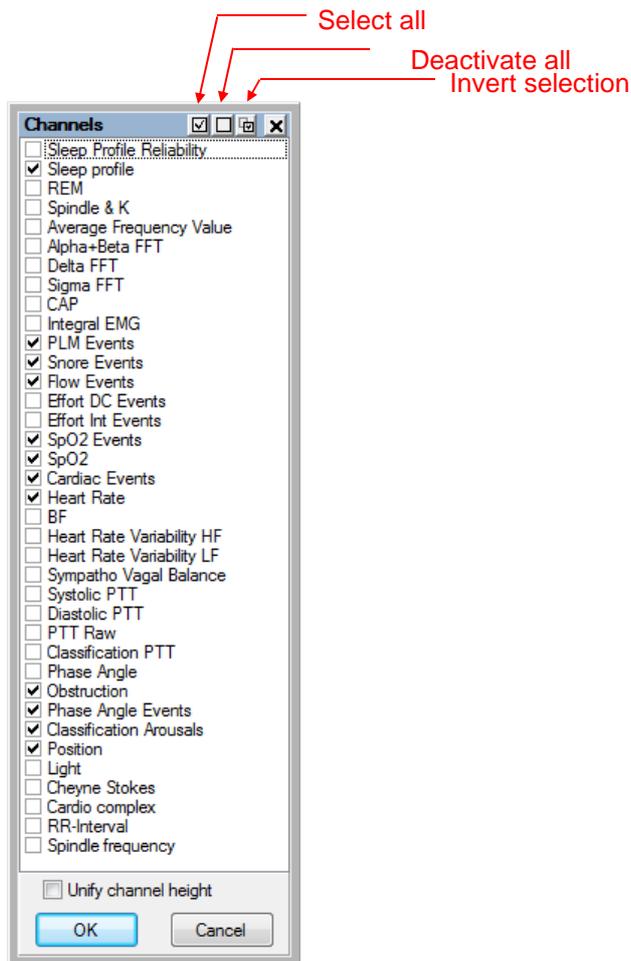


Fig. 8-62 Channel selection in the analysis window

Activation of the checkbox “**Unify channel height**” will display all channels with the same height.

- 4) If you click on “**None**” none of the channels will be displayed.
- 5) If you click on “**All**” any available analysis channel will be displayed.
- 6) “**Add Raw Data Channel**” adds a raw data channel in the analysis window. Alternatively, raw data channels can be added to the analysis window by drag & drop.
- 7) “**Add Ref/Calc-Analysis Channel**”: Here you can define the mode of calculation (addition, subtraction, multiplication, division) for two channels. Activate the checkbox “**Auto Name**” defines a standard name for the new reference channel consisting of the name of the two referenced channels. Confirm with “**OK**”, the window will be closed and the new generated channel will be displayed in the analysis window.  
The referencing of Sigma FFT and Integral EMG offers a tool for the REM analysis.

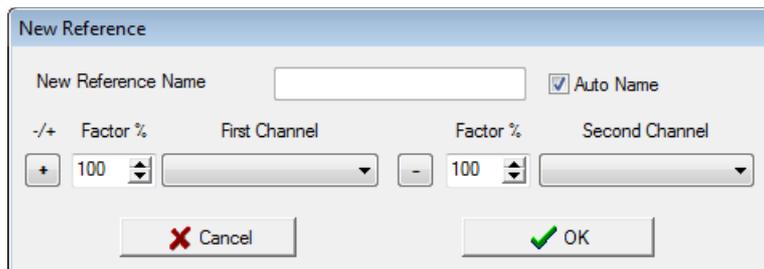


Fig. 8-63 Add Ref channel

- 8) For definition of TIB, the “**Lights on**”- and “**Lights off**”- markers can also be set in the analysis window. Reports only include the TIB. For a quick overview, the TIB is displayed in the display of the recording with a grey bar.

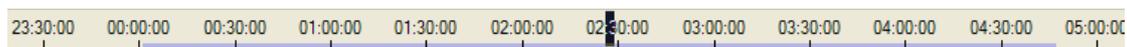


Fig. 8-64 Display of the TIB

- 9) “**Averaging**”: Repeating trends in the signal can be identified more easily (see chapter 8.7.2.2).

- 10) „**Print**“ prints the current display of the analysis window.

In order to use the following function, mark an area in the recording and then perform a right click:

- 11) “**Define Artefact**” defines the current selection as global artefact (in all channels) or as local artefact (for only one channel).
- 12) “**Remove Artefact**” deletes artefacts in the selected area.
- 13) “**Zoom Selected Area**” zooms the selected area to the width of the analysis window.
- 14) “**Show in Bottom Chart**” displays the corresponding raw data of the selected area in the raw data window.
- 15) “**Save Sample**” saves the currently selected area as a sample (see also chapter 8.9).
- 16) “**Define area as...**” assigns a label for the selected area (see also chapter 8.10).

### 8.7.2 Functions in the raw data window

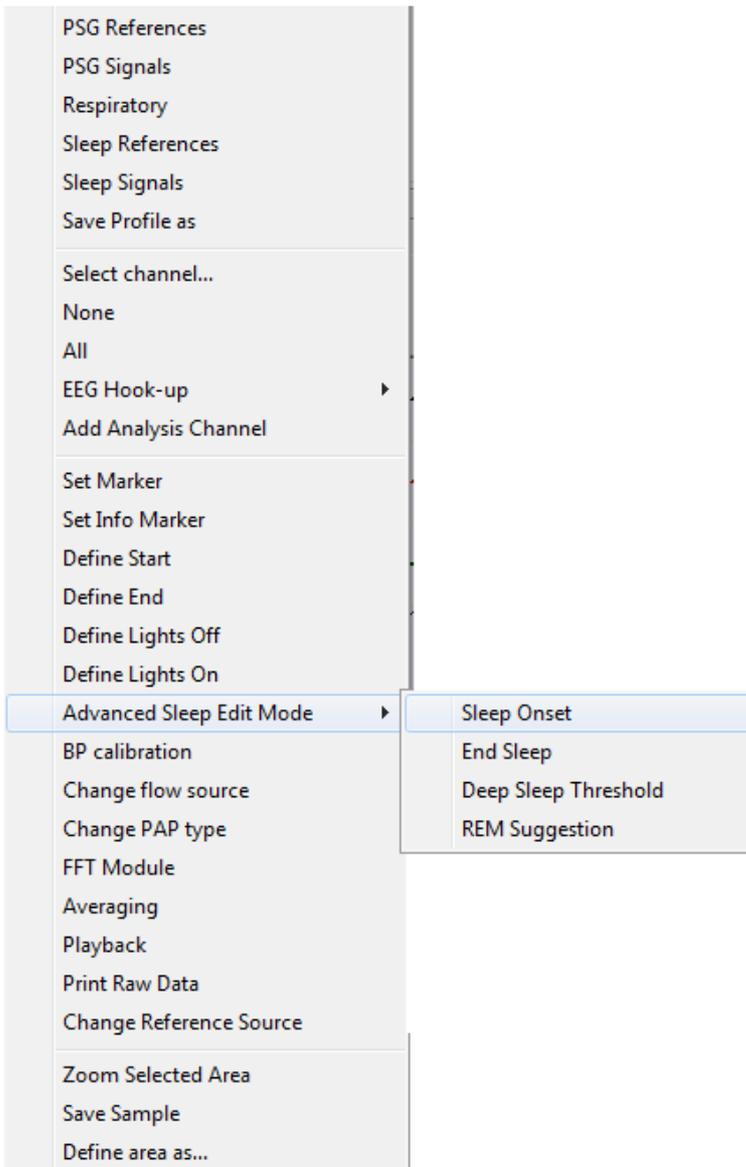


Fig. 8-65 Popup menu raw data

- 1) The profiles from “**PSG References**” to “**Sleep Signals**” select the corresponding raw data profile which was defined in the “**Global Preferences**” (see chapter 5.7).
- 2) “**Save Profile as**” saves the current raw data display as raw data profile.

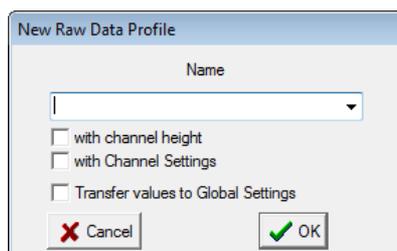


Fig. 8-66 Save raw data profile

Type in a name for the raw data profile and click on “**OK**”. If you want to save the raw data profile in the global settings, activate the checkbox “**Transfer values to Global Settings**”.

- 3) With “**Select channel**” you can define a selection of channels for display.

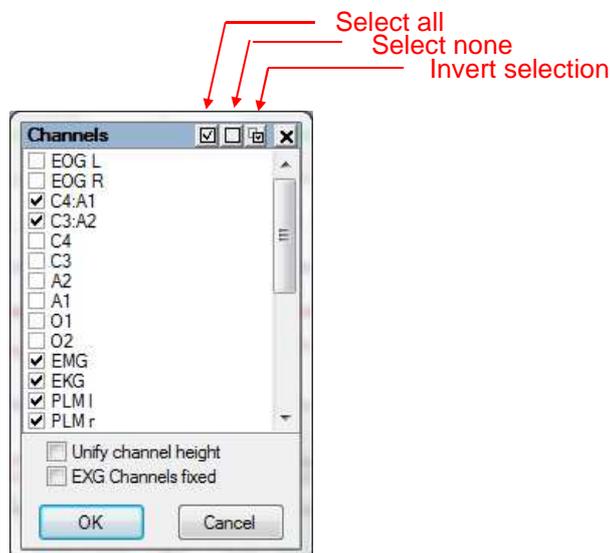


Fig. 8-67 Channel selection for raw data

Activating the checkbox “**Unify channel height**” displays all channels in the same height.

Activating the checkbox “**EXG Channels fixed**” will keep the channel height of EXG channels. This guarantees a constant visual impression for e.g. EEG channels if additional channels are added to the window or are deleted.

- 4) “**None**” deselects all raw data channels.
- 5) “**All**” selects all available raw data channels.
- 6) “**EEG Hook-up**” displays the EEG references which were defined in the EEG montage (see chapter 6).
- 7) “**Add Analysis Channel**” adds analysis channels to the raw data window. This channel can be saved together with the raw data channels as raw data profile (“**Save profile as**”) alternatively, analysis channels can be added to the raw data window by drag & drop.
- 8) “**Set Marker**” opens the marker window (see chapter 8.3.3.3).
- 9) “**Set Info Marker**” opens a window for entering text for a marker. Confirming with “**OK**” will set the marker at the time point in the recording, where you performed the right click to open the menu.
- 10) “**Define Start**” and “**Define End**” sets the corresponding marker in the recording and defines start and end of the recording. Areas which are not within these time points will not be considered in the analysis! Markers can be deleted in “**Tools**” → “**Edit markers**”.
- 11) “**Define Lights Off**” and “**Define Lights On**” sets the corresponding marker and defines the relevant time points for the calculation of TIB and the sleeping latencies.

In order to use the following function, you must choose the Edit Mode (**Mode** → **Edit Mode**):

- 12) With the “**Advanced Sleep Edit Mode**” the sleep profile can be edited in a time efficient way. In this mode, you can define thresholds for the channels A+B FFT, Delta FFT and I-EMG (see

also chapter 9.2). The time points “**Sleep Onset**” and “**End Sleep**” can only be set once for this analysis. The time frame before sleep onset and the time frame after End sleep will be defined as Wake. The “**Deep Sleep Threshold**” can be manually set for the transition between sleep stage 2 and 3. All epochs with a high delta proportion will be scored as sleep stage 3 or 4.

- 13) With “**BD calibration**” you can enter the manually measured blood pressure values. This is a prerequisite so the software can calculate the blood pressure for the whole recording (see chapter 16.3).
- 14) With “**Change flow source**” you can change the source for the flow analysis during the recording (see also Split-Night-Function in chapter 7.4).
- 15) With “**Change PAP type**” you can define a change in therapy device. This will be considered for the pressure analysis.
- 16) “**FFT Module**” displays the frequency percentages of a selected signal (see also chapter 8.7.2.1).
- 17) “**Averaging**”: repeating trends in the signal can be easily identified (see also chapter 8.7.2.2).
- 18) With “**Playback**” you can acoustically play back the raw data in different speeds. This function e.g. allows an easy analysis and detection of EEG patterns such as spike bursts. For

an acoustic playback click on . The activation of the acoustic playback will be depicted as an active loudspeaker .

Please note: The speed of playback must be chosen so that speed\*sampling rate equal at least 512 Hz. For EEG channels with a sampling rate of 128 Hz, the playback speed must be set to at least 5-times. The volume can be varied on the right side with the scrollbar. Click on “Play” to start the playback.

Interesting sequences in the raw data can be selected with the cursor and be played back in a loop by clicking on the “Loop”-Button .

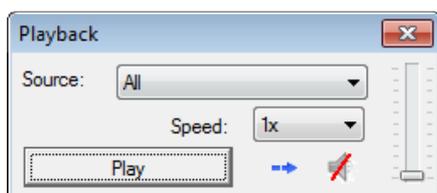


Fig. 8-68 Playback of EEG signals

- 19) “**Print Raw Data**” prints the currently displayed raw data.
- 20) “**Change Reference Source**” re-references channels which are referenced on A1, A2 or A1:A2. This function helps to eliminate ECG artefacts in A1 and A2 (see chapter 8.8).

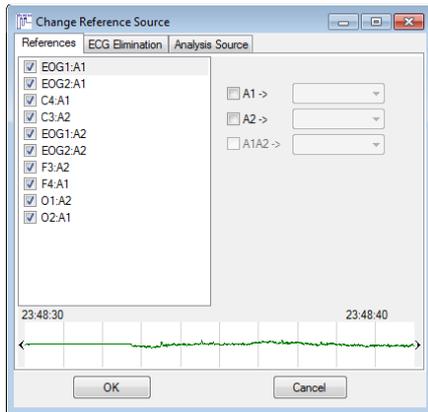


Fig. 8-69 Change reference source

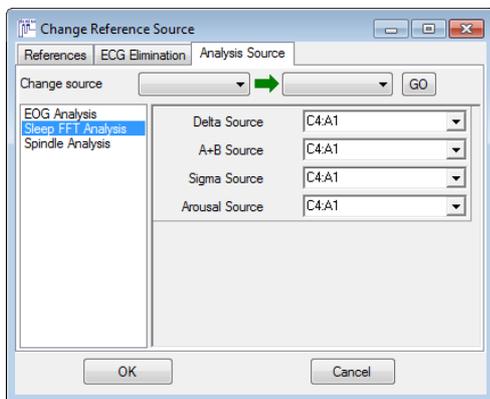
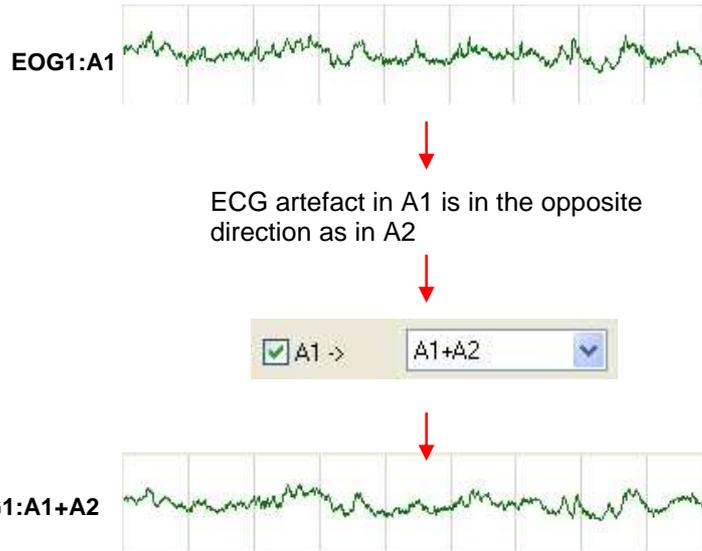


Fig. 8-70 Change reference source

In the tab “**Analysis Source**” you can change the sources for EOG-, Sleep FFT- and Spindle analysis.

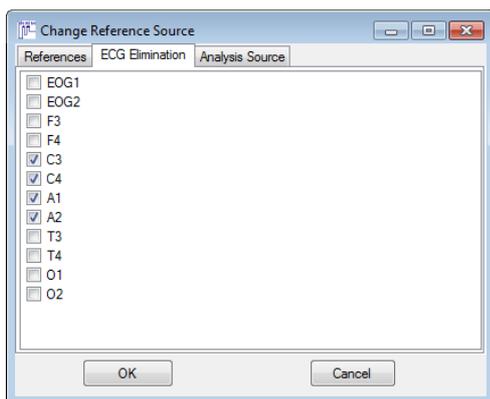


Fig. 8-71 ECG elimination

In the tab “**ECG Elimination**” you can activate the wavelet filter for ECG elimination for the EEG channels.

For the following functions, you have to select a sequence in the raw data with your cursor and then perform a right click:

- 21) “**Zoom Selected Area**” zooms the selected area to the width of the raw data window.
- 22) “**Save Sample**” saves the current selection as sample (see also chapter 8.9) for later usage in the report or filing in the database.

- 23) “Define area as...” saves the raw data of the current selection for data export (see chapter 8.10 and 13.1).

### 8.7.2.1 FFT Module

The FFT module displays the frequency components of a defined signal for a selected sequence. Select a sequence with the cursor in the raw data. Open the popup menu by right click and choose the FFT module. Select the signal of interest and move over the time window with your cursor to display changes in the frequency components over time.

The following figure shows the frequency distribution of the C4:A1 channel for the selected sequence. For the 3-dimensional view, the time is on the Z-axis, frequency is on the X-axis and amplitude is on the Y-axis as in 2D.

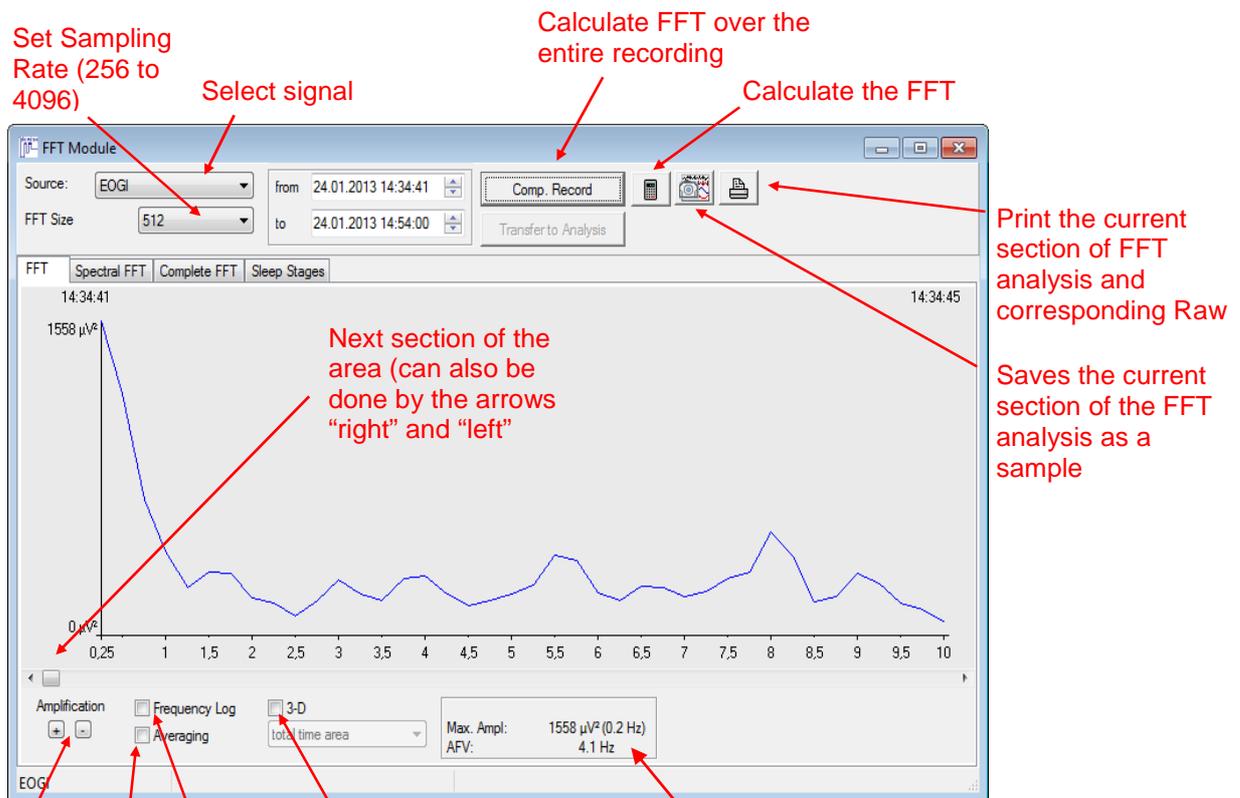
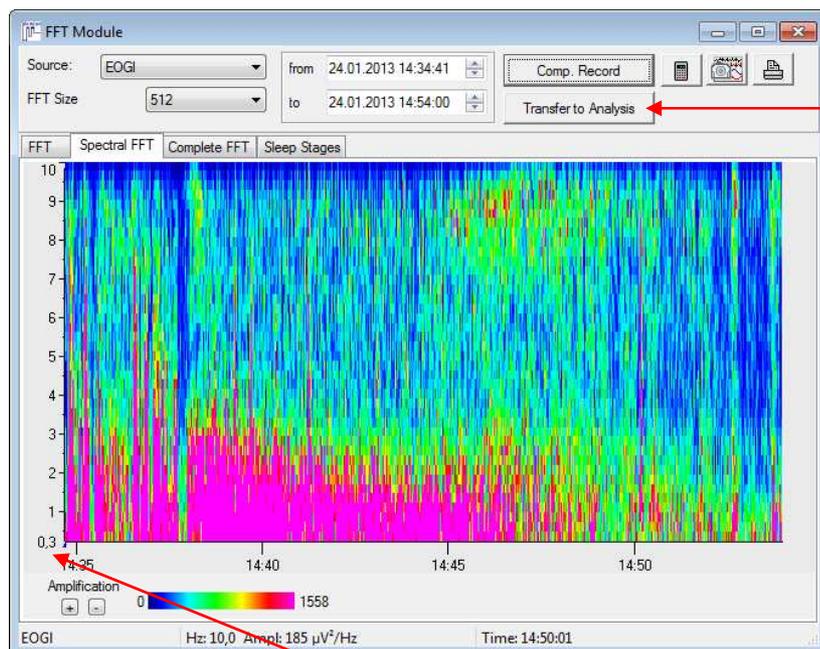


Fig. 8-72 FFT module

Select the **Spectral FFT** tab to get a spectral diagram of the signal over the selected period.



There's the option to transfer the spectral FFT as channel to the analysis window.

Fig. 8-73 Spectral display

It is possible to select and zoom in on a specific frequency range by marking a section on the frequency axis (hold left mouse button and drag up or down). Right click on the graph to return to the full default display.

To display defined frequency bands over a defined period of time, please select the menu “**Complete FFT**”.

Please see the following figure (Fig. 8-74) for the frequency range of the frequency bands Alpha (blue), Beta (red), Delta (green) and Theta (black). It is also possible to read the percentages of single parameters at specific moments within the defined section by moving your mouse over the section. The information will be shown in a yellow information window.

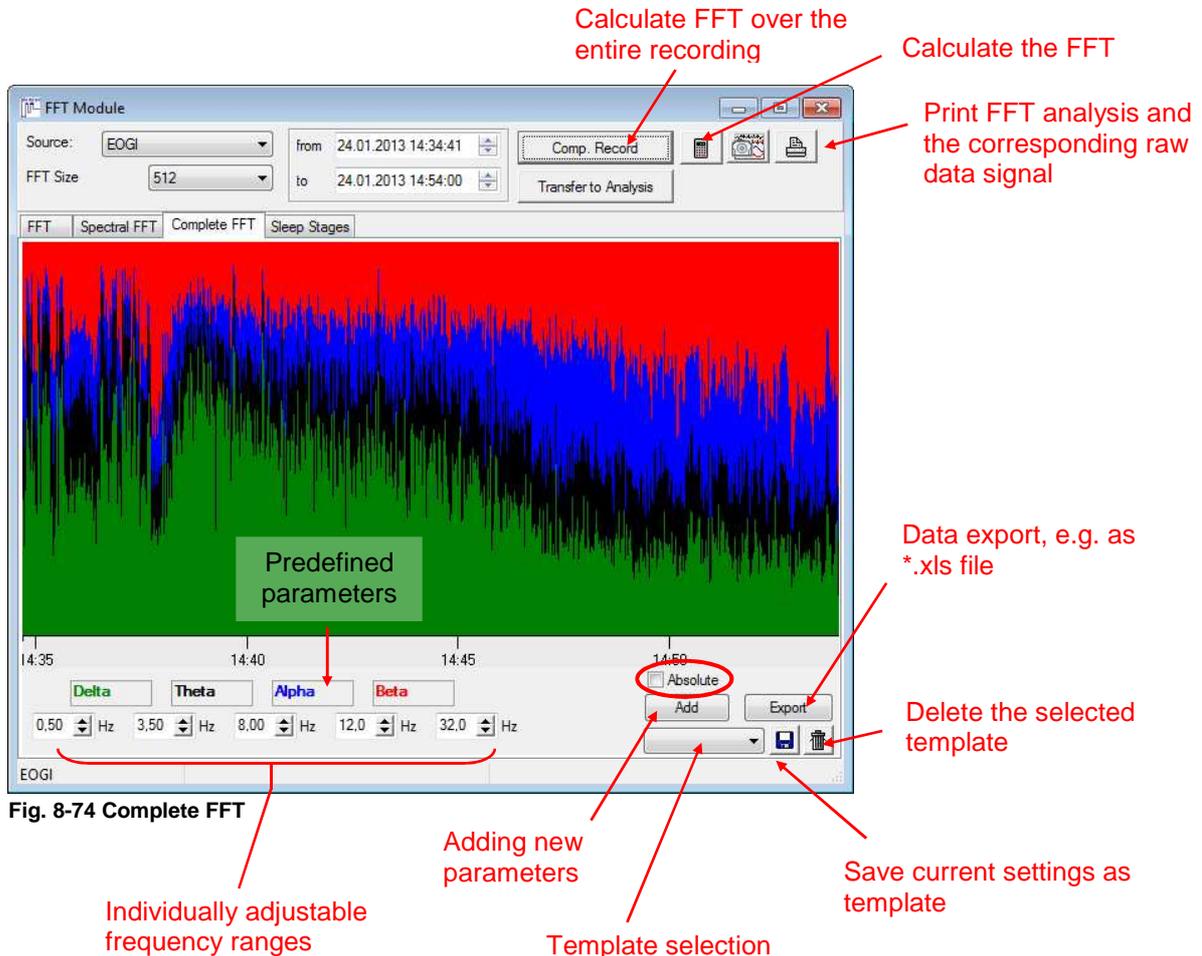


Fig. 8-74 Complete FFT

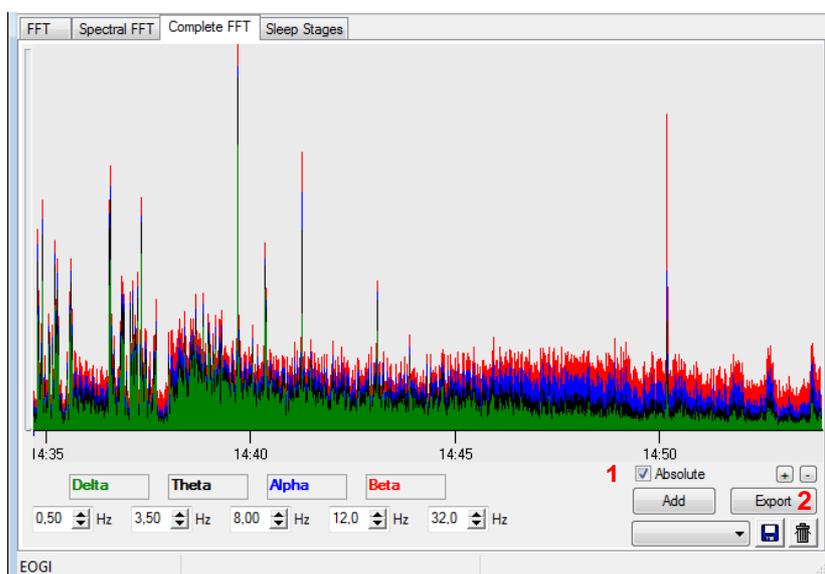


Fig. 8-75 Graphic display of the Absolute Values

Select **Absolute (1)** to see the absolute values.

Click on **Export (2)** to save the data of the selected range as \*.csv (ASCII, compatible with Excel) or as SPSS file.

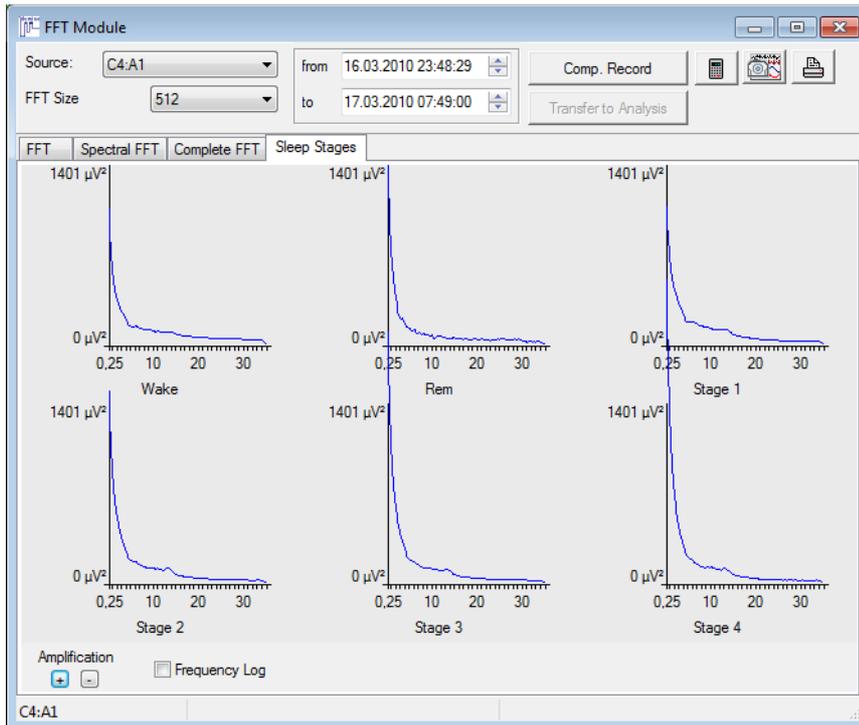


Fig. 8-76 FFT module Sleep Stages

### 8.7.2.2 Averaging

Repeated trends in the signal which cannot clearly be identified in the raw data, can be easily detected after averaging. The averaging function can be opened in the analysis or raw data window by right click → Averaging.

The selection of the time frame can be made by defining the time window (1), by markers in the recording (2) or by choosing events (3).

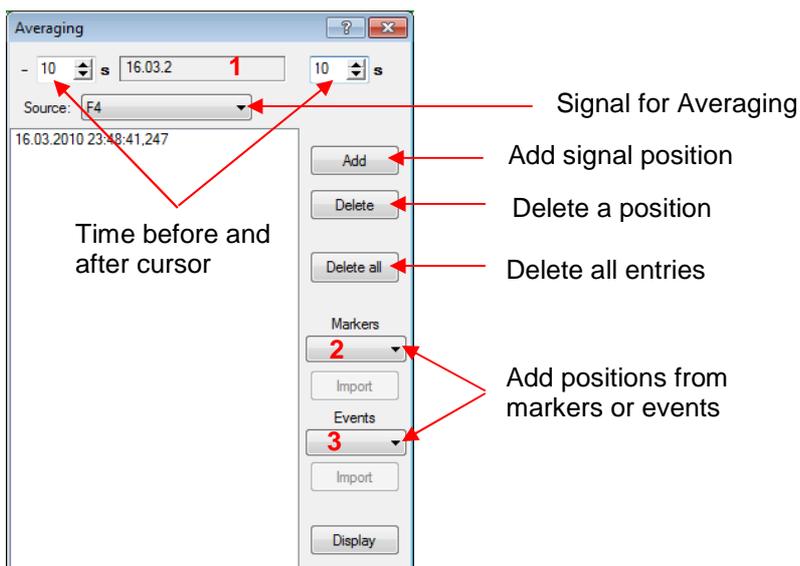


Fig. 8-77 Function Averaging

Choose a relevant time point in the raw data with your cursor and click on “Add”. The time point of the cursor position will be added. Repeat for all interesting time frames. Then click on “Display” to show the calculated curves.

