



## Profusion PSG

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# 1 Before You Begin

## Intended Use

### User Guide

The contains information for you to work with Compumedics Systems. It is one in a set of several user manuals designed to enhance your knowledge of Compumedics Systems.

### Software

**ProFusion Sleep 3** is a series of software applications which provide tools for the recording, review, analysis, summary and reporting of polysomnography (PSG) studies recorded with Compumedics Systems, thus assisting the Physician in making a diagnosis regarding sleep disorders.

The different programs in the Profusion Sleep 3 suite are:

<b>PSG Config</b>	For configuring settings used during study acquisition
<b>NetBeacon*</b>	For selecting PSG hardware to acquire data
<b>PSG Online</b>	For recording sleep studies and performing real time analysis
<b>Profusion PSG 3</b>	For reviewing, analysing and reporting studies
<b>Study Manager*</b>	For managing studies, including archiving

\* Users of the Compumedics neXus software should not use these programs.

## Safety and Effectiveness Considerations

Sleep studies should only be carried out under the recommendation of a physician.

This software is intended for use by persons trained in professional health care. The operator must be thoroughly familiar with the information contained in this User Guide before using the software.

## Indications for Use

Compumedics Systems are intended for use to aid in the evaluation and diagnosis of sleep disorders. Use this software only under the supervision of a physician, sleep technologist or clinician.

## Contraindications

None.

## Warnings and Cautions

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**Warning**

Do not operate the Compumedics Systems during electrical storms. Information could be lost or equipment could be damaged. Damaged items manufactured by Compumedics must be returned to a Compumedics Authorised Repair Centre.

## Prescription Device

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**Caution**

US federal law restricts this device to sale by or on the order of a physician.

## Placement of Equipment

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Place the system components on a sturdy and level surface. Do not place any unit on the carpet or in the bed with the patient.

## Manufacturer's Recommendations

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For all third party equipment used with the Compumedics Systems, follow all of the manufacturer's recommendations and instructions. Be sure to read, understand and follow the instructions in this User Guide and any others that come with the system and its components.

## Product Support

If you have a question regarding the operation of **ProFusion Sleep 3**, first look in this User Guide or consult the Online Help for the solution. To access the Help, press **F1** or select **Contents** from the **Help** menu.

If you are unable to find the answer in your documentation, contact Compumedics Product Support on:

Australia      **1800 244 773**

International    **+61 3 8420 7396**

USA             **1-877-294-1346**

or your authorised representative.

If you call, you should be sitting in front of your computer system with the **ProFusion Sleep 3** software running at the section you have the question on. You should also have this User's Guide at hand. When you call, please provide the following information:

- The version of software and operating system being used
- A description of what happened and what you were doing when the problem occurred
- The exact wording of any messages that appeared on your screen.
- A description of any attempts made to fix the problem

If you need to ship the equipment, pack the equipment and its accessories carefully to prevent shipping damage. All relevant accessories should accompany the equipment.

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[www.compumedics.com](http://www.compumedics.com)

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## 2 Introduction

**Profusion PSG 3** is used for reviewing, editing and reporting sleep studies. Studies recorded using previous versions of PSG Online can also be opened.

To start **Profusion PSG 3**, select from the Windows Start menu or click the **Profusion PSG 3** icon:



## 3 What's New

Profusion PSG 3.1 incorporates a significant number of new features to enhance your recording, analysis, reviewing and reporting process. Click the links below to go to the relevant topic.

### **PSG Online (see the *PSG Online help file* for more links)**

Security features. User Events are tagged with the user currently logged-in to PSG Online.

Support for Compumedics Digital Video 3, which allows IP (networked) cameras to be used, and controls Pan-Tilt-Zoom (PTZ) functions directly from the Digital Video window (for compatible cameras only).

Improved workflow:

Patient name now appears in title bar before recording starts

Patient details can be edited during acquisition

Change the input for the Flow-Volume loop on the fly

### **Profusion PSG**

[Track user log-in changes from acquisition.](#) <sup>131</sup> Changes to User Events are tagged with the logged-in user.

[Bookmark feature](#)<sup>[135]</sup> Take screenshots of the trace display for bookmarking. These can be included in reports, or sent to the Windows Clipboard for pasting into other applications.

[Customise Trace Label names](#)<sup>[29]</sup> (also available in PSG Online).

The [Zoom tool](#)<sup>[119]</sup> is back, now with interactive features including a caliper to measure exact durations and amplitudes.