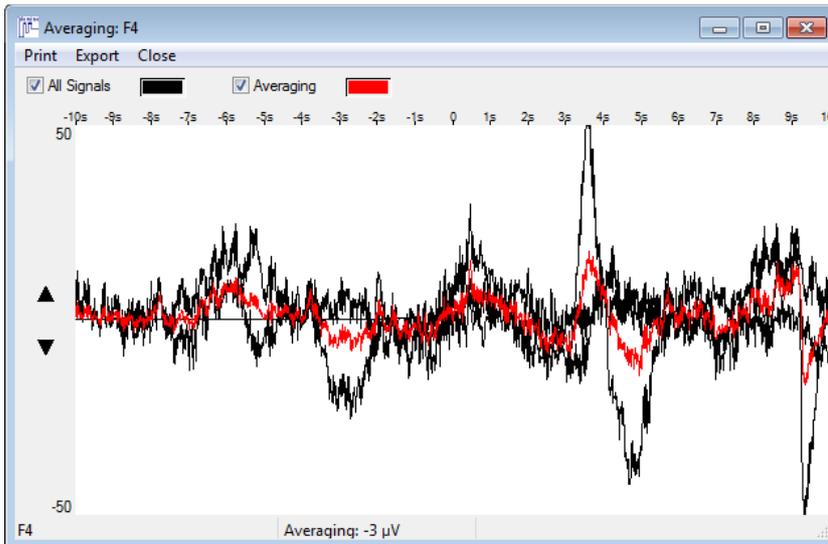


Fig. 8-78 Display of the averaging curve

In Fig. 8-78 above, all selected signals of the defined selections and the resulting averaged curve are displayed. Use the check marks to activate or deactivate the required information. With both boxes checked, all the signals and the averaged waveform are shown. The curves can be exported as a picture or data file (Excel) via the “**Export**” menu or printed via “**Print**”.

Additionally the averaging value is displayed in the info box.

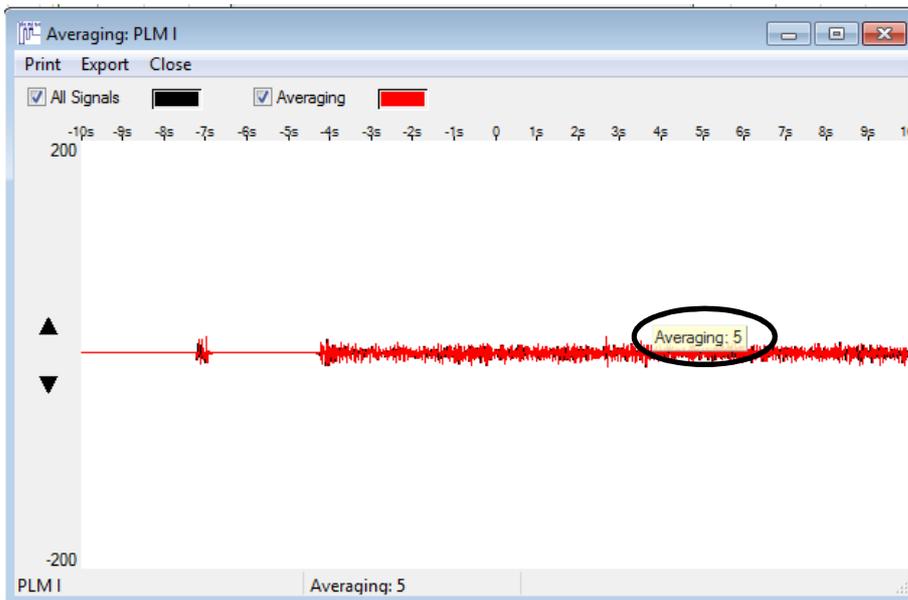


Fig. 8-79 Info window Averaging

## 8.8 Automated ECG elimination

If electrodes for the EEG recording were not appropriately applied, ECG artefacts can be visible in the EEG signals which complicate the visual or automated analysis of EEG signals. For the automated elimination of ECG artefacts in the EEG, an ECG elimination based on wavelet transformation is available.

There are three different ways how to activate the ECG elimination:

1. ECG elimination in the filter settings: open the local settings in the recording (→ Tools → Preferences) and select the tab “Filter”. Here, you can activate the ECG elimination for EEG or EMG channels by activating the corresponding checkbox. Confirm with OK and the signals will be calculated anew.

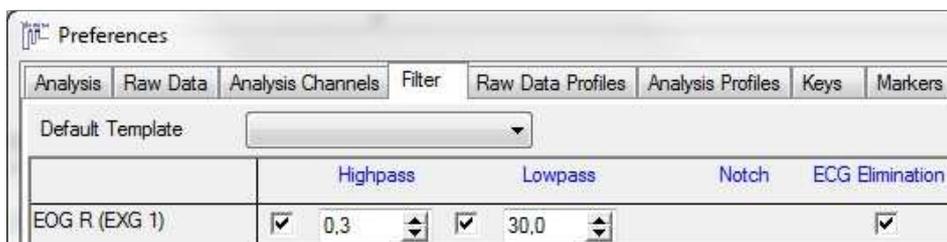


Fig. 8-80 ECG elimination

You can activate the ECG elimination by default in the Global Preferences. In the DOMINO software, the ECG elimination is activated by default for the channels A1 and A2!

2. Activate the ECG elimination in the display filter settings of the raw data channels: Make a right click on the channel name and select “**Display filter settings**”.

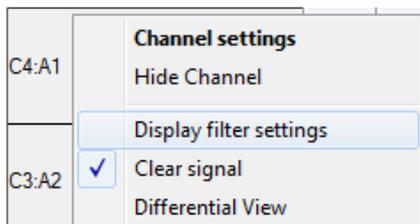


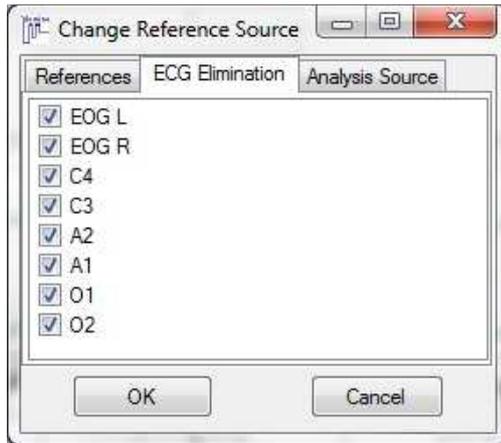
Fig. 8-81 Channel menu

The menu for the filter settings will open. Activate the checkbox “**ECG Elimination**” and confirm by clicking on the green check mark. If the sleep profile should be calculated anew with the ECG elimination, activate the checkbox “**Use these values for the analysis**”.



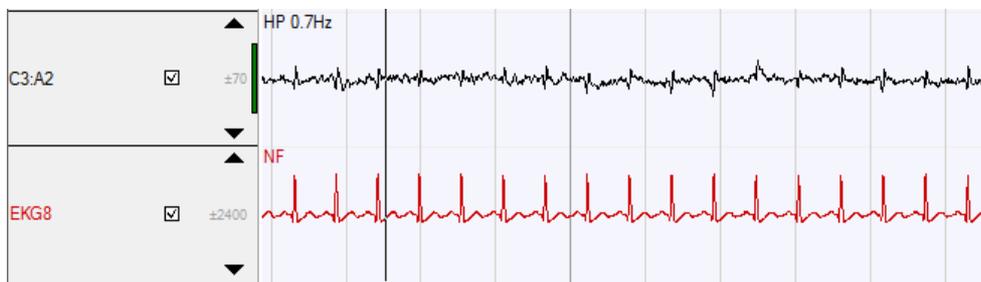
Fig. 8-82 ECG elimination in the display filter settings

3. Activate the ECG elimination via “Change Reference Source”: Open the popup menu of the raw data window with right click and choose “**Change Reference Source**”. In the tab “ECG Elimination” you can choose for which channels the ECG elimination should be calculated.

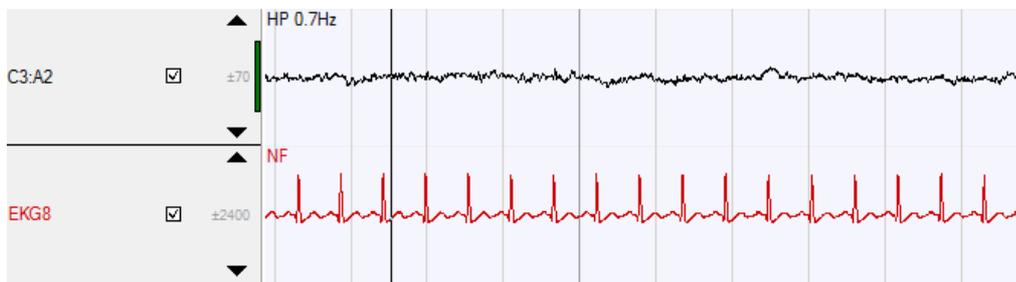


**Fig. 8-83 ECG elimination**

Examples for EEG signals with and without ECG elimination:



**Fig. 8-84 EEG signal with EKG artefacts, no ECG elimination**



**Fig. 8-85 EEG signal after wavelet elimination**

## 8.9 Generating and editing samples

Interesting episodes of the raw data or analysis data can be selected and be saved as „samples“. These samples can later be included in the report. Samples are automatically saved to the database (if database is available).

### Saving samples:

To save samples, select the episode in the raw data or analysis data. Then, make a right click in the selection and choose **“Save Sample”** in the menu. Type in a name for the sample and click on **“OK”**.

### Delete samples:

To delete samples, choose **“Tools”** → **“Edit Samples”** in the main menu. A list with all saved samples will pop up (Fig. 8-86). Select samples you would like to delete and click on **“Delete”**.

### Print samples:

To print samples, choose **“Tools”** → **“Edit Samples”**. Select samples and click on **“Print”** in the popup window.

To rename samples, click on the sample and rename it.

**“Display”** will show the corresponding episode in the raw data or analysis data.

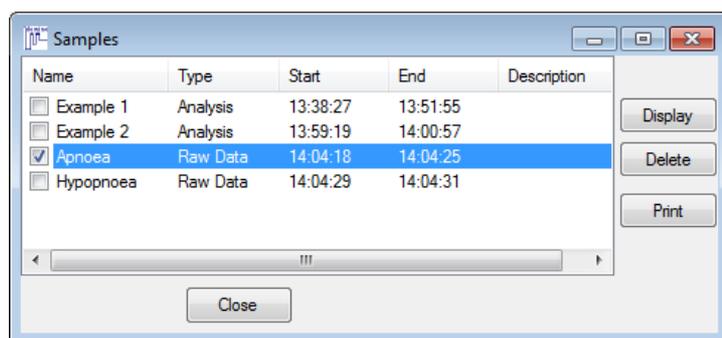


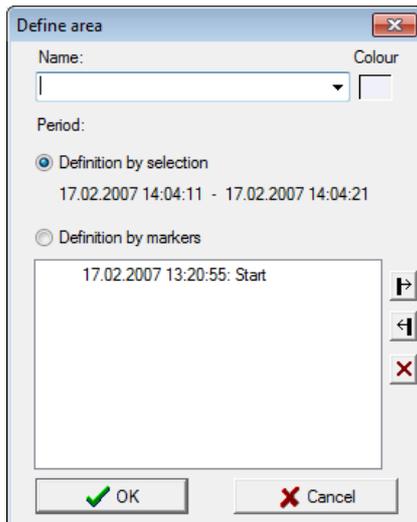
Fig. 8-86 Editing samples

## 8.10 Generating and editing areas

You can define parts of the recording as an area. In the report, these areas can be considered separately.

### Defining an area:

Select an area in the recording, make a right click and choose “**Define area as...**” in the popup menu. Type in a name or select one (names can be defined in the Global Preferences) and confirm with “**OK**”. You can as well choose a colour which will be shown in the background of the area in the raw data or analysis data.



Alternative to marking areas with the mouse an area can be defined by markers in the recording. First check “**Definition by markers**” then select a marker from the list. With the buttons  and  you define if the marker sets the beginning or the end of the area. Select a second marker that completes the area and confirm with “**OK**”.

Fig. 8-87 Defining areas

### Editing areas:

For editing areas, select “**User areas**” in the “**Tools**” menu. A popup window will come up with a list of all defined areas.

By activating the checkbox, you can choose areas for editing:

 **Jump to the selected area in the data**

 **Choose colour for the area**

 **Delete selected area**

By clicking on “**Add**” you can duplicate an existing area.

With “**Export**” you can export the analysis data of the defined areas as excel list, serial letter or SPSS file.

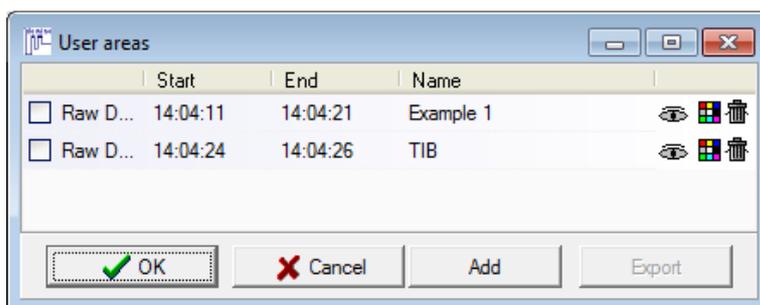


Fig. 8-88 Editing areas

## 8.11 Video functions

The DOMINO software offers several options for analysing videos. The processing status of videos can be viewed in the opening dialogue of recordings (see chapter 8.1, DOMINO-menu → Analysis) in the column “Video”.

### 8.11.1 Playing the video

This function offers the following options (see Fig. 8-89):

- Synchronised playback forwards  and backwards :  
Select the checkbox (3), if the raw data should be shown synchronised to the video. With  and  you can scroll through the video frames.
- Playback of video in a loop: Select “**Loop**” (9).
- Define the playback speed (8): The speed of the playback can be varied from 0.25-times up to 100-times.
- Selecting an episode of the video: The episode of the video can be selected with the symbol of the magnifying glass (10) or with the drop down menu in (1). The symbol  will only display the current video clip, the symbol  displays all episodes of the video in the blue band at the bottom.
- Zoomen: Select an area of the video picture with the left mouse button. To scale down the picture, make a double click on the video picture.

Make a right click on the video picture to view more functions in a popup menu:

- The video can be mirrored horizontally (11) or vertically (12).
- “**Transparent**” (13) allows the analysis or raw data window be seen in the background by a semi-transparent display of the video window.
- With “**Small view**” (14) you can limit the video player to a minimum display of functions.
- The function “**Show selected area in video window**” will show a selected area of the video picture as an own window within the video window.
- “**Maintain aspect ratio**” maintains the aspect ratio of the video window when you enlarge the window.

### 8.11.2 Editing the video

For editing the video, open the recording. The editing function is based on setting start and end points in the video. You can set as many markers as you want. All episodes outside these markers will be deleted afterwards. The marked areas in between start and end points will be displayed in green.

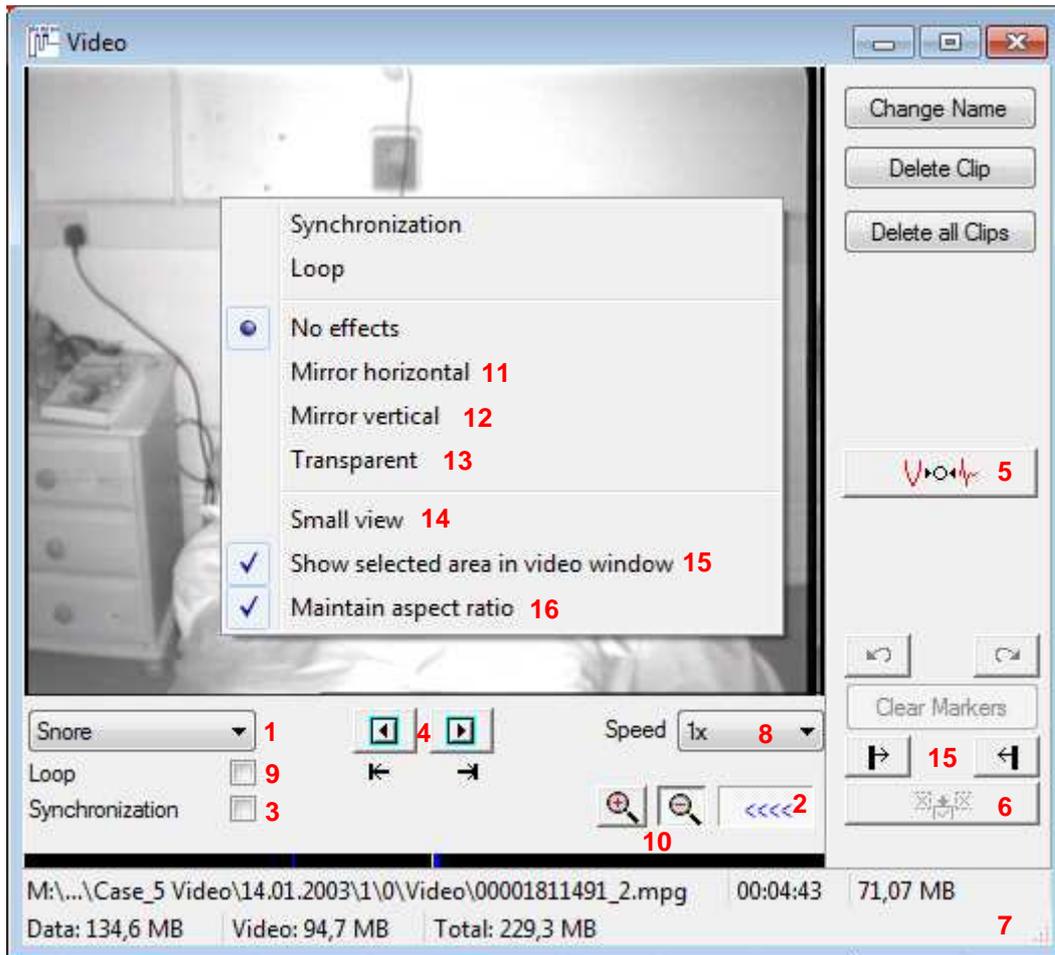


Fig. 8-89 Editing the video

! The video recording is automatically saved as several episodes (or clips). In the selection window (1) you can select the episode you would like to edit.

Activate the menu for editing the video by clicking the button (2).  
 Activate synchronisation of data and video “**Synchronization**” (3).  
 Start the playback of the video (4).  
 When the video reaches the beginning of the interesting episode, stop the playback (4).  
 Set a marker for start **P** (15).  
 Now type in a name for the video clip:

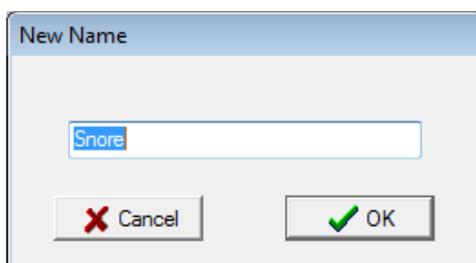
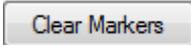


Fig. 8-90 Label the clip

The end of the clip will automatically be set at the end of the recording (marked green in the corresponding band).

Now start playback again and stop when you want the clip to end. Set an end marker  (15), the green mark will now show the length of the clip.

**Note that a clip has to be at least 10 seconds long.** Repeat the procedure for all interesting episodes.

If you want to change your selection and set different markers, click on . You can undo the last action or restore it by clicking on  or  respectively.

When all interesting areas are marked, click on the editing button  (6).

**Caution: When clicking this button, all video data that are not marked, will be deleted! Save a backup as a precaution.**

The cumulative size of your video is displayed in the right bottom corner (7). The size should not exceed 400 MB if you want to archive the video together with the corresponding raw and analysis data on a CD.

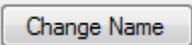
### 8.11.3 Synchronizing the video with the raw data after recording

If the synchronism of the video and the raw data is defective, follow these instructions:

Deactivate the checkbox “**Synchronization**” and search for an event in your raw data which can also be seen in the video (e.g. movement of the patient). Click on this time point in the raw data with your cursor. Then play back the video and stop it at the corresponding event in the video. Now click on the synchronize button  (5). Then activate the synchronization checkbox again and check whether the synchronism of the video with the raw data has improved.

### 8.11.4 Rename and delete clips

**Rename a clip:**

Click on the button  if you want to rename a clip.

**Delete clips:**

For deleting clips, choose one of the following possibilities: Either you delete each clip separately with

 or you delete all clips simultaneously with .



## 9 Manual Editing

### 9.1 Editing Events

Each recording is analysed automatically with the parameters from the “**Global Preferences**” (see chapter 5) when first opened. Interesting events (like longest desaturation, biggest desaturation, min. SpO<sub>2</sub>, max. SpO<sub>2</sub>, longest apnoea, min. PTT, max. PTT, max. PTT rise, max. PTT drop, min. HR, max. HR, max. HR Acc., max. HR Decc.) are detected and marked automatically.



Fig. 9-1 Interesting Events

These events are shown or hidden via “**View**” → “**Interesting Events**” → “**Show Interesting Events**”.

Selecting an event from the list takes you directly to the moment of the recording when the event took place.

The DOMINO software marks the events with coloured frames in the raw data. You can de-/ select these frames in the register “**Analysis Channels**” of the “**Global Preferences**” or in the opened recording via “**Tools**” → “**References**”. Simply de-/ activate the checkbox “**Event Box**” for the according signal.

Events and sleep stages in particular can be edited manually. Therefore different edit modes are available.

#### 9.1.1 Edit Modes

For the editing of events in the raw data, different modes are available:

Edit, Select Edit, Quick Edit and Repeat Mode. These modes can be selected from the “**Mode**” menu and are explained below.

Please attend to the following when editing manually:

- **Manually edited events are not influenced by the automatic analysis.**
- **Events can be deleted by a right click in the event box.**
- **Manually deleted events can be displayed dashed in the raw data window via “**Mode**” → “**Show Deleted**”.**
- **If an event is set in a local artefact area, the following dialogue appears:**

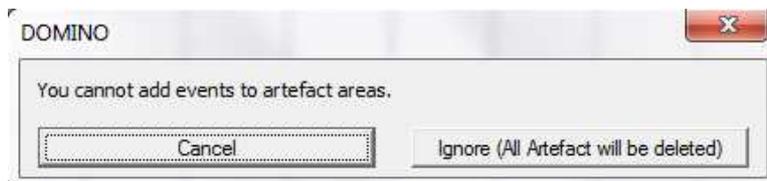


Fig. 9-2 Event in a local artefact area

“**Ignore**” deletes the whole artefact and sets the event. If the artefact is global, no events can be set within its area.

### 9.1.1.1 Edit Mode

For this mode you need the keys and key combinations respectively you set in the “**Global Preferences**” tab “**Keys**” (see chapter 5.9) to mark an event in the raw data. In an opened recording you can change them via “**Tools**” → “**Preferences**”.

For editing mark the significant area in the raw data and press the key/ -combination to classify the event. The according event box appears automatically then. The info box (“**View**” → “**Show Info Box**”) displays the parameters of the event.

**Example:** for an obstructive apnoea in the flow signal the key **O** has to be pressed.

When setting events manually you can jump to the next event with a predefined key/ -combination (  Jump to next event ).

#### Changing the type of an event:

If the cursor is above an event in the raw data without any selection, the event can be changed into another event pressing the according key/ -combination.

It is also possible to change a group of events (e.g. a sequence of hypopnoea you want to mark as obstructive apnoea). Keep the shift-key pressed and mark the events you want to change. A dashed frame is drawn around each event. Pressing the key/-combination for the obstructive apnoea changes the marked hypopnoea to obstructive apnoea.



Fig. 9-3 Changing the event type for a group of events

#### Correcting the duration of an event:

The duration of an automatically or manually set event can be edited subsequently.

Keep the shift-key pressed and take the cursor to the end of the event you want to edit. The cursor changes to edit the event. Keeping the left mouse button pressed you can extend or shorten the event box.

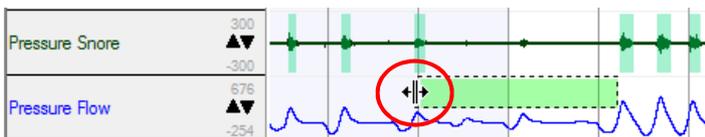


Fig. 9-4 Editing the event duration

### 9.1.1.2 Select Edit

If you mark an area in the raw data when in select edit mode, a pop up menu appears with all available events for the channel in which you marked the area. Attend to the analysis settings of the events.

### 9.1.1.3 Quick Edit

In contrast to the edit mode, the quick edit mode allows for a faster editing of an event (e.g. a hypopnoea) in a channel (e.g. flow). Therefore an event source (flow) for the event (flow analysis: hypopnoea) has to be defined in the “**Keys**” tab of the preferences (“**Global Preferences**” or “**Tools**” → “**Preferences**”). This means that when you mark a significant area in the flow channel (event source) a hypopnoea event box is drawn there automatically.

### 9.1.1.4 Repeat Mode

In repeat mode the last marked event type is repeated independent of the cursor position. If you are e.g. in edit mode and want to edit only hypopnoea on the flow channel, mark an event and press "H". Then change to Repeat Mode and just mark the areas you want to define as hypopnoea.

## 9.2 Editing Sleep Stages

For each recording the sleep profile is analysed automatically according to the parameters in the "Global Preferences" (see chapter 5) when opened for the first time. Those sleep stages are displayed in a bar above the raw data window.

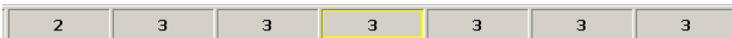


Fig. 9-5 Automatically edited sleep stages

The sleep stage of the current epoch is marked according to its reliability. The colours stand for:

- Green frame: reliability between 70-100%
- Yellow frame: reliability between 35-70%
- Red frame: reliability < 35%
- Pink frame: manually edited sleep stage

You have the possibility to edit all or only questionable (red frame) sleep stages. If you want to edit only the questionable stages, activate the checkbox  Questionable Stage to the left of the sleep stages bar. The edit mode only jumps from "red" stage to "red" stage then.

**Note: In both cases the period of the raw data has to be set to 30 sec. and the "Edit Mode" has to be selected as well as "Lock Time".**

For editing you can use the following keys:

Keys	Sleep Stage
1 End or ! 1	S1
2 ↓ or @ 2	S2
3 PgDn or # 3	S3
4 ← or \$ 4	S4
R	REM
W	Wake
Page Up or ←	Period back
Page Down or →	Period forward
↑	Period -
↓	Period +

The sleep stage reliability of manually edited epochs is shown in pink. Likewise for manually edited sleep stages the frame of the current epoch in the sleep stage bar is pink and the font is red.



Fig. 9-6 Sleep profile reliability of manually edited epochs



Fig. 9-7 Manually edited Sleep stages

This allows for a differentiation of manually edited and automatically analysed epochs.

### 9.3 Calculating the manually edited delta ratio of an epoch

For manual sleep staging it is possible to support the automatic delta frequency analysis by manually editing delta frequencies within an epoch.

Therefore a key combination for the Sleep FFT Analysis has to be defined in the “Keys” tab of the local and global preferences.



Fig. 9-8 Key combination manual delta

In edit mode areas can be marked manually as delta with the defined key combination. These areas are displayed by means of a green event box. The percentage of manually edited delta is displayed in red to the left of the sleep stage bar.

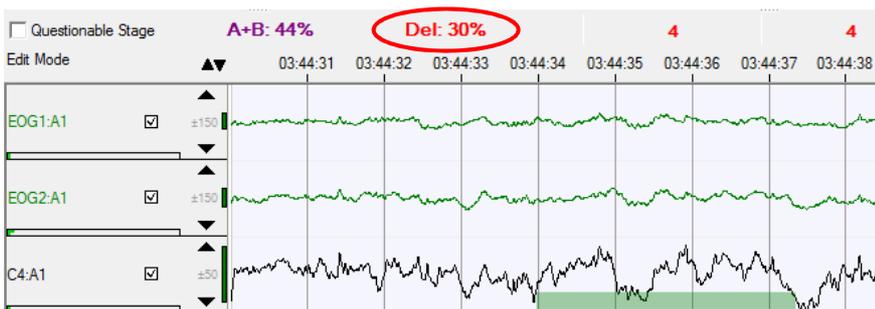


Fig. 9-9 Manually defined delta

### 9.4 Masking the automatic sleep profile

To score the sleep profile without being influenced by the automatically performed sleep analysis, the automatic sleep profile can be masked.

Via “Score entire recording as wake” of the sleep staging panel (see Fig. 8-13) all epochs are set to wake and the sleep stages can be scored without being influenced by the automatic sleep profile.

Alternatively the sleep profile can be set to wake for the next scorer when saving a scorer for the inter scorer variability (see chapter 8.3.1.2).

## 9.5 Advanced Sleep Edit Mode

This method of analysis allows a classification of sleep stages by setting a threshold for the onsets of sleep and deep sleep in the analysis channels “A+B FFT” and “Delta FFT”.

### Setting sleep onset and deep sleep threshold

Go to the epoch in the raw data where you want to set sleep onset. A right click opens the popup menu and “Sleep onset” can be selected from the “Advanced Sleep Edit Mode”. Defining sleep onset sets all previous epochs to wake.

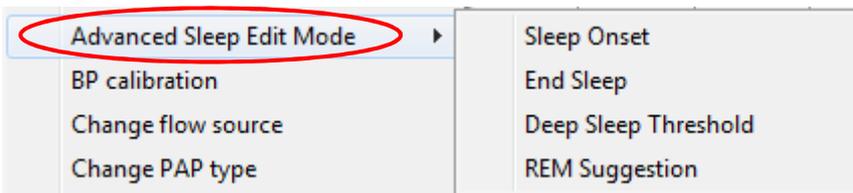


Fig. 9-10 Advanced Sleep Edit Mode

Further you're asked if “you want to define Sleep Onset and accept A+B Threshold for Wake”. This means if the A+B FFT value of the sleep onset shall be used to redo the classification of the following sleep stages. Simultaneously the A+B FFT channel is enlarged in the analysis window and the chosen moment is marked with a cross line. You can “Accept” the threshold directly or reposition the cross line via “Check Threshold”. Confirm the threshold with the green arrow.



Fig. 9-11 A+B FFT threshold

All proximate epochs whose calculated A+B ratios are above the defined threshold are assigned to wake.

**Note:** The threshold set via the cross line only has influence on the following epochs, providing they haven't been edited manually.

“End Sleep” can be assigned as well as “Sleep Onset”. All following epochs are set to wake.

Having defined Sleep Onset and End of Sleep the “Deep Sleep Threshold” can be set. Go to the epoch in the raw data where you want to set the deep sleep onset. Select “Deep Sleep Threshold” the “Advanced Sleep Edit Mode”. The Delta FFT value at this moment is used for the definition of deep sleep then. All epochs not yet set to wake by Sleep Onset and End of Sleep and whose Delta FFT value is above the defined threshold are set to stage 3 or 4. You can adjust the threshold like the one for A+B FFT with the cross line in the Delta FFT channel.

### REM Suggestion

Terminally you can edit REM stages in the sleep profile via “**REM Suggestion**”. All REM stages scored by automatic analysis are displayed grey. Additionally the channel “**REM Suggestion**” is displayed in the analysis window. This channel is calculated as product of Sigma FFT and I-EMG and is therefore a reliable indicator for REM sleep.



Fig. 9-12 REM Suggestion

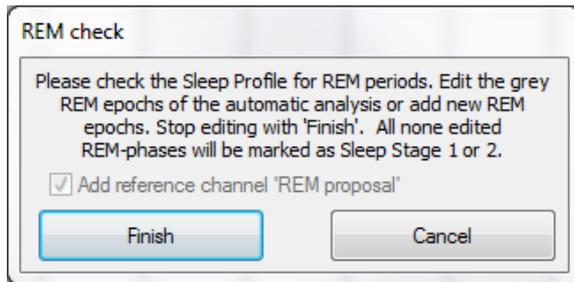


Fig. 9-13 REM Check

Now you can edit REM stages manually via the “R” key. When all REM stages are edited, complete the sleep stage analysis with “**Finish**”.

**Please note:** All automatically scored REM stages that were not confirmed as REM or scored as another stage are transferred to stage 1 or 2 depending on the presence of spindles and K-complexes.

**Notice:** When using the combi-electrode in combination with the sensor SEN6140 at the Acti-plug-in of the SOMNOScreen™, you can use the advanced sleep edit mode for the sleep analysis as well. Select “EMG Acti” as EMG source for the sleep profile analysis. The REM Suggestion then can result from this EMG source.

## 9.6 Learning function of the sleep profile analysis

If a recording was edited via the advanced sleep edit mode you can transfer the threshold values to the global preferences when closing the recording. Therefore activate the Checkbox “**Learning Sleep Profile**”.

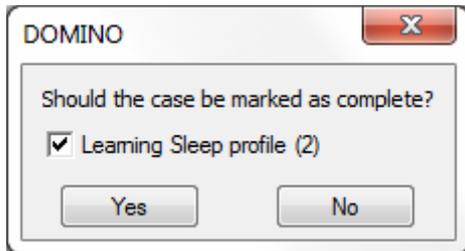


Fig. 9-14 Learning function of the sleep profile analysis

The defined thresholds from the recording are transferred to the sleep profile analysis of the global preferences. Transferring multiple thresholds from different recordings the values are averaged over the thresholds. The number of stored thresholds is displayed in brackets when closing the recording.

To reset the settings of the sleep profile analysis to default settings use the button “Basic settings” in the “sleep profile” analysis.

## 9.7 Manual marking of global artefacts

If you want to assign a period of time as invalid (which means that no events are generated because all raw data and analysis channels are marked as artefact) proceed as follows:  
Assign a key for the event “**Global Artefact**” in the “**Keys**” tab of the Global-/ Preferences.



Fig. 9-15 Key combination global artefact

Select the edit mode. Now you can mark time periods in the analysis or raw data window and assign them to artefacts via the defined key. If nothing is marked the whole epoch is assigned as artefact.

Please note that this change is assessed as manual editing in the sleep profile. If you want to reanalyse the sleep profile, close the recording and open it again. Activate “**Reset and reanalyse**” beforehand. This overwrites all changes carried out manually.

## 9.8 Manual removal of artefacts

If you want to delete a global or local artefact, mark the area in the analysis window, click right and select “**Remove Artefact**”.

## 10 Analysis samples

### 10.1 Sample “Sleep”

With DOMINO you can characterize sleep by different parameters. The following screenshot shows a sleep recording. You can display the default profiles for sleep raw data and sleep analysis in both windows when you select the according profile from the popup menu of each window (see chapter 8.7). You can create new profiles to adapt the display of the raw data and analysis either in the “Global Preferences” (see chapter 5.8) or from within an opened recording (chapter 8.7).

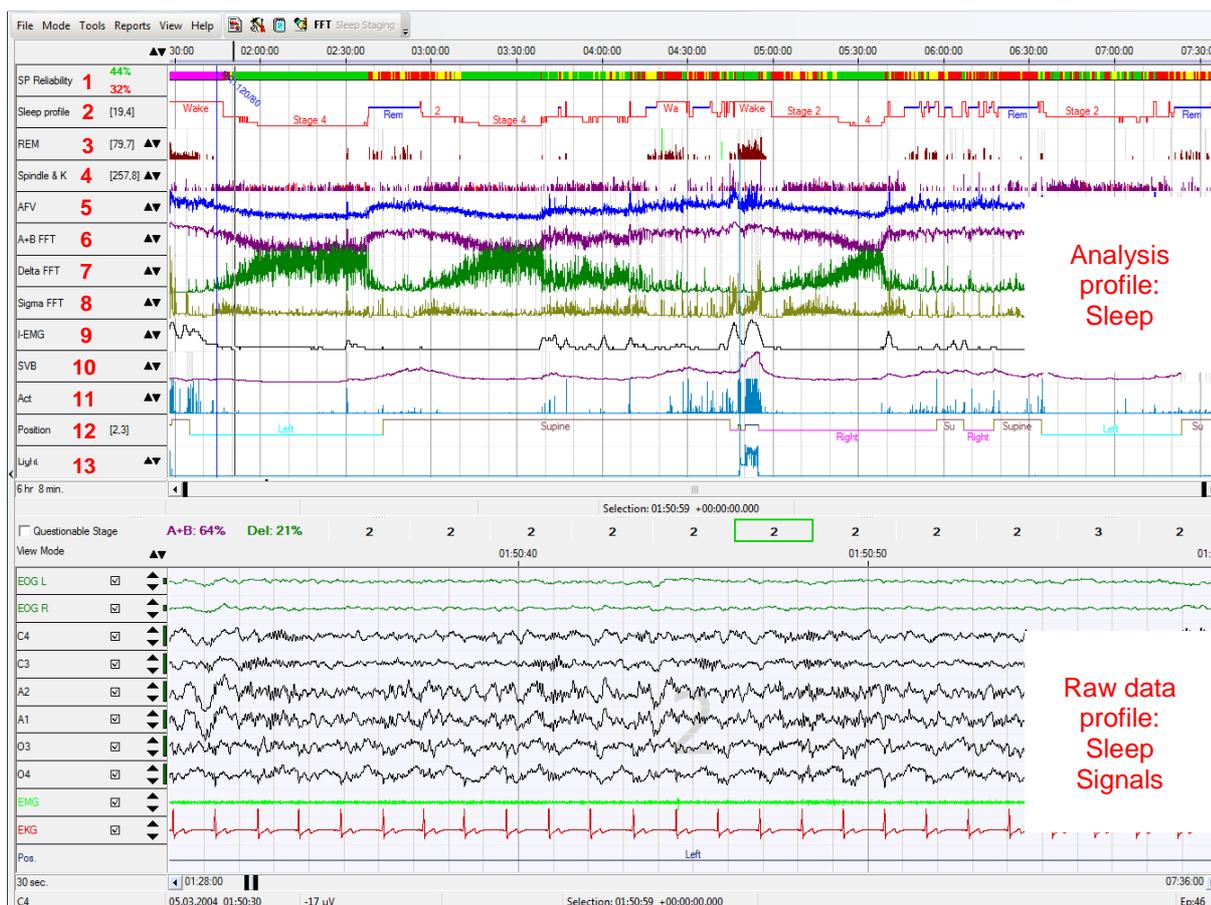


Fig. 10-1 Sample “Sleep” with default profiles

#### Explanation of the analysis parameters

##### (1) SP Reliability (SP: Sleep Profile)

The sleep profile reliability indicates the reliability of the automatically scored sleep stages:

Green = high reliability (70-100%),

Yellow = moderate reliability (35-70%),

Red = low reliability (<35%).

Manually scored stages are displayed pink.

##### (2) Sleep Profile

The sleep profile is analysed and displayed automatically according to the parameters in the “Global Preferences” (see chapter 5) when the recording is opened for the first time.

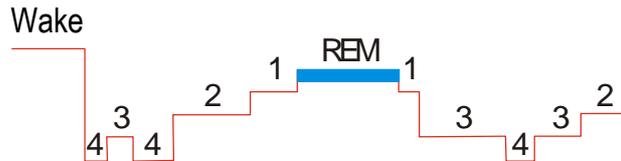


Fig. 10-2 Sleep Profile

**(3) REM**

The REM-Analysis searches for fast opposed movements on the EOG-channels. The height of the event bar represents the average change in amplitude while the width represents the duration of the particular REM event.

**(4) Spindle & K**

Displays all automatically or manually scored spindles and K-complexes.

**(5) AFV (Average Frequency Value)**

This analysis displays the average EEG frequency value (in Hz) in a 2 second moving sample.

**(6) A+B FFT**

The A+B analysis displays the spectral fraction in the Alpha + Beta frequency bands (8Hz – 32Hz) in a 2 second moving sample. A high FFT indicates “Wake”.

**(7) Delta FFT**

This analysis displays the spectral fraction in the Delta frequency band (0.5Hz – 4Hz) in a 2 second moving sample.

**(8) Sigma FFT**

The Sigma analysis displays the FFT values integrated over the Sigma frequency band (12Hz – 14Hz) in a 2 second moving sample.

It is used for the REM analysis in combination with the I-EMG.

**(9) I-EMG (Integral-EMG)**

This channel displays the Integral-EMG in 5s intervals. I-EMG is the standard way of displaying EMG signals for sleep staging. The values are shown in dB in relation to the minimum value.

**(10) SVB (Sympatho-Vagal Balance)**

Displays the values of the Sympatho- Vagal Balance.

**(11) Act (Activity)**

The activity analysis shows the maximum value of 8 consecutive values each.

**(12) Position**

This analysis displays the average body position over the time of the recording.

The length of the time window for the averaging can be adjusted in the “**Global Preferences**” (see chapter 5.3.3.3).

**(13) Light**

The analysis shows the filtered raw data signal (intensity of the ambient light) over the recording specified in lux.

## 10.2 Sample “Respiratory”

This setting allows the display of respiratory raw data as well as the analysis of respiratory events. Select the according profiles from each pop up menu. You can create new profiles to adapt the display of the raw data and analysis either in the “**Global Preferences**” (see chapter 5) or from within an opened recording (chapter 8.7).



Fig. 10-3 Sample “Respiratory” with default profiles

### Explanation of the analysis parameters

#### (1) Sleep Profile

The sleep profile is analysed and displayed automatically according to the parameters in the “**Global Preferences**” (see chapter 5) when the recording is opened for the first time.

#### (2) PLM Events (PLM: Periodic Leg Movements)

The bars of the PLM analysis display intensity and length of the PLM events by height and width. I-marker (isolated leg movement) and P-marker (periodic leg movements) are characterized by different colours. The analysis shows the events of both legs.

#### (3) Snore Events

The height and width of the bars displays the intensity and length of the events.

#### (4) Flow Events

The height and width of the bars displays the intensity and length of the events while the colour indicates their classification (hypopnoea, central apnoea, obstructive apnoea, mixed apnoea, flow limitation).

**(5) SpO<sub>2</sub> Events**

The bars indicate a desaturation. The length of the desaturation and the decline of the oxygen saturation are displayed by width and height of the bars.

**(6) SpO<sub>2</sub>**

Displays the values of the oxygen saturation.

**(7) HR (Heart Rate)**

The heart rate is calculated from the RR-intervals of the ECG.

**(8) Cardiac Events**

The level of the bars indicates the change in Heart Rate, the width the duration and the colour the type (Acceleration, Deceleration or Arrhythmia) of each event.

**(9) Class. Systolic**

This analysis categorizes increases in blood pressure as spontaneous, respiratory, PLM, cardiac, snore or positional. This categorization is carried out after correlating the events with the appropriate channels.

**(10) Bloodpress.**

This channel displays the continuous blood pressure waveforms of systolic and diastolic blood pressure and MAP. Please note that the pressure first needs to be calibrated to the Pulse Transit Time.

**(11) Obstruction**

The degree of obstruction is determined from the Phase Angle Analysis (e. g. phase angle = 0° → no obstruction, phase angle = 180° → total obstruction).

**(12) Phase Angle Events**

The height and width of the bars indicate the intensity and duration of the phase angle events whereas the colour indicates the type of the event (obstructive or central apnoea).

**(13) Arousal Class.**

This analysis categorizes the increase in frequency of the EEG and EMG bursts respectively. These events are correlated to respiratory, SpO<sub>2</sub>, cardiac or snore events. Arousal events occurring in the EEG or EMG that are not associated to any of the events above are classified as spontaneous.

**(14) Position**

This analysis displays the average body position over the time of the recording.

The length of the time window for the averaging can be adjusted in the “**Global Preferences**” (see chapter 5.3.3.3).

### 10.3 Sample “PTT”

The DOMINO Software can display the systolic blood pressure continuously over the entire night. You can therefore see a trend in the systolic blood pressure and discriminate for example “dipper” from “non-dipper” behaviour. Additionally, all systolic events will be indicated. You can create new profiles to adapt the display of the raw data and analysis either in the “**Global Preferences**” (see chapter 5) or from within an opened recording (chapter 8.7).



Fig. 10-4 Sample “PTT”

**(1) Sleep Profile**

The sleep profile is analysed and displayed automatically according to the parameters in the “**Global Preferences**” (see chapter 5) when the recording is opened for the first time.

**(2) PTT (Pulse Transit Time)**

This analysis determines the delay between the R-peak and the peripheral pulse pressure wave. The PTT curve is inversely proportional to the systolic blood pressure.

**(3) Class. PTT**

This channel categorizes decreases in the PTT as respiratory, PLM, cardiac, snore or positional events. PTT events that are not associated with any of the events above will be classified as spontaneous. This classification is carried out after correlating the events with the appropriate channels.

**(4) Class. Systolic**

This analysis categorizes increases in blood pressure as spontaneous, respiratory, PLM, cardiac, snore or positional. This categorization is carried out after correlating the events with the appropriate channels.

**(5) Blood Pressure**

This channel displays the continuous systolic and diastolic blood pressure curve. Please note that prior calibration is necessary.

**(6) Arousal Class.**

This analysis categorizes the increase in frequency of the EEG and EMG bursts respectively. These events are correlated to respiratory, SpO<sub>2</sub>, cardiac or snore events. Arousal events occurring in the EEG or EMG that are not associated to any of the events above are classified as spontaneous.

**(7) Position**

This analysis displays the average body position over the time of the recording. The length of the time window for the averaging can be adjusted in the “**Global Preferences**” (see chapter 5.3.3.3).



## 11 Reports

### Please Note:

Only events related to sleep will be evaluated in the report, i. e. all events that occur during sleep. Wake events are ignored.

To generate a report a recording has to be opened first. With DOMINO there are three ways to generate a report:

1. Using the DOMINO Report Generator,
2. Exporting Reports to Excel,
3. Exporting the entire list of results to Excel.

### 11.1 Creating Report Templates (Global Preferences)

#### 11.1.1 Standard Report

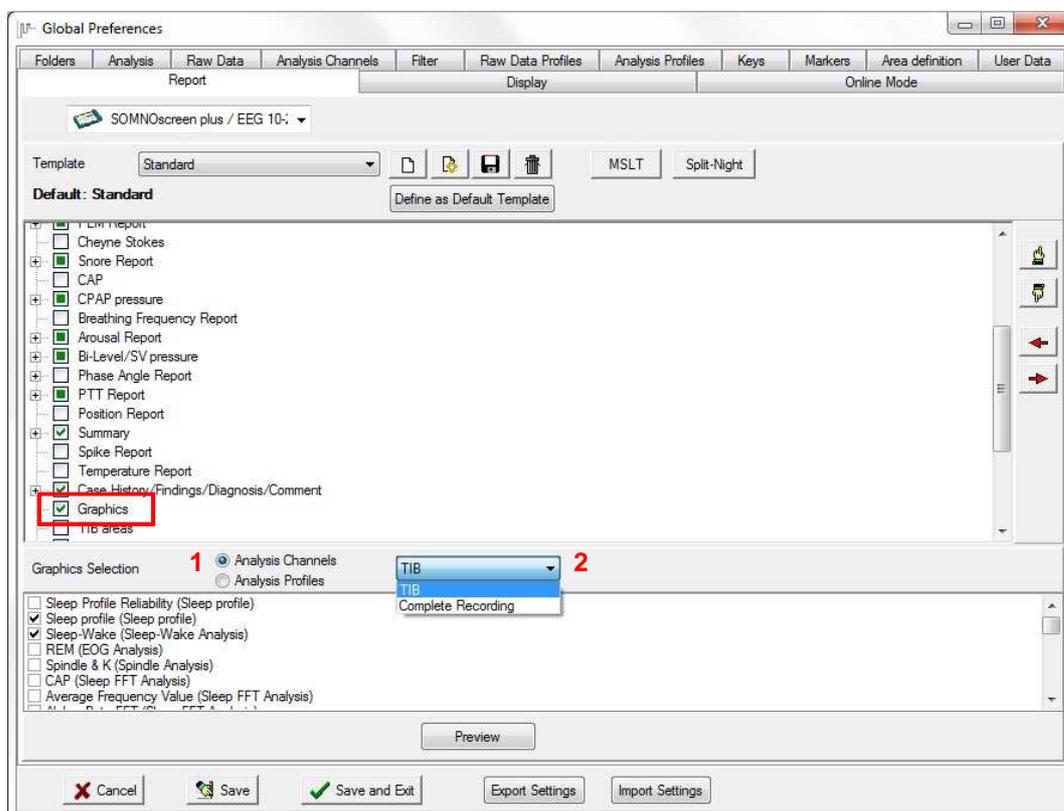


Fig. 11-1 Tab "Report"

You can define various reports (templates) for different requirements via the symbol . If you want to save a template under a new name press . Via you can delete particular templates. To create a new custom defined report press (see chapter 11.1.2). If you want to define a template as default press "Define as Default Template".

Composition, content and order of the reports can be set individually:

The order of the components can be changed via the "Hand" symbols or via Drag & Drop.

Via the red arrows page breaks can be entered or deleted.

Via  the submenu of the respective component can be opened to choose between variably detailed report versions.

**Please note:**

The components **PLM, CPAP, Bi-Level, User defined areas, Interesting Events and Samples** have a fixed order and cannot be moved.

Select only those components for the report that are relevant to it. Deactivate non-relevant parts.

Furthermore you can select which graphics shall be displayed at the end of the report. You can decide if you want to view analysis channels or profiles (1) in the graphics and if the whole recording or the TIB only (2) shall be displayed.

To open the graphics menu click at **“Graphics”** (red frame in Fig. 11-1).

To get an idea of the created report press **“Preview”**.

### 11.1.2 User defined report

Via the symbol  you can create a freely editable so called “Custom Report”.

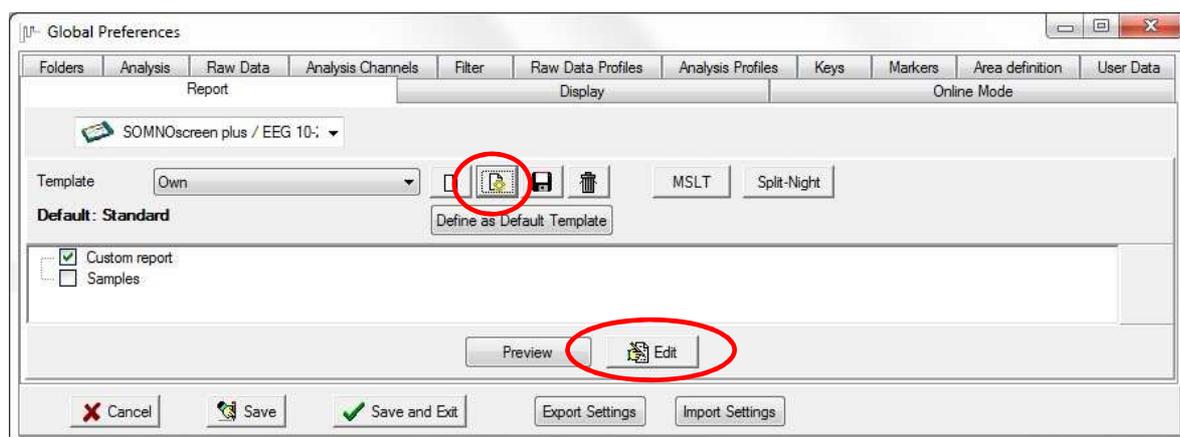


Fig. 11-2 Create Custom Report

Enter a name for the template (e.g. “Own”) and press . Select Portrait or Landscape as orientation of the page.

Above the still empty page you find the following symbols:

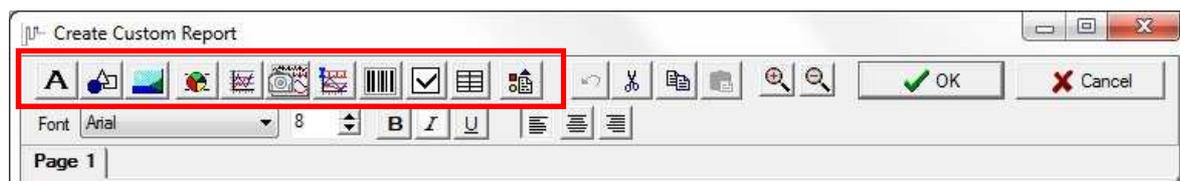


Fig. 11-3 Edit Custom Report

**Please note:** After clicking at a symbol you have to determine the position of the object first (left click at the desired position on the page).

**A** creates a description field (e.g. a cloze; editing see chapter 11.1.2.3).

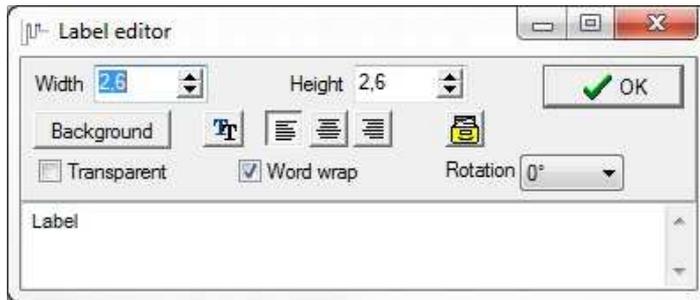


Fig. 11-4 Label Editor

Width  Height  defines the size of the label.

A background colour for the description field can be chosen here.

edits font type and size.

Text alignment (left-aligned, centred, right-aligned).

opens a list with placeholders for the results. Select a placeholder and click “Copy”. The placeholder is inserted automatically to the description field (marked by a “\$” in front and at the end). Alternatively you can open the Standard Report and copy placeholders from it. They can then be inserted to the description field (right click → paste).

**Transparent** The background gets transparent when activated.

**Word wrap** The text is automatically wrapped at the end of a line.

Rotation  The description field can be rotated.

Via the “**Shape Editor**” different types of shapes (e.g. circle, rectangle, horizontal line), line width, line colour and filling colour can be selected.

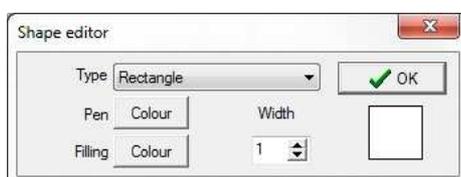


Fig. 11-5 Shape Editor

**Please note: A double click at any object allows for its editing.**

adds \*.jpg or \*.bmp pictures (e.g. your logo).

adds diagrams from the standard report.



integrates and displays analysis channels or profiles in the report.

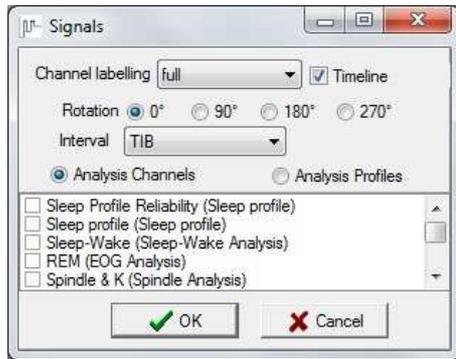
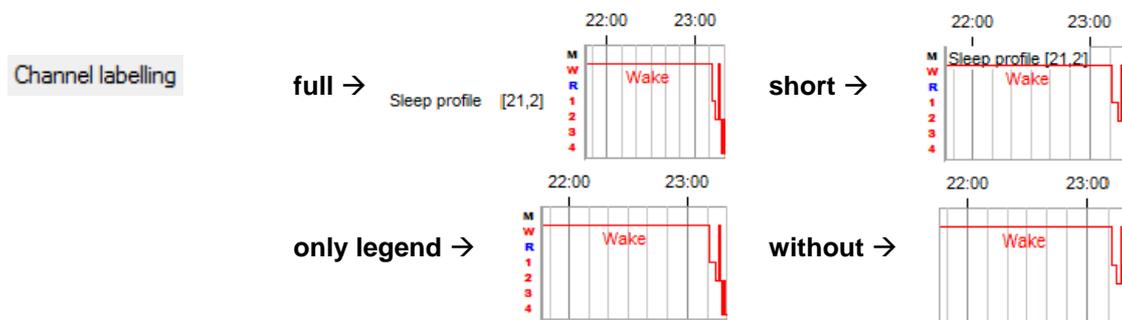
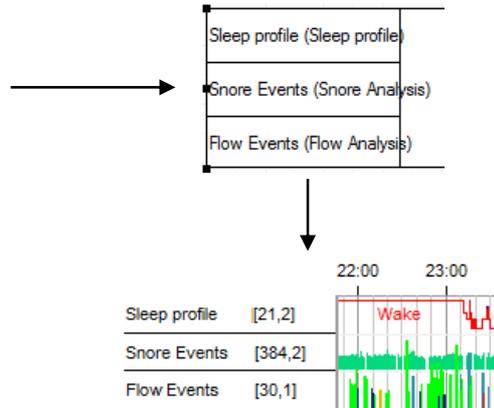


Fig. 11-6 Add Channels



The graphics can be rotated in fixed steps.



activates or deactivates the display of the timeline.



Here you can select if you want to view the whole recording or the TIB only.



Select particular analysis channels or whole analysis profiles for display.



adds placeholders for **“Samples”**. Enter a name for the placeholder. When a sample is saved under that name it is inserted to the according placeholder.



adds **“Interesting Events”** (see chapter 11.1.2.4).



generates and adds barcodes (see chapter 11.1.2.6).



adds a checkbox that can be activated in the opened report (see chapter 11.1.2.5).



adds a table (see chapter 11.1.2.2).

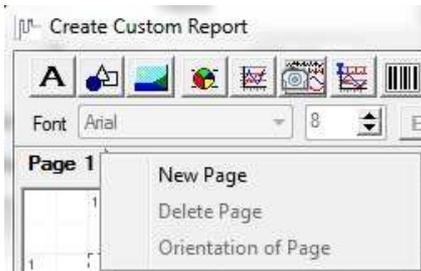


opens the Standard Report. You can select and copy objects from it and paste them to the custom report (see chapter 11.1.2.1).



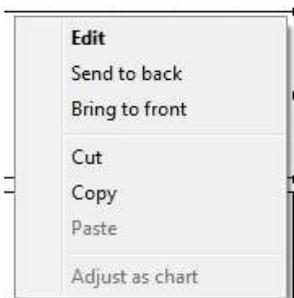
enlarges or minimizes the display.

Via a right click at the page tab you can add a new page, delete a page or change the orientation of the page.



**Fig. 11-7 New Page**

A right click at an object opens the following menu:



**Fig. 11-8 Popup Menu Report Objects**

“**Edit**” opens a window to edit the object.

“**Send to back**” sets an object to the background. You need this to display overlaying objects in the right order.

“**Bring to front**” sets an object to the foreground. You need this to display overlaying objects in the right order.

“**Cut**” removes the object and copies it to the cache. The symbol  in the top bar has the same function.

“**Copy**” puts a copy of the object in the cache. The symbol  in the top bar has the same function.

“**Paste**” inserts the object from the cache to the page. The symbol  in the top bar has the same function.

“**Adjust as chart**” aligns different label fields (text only) like a table.

### 11.1.2.1 The Standard Report as basis for the Custom Report

If you only want to change small parts of the standard report the whole standard report can be transferred to the custom report. Therefore click at the symbol **“Standard Report”**  in the window **“Create Custom Report”** (see Fig. 11-3) and select those parts of the report you wish to use for the custom report.

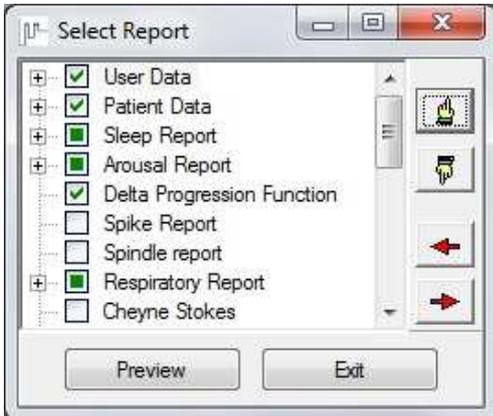


Fig. 11-9 Create Custom Report from Standard Report

Having opened the preview of the selected parts click **“Use as new custom template”** in the top bar.



Fig. 11-10 Use Standard Report as Custom Report

After the parts of the standard report have been transferred to the custom report they can be individually adapted and edited.

You can also select only particular components of the standard report for the custom report. Mark the components in question (Shift + left-click) in the preview window (marked labels are shown in grey) and transfer them to the custom report by copy & paste or drag & drop.

### 11.1.2.2 Creating Tables

**“Add table”** provides the opportunity to display analysis results in an even form. Tables can only be created within the custom report (see chapter 0).

Select the according report template in the **“Global Preferences”** and click **“Edit”** (see Fig. 11-2).

Then click at the **“Add Table”**  symbol.

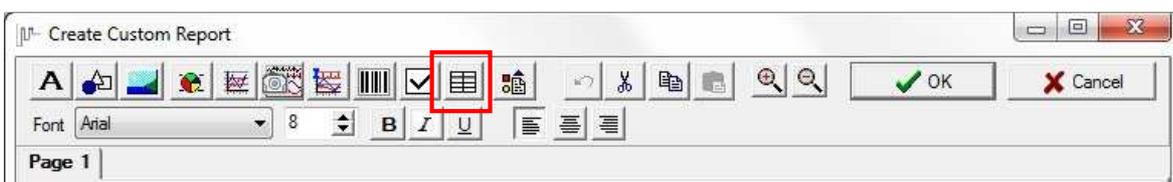


Fig. 11-11 Add a Table

The window “**Add Table**” opens where you can define number, width and height of columns and rows and the offset between them.

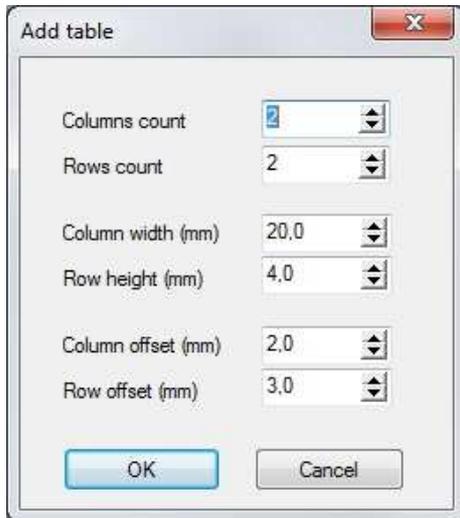


Fig. 11-12 Window “Add Table”

After confirming the settings with “**OK**” you have to select the position of the table in the report.

### 11.1.2.3 Editing of description fields

To write in a description field it has to be opened via double click. A user-friendly option to edit labels of the report is via the menu bar. There font type, size and style and the alignment of the text can be set.

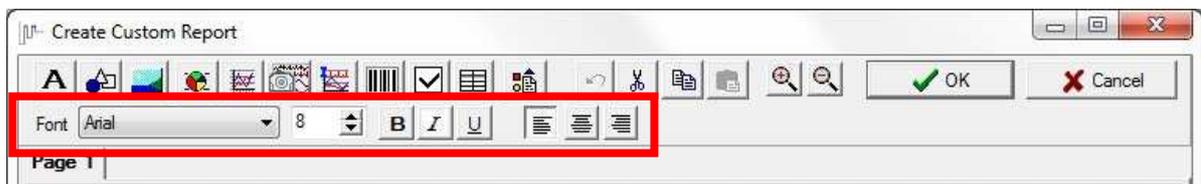


Fig. 11-13 Editing Description Fields

### 11.1.2.4 Display of interesting events

Via “**Add interesting events**” those events can be added to the custom report.



Fig. 11-14 Add Interesting Events

A click at the button opens the window “**Interesting Events**” where the event can be selected from the drop down menu and the display settings can be adjusted.



Fig. 11-15 Window “Interesting Events”

### 11.1.2.5 Add Checkboxes

Checkboxes can be added to the custom report that can be activated in the report with a double click. This allows for choices in the opened report (e.g. CPAP or BiLevel for therapy).



Fig. 11-16 Add a Checkbox

### 11.1.2.6 Barcode-Generator

The barcode generator provides the opportunity to add user defined barcodes to the report that allow for machine readability of the report. Barcodes can only be generated in the custom report (see chapter 11.1.2).

Click at the button “Add Barcode” and click at the page to position it.

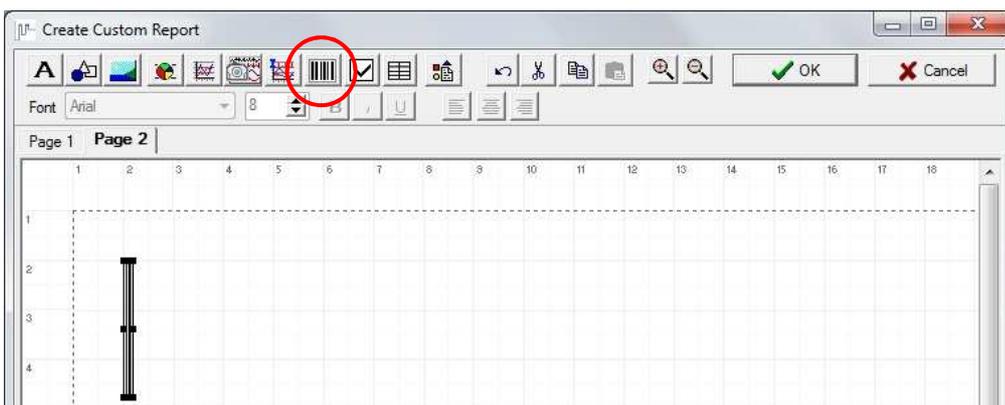


Fig. 11-17 Add a Barcode

Double clicking the barcode opens the “Barcode Editor” where the barcode can be edited and data can be assigned.