The [Statistics window](#)<sup>[133]</sup> now includes the Sleep Onset time.

[Lights out and Lights on times can be set via a dialog](#)<sup>[22]</sup>, in addition to through the Trend window.

More windows can be printed, including the [Observation Chart](#)<sup>[135]</sup>.

[Scoring Comparisons](#)<sup>[139]</sup> can now be performed for an epoch range (eg: 200 epochs for QA purposes).

[Manual Inputs can be edited after acquisition.](#)<sup>[137]</sup>

Automatic Analysis improvements:

[Snore analysis](#)<sup>[85]</sup> improved to handle different input devices (microphone, piezo sensors, SPL meters)

[Ability to perform Respiratory Event detection, Snore analysis and SpO<sub>2</sub> desaturation/artifact algorithms separately.](#)<sup>[67]</sup>

## Reporting

New report fields:

Chronological CPAP statistics.

[Include Bookmarks](#)<sup>[136]</sup> (screenshots).

[Include technician comments](#)<sup>[132]</sup> from the Study Log.

[Impressions can be placed anywhere in a report](#)<sup>[154]</sup> (Impressions is an optional feature).

[Recommendations can be placed anywhere in a report](#)<sup>[160]</sup> (Recommendations is an optional feature).

## Other

Data Card Manager now supports Somté studies, allowing Somté studies to be imported into Compumedics Nexus. See the Data Card Manager online help for details.

NetBeacon now supports Safiro devices (see the PSG Online help file for link).

## 4 Before You Start

Before you start scoring or reviewing a study, there are a few basics that need to be understood and configured. Please read the following sections before proceeding further:

- [Auto Save](#)<sup>[13]</sup>

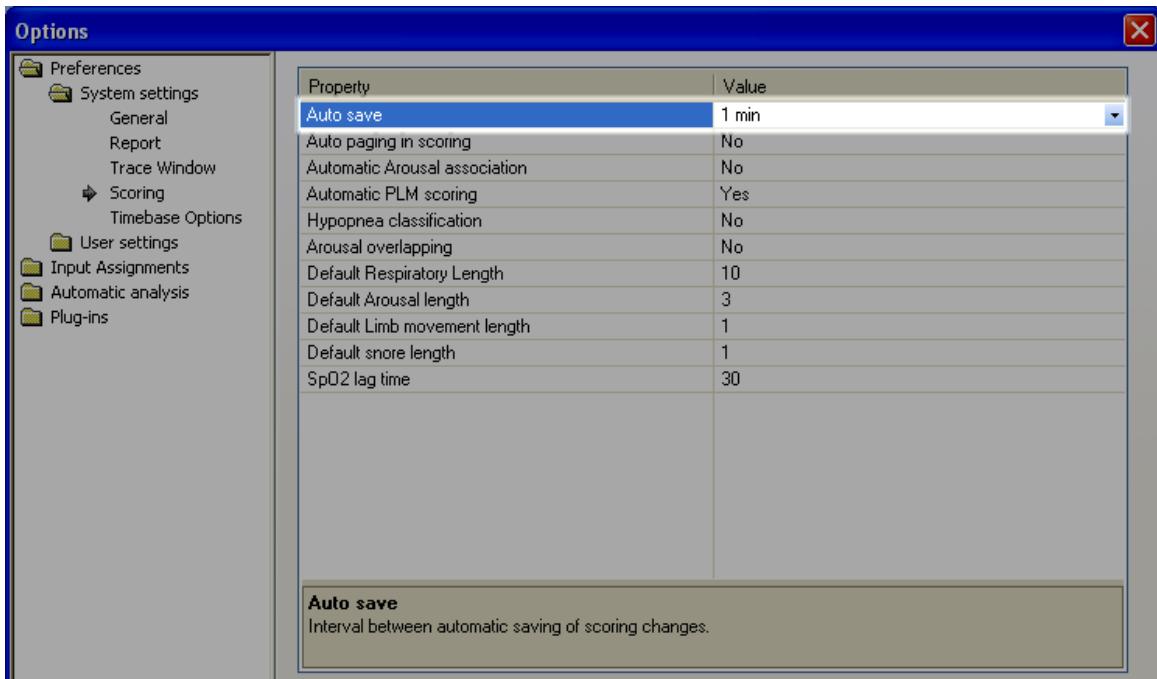
- [Using My Workspace™<sup>13</sup>](#)
- [Navigating Studies<sup>15</sup>](#)
- [Data Sets<sup>17</sup>](#)

## 4.1 Auto Save

Profusion PSG 3 can automatically save your work at 1, 2, 5 or 10 minute intervals.