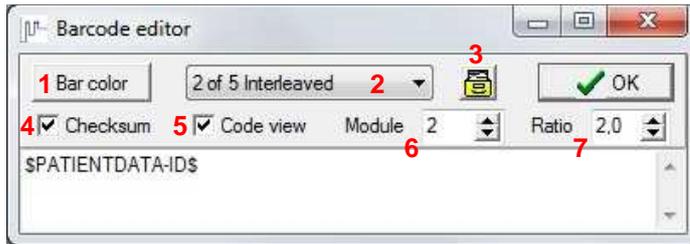


Fig. 11-18 Barcode Editor

You have the following options:

- (1) Barcodes in different colours.
- (2) Different types of barcodes.
- (3) Selects the data for the barcode. They are displayed in the field (in this example the patient-ID was selected).
- (4/5) Checksum and Code can be displayed in the report.
- (6/7) Sets the size of the barcode.

Confirm the settings with “OK” and proceed with the report.

## 11.2 Report generation using the DOMINO Report Generator

Activate or deactivate the display of information on GP or specialist, somnologist, scorer and night watch.

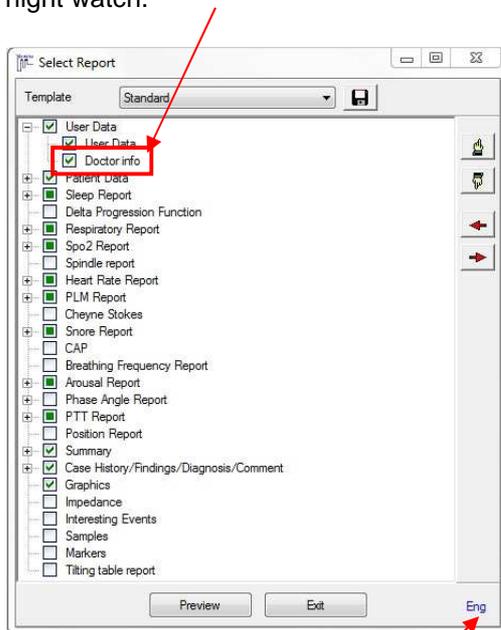


Fig. 11-19 Report Selection

Report language

From within an opened recording you can generate an individual report or use an existing report template via the “Reports” menu.

For most parts there are variably detailed report versions (e.g. “short” and “full”).

In Sleep, Respiratory, SpO<sub>2</sub> and PLM Report user defined areas can be selected if defined previously. Those areas are displayed separately in the according part of the report. In “Sleep Report” “Areas per hour” (report for each hour) and “Sleep periods” (periodical repetition of light, deep and REM sleep) can be selected.

The graphics to be displayed at the end of the report can be configured at will. All analysis curves and defined samples are available (see chapter 8.9). Additionally “Interesting Events” and “Markers” can be added to the report.

“Preview” displays the chosen report and corresponding graphics.



The order of the report-components can be set individually using the “Hand” symbols or drag & drop.

**Please note:**

The components **PLM, CPAP, BiLevel, User defined areas, Interesting Events and Samples** have a fixed order and cannot be moved.



With the red arrows page breaks are entered or deleted.

### 11.3 Report View

The shown reports were created using the DOMINO Report Generator.

**Please note:**

Some analysis reports contain “Artefact [min]” which is an index for the reliability of the analysis data.

#### 11.3.1 Sleep Stages



Fig. 11-20 Sleep-Profile

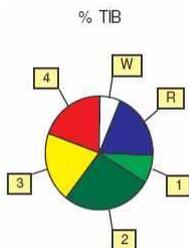


Fig. 11-21 Percentage of the different sleep stages during TIB

		Sleep Stage	Duration	(%) TIB	(%) TST	(%) SPT
Total Sleep Time (TST)	07:04:30					
Sleep Efficiency [%]	90,0					
Sustained Sleep Eff. [%]	97,1	Artefact	-	-	-	-
Sleep Latency Stage 1	00:34:32	Movement	-	-	-	-
Sleep Latency Stage 2	00:44:32	Wake	00:47:18	10,0	-	2,3
Deep Sleep Latency	00:47:32	REM	01:09:00	14,6	16,3	16,2
REM latency	01:07:00	Stage 1	01:07:30	14,3	15,9	13,8
Total Sleep Period (SPT)	07:06:00	Stage 2	01:50:30	23,4	26,0	25,9
Sleep Stage Change (Index)	164 (20,9)	Stage 3	01:29:00	18,9	21,0	20,9
# Wake (Index)	15 (2,1)	Stage 4	01:28:30	18,8	20,8	20,8
# Wake > 3 min (Index)	-	Light Sleep	02:58:00	37,7	41,9	39,8
Wake duration SPT	00:10:00	Deep Sleep	02:57:30	37,6	41,8	41,7
Maximum SVB [LF/HF x10]	-					
Minimum SVB [LF/HF x10]	-					
Average SVB	-					
REM Density [%]	19					
WASO	00:11:15					

Fig. 11-22 Section of the sleep stages report

On the right hand section of the table the duration and percentages of the sleep stages 1 to 4, REM, Wake, Light Sleep, Deep Sleep and Movement relative to the TIB (Time in Bed), TST (Total Sleep Time) and SPT (Sleep Period Time) are displayed. Additionally, artefacts are marked and their fraction of TIB, TST and SPT is also indicated as a percentage.

Explanations for the left hand section of table are given below:

<b>Total Sleep Time (TST) [h]</b>	Period of time between the Lights off and Lights on markers excluding all the Wake stages.
<b>Sleep Efficiency [h]</b>	$\frac{\text{Total Sleep Time}}{\text{TIB}}$
<b>Sustained Sleep Eff. [%]</b>	$\frac{\text{Total Sleep Time}}{\text{TIB} - \text{Sleep Latency Stage 1}}$
<b>Sleep Latency Stage 1</b>	Period of time between the Lights off marker and the beginning of Sleep Stage 1 (minimum of 3 epochs in stage 1 required).
<b>Sleep Latency Stage 2</b>	Period of time between the Lights off marker and the beginning of Sleep Stage 2 (minimum of 1 epoch in stage 2 required).
<b>REM Latency</b>	Period of time between sleep stage 2 and the beginning of the first REM epoch.
<b>Total Sleep Period (SPT)</b>	Period of time between Sleep Latency Stage 2 and the end of the last sleep period.
<b>Sleep Stage Change (Index)</b>	Number of Sleep Stage changes during TIB (index: #/h sleep).
<b># Wake (Index)</b>	Number of Wake periods during TIB (index: #/h sleep).
<b># Wake &gt; 3 min (Index)</b>	Number of Wake periods longer than 3 min. during TIB (index: #/h sleep).
<b>Wake Duration SPT</b>	Duration of wake periods during SPT.
<b>Maximum SVB (LF/HF x 10)</b>	Indication of the maximum value of the Sympatho Vagal Balance for the TST.
<b>Minimum SVB (LF/HF x 10)</b>	Indication of the minimum value of the Sympatho Vagal Balance for the TST.
<b>Average SVB</b>	Indication of the average value of the Sympatho Vagal Balance for the TST.
<b>REM Density [%]</b>	Percentage of the whole REM phase with mini REM-epochs of 3s.
<b>WASO (Wake after sleep onset)</b>	Time spent awake after the first sleep period.

### 11.3.2 Delta Progression Function

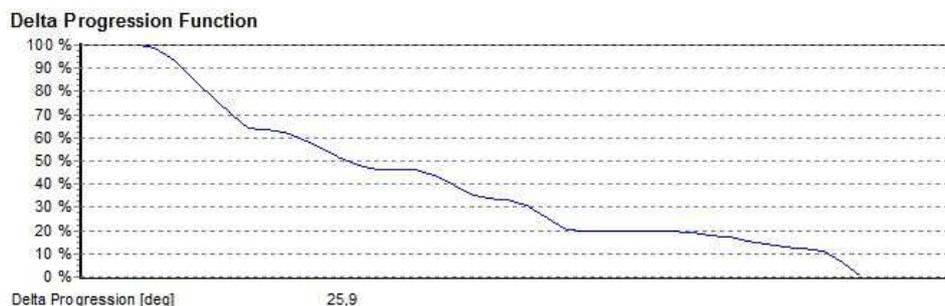


Fig. 11-23 Delta progression graphic

In the figure above the progression of delta frequency components during the recording is displayed.

### 11.3.3 Respiratory Report

Number (Index)		REM	Non-REM	Sleep
Obstructive	39 (7,3)	4 (2,7)	80 (20,6)	84 (15,8)
Mixed	27 (5,1)	26 (17,9)	27 (7,0)	53 (9,9)
Central	18 (3,4)	20,6	27,6	25,7
Undef A.	-	1 (0,7)	-	1 (0,2)
Total A.	84 (15,8)	12 (8,2)	13 (3,4)	25 (4,7)
Hypopnoea	53 (9,9)	20	76	76
<b>A+H</b>	<b>137 (25,7)</b>	69	64	69
Limitation	1 (0,2)	17,8	25,9	25,6
RERAs	25 (4,7)	31,8	29,2	30,5
RDI	163 (30,6)	0,2 (0,2%)	-	0,2 (0,1%)
Hypopnoea-rules 1: Desaturation 4 %, Ratio T0 %				

Position	Supine	not Supine	Left	Right	Prone	Upright
Sleep Time Fraction [%]	19,7	80,3	40,4	39,9	-	-
RDI	88 (83,8)	53 (12,4)	27 (12,5)	26 (12,2)	-	-
Obstructive Apnoea (Index)	27 (25,7)	14 (3,3)	7 (3,3)	7 (3,3)	-	-
Central Apnoea (Index)	15 (14,3)	3 (0,7)	2 (0,9)	1 (0,5)	-	-
Mixed Apnoea (Index)	27 (25,7)	-	-	-	-	-
Hypopnoea (Index)	19 (18,1)	35 (8,2)	18 (8,4)	17 (8,0)	-	-
Flow Limitation (Index)	-	1 (0,2)	-	1 (0,5)	-	-
RERAs (Index)	-	28 (6,5)	11 (5,1)	17 (8,0)	-	-

Fig. 11-24 Full respiratory report

**Definitions:**

<b>Obstructive</b>	<i>Number (Index):</i> Number of Obstructive Apnoea during TST (index: per hour of sleep).
<b>Mixed</b>	<i>Number (Index):</i> Number of Mixed Apnoea during TST.
<b>Central</b>	<i>Number (Index):</i> Number of Central Apnoea during TST.
<b>Undef. A.</b>	<i>Number (Index):</i> Number of undefined Apnoea during TST.
<b>Total A.</b>	<i>Number (Index):</i> Total number of all Obstructive, Mixed and Central Apnoea during TST.
<b>Hypopnoea</b>	<i>Number (Index):</i> Number of Hypopnoea during TST.
<b>A+H</b>	<i>Number (Index):</i> Number of Apnoea and Hypopnoea during TST.
<b>Limitation</b>	<i>Number (Index):</i> Number of Flow Limitations during TST.
<b>RERAs</b>	<i>Number (Index):</i> Number of respiratory arousals.
<b>RDI</b>	<i>Number (Index):</i> Respiratory Disturbance Index = "A+H" + "Limitations"

<b>Apnoea (Index)</b>	Number of Apnoea in REM Sleep, Non-REM Sleep and Sleep during TST (index: per hour of sleep).
<b>Hypopnoea (Index)</b>	Number of Hypopnoea in REM Sleep, Non-REM Sleep and Sleep during TST.
<b>AHI [h]</b>	$\frac{\text{Number apnoea} + \text{Number hypopnoea}}{\text{Total Sleep Time (h)}}$
<b>Flow Limitation (Index)</b>	Number of Flow Limitations in REM sleep, Non-REM Sleep and Sleep during TST.
<b>Max. Apnoea Duration (s)</b>	Maximum duration of Apnoea in REM Sleep, Non-REM Sleep and Sleep during TST.
<b>Max. Hypopnoea Duration [s]</b>	Maximum duration of Hypopnoea in REM Sleep, Non-REM Sleep and Sleep during TST.
<b>Average Apnoea Dur. [s]</b>	Average duration of Apnoea in REM Sleep, Non-REM Sleep and Sleep during TST.
<b>Average Hypopnoea Dur. [s]</b>	Average duration of Hypopnoea in REM Sleep, Non-REM Sleep and Sleep during TST.

**Position**

Number (Index) of the respiratory events in relation to the different body positions.

<b>Sleep Time Fraction [%]</b>	Percentage of Sleep Time in the particular Body Positions (Prone, Supine, Left, Right and Upright).
--------------------------------	---

Additionally, the rule for the scoring of the hypopnoea is displayed in the respiratory report.

If "**Respiratory Type**" was activated in the report selection, an overview for the different types of respiratory events is displayed with number and index of obstructive, central and undefined hypopnoea and obstructive, mixed, central and undefined apnoea.

**Please note:**

**Obstructive und central hypopnoea can only be defined manually (see chapter 5.9).**

	Obstructive	Mixed	Central	Undefined	sum
Apnoea (Index)	39 (7,3)	27 (5,1)	18 (3,4)	-	84 (15,8)
Hypopnoea (Index)	-	-	-	53 (9,9)	53 (9,9)
A+H (Index)	39 (7,3)	27 (5,1)	18 (3,4)	53 (9,9)	137 (25,7)
RERAs	25 (4,7)				
RDI obstructive	91 (17,1)				

Fig. 11-25 Respiratory events according to type

<b>RDI obstructiv</b>	Composed of the indices of the obstructive and mixed apnoea and hypopnoea and RERAs.
-----------------------	--

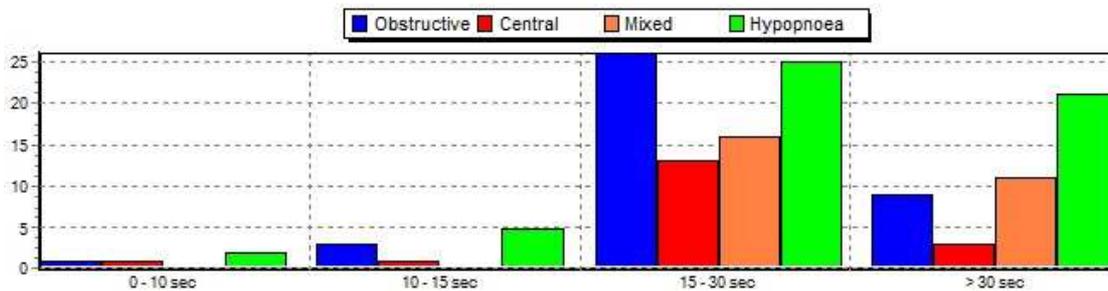


Fig. 11-26 Respiratory distribution

### 11.3.4 SpO2 Report

#### O2 Saturation

	Number (Index)	Time
Number of Desaturations	121 (22,7)	
Minimal SpO2 [%]	82	04:09:27
Baseline O2 Saturation	94	
Average SpO2 [%]	94	
Number desaturations < 90 %	68	11,5 %
Number desaturations < 80 %	-	0,0 %
SpO2 Time < 90 %	5,3 %	00:16:47
Biggest Desaturation [%]	14	02:36:24
Average Desaturation [%]	7,5	31,3 s
Longest Desaturation [s]	108,8	01:25:22
Average Min. Saturation [%]	89	
Deepest Desaturation [%]	82	04:09:29
Sum all desaturation	01:03:05	19,8 %
Average Circulatory delay [s]	29,0	
Artefact [min]	0,7 (0,2%)	

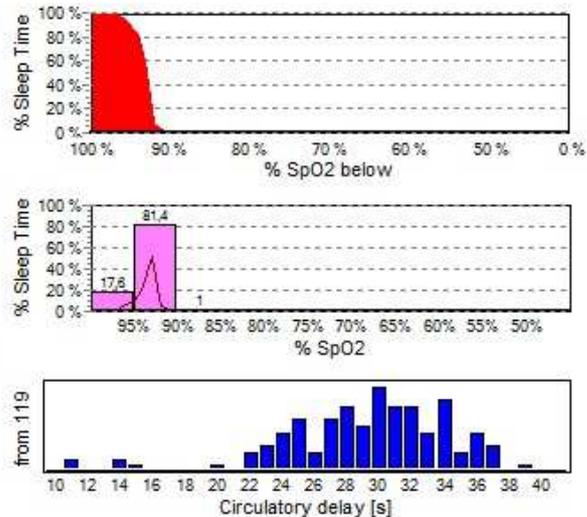
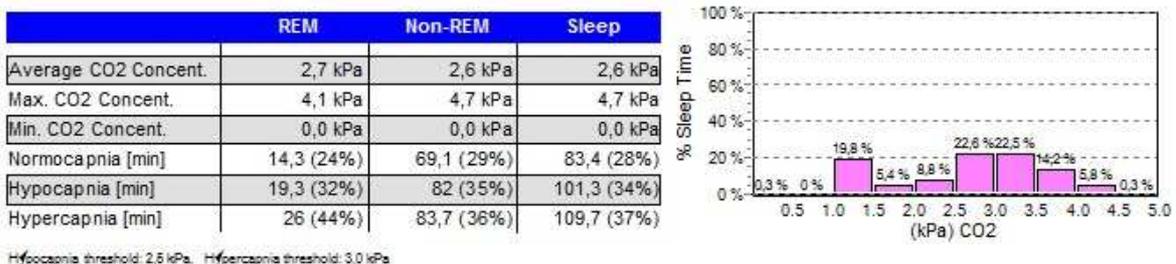


Fig. 11-27 SpO<sub>2</sub> Report

**Definitions:**

<b>Number of Desaturations</b>	Number of Desaturations during TST (index: per hour of sleep).
<b>Minimal SpO2 [%]</b>	Indication of minimum SpO <sub>2</sub> value during TST.
<b>Baseline O2 Saturation</b>	Average value of the SpO <sub>2</sub> curve without considering the SpO <sub>2</sub> events.
<b>Average SpO2 [%]</b>	Average value of the complete SpO <sub>2</sub> curve.
<b>Number desaturations &lt; 90%</b>	Number of desaturations occurring under 90% with indication of its percentage against Sleep Time.
<b>Number desaturations &lt; 80%</b>	Number of desaturations occurring under 80% with indication of its percentage to Sleep Time.
<b>SpO2 Time &lt; 90%</b>	Total time during TIB when the SpO2 value was below 90%
<b>Biggest Desaturation [%]</b>	Indication of the moment of the Biggest Desaturation event.
<b>Average Desaturation [%]</b>	Average duration of all desaturations.
<b>Longest Desaturation [s]</b>	Duration of the Longest Desaturation and the time of the event.
<b>Average Min. Saturation [%]</b>	Average of the Lowest SpO <sub>2</sub> values in each marked SpO2 event.
<b>Deepest Desaturation [%]</b>	Deepest desaturation that occurred.
<b>Sum all desaturation</b>	Total duration of all desaturations.
<b>Average Circulatory Delay [s]</b>	Mean delay between the end of a flow event and the end of the desaturation.
<b>Artefact [min]</b>	Duration and percentage of artefacts in TIB.

**11.3.5 CO2 Report**



**Fig. 11-28 CO<sub>2</sub> Report**

The scaling of the report graphic can be set manually (see chapter 5.3.2.7). If no fixed scaling is defined it is adjusted to the measured values.

**Definitions:**

<b>Average Max. Min. CO2 Concent.</b>	Average/Max./Min. CO2 Concentration in REM, Non-REM and total sleep
<b>Normo-Hypo-Hypercapnia [min]</b>	Time with normo-, hypo- and hypercapnic CO <sub>2</sub> -values (% of according sleep time)

### 11.3.6 Spindle Report

This report gives a detailed overview of number and index of spindles within the respective sleep stages. Additionally the average number of spindles per epoch and the average spindle frequency are displayed.

Furthermore the spindle source is displayed to the top right of the report.

#### Spindle report

Spindle source: C4:A1

	Wake	Sleep	REM	Stage 1	Stage 2	Deep Sleep	Total
Number (Index)	290 (98,3)	422 (79,2)	104 (71,5)	21 (25,0)	124 (101,2)	173 (95,7)	712 (86,0)
Ø Number/epoch	0,8	0,7	0,6	0,2	0,8	0,8	0,7
Ø Spindle freq. [Hz]	13,05	13,00	13,04	12,93	13,01	12,97	13,02

Fig. 11-29 Spindle Report

#### Definitions:

<b>Number (Index)</b>	Number of spindles during TIB (Index: per hour of sleep)
<b>Ø Number/Epoch</b>	Average number of spindles per epoch during TIB
<b>Ø Spindle freq. [Hz]</b>	Average spindle frequency during TIB

### 11.3.7 Heart Rate Report

	Number (Index)	Time
Acc. (Index)	74 (13,9)	
Dec. (Index)	59 (11,1)	
Arrhythmia (Index)	23 (4,3)	
Maximum HR [bpm]	99	23:47:14
Minimum HR [bpm]	46	01:23:03
Average HR [bpm]	55	
Std. deviation [bpm]	6,5	
Artefact [min]	0,4 (0,1%)	

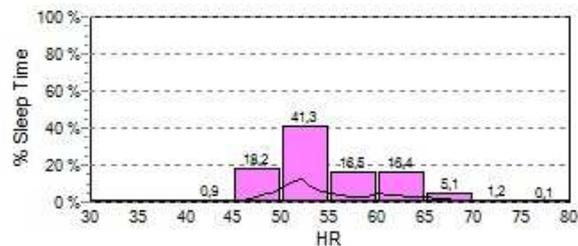


Fig. 11-30 Heart rate report with distribution of the heart rate over TST

#### Definitions:

<b>Acc. (Index)</b>	Number of Increases in the Heart Rate during TST (index: per hour of sleep).
<b>Dec. (Index)</b>	Number of Decreases in the Heart Rate during TST.
<b>Arrhythmia (Index)</b>	Number of Arrhythmia occurring during TST.
<b>Maximum HR (bpm)</b>	Maximum Heart Rate during TST with indication of the moment of the event.
<b>Minimum HR (bpm)</b>	Minimum Heart Rate during TST with indication of the moment of the event.
<b>Average HR (bpm)</b>	Average value of all Heart Rates during TST.
<b>Std. deviation (bpm)</b>	Standard deviation of all Heart Rates during TST.
<b>Artefact [min]</b>	Duration and percentage of artefacts in TIB.

### 11.3.7.1 RR-Intervals

Additionally to the normal heart rate analysis a RR-interval analysis is available. The RR-intervals are displayed graphically in a "Poincaré-Plot".

#### RR-Interval

Average [ms]	879,6
RR SD [ms]	93,08
Max. RR [ms]	1261
Min. RR [ms]	199
SD1 [ms]	29,45
SD2 [ms]	108,86
SD1 / SD2	0,27

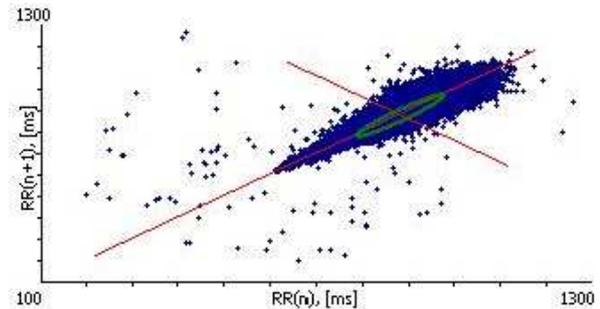


Fig. 11-31 RR-Table and Poincaré-Plot

#### Definitions:

<b>Average [ms]</b>	Mean average over all RR-intervals of the whole recording
<b>RR SD (ms)</b>	Standard deviation from the mean.
<b>Max. RR [ms]</b>	Maximum RR-interval.
<b>Min. RR (ms)</b>	Minimum RR-interval.
<b>SD1 [ms]</b>	Standard deviation of the semi-minor axis of the Poincaré-Plot.
<b>SD2 [ms]</b>	Standard deviation of the semi-major axis of the Poincaré-Plot.
<b>SD1 / SD2</b>	Standard deviation of the differences between adjacent RR-intervals.

### 11.3.8 Breathing Volume Report

	Sleep	REM	Non-REM	Wake	Total
Average BV [L/min]	4,7	4,7	4,7	6,6	4,9
Maximum BV [L/min]	36,0	36,0	35,0	35,0	36,0
Minimum BV [L/min]	0,0	0,0	0,0	0,0	0,0
Hypoventilation	04:48:33	00:48:20	04:00:12	00:17:54	05:06:28
Hyperventilation	00:20:51	00:04:52	00:15:59	00:00:59	00:21:51

Fig. 11-32 BV Report

#### Definitions:

<b>Average BV [l/min]</b>	Average Breathing Volume during TIB
<b>Maximum BV [l/min]</b>	Maximum Breathing Volume during TIB
<b>Minimum BV [l/min]</b>	Minimum Breathing Volume during TIB
<b>Hypoventilation</b>	Periods of hypoventilation during TIB
<b>Hyperventilation</b>	Periods of hyperventilation during TIB

### 11.3.9 PLM Report

	Sleep	REM	Non-REM	Wake	Total
Total LMs (Index)	76 (14,3)	42 (28,9)	34 (8,8)	278 (94,2)	354 (42,8)
Isolated-LMs (Index)	48 (9,0)	23 (15,8)	25 (6,5)	152 (51,5)	200 (24,2)
PLMs (Index)	6 (1,1)	5 (3,4)	1 (0,3)	72 (24,4)	78 (9,4)
Resp-LMs (Index)	18 (3,4)	10 (6,9)	8 (2,1)	33 (11,2)	51 (6,2)
Body Position-LMs (Index)	4 (0,8)	4 (2,7)	-	21 (7,1)	25 (3,0)
PLMs with Arousal (Index)	1 (0,2)	1 (0,7)	-	12 (4,1)	13 (1,6)
LMs with Arousal (Index)	-	-	-	-	-

Fig. 11-33 Full PLM Report

PLM's average power (dB)	17	17	17	17	17
PLM's average amplitude (dB*s)	21	22	19	31	30
PLM's average duration [s]	1,2	1,2	1,1	1,7	1,7

Fig. 11-34 Advanced PLM Report

If you selected the separate PLM analysis for left and right leg (see chapter 8.6.1) the results can be added to the report ticking “PLM left/right” in the report selection.

#### Periodic Limb Movement (PLM) Left/Right

	PLM l	PLM r	Total
Total LMs (Index)	32 (4,5)	21 (2,9)	35 (4,9)
Isolated-LMs (Index)	30 (4,2)	20 (2,8)	31 (4,3)
PLMs (Index)	-	1 (0,1)	3 (0,4)

Fig. 11-35 Separate Analysis PLM left/right

#### Definitions:

<b>Total LMs (Index)</b>	Sum of all leg movements during TIB (index: per hour of sleep).
<b>Isolated-LMs (Index)</b>	Leg Movements during TST which do not meet the PLM criteria.
<b>PLMs (Index)</b>	Leg Movements during TST which meet the PLM criteria.
<b>Resp-LMs (Index)</b>	Leg Movements during TST caused by a Respiratory event.
<b>Body Position-LMs (Index)</b>	Leg Movements caused by changes of the Body Position during TST.
<b>PLMs with Arousal (Index)</b>	PLMs causing an arousal.
<b>LMs with Arousal (Index)</b>	LMs causing an arousal.

<b>PLMs average power (dB)</b>	Mean PLM value irrespective of the duration of the PLM events.
<b>PLMs average amplitude (dB*s)</b>	Mean PLM amplitude (cp. analysis channel “PLM”).
<b>PLMs average duration (s)</b>	Mean PLM duration.

The formula below clarifies the last three values:

$$\text{PLMs average power [dB]} = \text{PLMs average amplitude [dB*s]} / \text{PLMs average duration [s]}$$

#### PLM distribution:

The index for the PLM distribution is shown per hour of sleep or per hour of wake. The distribution will indicate whether the RLS (Restless-Legs-Syndrome) disease is Type 1 (PLM's occurred mainly in the

first third of sleep) or Type 2 (PLM's occurred mainly in the last third of sleep). This allows for the selection of the appropriate pharmaceutical.



Fig. 11-36 PLM Distribution

### 11.3.10 Snore Report

#### Snore Analysis

	All	Prone	Supine	Left	Right	Upright
Snore (Index)	4231 (598,0)	-	90 (219,7)	-	4141 (621,3)	-
Absolute Snore [min]	72,7	-	1,3	-	71,4	-
Snore episodic [min]	249,0	-	3,9	-	245,1	-
Snore episodic [% TST]	58,7					

Fig. 11-37 Normal Snore Report

#### Definitions:

<b>Snore (Index)</b>	Number of snore events in each body position (Prone, Supine, Left, Right and Upright) during TST (index: per hour of sleep).
<b>Absolute Snore [min]</b>	Total duration of snore events in each position.
<b>Snore Episodes [min]</b>	Sum of all time intervals between 2 snore events if they are less than 10 seconds.
<b>Snore episodic [% TST]</b>	$\frac{\text{Snore episodes [ min ]}}{\text{Total Sleep Time [ min ]}} \cdot 100\%$

#### Advanced Snore Report

The advanced snore report displays the results of the snore topography. Indicated are the average amplitude of the snore events and the percentage of the snore source relating to body position and sleep stage.

### Snore Analysis

	All	Prone	Supine	Left	Right	Upright
Snore (Index)	239 (34,1)	-	91 (17,8)	4 (19,3)	129 (78,4)	15 (230,0)
Absolute Snore [min]	3,5	-	1,6	0,0	1,6	0,2
Snore episodic [min]	11,0	-	1,9	-	8,2	1,0
Ø Ampl. (Max. Ampl) [dB]	60 (100)	-	59 (91)	59 (64)	62 (100)	68 (77)
Nasal (%)	80	-	73	73	85	80
Soft palate (%)	14	-	18	17	12	15
Root of tongue (%)	6	-	9	10	4	5

Topography	Sleep	REM	Non-REM	Light Sleep	Deep Sleep
Nasal (%)	80	-	-	-	-
Soft palate (%)	14	-	-	-	-
Root of tongue (%)	6	-	-	-	-

Snore episodic [% TST] 2,6

Fig. 11-38 Advanced Snore Report

### Definitions:

<b>Ø Ampl. (Max. Ampl) [dB]</b>	Average amplitude of the snore signal relating to the body position
<b>Nasal (%)</b>	Percentage of the snore sources relating to body position and sleep stage.
<b>Soft palate (%)</b>	
<b>Root of tongue (%)</b>	

### 11.3.11 CAP (Cyclic Alternating Pattern) Report

	REM	Non-REM		Sleep
		Light Sleep	Deep Sleep	
Duration [%]	-	00:00:34 (0,3%)	-	00:00:34 (0,2%)

Fig. 11-39 CAP Report

<b>Duration (%)</b>	Duration of the CAP events in the respective sleep stages → overall duration per sleep stage in seconds and percentage of the sleep stage (or whole sleep in the column “ <b>Sleep</b> ”)
---------------------	---

### 11.3.12 CPAP Report

You have the choice between differently detailed reports that display the events per pressure stage, pressure stage and body position or pressure stage, body position and sleep stage.

Average CPAP							7,5 mbar
mbar	A+H	Obstr.	Central	Hyp.	Desaturation	Duration	
4	-	-	-	-	-	00:54:00	
5	-	-	-	-	-	00:36:30	
6	1 (1,2)	-	-	1 (1,2)	-	00:48:07	

Fig. 11-40 Section of CPAP Report (short)

mbar	A+H	Obstr.	Central	Hyp.	Desaturation	Duration
4	All	-	-	-	-	00:54:00
	Prone	-	-	-	-	-
	Supine	-	-	-	-	00:01:16
	Other	-	-	-	-	00:52:43

Fig. 11-41 Section of CPAP Report

mbar	TST (min)	REM (min)	NREM (min)	Sleep Eff.	A+H	Obstr.	Central	Hyp.	Desat.	Arousals	Duration
4	All	54,0	-	54,0	100,0 %	-	-	-	-	-	00:54:00
	Prone	-	-	-	-	-	-	-	-	-	-
	Supine	-	-	-	-	-	-	-	-	-	00:01:16
	Other	-	-	-	-	-	-	-	-	-	00:52:43

Fig. 11-42 Section of CPAP Report (advanced)

The percentage pressure distribution over TST can be displayed in a histogram:

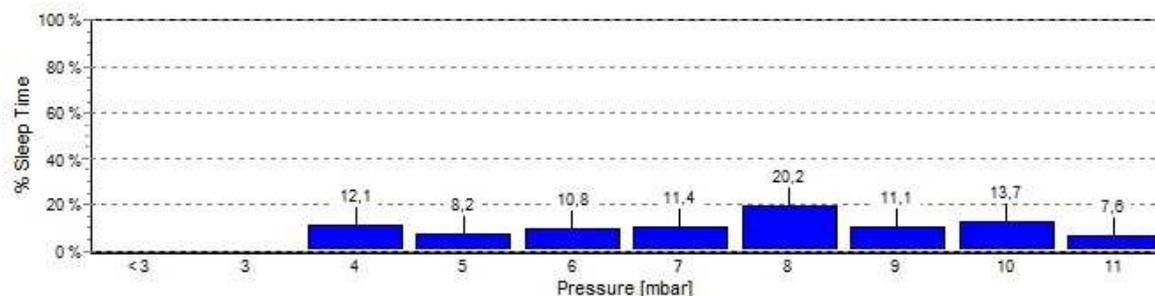


Fig. 11-43 Pressure Histogram

The leakage can be tabulated (Fig. 11-44) and/or displayed in a diagram (Fig. 11-46). The table indicates the duration of a defined pressure stage as well as the average leakage for this stage and its percentage of the duration of the stage. Additionally the used mask and the threshold for the registration of a leakage as defined in the analysis settings are displayed. (The used mask and its maximum leakage can be stored to the settings of the breathing volume analysis; see chapter 5.3.2.9)

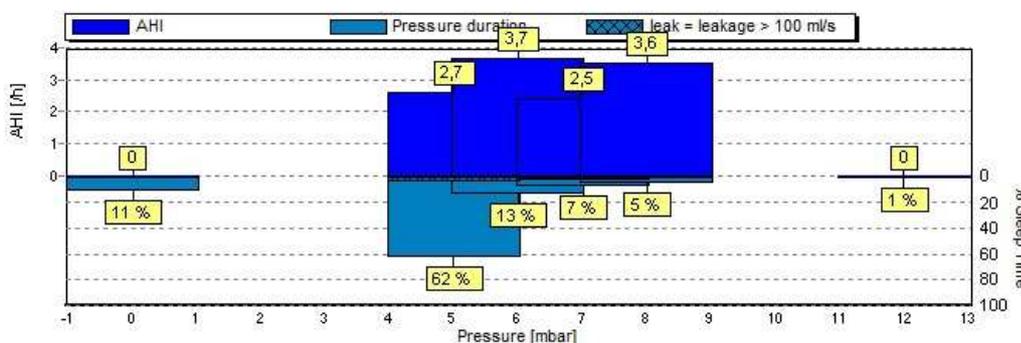
**CPAP Leakage**

mbar	Duration	% leak ; Ø leakage
0	00:38:30	0 % ; 0 ml/s
5	03:46:07	6 % ; 56 ml/s
6	00:48:45	10 % ; 63 ml/s
7	00:24:15	28 % ; 82 ml/s
8	00:16:52	38 % ; 90 ml/s
12	00:04:07	87 % ; 112 ml/s

leak = leakage > 100 ml/s  
Mask: Standard

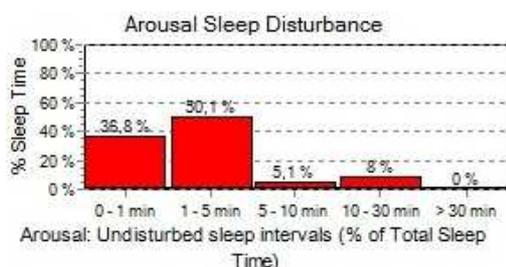
**Fig. 11-44 Leakage relating to pressure stage**

The diagram “Leakage Distribution” displays the pressure stages at the X-axis. At the Y-axis the AHI for each stage is displayed upwards (dark blue) while the percentage of each stage of the TST is displayed downwards (light blue). The percentage of maximum leakage at a pressure stage is displayed as shaded area within the duration.



**Fig. 11-45 Diagram Leakage Distribution**

**11.3.13 Arousal Report**



**Fig. 11-46 Percentage of undisturbed sleep intervals during total sleep time**

This diagram indicates the sleep fragmentation of a patient’s sleep caused by arousals. It shows how “Disturbed” or “Undisturbed” a patient’s sleep is.

**Disturbed:** Sleep fragmentation mainly in intervals of 0-1 min and 1-5 min.

**Undisturbed:** Sleep fragmentation mainly in intervals of 10 - 30 min. and > 30 min.

The bars indicate the percentage of sleep that was disturbed by 2 arousals within an interval of e.g. 0-1 min.

	REM	Non-REM	Sleep	%
<b>Total</b>	<b>86 (59,1)</b>	<b>191 (49,3)</b>	<b>277 (52,0)</b>	<b>100</b>
Respiratory A.	15 (10,3)	41 (10,6)	56 (10,5)	20,2
Flow Limitation A.	-	-	-	-
Desaturation A.	18 (12,4)	58 (15,0)	76 (14,3)	27,4
PLM A.	1 (0,7)	-	1 (0,2)	0,4
LM A.	-	-	-	-
Snore A.	8 (5,5)	31 (8,0)	39 (7,3)	14,1
Heart rate A.	3 (2,1)	5 (1,3)	8 (1,5)	2,9
Spontaneous A.	41 (28,2)	56 (14,5)	97 (18,2)	35,0
Artefact [min]	0,3	0,0	0,3	0,1

**Fig. 11-47 Arousal Report**

**Definitions:**

<b>Total</b>	<i>Number (Index):</i> Number of all arousals during TST (index: per hour of sleep). <i>100%:</i> Sums up all arousal events.
<b>Respiratory A.</b>	<i>Number (Index):</i> Arousals during TST that correlate with a respiratory event. <i>%:</i> Percentage of arousals correlating with a respiratory event.
<b>Flow Limitation A.</b>	<i>Number (Index):</i> Arousals during TST that correlate with a flow limitation event. <i>%:</i> Percentage of arousals correlating with a flow limitation event.
<b>Desaturation A.</b>	<i>Number (Index):</i> Arousals during TST that correlate with a desaturation. <i>%:</i> Percentage of arousals correlating with a desaturation.
<b>PLM A.</b>	<i>Number (Index):</i> Arousals during TST that correlate with a PLM event. <i>%:</i> Percentage of arousals correlating with a PLM event.
<b>LM A.</b>	<i>Anzahl (Index):</i> Arousals during TST that correlate with a LM event. <i>%:</i> Percentage of arousals correlating with a LM event.
<b>Snore A.</b>	<i>Number (Index):</i> Arousals during TST that correlate with a snore event. <i>%:</i> Percentage of arousals correlating with a snore event.
<b>Heart rate A.</b>	<i>Number (Index):</i> Arousals during TST that correlate with a heart rate event. <i>%:</i> Percentage of arousals correlating with a heart rate event.
<b>Spontaneous A.</b>	<i>Number (Index):</i> Arousals during TST that do not correlate with one of the above mentioned events. <i>%:</i> Percentage of spontaneous MA in relation to all MA.

**11.3.14 Phase Angle Report**

	Number (Index)	REM	Non-REM	Sleep
Obstructive	27 (5,1)	11 (7,6)	21 (5,4)	32 (6,0)
Central	5 (0,9)	28	28	28
Total A.	32 (6,0)	19,1	15,5	16,7
Average Angle of Obstruction	10	11	10	10

Position	Supine	not Supine	Left	Right	Prone	Upright
Sleep Time Fraction [%]	19,7	80,3	40,4	39,9	-	-
Total Events (Index)	8 (7,6)	24 (5,6)	14 (6,5)	10 (4,7)	-	-
Obstructive Apnoea (Index)	3 (2,9)	24 (5,6)	14 (6,5)	10 (4,7)	-	-
Central Apnoea (Index)	5 (4,8)	-	-	-	-	-
Average Angle of Obstruction [deg]	22	6	2	12	-	-

Fig. 11-48 Phase Angle Report

**Definitions:**

<b>Obstructive</b>	<i>Number (Index):</i> Number of obstructive apnoea during TST deduced from the raw data channels thorax and abdomen (Index: per hour of sleep).
<b>Central</b>	<i>Number (Index):</i> Number of central apnoea during TST deduced from the raw data channels thorax and abdomen.
<b>Total A.</b>	<i>Number (Index):</i> Sum of all obstructive and central apnoea during TST.
<b>Average Angle of Obstruction</b>	Average value of the obstruction curve from the analyses based on TST.

<b>Apnoea (Index)</b>	Number and index of apnoea in REM sleep, Non-REM sleep and total sleep during TST.
<b>Max. Apnoea Duration [s]</b>	Maximum duration of apnoea in REM sleep, Non-REM sleep and total sleep during TST.
<b>Average Apnoea Dur. [s]</b>	Average duration of apnoea in REM sleep, Non-REM sleep and total sleep during TST.
<b>Average Angle of Obstruction</b>	Average value of the obstruction level in REM sleep, Non-REM sleep and total sleep during TST.

<b>Sleep time fraction [%]</b>	Percentage of sleep time in the respective body positions (supine, not supine, prone, left, right, and upright).
<b>Total events (Index)</b>	Total number and index of events in the respective body positions during TST (Index: per hour of sleep)
<b>Obstructive Apnoea (Index)</b>	Number of obstructive apnoea in the respective body positions during TST.
<b>Central Apnoea (Index)</b>	Number of central apnoea in the respective body positions during TST.
<b>Average Angle of Obstruction [deg]</b>	Average value of obstruction curve in the respective body positions during TST.

### 11.3.15 PTT Report

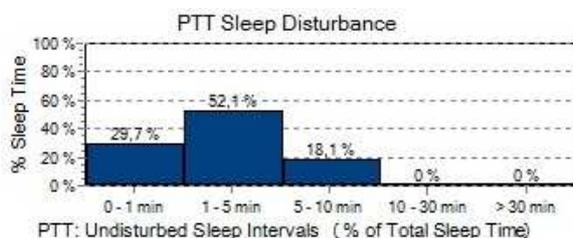


Fig. 11-49 Percentage of undisturbed sleep intervals (PTT) during TST

The diagram indicates the sleep fragmentation of a patient's sleep caused by PTT changes. It shows how "Disturbed" or "Undisturbed" a patient's sleep is.

**Disturbed:** Sleep fragmentation mainly in intervals of 0-1 min and 1-5 min.

**Undisturbed:** Sleep fragmentation mainly in intervals of 10 - 30 min. and > 30 min.

The bars show the percentage of sleep that was disturbed by two consecutive PTT events within an interval of e.g. 0-1 min.

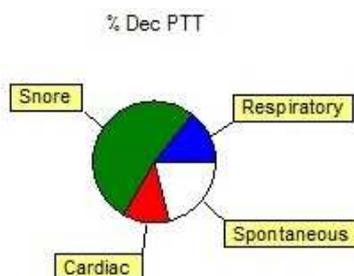


Fig. 11-50 Percentage of PTT decreases correlating to other events

	Number (Index)	Time	PTT-Dec - Classification	Number (Index)	%
Dec. (Index)	221 (41,5)		Total	221 (41,5)	100,0
Maximum Dec. [ms]	44	02:46:56	Respiratory PTT	32 (6,0)	14,5
Maximum PTT [ms]	358	05:27:59	Flow Limitation	-	-
Minimum PTT [ms]	287	00:14:18	PLM PTT	-	-
Average PTT [ms]	325		Snore PTT	115 (21,6)	52,0
Artefact [min]	0,4 (0,1%)		Heart Rate PTT	27 (5,1)	12,2
			Body Position PTT	-	-
			Spontaneous PTT	47 (8,8)	21,3

Fig. 11-51 PTT Report

**Definitions:**

<b>Dec. (Index)</b>	Number of PTT Decreases – according to the criteria of PTT – during TST (index: per hour of sleep).
<b>Maximum Dec. [ms]</b>	Maximum Decrease of PTT and indication of exact time.
<b>Maximum PTT [ms]</b>	Maximum value of PTT and indication of exact time.
<b>Minimum PTT [ms]</b>	Minimum value of PTT and indication of exact time.
<b>Average PTT [ms]</b>	Average value of all PTT values.
<b>Artefact [min]</b>	Duration and percentage of artefacts in TIB.

<b>Total</b>	<i>Number (Index):</i> Number and index of PTT decreases – according to the criteria for PTT – during TST (index: per hour of sleep). <i>%:</i> Percentage of all PTT decreases.
<b>Respiratory PTT</b>	<i>Number (Index):</i> PTT decreases during TST caused by a respiratory event. <i>%:</i> Percentage of PTT decreases correlating to respiratory events.
<b>Flow Limitation</b>	<i>Number (Index):</i> PTT decreases during TST caused by flow limitations. <i>%:</i> Percentage of PTT decreases correlating to flow limitations.
<b>PLM PTT</b>	<i>Number (Index):</i> PTT decreases during TST caused by a PLM event. <i>%:</i> Percentage of PTT decreases correlating to PLM events.
<b>Snore PTT</b>	<i>Number (Index):</i> PTT decreases during TST caused by a snore event. <i>%:</i> Percentage of PTT decreases correlating to snore events.
<b>Heart Rate PTT</b>	<i>Number (Index):</i> PTT decreases during TST caused by a Heart Rate event. <i>%:</i> Percentage of PTT decreases correlating to heart rate events.
<b>Body Position PTT</b>	<i>Number (Index):</i> PTT decreases during TST caused by a change of Body Position. <i>%:</i> Percentage of PTT decreases correlating to position changes.
<b>Spontaneous PTT</b>	<i>Number (Index):</i> PTT decreases during TST not caused by any of the above-mentioned events. <i>%:</i> Percentage of all spontaneous PTT decreases in relation to all PTT decreases.

### 11.3.16 Systolic Blood Pressure Report

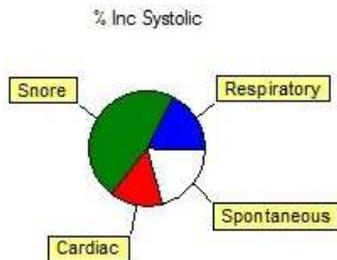


Fig. 11-52 Percentage of Events causing an increase of Blood Pressure

	Number (Index)	Time	Blood Pressure Inc.	Number (Index)	%
<b>Inc. (Index)</b>	<b>143 (26,8)</b>		<b>Total</b>	<b>143 (26,8)</b>	<b>100,0</b>
Maximum Increase [mmHg]	24	23:25:23	Respiratory Systolic	26 (4,9)	18,2
Average Increase [mmHg]	13		Flow Limitation	-	-
<b>Max. Systolic [mmHg]</b>	<b>155</b>	<b>00:14:18</b>	PLM Systolic	-	-
Min. Systolic [mmHg]	117	05:27:59	Snore Systolic	66 (12,4)	46,2
Average Systolic [mmHg]	131		Heart Rate Systolic	21 (3,9)	14,7
Artefact [min]	0,4 (0,1%)		Body Position Systolic	-	-
			Spontaneous Systolic	30 (5,6)	21,0

Fig. 11-53 Systolic Blood Pressure Report

#### Definitions:

<b>Inc. (Index)</b>	Number and index of all increases of the Systolic Blood Pressure during TST (index: per hour of sleep).
<b>Maximum Increase [mm Hg]</b>	Maximum increase of the Systolic Blood Pressure and indication of the exact moment.
<b>Average Increase [mm Hg]</b>	Average value of all increases of the Systolic Blood Pressure.
<b>Max. Systolic [mm Hg]</b>	Maximum value of the Systolic Blood Pressure and indication of the exact moment.
<b>Min. Systolic [mm Hg]</b>	Minimum value of the Systolic Blood Pressure and indication of the exact moment.
<b>Average Systolic [mm Hg]</b>	Average value of all Systolic Blood Pressure values.
<b>Artefact [min]</b>	Duration and percentage of artefacts in TIB.

<b>Total</b>	<i>Number (Index):</i> Number and index of all Blood Pressure (BP) increases during TST (index: per hour of sleep). <i>%:</i> Percentage of all Blood Pressure (BP) increases.
<b>Respiratory Systolic</b>	<i>Number (Index):</i> BP increases during TST caused by a respiratory event. <i>%:</i> Percentage of BP increases correlating to respiratory events.
<b>Flow Limitation</b>	<i>Number (Index):</i> BP increases during TST caused by a flow limitation event. <i>%:</i> Percentage of BP Increases correlating to flow limitations.
<b>PLM Systolic</b>	<i>Number (Index):</i> BP increases during TST caused by a PLM event. <i>%:</i> Percentage of BP Increases correlating to PLM events.
<b>Snore Systolic</b>	<i>Number (Index):</i> BP increases during TST caused by a Snore event. <i>%:</i> Percentage of BP increases correlating to snore events.

<b>Heart Rate Systolic</b>	<i>Number (Index):</i> %:	BP increases during TST caused by a Heart Rate event. Percentage of BP increases correlating to heart rate events.
<b>Body Position Systolic</b>	<i>Number (Index):</i> %:	BP increases during TST caused by a change of Body Position. Percentage of BP increases correlating to position changes.
<b>Spontaneous Systolic</b>	<i>Number (Index):</i> %:	BP increases during TST not caused by any of the above mentioned events. Percentage of all spontaneous BP increases in relation to all BP increases.

Night = TIB

	Ref.	Min. Night	Max. Night	ø Night (Sleep; Wake)	ø Day	ø Record
Systolic [mmHg]	171	129 (-25%)	203 (19%)	148 (148;157)	175	149
Diastolic [mmHg]	83	68 (-18%)	86 (4%)	77 (76;80)	82	77

Position	Supine	not Supine	Left	Right	Prone	Upright
Systolic [mmHg]	153	147	-	147	-	-
Diastolic [mmHg]	78	76	-	76	-	-
MAP [mmHg]	103	100	-	99	-	-

Fig. 11-54 PTT Reports Blood Pressure Day/Night and Blood Pressure Position

**Definitions:**

**Blood Pressure Day/Night**

<b>Systolic / Diastolic [mm Hg]</b>	<ul style="list-style-type: none"> <li><b>Ref.:</b> reference pressure → corresponds to the blood pressure shortly (~3 min) after the beginning of the TIB</li> <li><b>Min. Night:</b> minimum blood pressure measured during the TIB and the fractional change relative to the reference pressure</li> <li><b>Max. Night:</b> maximum blood pressure measured during the TIB and the fractional change relative to the reference pressure</li> <li><b>ø Night (Sleep; Wake):</b> average blood pressure during the entire TIB, as well as during Sleep and Wake periods, respectively</li> <li><b>ø Day:</b> average blood pressure during the day</li> <li><b>ø Record:</b> average blood pressure during the entire recording</li> </ul>
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**Position BP**

<b>Systolic / Diastolic [mm Hg]</b>	Average blood pressure during sleep in the different body positions
<b>MAD (mm Hg)</b>	Mean arterial pressure during Sleep in the different body positions

### 11.3.17 Advanced Blood Pressure Report

The Report "Blood Pressure Day/Night (advanced)" constitutes an adjustment to reports of conventional 24h- blood pressure gauges. It can be selected as part of the PTT report.

#### Blood pressure Day/Night (Non-Dipper)

Total report

	Min.	Aver.	Max.	SD	> Limit
Syst	118	132	181	6,6	93,7 %
Diast	87	96	105	3,0	99,4 %
Pulse	46	56	104	8,2	3,7 %
MAP	99	108	125	3,6	99,3 %
PP	19	36	83	5,9	1,5 %

Day/Night Dipping

Syst	4,4 %
Diast	0 %
Pulse	13,4 %
MAP	2,7 %
PP	12,2 %

Day report

	Min.	Aver.	Max.	SD	> Limit
Syst	127	137	154	5,6	34,9 %
Diast	91	96	105	2,9	97,5 %
Pulse	52	63	104	9,3	1,7 %
MAP	104	110	118	3,0	96,4 %
PP	30	41	54	5,0	0,1 %

Limit: Syst=140, Diast=90, Pulse=60, MAP=105, PP=60

Night report

	Min.	Aver.	Max.	SD	> Limit
Syst	118	131	181	6,5	98,9 %
Diast	87	96	105	3,0	99,5 %
Pulse	46	56	99	7,8	3,8 %
MAP	99	107	125	3,6	99,5 %
PP	19	36	83	5,8	1,6 %

Limit: Syst=120, Diast=80, Pulse=70, MAP=90, PP=50

Fig. 11-55 Advanced Blood Pressure Day/Night

The report lists the percentage of time in which the values of blood pressure, pulse, MAP (mean arterial pressure) and PP (pulse power) lay above predefined values in the column "> Limit" (marked red in the figure above).

Thresholds and limits for the blood pressure report can be defined in the global preferences (see chapter 5) or the local preferences of a particular recording. A dipping threshold can be defined in the settings of the PTT analysis. The report constitutes if the patient is a "Dipper" or "Non-Dipper".

Additional to the table there's a graphic display of the chronological course of systolic and diastolic blood pressure, MAP, Pulse and PP. For an ideal visual impression the TIB period is highlighted grey.

#### Blood pressure

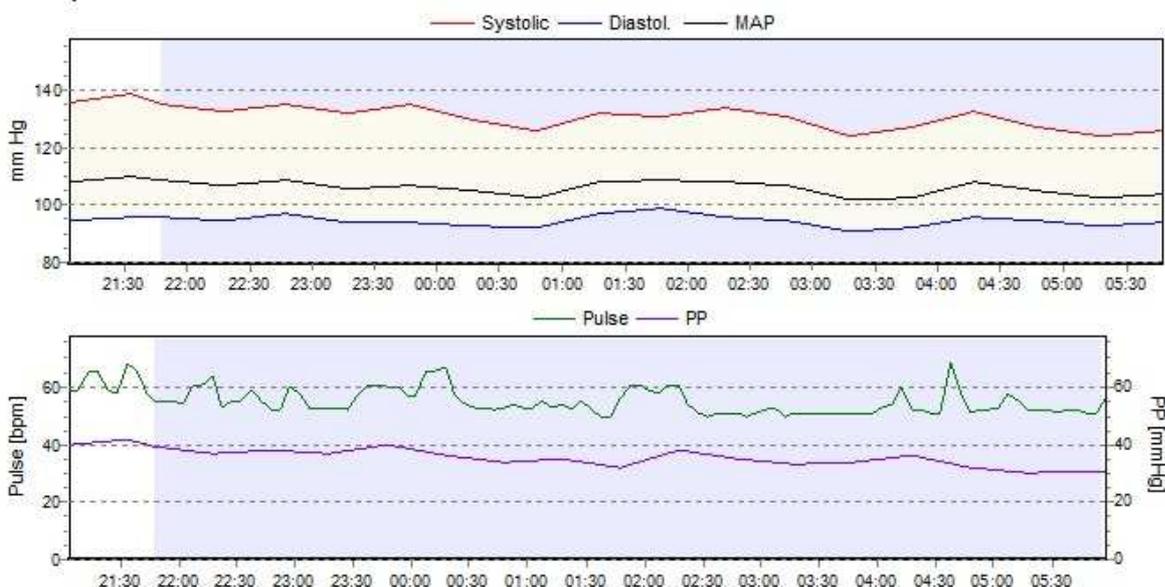


Fig. 11-56 Blood Pressure Graph

For the completion of the blood pressure analysis a blood pressure statistic was appended to the PTT report. It shows additional information on standard deviation, median and percentile values.

### Blood pressure statistic

	Sleep	REM	Non-REM	Wake
Systolic mean [mmHg]	131	131	130	133
Systolic SD [mmHg]	5,4	5,6	5,3	7,8
Systolic 95% Percentile [%]	96,3	96,6	96,3	96,5
Systolic median [mmHg]	130	130	130	133
Diastolic mean [mmHg]	95	96	95	97
Diastolic SD [mmHg]	3,0	2,6	3,1	2,8
Diastolic 95% Percentile [%]	97,2	96,2	95,5	95,6
Diastolic median [mmHg]	95	97	95	96
MAP mean [mmHg]	107	107	106	109
Average HR [bpm]	55	57	54	57

Fig. 11-57 Blood Pressure Statistic

### Definitions:

<b>Syst</b>	<b>Min.</b>	Minimum, average, maximum and standard deviation (of the mean) of systolic and diastolic blood pressure, pulse, mean arterial pressure and pulse power.  Also percentage of time the values lay above the limit set in the global or local preferences.
<b>Diast</b>	<b>Aver.</b>	
<b>Pulse</b>	<b>Max.</b>	
<b>MAD</b>	<b>SD</b>	
<b>PP</b>	<b>&gt; Limit</b>	
<b>Day/Night Dipping</b>	Percentage drop of each parameter between day and night.	

<b>Systolic / diastolic mean [mmHg]</b>	Blood pressure averaged over the respective stages of TIB.
<b>Systolic / diastolic SD [mmHg]</b>	Standard deviation of the blood pressure for the respective stages.
<b>Systolic / diastolic 95% Percentile [%]</b>	Percentage of values within the 95% percentile.
<b>Systolic / diastolic median [mmHg]</b>	Median of the blood pressure for the respective stages.
<b>MAP mean [mmHg]</b>	Mean MAP for the respective stages.
<b>Average HR [bpm]</b>	Averaged heart rate for the respective stages.

### 11.3.18 Body Position Report

	All	Prone	Supine	Left	Right	Upright	not Supine
Sleep Time Fraction [%]	100	-	19,7	40,4	39,9	-	80,3
Duration during sleep	05:19:47	-	01:03:01	02:09:09	02:07:36	-	04:16:46
Duration during REM	01:27:17	-	00:05:31	00:30:09	00:51:36	-	01:21:46
Duration during Non-REM	03:52:30	-	00:57:30	01:39:00	01:16:00	-	02:55:00
Duration awake	02:57:02	-	00:43:46	01:27:11	00:41:08	00:04:55	02:13:15
Position Changes (Index)	18 (3,4)						

Fig. 11-58 Body Position Report

#### Definitions:

<b>Sleep Time Fraction [%]</b>	Percentage of TIB for each body position (Prone, Supine, Left, Right and Upright).
<b>Duration during sleep</b>	Time the patient spent in each body position.
<b>Duration during REM</b>	Time the patient spent in the respective body position during REM sleep.
<b>Duration during Non-REM</b>	Time the patient spent in the respective body position during Non-REM sleep.
<b>Duration awake</b>	Time the patient spent in the respective body position during wake periods.
<b>Position Changes (Index)</b>	Number and index of all changes of body position during TIB (index: per hour of sleep).

### 11.3.19 pH Report

#### pH Report

	Sleep	REM	Non-REM	Wake
Average pH	5,4	5,1	5,5	5,7
Min pH	4,2	4,4	4,2	4,7
Max pH	7,0	5,9	7,0	7,2
pH Episode (Index)	1 (0,2)	1 (0,8)	1 (0,2)	-

Limit: 4,5 pH

	All	Prone	Supine	Left	Right	Upright
Min pH	4,2	-	-	4,9	4,2	-
Average pH	5,4	-	-	5,6	5,2	-
Time < Limit [min] (% TIB)	2,8 (1%)	0,0 (0%)	0,0 (0%)	0,0 (0%)	2,8 (1%)	0,0 (0%)
Time < 6,5 [min] (% TIB)	370,5 (84%)	0,0 (0%)	0,0 (0%)	217,4 (49%)	152,9 (35%)	0,0 (0%)
Numbers pH episodes (Index)	1 (0,2)	-	-	-	1 (0,4)	-
Longest pH episode [min]	2,7	0,0	0,0	0,0	2,7	0,0
OSAS per pH episodes (Index)	-	-	-	-	-	-

Fig. 11-59 Advanced pH Report

The calculation of pH episodes is carried out depending on the threshold set in the preferences (Limit 1). The threshold is shown to the right above the table.

The graph "pH below" displays the percentage of pH values that dropped below a defined value during TIB.

**Definitions:**

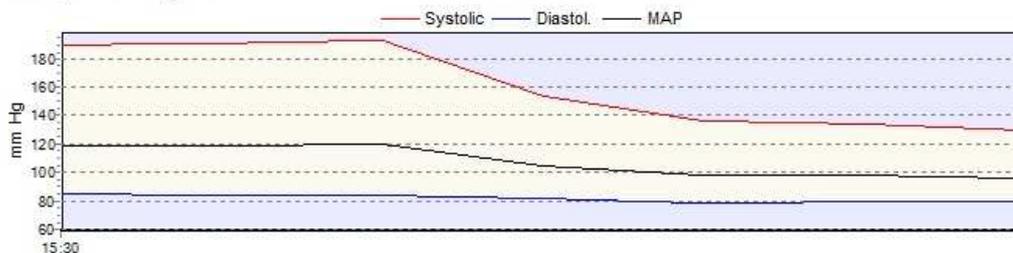
<b>Average Min Max pH</b>	Average, minimum and maximum pH-value for the different sleep stages and body positions.
<b>pH Episode (Index)</b>	Number and index of pH episodes for the different sleep stages and body positions.
<b>Time &lt; Limit [min] (% TIB)</b>	Time in min. and in % of TIB, the pH lay below the set threshold (Limit 1).
<b>Time &lt; 6,5 [min] (% TIB)</b>	Time in min. and in % of TIB, the pH lay below the fixed threshold 6.5.
<b>Longest pH Episode [min]</b>	Duration of the longest pH episode related to the body position.
<b>OSAS per pH episodes (Index)</b>	Number and index of OSAS occurring within 5 minutes before a pH episode (Index: per hour of sleep)

**11.3.20 Tilting Table Report**

The tilting table report gives a tabular overview of blood pressure, pulse and SpO<sub>2</sub> values per minute and the respective body position.

The graph displays the time curve of systolic and diastolic blood pressure and MAP over the time of the recording.

**Tilting table report**



Time	Blood pressure [mmHg]	Pulse [bpm]	SpO <sub>2</sub> [%]	Position
15:30:00	189 / 85	96	94	Upright
15:31:00	190 / 84	99	93	Upright
15:32:00	193 / 84	100	93	Upright
15:33:00	153 / 82	86	94	Supine
15:34:00	136 / 79	77	93	Supine
15:35:00	134 / 80	76	93	Supine
15:36:00	130 / 80	77	93	Supine
15:37:00	123 / 79	74	92	Supine

**Fig. 11-60 Tilting Table Report**

### 11.3.21 Summary

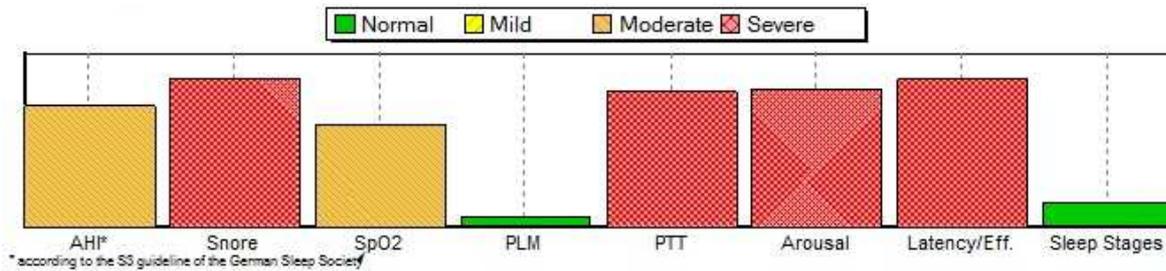


Fig. 11-61 Report Summary

The Summary provides an indication of the severity of the analysed parameters (Green = Normal, Yellow = Mild, Orange = Moderate and Red = Severe). The calculations are based on the relevant bibliographical references.

The analysis for the summary can be selected in the report generator.

### 11.3.22 Case History, Findings, Diagnosis, Comments

**Case History** \_\_\_\_\_

**Findings** \_\_\_\_\_

**Diagnosis** \_\_\_\_\_

**Comments** \_\_\_\_\_

Fig. 11-62 Report fields for Patient Data

In this section of the report, all information entered into the patients file via the menu **“Tools”** → **“Patient Data”** (see chapter 8.3.3.2) is displayed.

## 11.4 Exporting Reports to EXCEL

We have provided some sample Excel reports which can be accessed via the “**MS Excel Reports**” entry in the “**Report**” menu:

- Summary,
- Arousal,
- PLM,
- Respiratory,
- Sleep fragmentation,
- SpO<sub>2</sub>,
- Report Selection: here you can make an individual report selection.

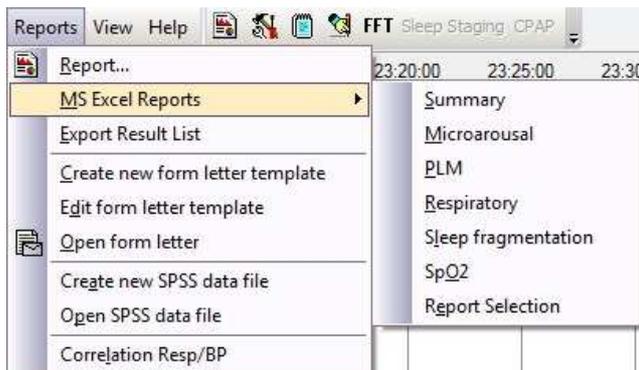


Fig. 11-63 Excel Report Selection

## 11.5 Export Result List

Using the option “Export Result List” of the “Report” menu it is possible to export all analysis results to MS Excel. A maximum of 3,500 values can be exported. The amount depends on the number of channels selected. You can use these values to perform your own calculations or to create your own Reports.



## 12 Form letters

The function for generating form letters simplifies to share diagnostic information with referring physicians, healthcare workers, insurance companies and the patient. In the following, it is explained how you can create a Form Letter or open an already existing one.