The Auto Save feature can also be turned off, but this is not recommended.

To set the Auto Save interval, go to Tools > Options > Preferences > System Settings > Scoring.



## 4.2 Using My Workspace

"My Workspace" is a feature of Profusion PSG 3 that allows customisation of the position, size and properties of the many windows available as part of Profusion PSG 3.

### Default Workspace

The default Workspace is loaded when a study is opened in Profusion PSG 3.

To save the current Workspace as the Default, select **Window > Save current workspace as default**. This Workspace will then be loaded each time a study is opened.

### Custom Workspaces

Customised Workspaces can be loaded by selecting **Window > Load Workspace** and choosing the required Workspace.

The Workspace can then be adjusted, or a new Workspace created and saved.

To save a custom Workspace, select **Window > Save Workspace** and choose one of the four Workspaces.

 **Info** Up to 4 Workspaces can be saved.

## ***Configuring Workspaces***

See the [My Workspace™<sup>\[194\]</sup>](#) section for details on configuring Workspaces.

## 4.3 Navigating Studies

To move through the study, a variety of options are available. The main navigation tools are found in the Navigation toolbar:



Keyboard shortcuts are also available for navigation, and some navigation options are only available using the keyboard.

Icon	Key	Action
	Page Down	Next page
	Page Up	Previous page
	Ctrl + Page Down	Halfpage forward
	Ctrl + Page Up	Halfpage backward
	Ctrl + T	Go to time
	Ctrl + G	Go to epoch
	→	1 second forward
	←	1 second back
	Ctrl+ →	10% forward
	Ctrl+ ←	10% back



**Info** Ctrl+left and Ctrl+right arrow keys moves backward and forward by 10% of the timebase. For example, if the timebase is 1 minute (60 seconds), these commands will move the trace display by 6 seconds.

**Mouse scroll wheel:** Use the scroll wheel on your mouse to move forward and backward through pages.

**Enter key:** Realigns the display to line up with the epoch markers. For example, if the arrow keys have been used to move a few seconds forward while sleep staging, pressing *Enter* will move the display back to the start of the epoch so that sleep staging can continue based on 30 second epochs.

**Center Cursor Time:** Available from the View menu, the Center Cursor Time option allows you to center the trace display around the selected cursor position.

 **Info** A page refers to the displayed number of epochs in a window as determined by the timebase. For example, if the focus is on a pane with a timebase set at 5 minutes, the page forward command will display the next 5 minutes of data.

## Automatic Paging

Click one of the Automatic Paging icons:



The trace display will automatically move forward or backward by one page at a time.

## Automatic Scrolling

Click one of the Automatic Scrolling icons:



The trace display will automatically scroll forward by one second at a time.

The speed of automatic paging and scrolling is set by the drop down list:



Automatic paging and scrolling can be stopped by clicking the icon again, or pressing the Spacebar.

## 4.4 Data Sets

When a study is analysed, the scored data (sleep staging, arousals, respiratory events, limb movements etc) is saved as a Data Set. This is a separate file that contains all scoring data. After a study has been scored, another Data Set can be created. The original Data Set is saved. There is no limit to the number of Data Sets that can be created for a study.

A Data Set is created if Online Analysis (manual or automatic) was performed.

When reports are generated, the statistics will be calculated from the open Data Set.

The [Scoring Comparison](#)<sup>[139]</sup> tool allows two different Data Sets to be compared for training or quality purposes.

If a study has multiple Data Sets, the Data Set that was open at the time of closing the study will be loaded next time the study is opened.

### ***Creating a new Data Set***

To create a new Data Set, select **Edit > Score Data Set > New** from the menu. This automatically creates a blank Data Set for analysis. The only data retained is information from the **Summary** analysis (if it has been run).

### ***Selecting an existing Data Set***

To open an existing Data Set, select **Edit > Score Data Set > Select** from the menu. Choose the Data Set that you want to open.

### ***Data Set Details***

To view the details of the open Data Set, select **View > Score Data Set > Details** from the menu. The only detail that can be edited is the Comments field, which can be used to enter information about the Data Set.

### ***Deleting a Data Set***

To delete a Data Set, select **Edit > Score Data Set > Delete** from the menu. Choose the Data Set that you want to delete.