### 12.1 Create a template for form letters

This function can be activated in the main menu of a recording → Reports → Create new form letter template.

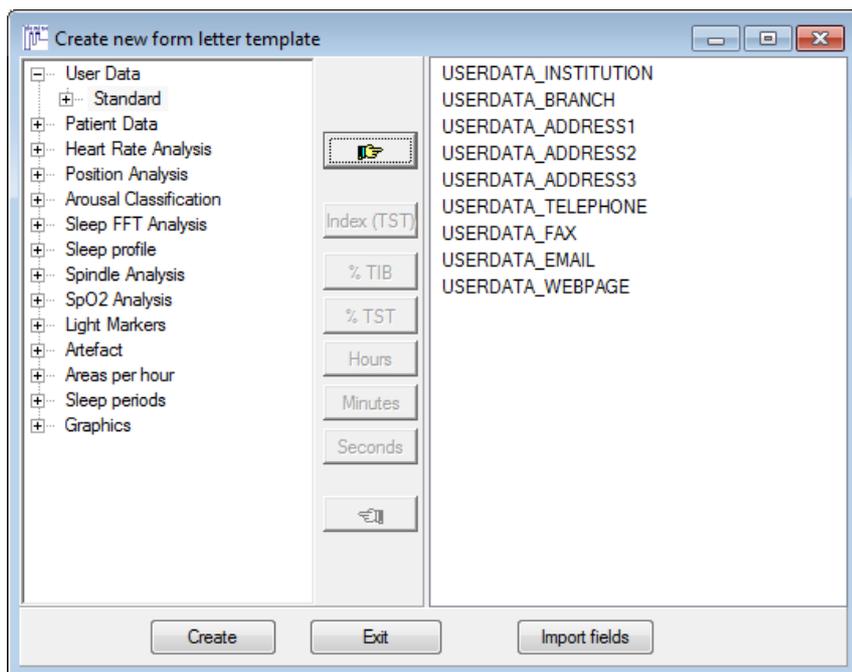


Fig. 12-1 Select items for the form letter

A window will open where you can add items you wish to appear in the form letter with . You can either add all items of a category (select category and click on the button) or just a single item (select item and click on the button).

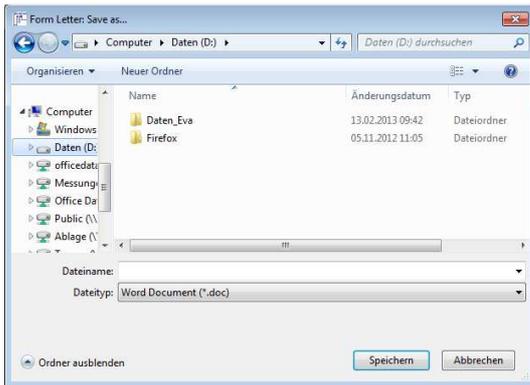
To delete single items from the form letter template, select the item and click on .

With “**Import fields**” you can import fields (items) from existing form letter.

With the buttons “**Index (TST)**”, “**% TIB**”, “**% TST**”, “**Hours**”, “**Minutes**”, “**Seconds**” the item will be included for the selected time frame or displayed in the selected unit.

 **Notice: The maximum number of items for a form letter is 63.**

After selecting all items you wish to include, click on “**Create**” for confirming your selection.



Choose the file path, type in the name of the form letter and click on **“Save”**. The document can be saved as \*.doc or \*.docx format.

**Fig. 12-2 Save template**

The form letter will be opened with MS-Word for further editing. You can add items with **“Insert Merge Field”**. Additionally, it is also possible to use **“Insert Word Field”** to define verbal assignments.

## 12.2 Open a form letter

To create an existing form letter for a specific recording, open the recording and select **“Open form letter”** in the menu **“Reports”** and then select the form letter with double click. The form letter will be opened automatically in MS-Word.



**Notice:** Save the form letter as soon as it opened in MS-Word with a different name. Otherwise, you will overwrite the existing form letter template.

## 12.3 Edit a form letter template

An existing form letter template can be edited by selecting **“Reports”** in the main menu of a recording and then **“Edit form letter template”**. Save the edited template with a different name, otherwise the existing template will be overwritten.

## 13 Data exchange

EDF+ export and import can be used to share data with other sleep laboratories or devices. This function is often used for international scientific studies.

### 13.1 Data export

#### 13.1.1 EDF Export (EDF: European Data Format)

For EDF export, you can use one of the following ways:

- EDF export of raw data that were not filtered:  
Select a recording in the opening dialogue (Fig. 8-1) and click on **“EDF Export”**.
- EDF export of filtered or referenced raw data:  
Open a recording and click on **“File”** → **“Export raw data”** → **“EDF Export”**.

Either way, you will be shown the following window (Fig. 13-1), in which you can type in a name for the file and select a file path.

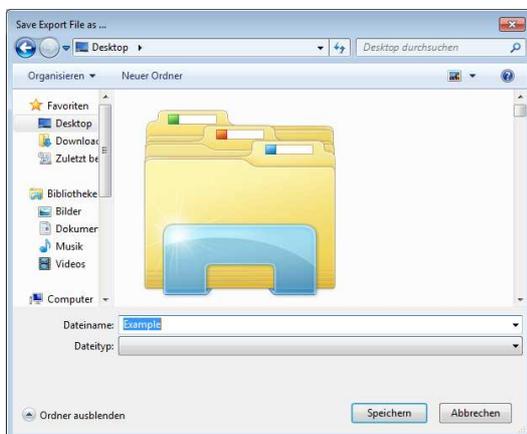
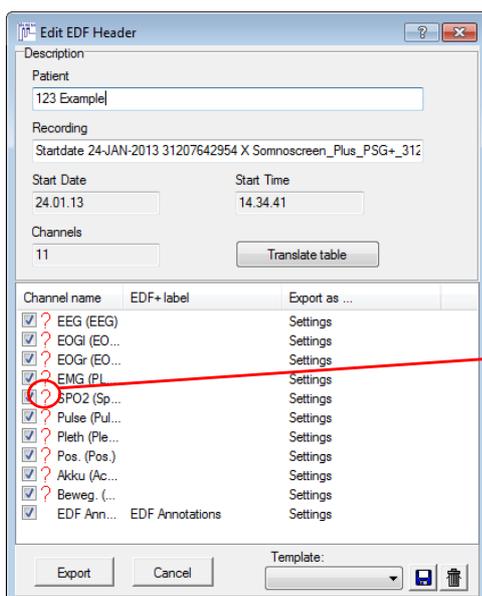


Fig. 13-1 File path for EDF export

After defining the file path, click on **“Save”**. The following window will appear (Fig. 13-2):



? = There is no EDF+ label assigned to the channel.

v = There is an EDF+ label assigned to the channel from the translation table.

 = An EDF+ label was manually assigned to the channel.

Fig. 13-2 EDF+ export channels

The window displays the patient name at the top, with birthdate, start of the recording and the number of channels. At the bottom of the window, you can select channels for the export for activating or deactivating the checkboxes. To simplify the selection of the channels, make a right click on “**Channel name**” to open the menu shown in Fig. 13-3. Here, you can select all channels, deselect all channels or invert channels.

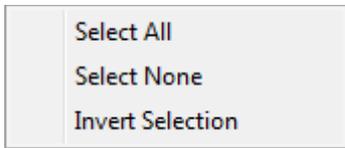


Fig. 13-3 Selection of channels for the EDF export

If you click on “**Settings**” of the channels (column “**Export as ...**”), the following window will pop up (Fig. 13-4):

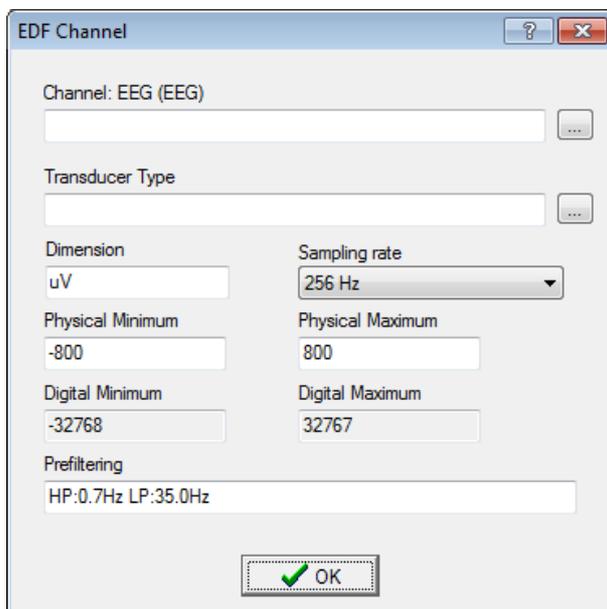


Fig. 13-4 EDF settings for the channel EEG

The window displays the filter settings of the selected channel (channel name, unit, physical minimum and maximum, digital minimum and maximum, prefiltering).

You can assign an EDF label manually, define a transducer type (e.g. reference, rectal temperature recording), change the unit or scale the physical minimum or maximum. Confirm with “**OK**” and you will get back to the window shown in Fig. 13-2.

With a click on “**Translate table**” the following window will appear (Fig. 13-5):

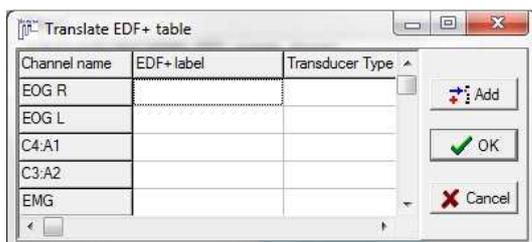


Fig. 13-5 EDF+ translation table

With “**Add**” additional channels can be added to the table.

For entering EDF+ label and transducer type, make a double click on the corresponding field.

Click on “OK” and you will get back to the window shown in Fig. 13-2.

If you want to save your changes as a template, click on .

Templates can be deleted with .



Fig. 13-6 Selection of EDF template

The EDF export can be start by clicking on “Export”.

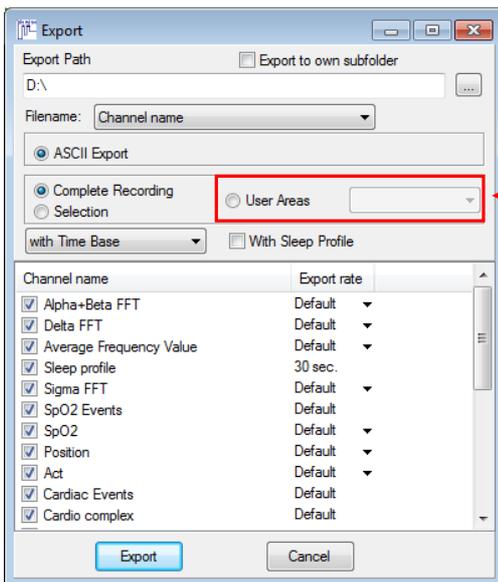
If the export was successful, the window “Export successful” will appear.

### 13.1.2 Export of data as picture or in RIFF or ASCII format

The export window can be opened in a recording by selecting the main menu “File” → “Export analysis data” or “Export raw data”. Besides the EDF export of raw data, analysis and raw data can be exported as picture (.bmp-file or JPEG) or as data (RIFF format or ASCII format).

When exporting analysis data, you can decide whether to export data of the complete recording, for a selected time frame or for defined areas.

The menu for a simplified selection of channels can be opened with a right click on “Channel name”.



Selection of user defined areas for the data export.

User defined areas can be defined by → **Selecting the area** → **right click** → **Define area as**.

Fig. 13-7 Export of analysis data

For the export of channels, you can define a sampling rate (Export rate). Additionally, you can export the time base or the sleep profile for the corresponding data. If the analysis should be exported to an own folder, activate the checkbox “Export to own subfolder”.

Start the export by pressing the button “Export”.

### 13.1.3 SPSS file

SPSS files can display patient data and results of analysis in a table. You will need an appropriate program in order to open and edit the file.

After opening a recording, you can create an SPSS file by selecting **“Reports”** → **“Create new SPSS data file”** in the main menu.

The following window will pop up:

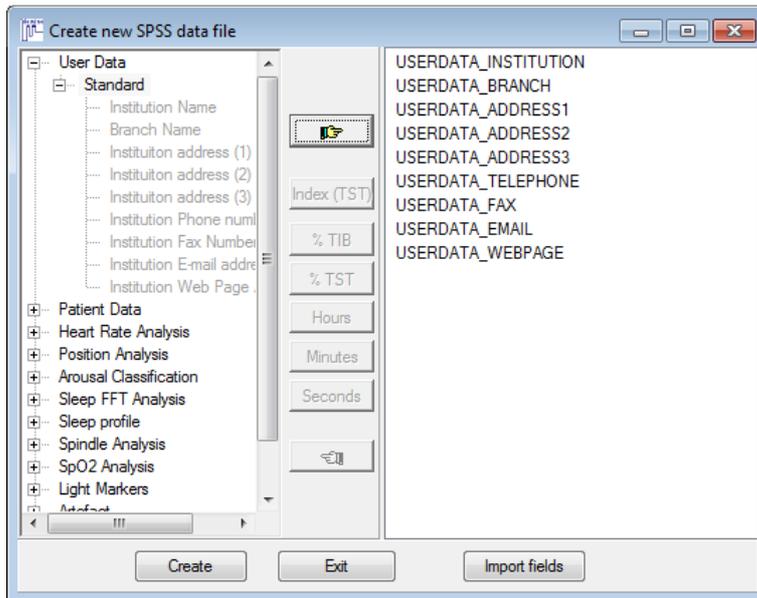


Fig. 13-8 Select items for SPSS file

In the above window, you can select items for adding to the SPSS file. With  you can add items. You can either select a category and add it or add only single items.

For deleting single items from the template, select the item and delete it via .

You can also import existing files with **“Import fields”**. With **“Index (TST)”**, **“% TIB”** and **“% TST”** you define the time frame which is included, **“Hours”**, **“Minutes”**, **“Seconds”** define the unit.

After selecting the items, confirm with **“Create”**.

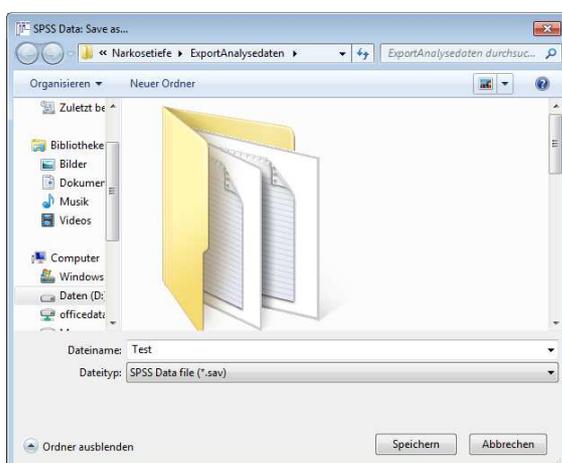


Fig. 13-9 Save data template

Define the file path, type in a name for the SPSS file and confirm with **“Save”**.

The file will be saved in \*.sav format.

Via **“Reports”** → **“Open SPSS data file”** you can open a SPSS data file based on this template. Defining and exporting SPSS data files in the patient database (optional) works analogous.

### 13.1.4 DOMINO Viewer

The DOMINO Viewer can share password protected recordings in an executable file. The recordings can be opened and viewed on other PCs without installing the DOMINO software. Reports can be created for the recording.

To export recordings with the DOMINO viewer, use the function **“File”** → **“Export recording to DOMINO viewer”**.

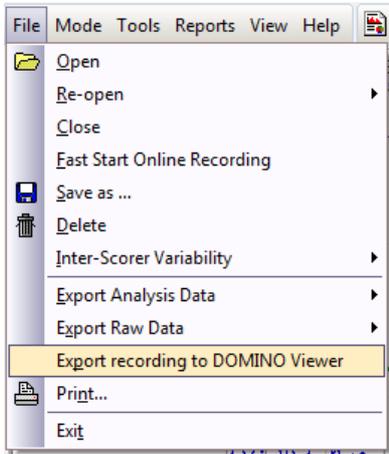


Fig. 13-10 File Menu “Export recording to DOMINO viewer”

After defining a file path, you will be asked to choose a password.

After confirming the password with “OK”, the data will be compressed and exported. Since the file is password protected, it can only be opened by using the correct password. You can share the password e.g. per mail or telephone with the correct recipient. You could also agree upon a standard password with your colleague.

### 13.2 EDF import

This function allows for the EDF import of data.

Select **“Import EDF”** in the opening dialogue of recordings (see also Fig. 8-1). Define the file path in the appearing window and click on **“Open”**. You must then select the correct hardware configuration and confirm with **“OK”**.

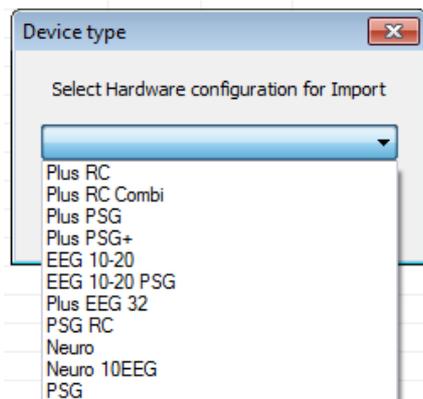


Fig. 13-11 EDF import hardware ID

The following window will appear:

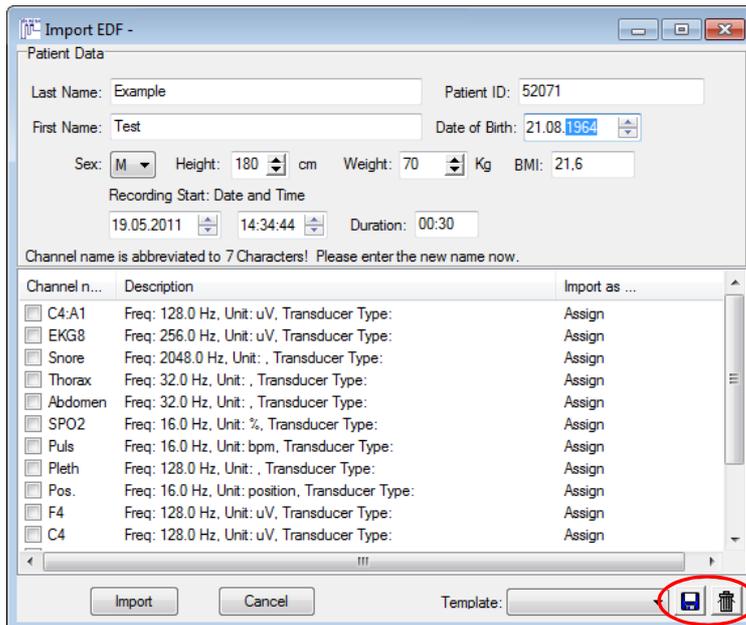


Fig. 13-12 EDF import of channels

In this window, patient data, start and duration of the recording are displayed. Channels can be activated for import after assigning a hardware channel. For the assignment, select the channel name (it will then be marked blue) and click on “Assign”.

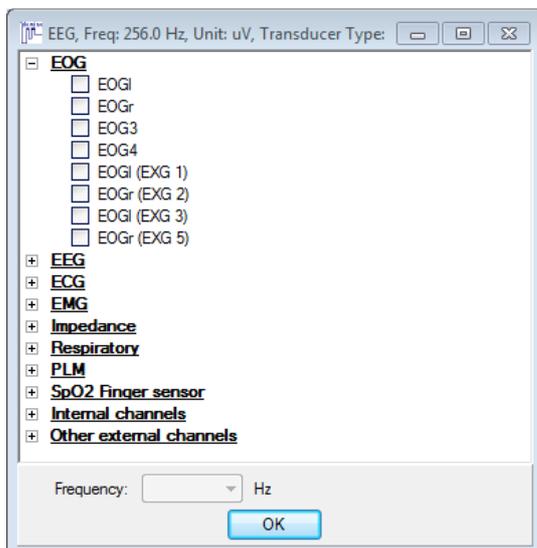


Fig. 13-13 EDF import assignment

Choose a label and the sampling rate (“Frequency”) for each channel. After clicking on “OK” the chosen label for the channel will be displayed in the column “Import as ...” and the channel is activated for import. Repeat the procedure for each channel you would like to import. If you want to rename the channel (Fig. 13-12), mark it, then click on the name again and rename it (just like you are used to in the Windows explorer).

You can create a template with  (Fig. 13-12). The template will save the channel names and labels. The symbol  deletes a template. If you want to start the import, click on “Import”. The recording will be saved to your standard folder.

### 13.3 Simplified data transfer of scorings (e.g. for mobile scoring)

Data exchange between PCs is difficult due to the large data volumes. A simplified method for the exchange of data is realizable with the inter-scorer function (see chapter 8.3.1.2). If you would like to score the recording e.g. on your laptop, you can download the recording online from your server. Then you can score the recording (manually). For the data transfer back to your server, use the function “Inter Scorer Variability”. Save your scoring (analysis window → File → Inter Scorer Variability → Save scorer). With the button “Export” (analysis window → File → Inter Scorer Variability → Scorer Manager) the scoring can be saved as a zip-File. Afterwards, the scorer can be imported in an opened recording with the function “Scorer Manager”. Due to the small data volume of the zip-file, the data transfer can be done with UMTS as well. The import of the inter scorer file is tagged with the ID of the recording. This ensures that only scorings of the opened recording can be imported.

## 14 Archiving

We recommend archiving all successfully analysed recordings on a regular basis and deleting the records from your hard drive once the data is archived. This process should be executed weekly to ensure that there is sufficient storage space on the hard drive and that the data is protected from any damage.

### 14.1 Archiving Data

To Archive Data, proceed as follows:

Insert a CD-R into your CD-writer or a DVD+/-R into your DVD-writer.

**Note: Double Layer DVDs are supported and it is possible to burn multisession CDs.**

Click on the button “**Analysis**” in the **DOMINO** panel and then click on “**Archive**” in the “**Open Recording**” window. The “**Preparing Archive**” window opens. Select the capacity of the storage medium (1) and enter a descriptive name (e.g. calendar week and year) (2).

Activate the pin symbol (3) to keep the window in the front. Thereby you can easily add recordings via drag & drop.

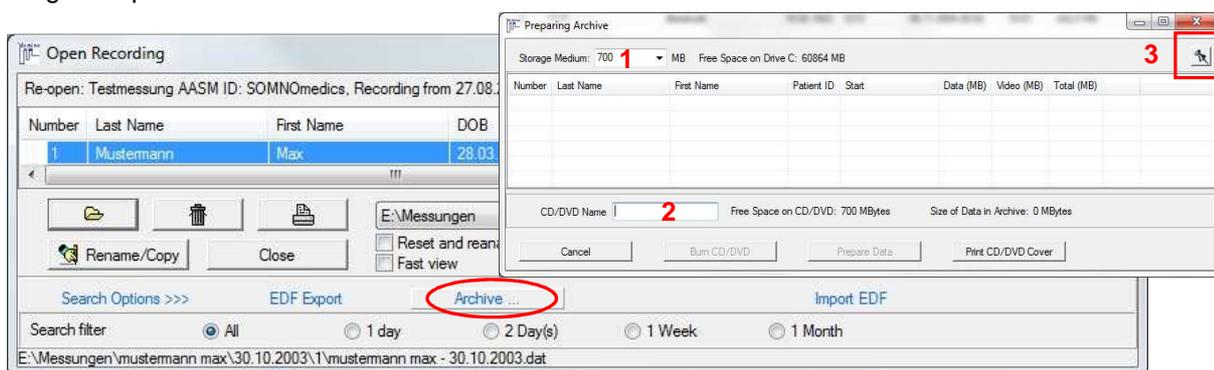
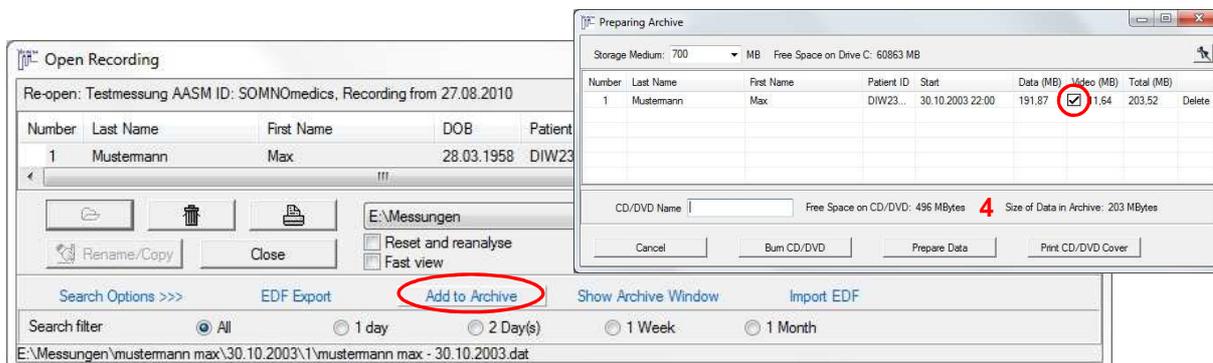


Fig. 14-1 Preparing Archive

Return to the first window and mark a recording you want to add to the archive. Then click “**Add to Archive**” (Fig. 14-2). Repeat this for all recordings you want to archive. If you didn’t set the “**Preparing Archive**” window to the front, click “**Show Archive Window**”. There all added recordings are listed. Check the required capacity of the disc (4). If necessary, single recordings have to be removed from the list or the video archiving (red circle) has to be deactivated. Afterwards click “**Burn CD/DVD**” to start the burning.

Clicking on the **“Prepare Data”** button, all marked recordings will be saved to the folder which was defined as Archive Folder in the **“Global Preferences”** (see chapter 5.2).



**Fig. 14-2 Archiving Data**

A successful burning of the recordings is displayed by **“Writing Successful”** on the screen. The CD symbol and name will be displayed in the **“Archived”** column for all archived recordings if you confirmed this option in the previous dialogue window. It will also be marked as archived in the optional patients database (see chapter 16.6).

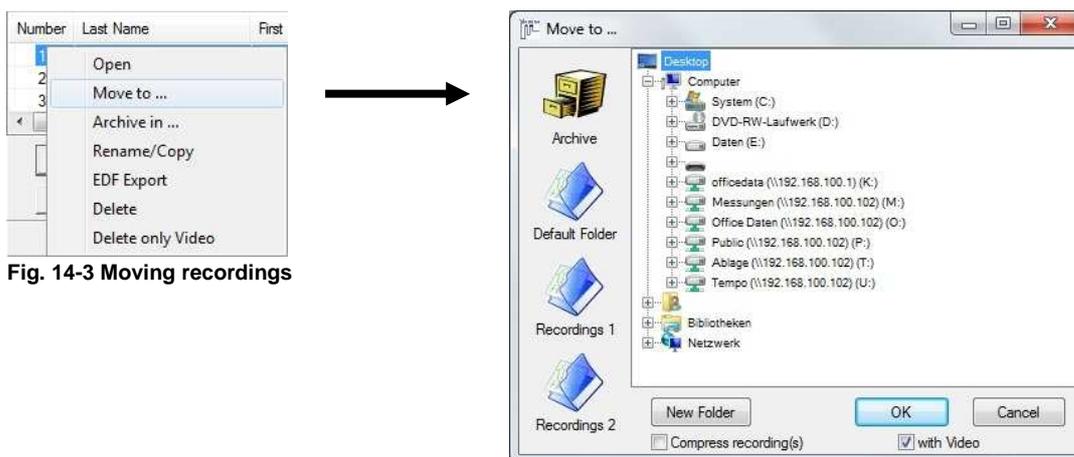
**Please delete the recordings from the hard drive after archiving them successfully!**

**Importing an archived recording:**

Please copy the complete folder (folder name = patient name) from the CD/DVD to the directory **“C:\SOMNOmedics\SomnoScreen x.x.x\measurement”** and remove the write protection. The copied recordings will now be displayed in the **“Open Recording”** window.

**14.2 Moving recordings to an archive or server**

In the **“Open Recording”** window recordings can be moved to some predefined directory (*Global Preferences* → *Folders* → *Default Folder/Recordings/Archive*) via the popup menu.



**Fig. 14-3 Moving recordings**



## 15 SOMNO scheduler

Appointments for patients can be scheduled with the SOMNO scheduler (Fig. 15-1).

You can choose between the three different displays **“Month”**, **“Week”** and **“Daily overview”**. Click on the corresponding tab (1).

Via the arrows << and >> you can scroll through weeks and month, respectively.

To add a new appointment, make a right click on the corresponding date and choose **“Add entry”** (2).



Fig. 15-1 SOMNO scheduler

The following window will come up (**“New entry”**, Fig. 15-2):

Fig. 15-2 Window "New entry"

The functions within the red frame are identical to functions described in chapter 7 (compare to Fig. 7-2).

Enter the time of the appointment in (1). It will be displayed in front of the name in the month view and in the according row of the week view.

If you want to add a note to an appointment, use the field "Note" (2).

You can initialize an online recording starting from the scheduler. Prepare the recording in order to do so (3): Select a montage and define the duration of the online recording. If you would like to, you can also activate the video function.

If you want to additionally record external channels with the ADC board, select a corresponding template for the ADC board.

You can assign colours to your entries, e.g. according to recording type (4). If you do NOT select the checkbox "Appointment", the entry will be displayed in the chosen colour with dashed line. Confirm with "Ok".

The entry will then be displayed in the scheduler (Fig. 15-3). If you point your cursor on the entry, you will be displayed an information window with relevant data.

You can select more functions by making a right click.

4/9/2013	4/10/2013	4/11/2013	4/12/2013
One Example			
4/16/2013			4/19/2013
4/23/2013			4/26/2013
4/30/2013			5/3/2013

Edit entry 1

Start online recording 2

Initialise Flash Card 3

Find recordings 4

Show patient in database 5

Questionnaire 6

Notes 7

Delete entry 8

Fig. 15-3 Popup menu for entry

(1) Edit entries. The window shown in Fig. 15-1 will pop up.

(2) Start an online recording. If you have prepared an online recording for the patient in advance, the software will jump to the preview mode of the recording. Settings like the COM port or IDs for the SOMNOscreen™, camera or ADC Board will be uploaded from the lastly defined settings. If you didn't

prepare for an online recording, only the patient's data are taken over and you have to prepare the recording manually.

- (3) Initialize the flashcard.
- (4) Search for existing recordings of the patient.
- (6) If you have purchased the database, you can search the patient data.
- (6) and (7) These functions are analogous to the functions described in chapter 7.1 (“**Questionnaire**” and “**Notes**”).
- (8) Delete an entry.

### 15.1 Organizing patient appointments

For sleep laboratories with a high number of patients, the function “**Filter**” will be helpful. This function differentiates between patients with already scheduled appointments and patients who do not have an appointment yet. Select “**Filter**” and “**All entries**” and you will be displayed all entries. Patients with an appointment will be shown in full colour, patient who do not yet have an appointment will be shown with dashed background. “**Non scheduled entries**” will display patients without a scheduled appointment only.



Fig. 15-4 Filter function for SOMNO scheduler

### 15.2 Daily overview

For the optimal overview of all patients scheduled for the day, you can select “**Daily overview**”. All entries for the day are displayed on the left side, the test sites are listed on the right. For adding test sites, click on “**Add test site**” and enter a name for the site. Confirm with “**OK**”.



Fig. 15-5 Daily overview in the SOMNO scheduler

Existing recording sites can be edited with a right click (see Fig. 15-6).

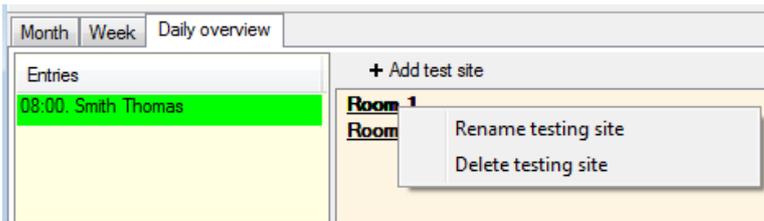


Fig. 15-6 Edit recording site

With drag & drop you can associate appointments with a test site. Editing entries and the initialization of recordings can be performed with right click on the patient name and selecting “**Edit entry**”.

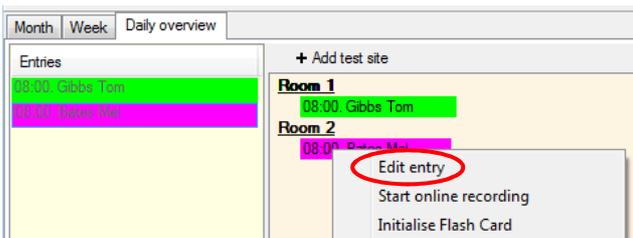


Fig. 15-7 Edit entries

The window “**Edit entry**” (Fig. 15-8) gives an overview of the patient data in the upper half. In the lower half, you can initialize a recording.

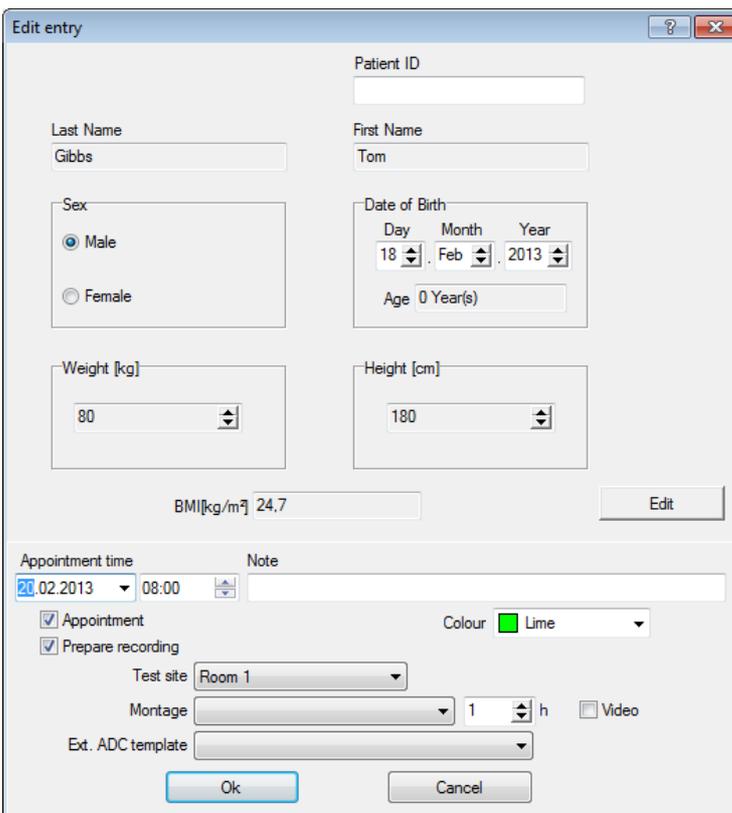


Fig. 15-8 Window “Edit entry”

In this dialogue, you can edit the appointment time, select a test site or choose a montage.

Additionally, you can enter the recording time and activate video recording. If external channels are recorded with the ADC board, you can choose an ADC template.

If you have important notes on the patient (e.g. wears a pacemaker), you can enter them here.

After entering all data, these will be available in the daily overview.

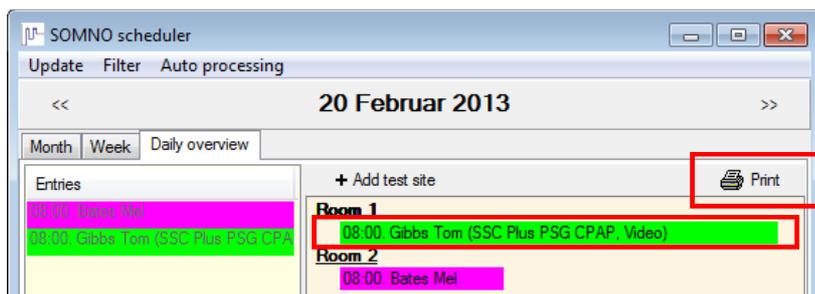


Fig. 15-9 Extended daily overview

All relevant data, e.g. scheduled patients and prepared recordings, test sites, montages, ADC template, video recording and notes can be printed as an overview of the day in a list. Click on “Print”.

The prepared recordings can be started in the menu of the scheduler by making a right click on the entry and selecting “Start online recording” (see Fig. 15-7). The recording will be started with the defined montage and with the video configuration and device IP of the latest setting.

## 16 Options

### 16.1 Calibration of signals from external devices

**Notice:** External devices must be connected via the Optical Coupler (article no.:SSC082)!

In order to connect external devices (for example Capnograph) to the SOMNOscreen™, it is necessary to use an analogue Optical Coupler. This is available from SOMNOmedics under article no. SSC082. Please note the external systems Signal Voltage. Only connect external systems to the channels AUX and both left and right PLM channels!

Channel	Signal type	Signal voltage	
AUX	DC	AUX-DC	±1,2V
	AC	AUX-Ext	±120mV
PLM left	AUX-DC-l	±120mV	
PLM right	AUX-DC-r	±120mV	

#### 16.1.1 Active calibration

Active calibration is a two-point calibration. You will need an external device **with** a Display.

Please proceed as follows:

- Connect the external device (via the Opto-Coupler) and all other required sensors to the SOMNOscreen™.
- Start the Online Mode and switch on the external device as well as the SOMNOscreen™.
- For a two-point calibration, it is recommended to choose two points near the minimum and maximum signal value of the external device
- Press the Patient Marker on the SOMNOscreen™ as soon as the external device reaches the minimum value. Now apply a signal to the external device and when the value reaches its maximum, press the Patient Marker a second time.

- Note both values obtained from the external device and the values at the position of the Patient Markers. To see the values at the Markers, activate **“View”** → **“Show Info Box”**.
- To calibrate the signal, double-click on the channel name. The Channel Settings of the Raw Data will open. Click on the  button to open the Calibration menu.

The following window will appear:

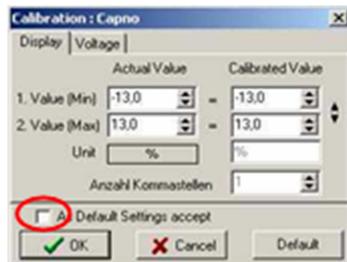


Fig. 16-1 Calibration window: display

The standard settings for this channel are shown as the default values. Now enter the values which were displayed on the device under the heading **“Calibrated Value”** and the values from the raw data curve under **“Actual Value”**. Insert the Minimum Value into the box corresponding to 1. Value (Min), and the Maximum Value into the box corresponding to 2. Value (Max). Select a Unit for the signal, for example kPa. Confirm by clicking **“OK”**.

**This will save these values for the current recording only!** If you wish to save these settings as a default value for all other recordings, activate the checkbox **“Accept as Default Settings”** (marked red in Fig. 16-1). By clicking on the **“Default”** button, it is possible to restore the predefined factory values.

### 16.1.2 Passive calibration

It is also possible to calibrate the system using a Passive technique. Using the information obtained from the Data Sheet of the external device, open the **“Global Preferences”** and select the **“Channels”** menu. Double click on the channel you wish to connect the External Device to and click on the  button to open the calibration menu.

Select the **“Voltage”** menu.

Enter the parameters from the datasheet as well as the unit of the calibrated values.

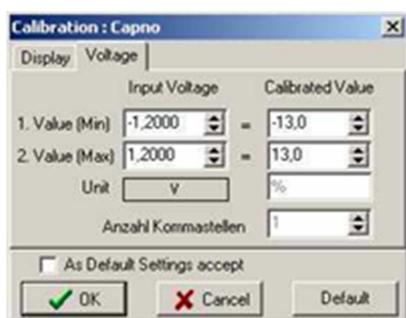


Fig. 16-2 Calibration window: voltage

It is also possible to perform a Passive Calibration after a recording has been completed. From within the Analysis window select the **“Channels”** menu from **“Tools”** → **“Preferences”**. Double click on the relevant channel and click on the  button to open the calibration menu.

Select the **“Voltage”** menu.

Enter the parameters from the datasheet as well as the unit of calibration.

## 16.2 Extension of channels with external ADC

It is possible to expand the number of recording channels with the external ADC. The inputs support DC voltages (range: 0V to 4V and -2V to +2V respectively).

### Please note:

- Only use the delivered 5V power supply.
- Don't connect electrodes like e.g. EEG or ECG directly to the ADC.

### Connection to the PC

- Serial cable (or USB to serial adapter + serial cable)
  - max. distance to PC: 15m
  - max. sampling rate per channel: 128 samples / s
- LAN to serial adapter
  - max. sampling rate per channel: 32 samples / s

### Preparations:

Create a folder named **“ExternChannels”** in  
C:\Program Files\SOMNOmedics\SomnoScreen\bin\plugins.

Copy the file **“ExternChannels.dll”** into this folder.

Afterwards copy the file **“hardware PSG.cfg”** to  
C:\Program Files\SOMNOmedics\SomnoScreen\etc. Overwrite the already existing file.

Start the **“Online Mode”** and select a montage with the hardware ID **“PSG” (1)**.  
Now it is possible to select **“External ADC” (2)**.

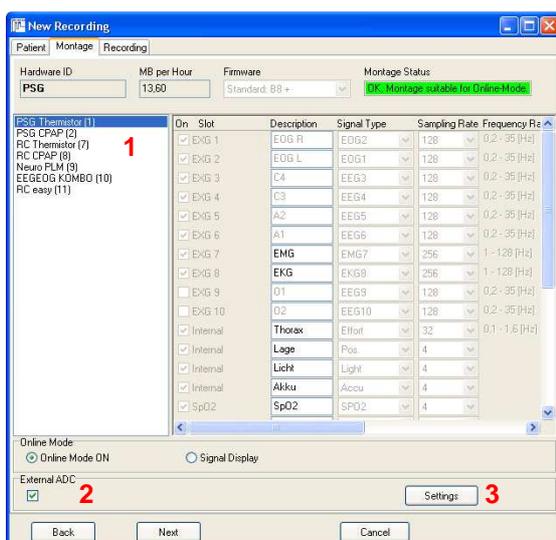


Fig. 16-3: External ADC

Click on **„Settings” (3)**. The window shown in Fig. 16-4 will open:

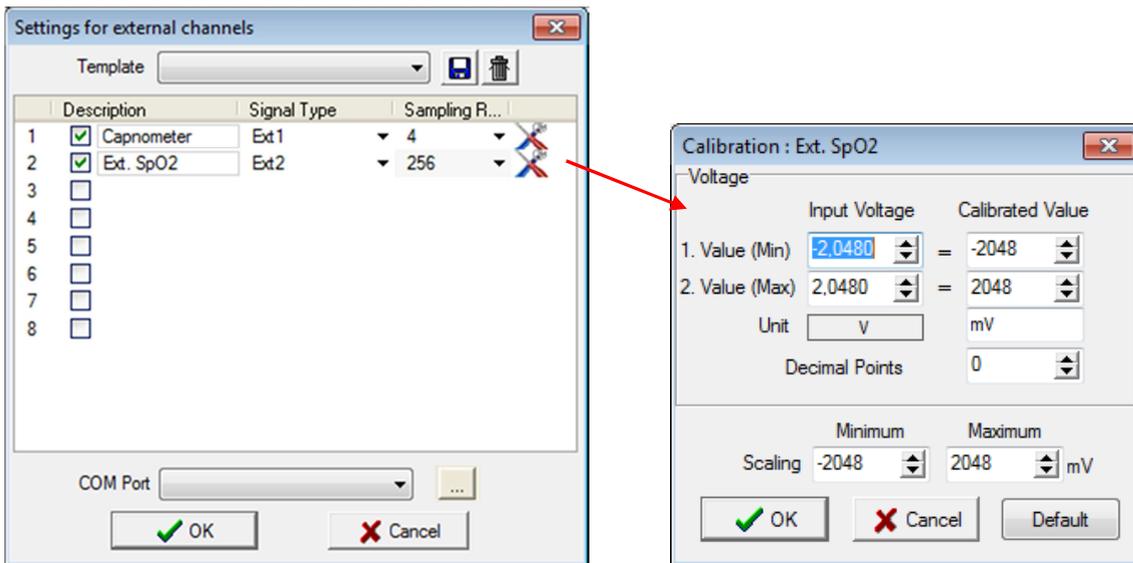


Fig. 16-4 Settings for external channels

Select channels you would like to record. Label the channels and select signal type and sampling rate.

For entering the IP address, click on .

By clicking on the tools symbol , the window shown on the right of Fig. 16-4 will open. Here, you can calibrate the external channels just like in the Global Preferences. You can also choose the scaling of channels here.

For saving the settings, click on .

You will be asked to enter a name for the template. Save the template by clicking on “OK”.

Defined templates are available in the selection menu “Template” and can be selected for the recording. Templates can be deleted by clicking on .

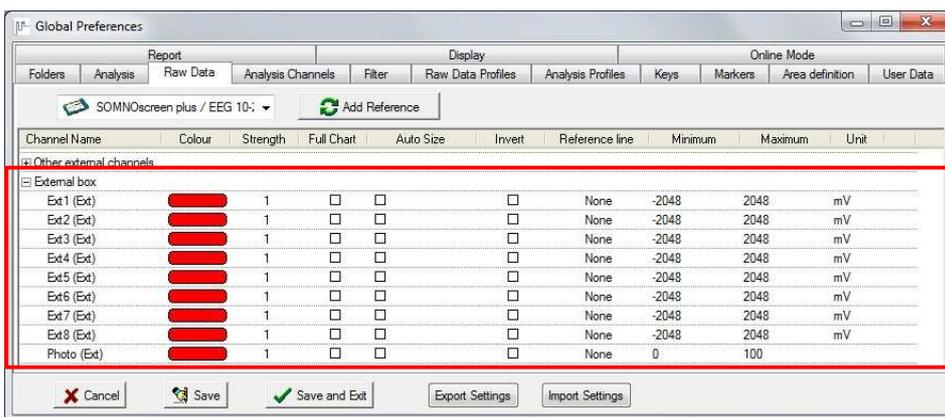


Fig. 16-5 Channel settings

The defined channels will be displayed in “Global Preferences” → “Raw Data” → “External box”.

**Notice:**

You can change settings and filters for external channels in the Global Preferences before starting a recording.

## 16.3 Determination of blood pressure

### 16.3.1 Determination of blood pressure in offline recordings

**Prerequisite:** The blood pressure of the patient must be measured with an external device at the beginning of a recording and the patient marker (  ) must be pressed simultaneously.

Activate the checkbox Signal check during initialisation of the flashcard and select the time you need for manually measuring the blood pressure (e.g. 5 min).

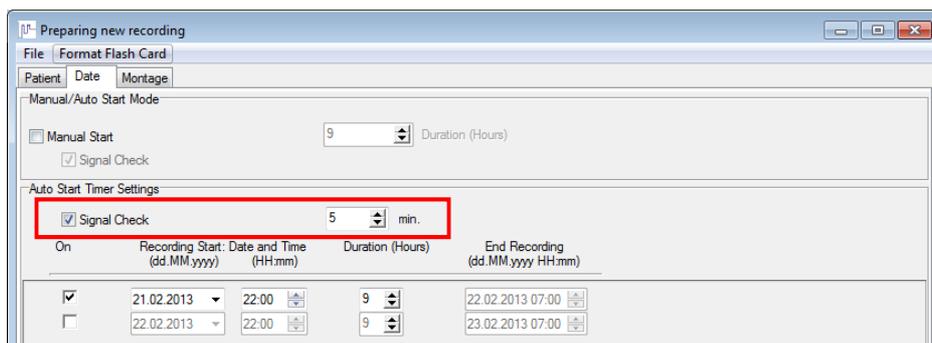
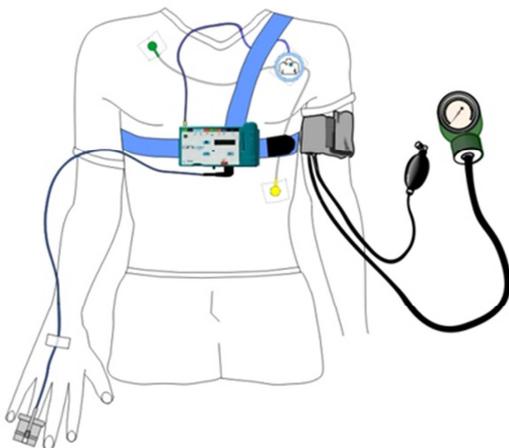


Fig. 16-6 Settings during initialisation

Insert the flashcard into the SOMNOscreen™ and activate the device (press on “O” of “SOMNOscreen”). The SOMNOscreen™ will start with the programmed signal check (e.g. 5 min). The display will show “01. Recording...”. During the pre-set time, the systolic and diastolic blood pressure of the patient have to be measured.

**Please proceed as follows when measuring the blood pressure with an external device:**

with the 3-channel ECG electrode:



with ECG over headbox:

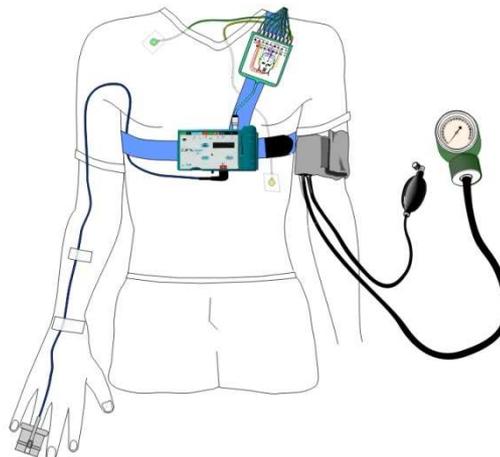


Fig. 16-7 Applying the device for measuring blood pressure

Press the patient marker (  ) on the SOMNOscreen™ as close to the blood pressure measurement as possible (best is simultaneously) and write down the measured blood pressure values.

After the programmed time (e.g. 5 min) the device will switch to the waiting mode automatically (a green light on the front will blink).

During transfer of data after the recording, you will be shown two recordings. Please transfer both recordings (1) and activate the checkbox “Add Signal Check” (2). Both recordings will be included in one recording.

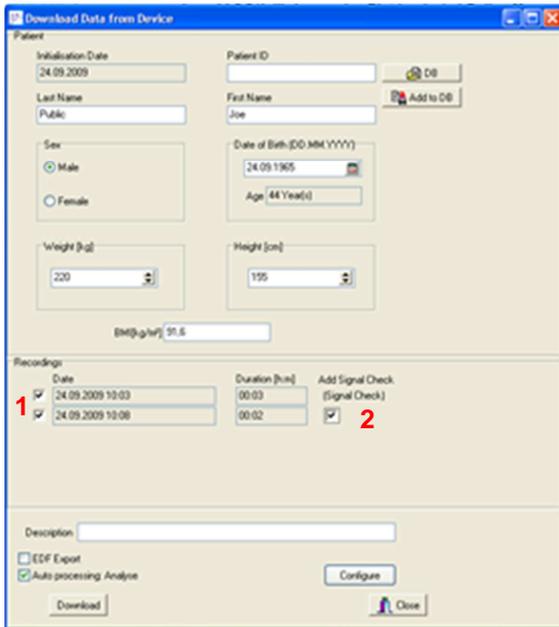


Fig. 16-8 Data transfer with signal control

Open the recording and select “**Mode**” → “**Edit Mode**”. Position the cursor on the patient marker and make a right click. Select “**BD calibration**” and enter the blood pressure values you measured with the external device.

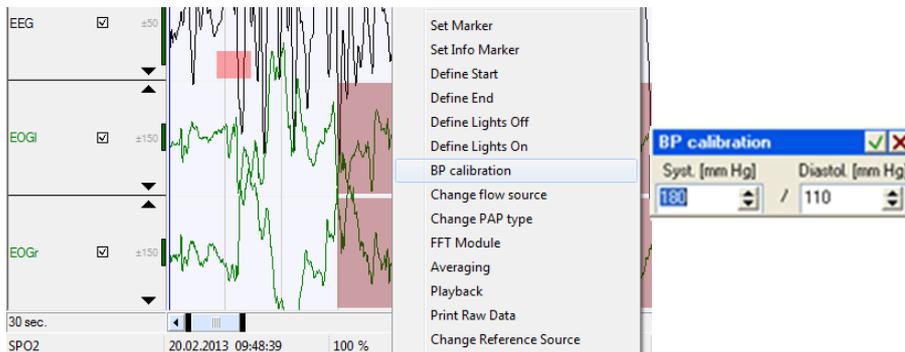


Fig. 16-9 Calibrate BP

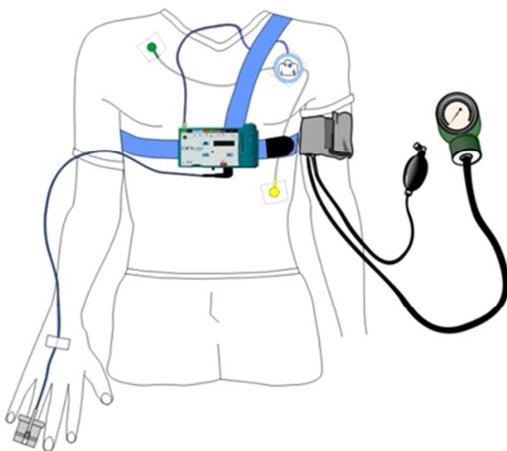
The blood pressure curve will be calculated automatically and will be displayed in the analysis window.

### 16.3.2 Determination of blood pressure in online recordings

**Prerequisite:** The blood pressure of the patient must be measured with an external device at the beginning of a recording and the patient marker (  ) must be pressed simultaneously.

**Please proceed as following when measuring the blood pressure with an external device:**

with the 3-channel ECG electrode:



with ECG over headbox

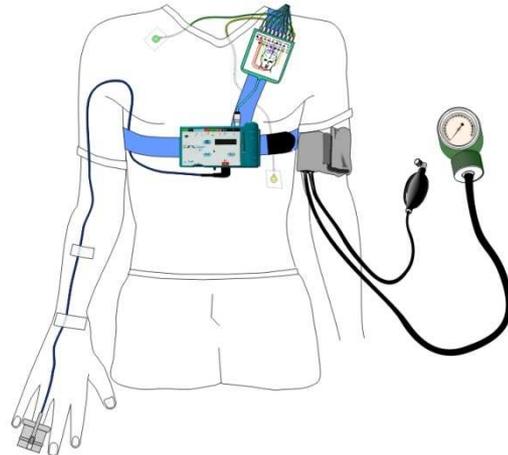


Fig. 16-10 Applying the device for measuring blood pressure

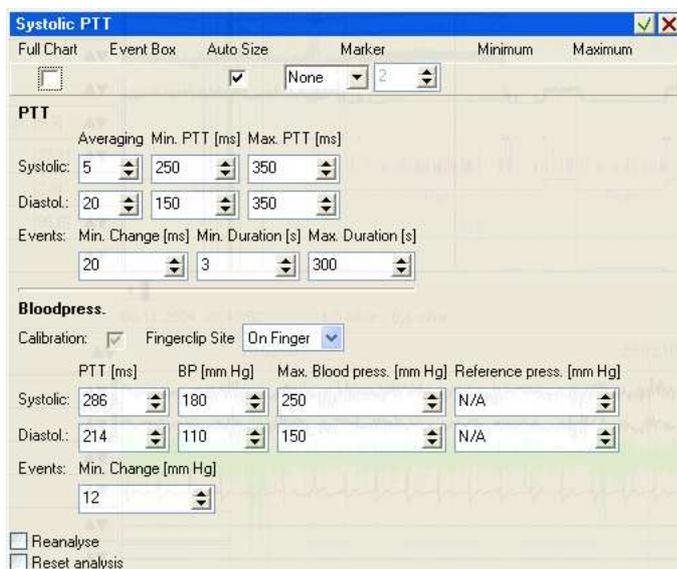
Set a patient marker (  ) simultaneously to measuring the blood pressure and write down the measured blood pressure values.

Position the cursor on the patient marker during online recording and select the point “**BP calibration**” by making a right click. Enter the measured values into the window.

The blood pressure curves will be calculated and displayed in the analysis window.

**When applying the SpO2-sensor on the toe:**

Double-click on “**PTT**” (on the left hand side of the analysis window). The parameter window (Fig. 16-11) will open automatically.



Select the respective position of the finger clip in “**Fingerclip Site**”. By using the tick button (  ) the parameter window is closed and the blood pressure curve will be displayed in the analysis window.

Fig. 16-11 Blood pressure settings

## 16.4 Photo Stimulator

During the online recording there's the possibility to perform a frequency controlled photo stimulation directly from DOMINO. Connect the photo stimulator to the selected COM Port and click at the photo stimulator symbol  in the quick start bar. If the symbol is not there yet you can adjust the bar as described in chapter 8.5.

The following window opens:

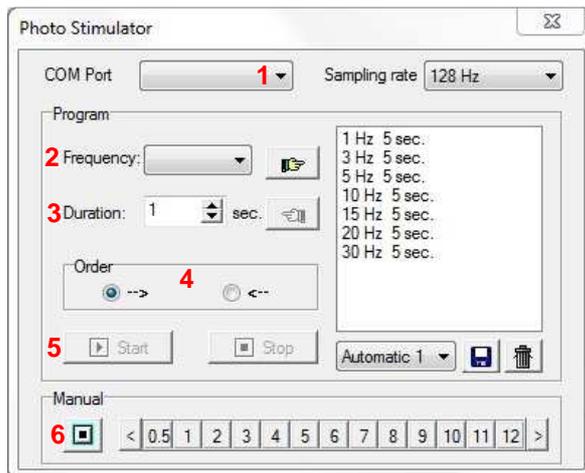


Fig. 16-12 Photo Stimulator

Select the port of the photo stimulator at (1).

now there are two ways to axecute the photo stimulation:

### 1. Programmed:

Select frequency (2) and duration (3) of a photo stimulation phase and transfer the settings to the process list via . The order of the list can be set to ascending (<-->) (4). The Program can be saved via the disk button and loaded from the drop down menu.

“Start” (5) launches the program.

### 2. Manual

Selecting a frequency in the “Manual” field (6) a photo stimulation of constant frequency and optional length can be executed.

## 16.5 User Manager

The function “**User Manager**” enables the assignment of different access rights for different users. Functions like analysis of recordings or access to the global preferences can be denied to particular users. Further on the User Manager enables access to a central configuration folder for multiple PCs of a network.

The use of the User Manager affords a password that can be set individually for each user. Likewise a profile can be adjusted for each user where the access to the different software functions is selected. Those rights can only be granted by the administrator.

The User Manager is an independent program you find in “C:\SOMNOmedics\SomnoScreen x.x.x\bin\UsersManager.exe”.

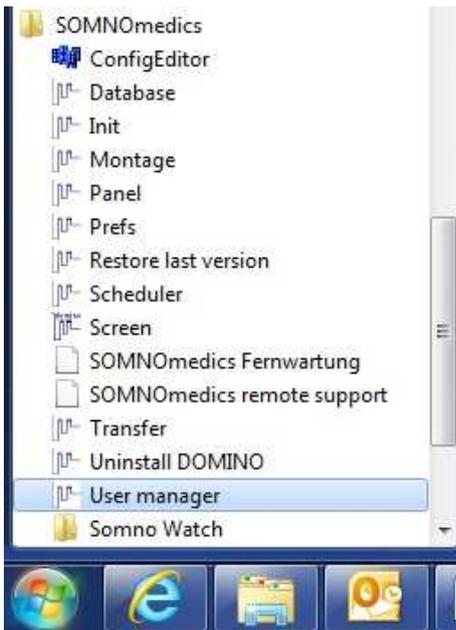


Fig. 16-13 Open the User Manager



Fig. 16-14 Add User

The administrator can add multiple users and protect the profiles with a password.

Confirmation with “**OK**” adds the user to the User Manager and opens the according window.

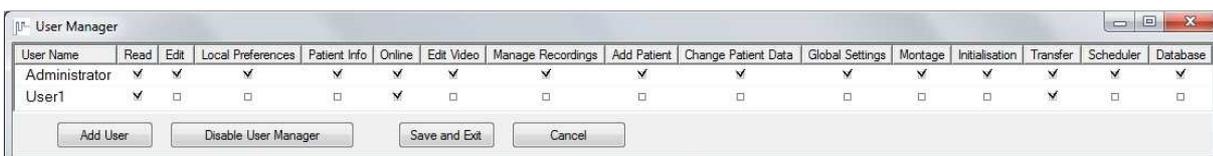
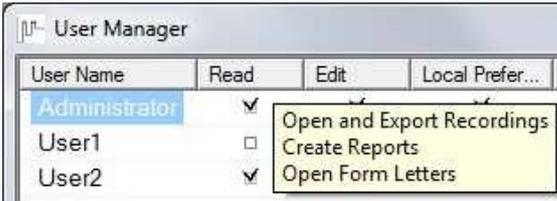


Fig. 16-15 User Manager

The Administrator grants the access rights by ticking the respective checkboxes.



When the cursor is above a column name a yellow infobox pops up where the rights of the specific function are described.

Fig. 16-16 User rights

Via the buttons of the lower bar of the User Manager users can be added, settings can be saved and the User Manager function can be deactivated.

If the User Manager is active, a login is required to use DOMINO. A login window opens where user name and password have to be entered.

The name of the currently logged in user is displayed next to the software information. Non-available functions are displayed in grey.

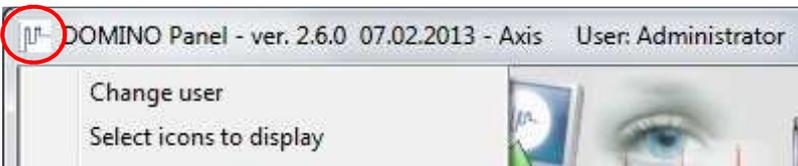


Fig. 16-17 DOMINO Panel for different users

To change the user click at the SOMNOmedics icon in the top left corner of the panel. Select “**Change user**” from the opening menu.



## 16.6 Patient Database

The patient database offers detailed information on all added patients, their recordings and results. The database can also display a trend for an individual patient. It allows you to search for patients according to different criteria and to sort and display them in any order. The **“File”** menu includes the **“Import”** feature which makes it possible to import CSV-files.

### 16.6.1 Registration

The patient database is an optional function and has to be activated with a registration code. If you open the database without registration, a computer ID is displayed which has to be sent to the SOMNOmedics service to get your registration code for the database.

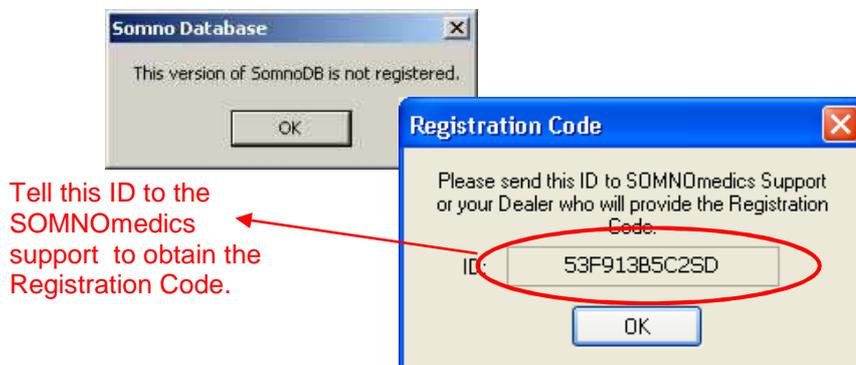


Fig. 16-18 Registration of the database

Enter the code in the **“Folders”** tab of the **“Global Preferences”** and confirm with **“Save”** or **“Save and Exit”**.

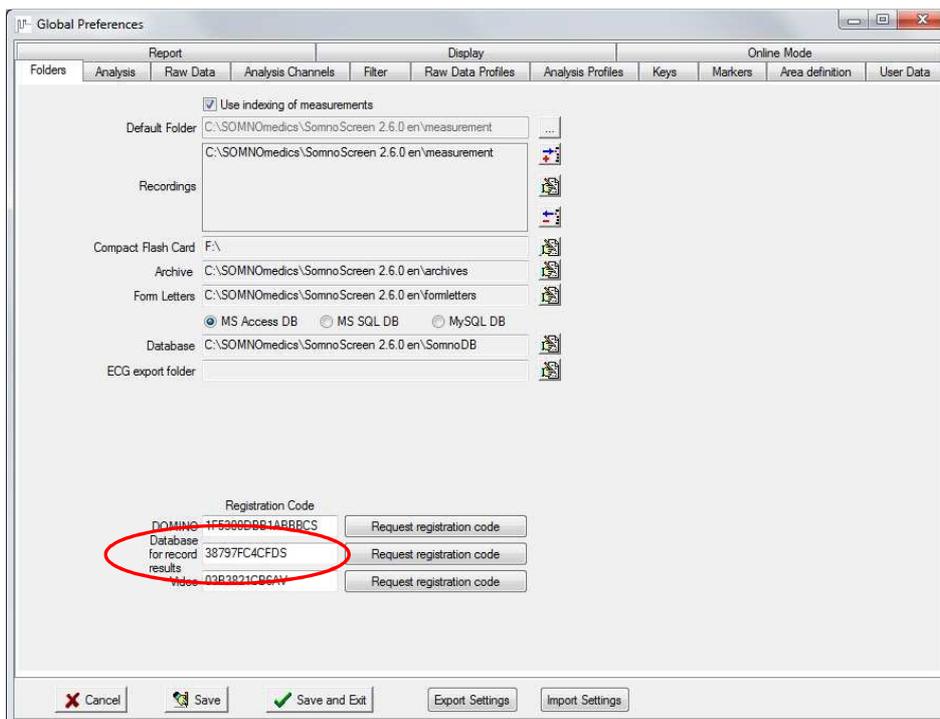


Fig. 16-19 Enter Registration Code

## 16.6.2 Opening the database

When opening the database the following window opens:

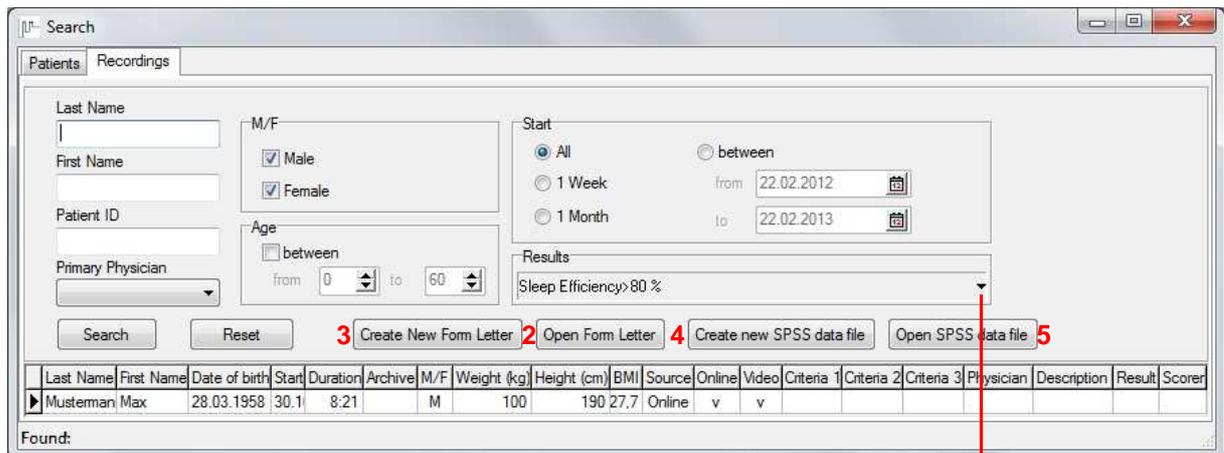
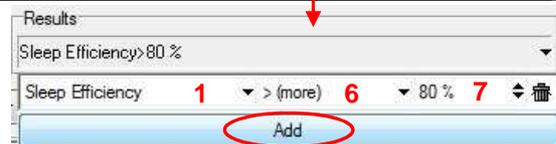


Fig. 16-20 Searching the database



You can search for patients or recordings by means of different criteria, e.g. name. You can also search for recordings by means of recording results (1). There are the following relational operators (6):

- “=”: equal
- “>”: more
- “>=”: more or equal
- “<”: less
- “<=”: less or equal
- “<>”: not equal

Link a result criterion (1) with a relational operator (6) to a value (7). You can define up to 5 search criteria. Afterwards click “**Search**”.

The results of the search are displayed in the lower part. Click right into the display field to select the columns to be displayed. The results can be arranged by left clicking the columnname for the sorting. When a recording is selected a form letter can be opened (2) or created (3) as well as a SPSS data file can be opened (5) or created (4).

A double-click at a recording transfers it to the list of the main window.

### 16.6.3 Tab “History”

Edits patient data like name or date of birth.

Deletes a patient from the database

Deletes single recordings of a particular patient from the database

Creates a PDF document consisting of:  
- patient picture  
- questionnaire results  
- notes

Fig. 16-21 Tab “History”

Patient data and corresponding recording/s.

Adds results of questionnaires on Daytime Sleepiness (ESS), Restless Legs Syndrome (RLS) or the STOP-Bang questionnaire.

Adds important information on the patient with date and time.

Last Name	First Name	Date of birth	M/F	Patient ID	Age	Recordings	CPAP De...	Question...	Notes	Summary
Mustermann	Max	28.03.1958	M	DIW2319.3.2.73...	54	1		0	0	0

Start	Duration	Source	Online	Video	Archive	Height (cm)	Weight (kg)	BMI	Age	Physician	Scorer	Description	Criteria 1	Criteria 2	Criteria 3	CPAP Counter
30.10.2003	8:21	Online	v			190	100	27.7	45							0

After selecting the required patient, the data and parameters of the patient's recording/s will be displayed in the lower part of the window. You can delete entire patient entries as well as individual recordings of a patient. Multiple recordings can be sorted e.g. by means of “Start” with a click on the column name.

Via “Search” you can access the search window anytime to start a new search.

#### 16.6.3.1 Edit Patient Data

Patient Data

Patient ID:

Last Name:  Unknown

First Name:  Unknown

M/F:  Male  Female

Date of birth: day: 21, Month: Feb, Year: 1980

Age: 33 Year(s)

Weight [kg]:  80

Height [cm]:  180

BMI [kg/m<sup>2</sup>]: 24.7

Address:

Initials:

Referred:

Indication:

Occupation:

Race:

Working status:

Studies level:

Post menopause:

Heart disease:

Subj. somatotype:

Epilepsy:

Alcohol:

Freq.:  Volume:

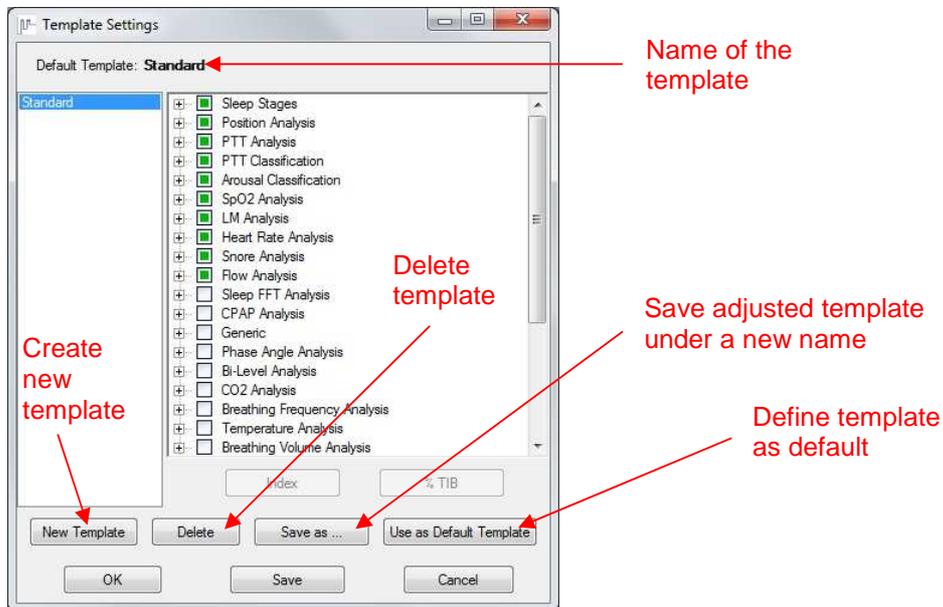
OK Cancel

Fig. 16-22 Edit Patient Data

Via the arrow button (1) you get to an extended area (red frame) of the window “Patient Data” where additional information can be entered.

### 16.6.3.2 Add Trend Display

From the tab “**History**” a trend display can be created for multiple recordings of a patient. Therefore define a template with the desired results via “**Tools**” → “**Result Templates**”. The following window opens:



**Fig. 16-23 Define Template**

When opened the results of the default template are displayed. Other templates can be selected for display.

“**Tools**” → “**Results**” opens the result list below where sleep stages and trends of the recordings can be displayed.

Results from this window can be added to the list via drag & drop.

Mark parameters in the list for the trend display. Via "Create Trend Display" / "Show Trend Display" the trends are displayed.

Sleep stages of the recordings are displayed here.



Closes the window.

Selected results will be deleted

Results of this study

Last Name: Junker, First Name: Mandy, Date of birth: 30.04.1981

Template: Standard

	Start	Duration	Source	Height	Weight	Age s
Recording 1	17.06.2004 21.5	7:54	CF	1.70	83.0	23
Recording 2	20.08.2004 10.5	0:37	Online	1.80	80.0	23

Result	Unit	Recording 1	Recording 2	Average	σDeviation
TIB		07:54:00	-	07:54:00	00:00:00
Total sleep time		07:39:30	-	07:39:30	00:00:00
Wake % TIB	%	3.3	-	3.3	0.0
REM % TIB	%	15.0	-	15.0	0.0
NonREM % TIB	%	81.8	-	81.8	0.0
Stage 1 % Sleep d.	%	6.1	-	6.1	0.0
Stage 2 % Sleep d.	%	25.3	-	25.3	0.0
Stage 3 % Sleep d.	%	13.6	-	13.6	0.0
Stage 4 % Sleep d.	%	25.7	-	25.7	0.0
Sleep latency		00:00:00	-	00:00:00	00:00:00
Sleep efficiency	%	96.7	-	96.7	0.0
Sleepstage change	1/h	30.6	-	30.6	0.0
Position changes L	1/h	0.8	-	0.8	0.0
Phone sleep duration		00:00:00	-	00:00:00	00:00:00
Left sleep duration		00:24:15	-	00:24:15	00:00:00
Right sleep duration		03:16:02	-	03:16:02	00:00:00
Dec. (Index)	1/h	86.0	-	86.0	0.0
Spontaneous PTT	1/h	70.5	-	70.5	0.0
Respiratory PTT (l)	1/h	1.4	-	1.4	0.0
PLM PTT (Index)	1/h	0.0	-	0.0	0.0
Heart rate PTT (ln)	1/h	13.3	-	13.3	0.0
Score PTT (Index)	1/h	1.4	-	1.4	0.0
Bodyposition PTT	1/h	0.0	-	0.0	0.0
Spontaneous MA (l)	1/h	9.4	-	9.4	0.0
Respiratory MA (ln)	1/h	0.0	-	0.0	0.0
PLM MA (Index)	1/h	0.0	-	0.0	0.0
Desaturation MA (l)	1/h	0.0	-	0.0	0.0
Heart rate MA (Ind.)	1/h	1.3	-	1.3	0.0
Snore MA (Index)	1/h	0.1	-	0.1	0.0
Desaturation (Index)	1/h	0.4	-	0.4	0.0
Baseline O2 Sat. (%)	%	95	-	95.0	0.0
Isolated LMs (Index)	1/h	4.3	-	4.3	0.0
PLMs (Index)	1/h	0.0	-	0.0	0.0
RespLMs (Index)	1/h	0.1	-	0.1	0.0
HR Acc. (Index)	1/h	11.1	-	11.1	0.0
HR Dec. (Index)	1/h	15.0	-	15.0	0.0
HR Arrhythmia (Ind.)	1/h	12.3	-	12.3	0.0
Minimum HR	bpm	49	-	49.0	0.0
Maximum HR	bpm	103	-	103.0	0.0
Average HR	bpm	64	-	64.0	0.0
Snore (Index)	1/h	10.5	-	10.5	0.0
Apnoea (Index)	1/h	0.9	-	0.9	0.0
Obstr. Apnoea (Ind.)	1/h	0.9	-	0.9	0.0
Central Apnoea (ln)	1/h	0.0	-	0.0	0.0
Hypopnoea (Index)	1/h	4.0	-	4.0	0.0
Flow Limitations (ln)	1/h	0.0	-	0.0	0.0
Apnoea+Hypop.		33	-	33.0	0.0
AHI		4.9	-	4.9	0.0

Fig. 16-24 Results list of the recordings

### 16.6.4 Tab “Recording”

The sleep profile of the selected patient is displayed with relevant results and edited information from case history, findings, diagnosis and comments. The displayed results can be selected via “Tools” → “Result Templates”.

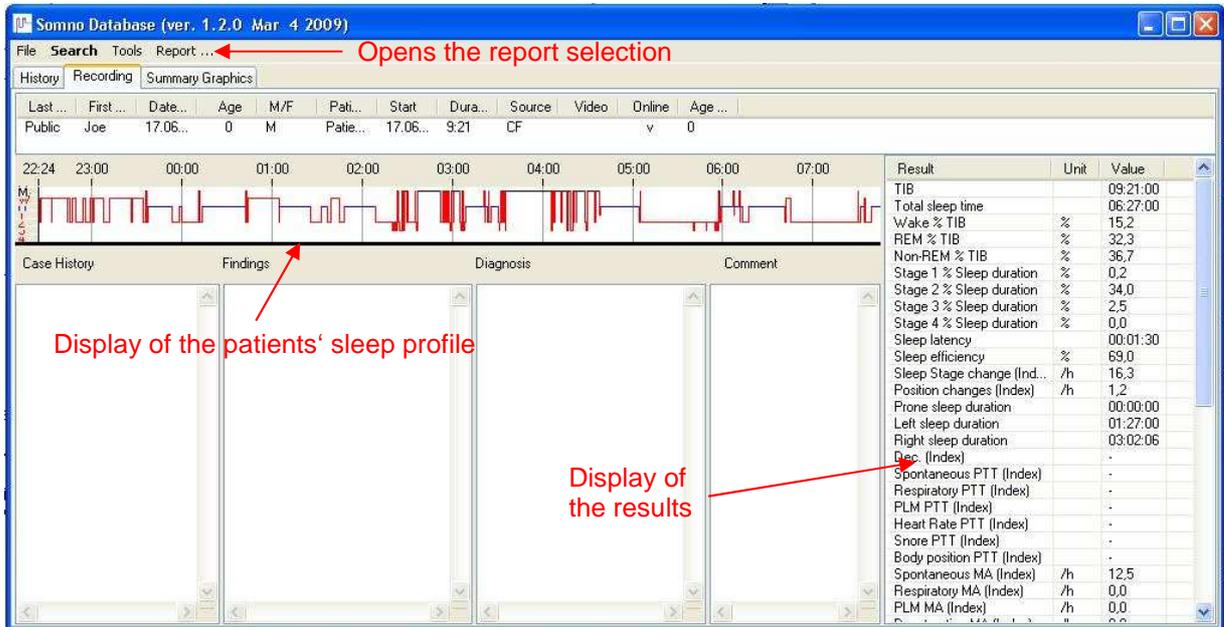


Fig. 16-25 Tab “Recording”

Pressing “Report” opens the report selection where you can select a pre-defined template (see chapter 5.13) as well as de-/activating particular items, changing the order or adding a page break. “Preview” opens the report for the previously selected recording.

### 16.6.5 Tab “Summary Graphics”

Here data and analysis curves of the patient are displayed in a general view.

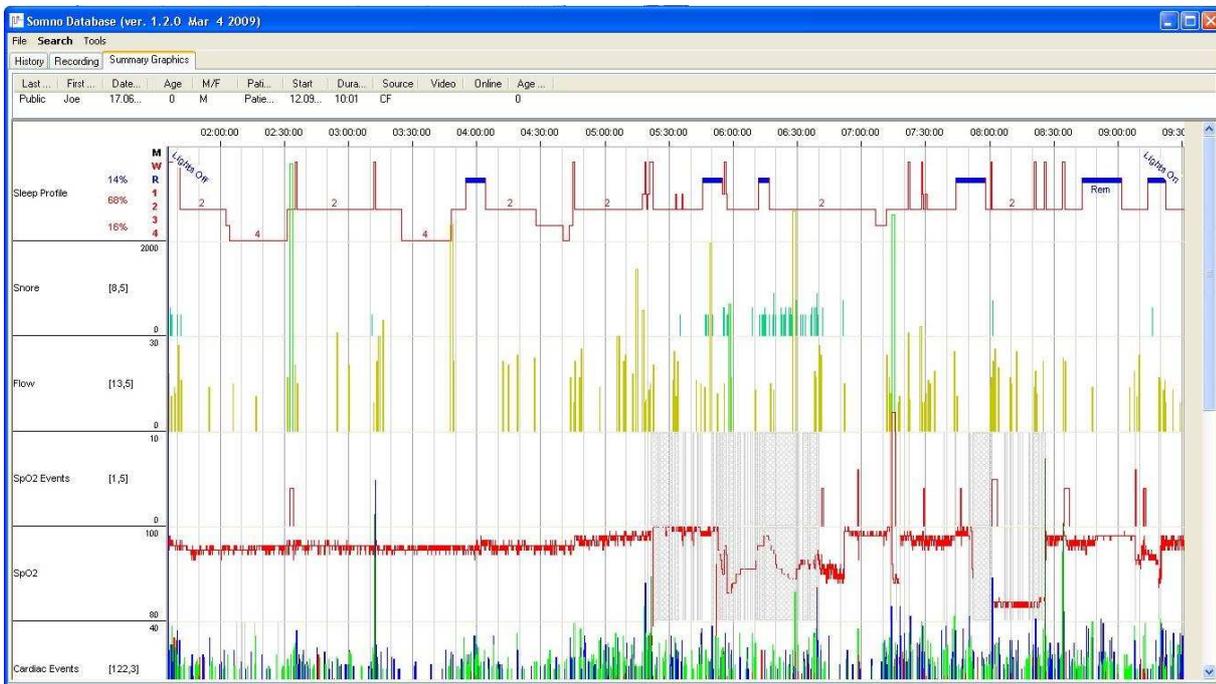


Fig. 16-26 Tab “Summary Graphics”

### 16.6.6 Filing the Database

File your database weekly. In order to do so, proceed as follows:

First of all close the DOMINO panel and all other applications. Then start the Windows-Explorer and select the directory with the folders for archive, serial-number and database (Standard: C:\SOMNOmedics\Somnoscreen x.x.x). Select the folders “**archives**”, “**formletters**” and “**SomnoDB**” and copy them to your local folder (e.g. C:\Backup). Now save this file by burning it onto a CD/DVD (e.g. using Nero or WinOn-CD).

**!** Label the CD/DVD distinctly with date or calendar week and year!

## 17 Troubleshooting/ FAQ

### 17.1 Review

Problem	Possible Reason	Action
<b>Error codes on the SOMNOscreen™ Display</b>		
ERROR 01 Contact SERVICE	The internal lithium battery of the clock is empty → The device was stored without a battery.  or service required	Please contact SOMNOmedics Support or authorized dealer. Send in the device for changing the battery.
ERROR 04 Contact SERVICE	The Compact Flash Card was formatted incorrectly.  Faulty Compact Flash Card or Card Slot of the SOMNOscreen™.	Remove the Compact Flash Card from the SOMNOscreen™ and format it using the FAT file system.  Return the Compact Flash Card or the SOMNOscreen™ to your Dealer or directly to SOMNOmedics.
ERROR 10 Contact SERVICE	Too many channels selected or Sampling Rate is too high.	Remove the Compact Flash Card from the SOMNOscreen™ and reinitialise it with a suitable montage. A Special Firmware is available as an option if a higher sampling rate is required. Please contact SOMNOmedics for details.

Problem	Possible Reason	Action
<b>SOMNOscreen™</b>		
Unable to start SOMNOscreen™	Defective snore microphone	Replace the microphone. If a spare is not available use a nasal cannula if the recording is absolutely necessary. Change the montage and start recording again.
SOMNOscreen™ reports "Duration failed" in spite of the fact that the battery was placed in the charger.	The battery was not inserted into the charger correctly.	Please check the polarity of the battery when inserting it into the charger. Try rolling the battery in the charger to obtain a good contact. Check to make sure that the red LED comes on when the battery is first placed in the charger. You can check the capacity of the battery using the SOMNOscreen™. To do so, go to the "System" menu of the SOMNOscreen™.
<b>Analysis Window</b>		
Unable to start display window.	Registration code not entered.	Contact SOMNOmedics Support and request the registration code. Enter the registration code into the "Global Preferences" in the "Folders" menu. After entering the code, click on the "Save and Exit" button.

Problem	Possible Reason	Action
<b>Flash Card</b>		
Flash card cannot be initialized.	Wrong drive letter chosen for the card reader.	Check to ensure that the correct drive letter was entered in the "Folders" menu of the "Global Preferences". Reformat the Compact Flash Card using the FAT file system and start the initialisation.
Unable to format the flash card using the SOMNOpanel.	Wrong drive letter chosen for the card reader.	Check to ensure that the correct drive letter was entered in the "Folders" menu of the "Global Preferences".  Or: Disconnect the card reader for about 10 seconds and plug it in again. Alternatively, try using a different USB port.  Open Windows Explorer and format the Compact Flash Card from here. Right click on the drive associated to the Compact Flash Card Reader and select "Format" from the drop down list.  Try connecting the card reader to another PC and formatting it on this computer. If it works, initialise the flash card on the SOMNOmedics PC.
SOMNOpanel reports that you are not authorized to format	You are not authorized to format.	Please contact your Network Support or Technical Department to obtain the correct rights.
SOMNOscreen reports "wrong Flash Card"	Flash Card empty	Please initialise the Flash Card.
SOMNOscreen reports "wrong Hardware"	Wrong Hardware ID	Either the Compact Flash Card was not initialised correctly or the montage does not fit the SOMNOscreen model you are try to use it on. Please check and initialise it again using the correct Montage.
Recording cannot be transferred from the Compact Flash Card.	Hard disc full.	Archive all recordings and then delete them from the hard disk.
	You are not authorized to write onto the hard disk.	Check to ensure that you have the correct rights to save data onto the hard disk. If necessary, contact your System Administrator.
	Wrong drive letter chosen for the card reader.	Ensure that the correct drive letter was entered in the "Folders" menu of the "Global Preferences".

Problem	Possible Reason	Action
Flash Card Transfer does not work (although data.dat file is available).	The flash card was removed during a recording.  Wrong drive letter chosen for the card reader.	Please contact the SOMNOmedics hotline.  Ensure that the correct drive letter was entered in the "Folders" menu of the "Global Preferences".
<b>Recording doesn't start</b>		
Pre-programmed recording does not start.	Date or Time of SOMNOscreen™ and Date or Time of PC are different.  Defective snore microphone	Check date and time on the PC and the SOMNOscreen™. Insert the Compact Flash Card (pre-programmed with a Manual Start) and check the Date and Time on the SOMNOscreen™. Correct if necessary.  <b>Please note: The programmable time range is 00:00 to 23:59. If you want to start a recording at 24:00, please enter the date of the following day and set the start time to 00:00.</b>  Replace the microphone. If a spare is not available use a nasal cannula if the recording is absolutely necessary. Change the montage and start again.
Maximum recording period is 10 h.	Online Mode has been activated.	In the Online mode, recordings are limited to 10h. Deactivate the online mode to execute an offline recording. In offline mode recording periods up to 24h are possible.

Problem	Possible Reason	Action
<b>Online-Mode</b>		
Online mode does not start or no signals are displayed on the screen.	SOMNOscreen™ is not yet recording (for example auto start).  The transmitter or receiver may not be connected correctly to the SOMNOscreen™ or PC.  Antenna of the Receiver may not be set up or lined up correctly.  Insufficient distance between video- and data receiver.	Make sure that the SOMNOscreen™ is turned on and that the pre-programmed recording has already started.  Check all cables and connectors including the power adapter. Make sure that the transmitter module or the digital Optocoupler is plugged in correctly. Adjust the antenna of the receiver module to a vertical position and ensure that it is secure. If necessary restart the PC.  Change the position of the receiving antenna and if necessary of the receiver as well.  The distance between the video- and data receivers must be at least 1.5 m. If possible, place them at different heights. If necessary, use a longer data cable to obtain more distance. It may be necessary to use a booster to transfer the data signals.

Problem	Possible Reason	Action
	<p><b>For non-bidirectional initialisation:</b></p> <p>Checkbox “Online Mode” has not been selected during initialisation procedure.</p> <p>When activating the online-mode you have not selected the same montage as when the Compact Flash Card was initialised.</p>	<p>Abort the recording on the SOMNOscreen™ and initialize the Compact Flash Card again. Ensure that the “Online Mode” is selected!</p> <p>Abort the recording on the PC and start the Online recording again. Ensure that the same montage is used on both the SOMNOscreen™ and the PC.</p>
Online mode aborted immediately after recording start.	<p>Hard disk is full.</p> <p>Insufficient RAM available.</p>	<p>Archive all recordings and then delete them from the hard disk.</p> <p>Please close all other applications.</p>
Interrupted or unclear video signal or raw data in the online mode.	<p>The receivers’ antennas may not be set up or lined up correctly.</p> <p>Insufficient distance between video- and data receiver.</p>	<p>Change the position of the receiving antennas and if necessary of the receiver as well.</p> <p>The distance between the video- and data receiver must be at least 1.5 m. If possible, place them at different heights. If necessary, use a longer data cable to obtain more distance. It may be necessary to use a booster to transfer the data signals.</p>
No video visible during online mode.	<p>The “With Video” Checkbox was not selected when starting the online mode.</p> <p>Video camera not connected correctly</p>	<p>Start online mode again and select the “With Video” checkbox in the starting dialog.</p> <p>Check the connections for the video cables and power connector.</p>

Problem	Possible Reason	Action
<b>Signals</b>		
Flow signal not recorded.	Montage not set up correctly.	<p>First check in the montage, whether the flow sensor has been selected.</p> <p>If there is the possibility to repeat the recording, check the montage and adjust it when necessary.</p> <p>In the menu “Tools” → “Preferences” → “Channels” add a New Reference in which you add the two effort signals, give it a new name, e.g. Sum of Efforts and confirm with “OK”. Now insert this reference as source of the “Flow Analysis”. It is also possible to analyse a patient’s flow using the “Phase Angle Analysis”.</p>
Noisy EEG/EOG signals, not suitable for analysis.	<p>Incorrect filter settings.</p> <p>Contact sites not properly cleaned; impedances too high</p> <p>Ground- or Reference electrode was not applied.</p>	<p>Check filters. Recommended filter for <b>SOMNOscreen™</b>: EEG and EOG: 0.3 - 30Hz <b>SOMNOscreen™ EEG 10-20</b>: EEG and EOG: 0.2 - 35Hz.</p> <p>Clean the contact site thoroughly with paste (Nuprep) and use GRASS Gold plated electrodes with GRASS EC2 cream. Apply the reference (REF) to CZ. In online mode use the Impedance check.</p> <p>Check whether all electrodes were applied and if necessary add the missing ones.</p>
Efforts signals either too high or too small.	Belt not fastened correctly (too loose or tight).	Adjust the tightness of the belts. Belts should be tight enough that they do not slide up or down but loose enough to allow the patient to breathe unrestrictedly.
Flow and Effort signals are noisy or difficult to analyse.	Incorrect filter settings.	<p>Check the filter settings. Recommended low-pass filters:</p> <p>for adults: ~ 1 Hz for children (aged 3 or more): ~ 3 Hz for babies and small children: ~ 5 Hz.</p>
Blood pressure values are too high (for example 195/35mmHg).	Patient’s height and weight were not entered correctly.	<p>Please correct the data in the Patient Data/ Patient Info window (Menu “Tools” → “Patient Info”) and recalculate the blood pressure.</p> <p>(In order to recalculate the Blood Pressure, it is necessary to change a parameter. Change and re-change any one parameter, for example the Min. Duration in the Parameters menu of the PTT analysis. Close the window and the Systolic Blood Pressure will be re-calculated.)</p>

Problem	Possible Reason	Action
<b>Time Base</b>		
It is not possible to change the time base in the Analysis or Raw Data menu.	Wrong mode selected.	Please activate the "View Mode" ("Mode" → "View Mode").  The time base of the raw data can be set up to a maximum of 30 minutes. It <b>cannot</b> be longer than the time base of the analysis channels.
<b>PC</b>		
PC crashes during synchronised editing with video or with fast playback of video.	PC too slow/ not enough RAM.	Improve PC performance. Try defragmenting the hard disc drive. If this does not work, try using a slower video playback mode.
	Other applications may be running parallel.	Please close all other applications.
PC reports "NTLDR missing" after a start or restart.	Floppy disk inserted to floppy drive.	Remove the Floppy Disk from the Disk Drive and try rebooting the Computer. Windows start files could be damaged. Please inform your system administrator or SOMNOmedics.

## 17.2 Description of errors in the Logbook

Error Code Number	Description
E01	Lithium battery for integrated clock is flat.
E02	Voltage of Li ION battery during recording is less than 3.2 V. The recording is terminated.
E03	Waiting mode has been interrupted.
E04	Write fault when trying to write on the flash card, for example caused by removal of the flash card during a recording.
E05	- Not currently used -
E06	Recording started with insufficient battery capacity for the set recording duration. Recording was started with "IGNORE" (and reduced recording time).
E07	Recording started with insufficient memory capacity. Recording time was reduced automatically.
E08	The recording was manually terminated before the programmed end time. (Pressing the keys S1, S2 and S3 simultaneously).
E09	- Not currently used -
E10	Performance problem. Either the Sample Rate was set to high or too many channels were selected.
E11	Performance problem. Either the Sample Rate was set to high or too many channels were selected.
E12	Date was changed manually.
E13	Unauthorised change of date during a recording.
E18	Reset during a recording – the recording was continued.
E19	When the programmed end of recording time was reached, there was no flash card in the SOMNOscreen™.

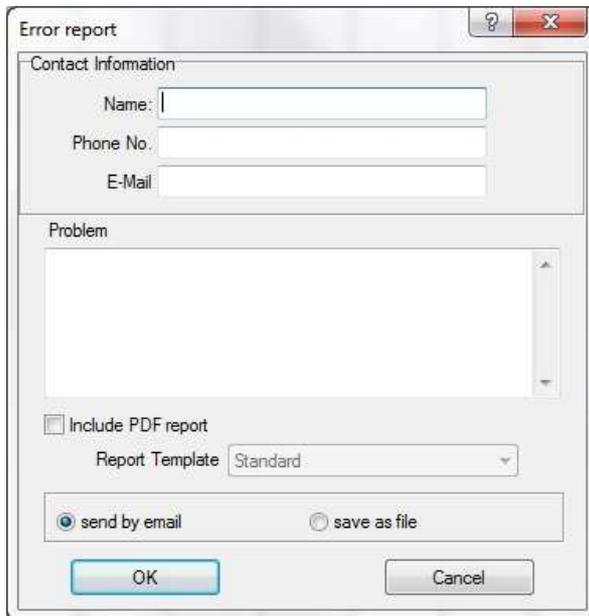
### 17.3 Bug Report

The Bug Report allows a fast and easy transfer of software errors or problems to the SOMNOmedics service by sending an E-Mail with data of the error analysis: Service report, config- file and raw data samples.



To create a bug report, mark the corresponding area in the raw data and select **“Help”** → **“Error Report”** subsequently.

Fig. 17-1 Create Bug Report



The window **“Error Report”** opens.

There you can enter your contact data as well as a short description of the problem.

Additionally the PDF report can be added to the bug report. Select the appropriate template from the drop down menu.

Activating **“send by email”** automatically creates an E-Mail that’s sent to the SOMNOmedics service.

Fig. 17-2 Bug Report

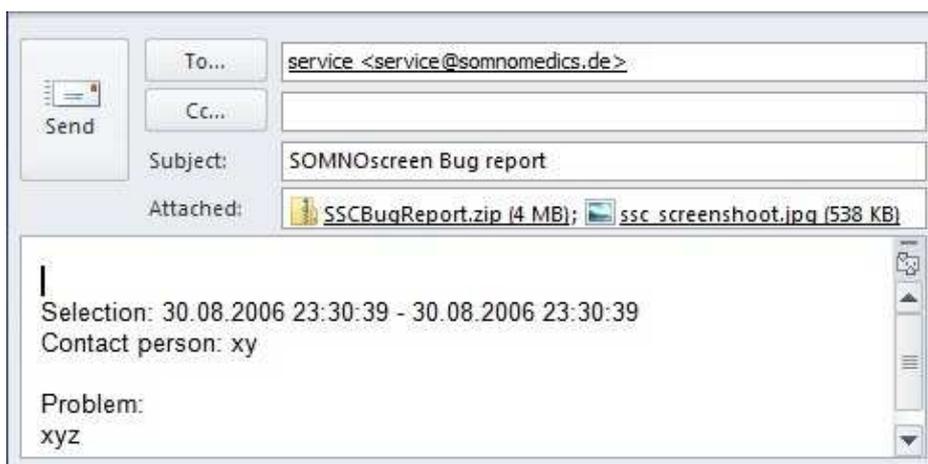


Fig. 17-3 Send Bug Report as E-Mail

If there’s no internet access available, the report can be saved locally as an alternative. Therefore activate **“save as file”** instead. You can then send it to SOMNOmedics burned on CD or transfer it to another PC (e.g. via USB) and send it via E-Mail therefrom.

## 18 Contact

For all questions, problems and suggestions please contact us via telephone or fax. We assure a quick and qualified advice and handling for all your enquiries.



Our Service-Hotline offers competent help and advice at:

**866 361 9937 (toll free)\***



You can send us important information by fax to:

**931 451 3757**



We also provide service and support via e-mail on:

**service@somnomedics.de**



Our homepage:

**www.somnomedics-diagnostics.com**

\* If due to technical difficulties our staff is not available, you will be redirected to our mail box. If that is the case, please leave your name and telephone number so that we can call you back as soon as possible.