### ***Importing and Exporting Data Sets***

Data Sets can be exported for transfer to other copies of the same study.

To export a Data Set, select **Edit > Score Data Set > Export** from the menu. Enter a name and directory path for the export, then click Save. The Data Set will be saved as a Score data file (\*.scoreddata.xml).

To import a Data Set, select Edit > Score Data Set > Import from the menu. Select the correct directory path and Score data file (\*.scoreddata.xml), then click Open. The Data Set will be imported and loaded as the active Data Set.

## 5 Open Study

### **To open a Legacy study**

1. Start Profusion PSG 3.
2. The Open Study Dialogue Box appears. If Profusion PSG is already open, select **Study > Open**.
3. Select the appropriate drive (local or network) from the drop-down list at the lower-left corner.
  - The drop-down list shows study locations that have already been accessed. To select a new study location, select the Browse button and select the new drive and path as appropriate.
  - The list of available studies for the selected location is then presented in the list box. If the study list in that location is changed, for example by another reviewer, the Rebuild Study Index button will update the list to reflect the changes.
4. Double-click a study from the list box or highlight it and click OK to display it.

### **To open a neXus study**

Studies stored in **Profusion neXus** can be opened from within the **neXus Control** application, which in turn launches **Profusion PSG 3** with the selected study, or from within **Profusion PSG 3** as follows

1. The Open Study Dialogue Box appears. If Profusion PSG is already open, select **Study > Open**.
2. Change to **neXus** mode if necessary, using the drop-down box on the right side of the Open Study Dialogue Box.
3. Locate the patient's name in the studies list.
  - Filtering functions are available to focus the search for studies. Options include free-text searching of the patient name, display by status, service type and within a specified time period.
  - The columns are configurable with respect to visibility and display order.
  - Where a patient has had multiple studies recorded, all will appear in the list box.
4. Double-click a study from the list box to display it.
  - Where the study has been previously archived, it will be opened in Read Only mode.
  - Where the study is not currently stored on the **neXus Server**, an Unreachable Document prompt will appear, requesting that the media on which the study is stored be made available to the **neXus Server**.

## To open a legacy study under neXus

The **neXus** Open Study dialogue is used to view **neXus** studies. If a legacy study needs to be viewed, change the Open Study dialogue as follows:

1. Close all open **neXus** studies.
2. Select **Study > Open**.
3. Change to Legacy Mode using the mode dropdown box on the right side of the study list.
4. Locate and open the legacy study as listed above

## 5.1 Study Details

### Patient / Study Information

To view information about the patient, and general information about the study, select **View > Patient / Study Information**. This opens the Patient and Study Information in a tabbed window. Enter or edit relevant patient and study details. Click on the main tab to switch back to the rawdata view, or close the Patient Information tab.

For studies contained in a **neXus** database, selecting **View > Patient / Study Information** will instead display information directly from the **neXus Control** Patient database module. Refer to the **neXus Control Online Help** for further information.

### Study Configurations

To view technical information about the recording, select **View > Study Configurations**. Study properties and the inputs recorded can be viewed.

The Scoring Mode can be set to **AASM** or **R&K** mode.

The Scoring Type can be changed for Adult, Child or Infant sleep staging.

The Notch filter frequency can be changed, but this would not normally be necessary unless the notch filter was not properly configured in PSG Config.

See the [Derived Traces](#)<sup>36</sup> section for details on the options available from the icons at the top of the Study Configurations window.

## 5.2 Check Online Analysis

If online analysis was performed during recording (automatic or manual), review and edit the sleep staging and marked events (arousals, respiratory events, limb movements etc).

If the online analysis needs significant changes, either change the [Automatic Analysis parameters](#)<sup>[67]</sup> and re-run the Automatic Analysis, or open a new score [Data Set](#)<sup>[17]</sup> to reset all staging and events.



**Tip** Use the [Scored Events](#)<sup>[113]</sup> window to see all events scored. Clicking on an event will take you to that epoch.

Once a new data set has been created, any of the Automatic Analysis algorithms can be run. For example, just the Sleep Staging and Arousal analyses could be run.

## 5.3 Check Patient Calibration

If biological calibrations were recorded using the Patient Calibration feature, these can be viewed by selecting View > Patient Calibration. The data will be opened in a new tab, and can be closed after review.



**Tip** If you want to compare the Patient Calibration data to sections of the sleep study, right-click the title of the Patient Calibration tab and select New Horizontal Tab Group. This will position the Patient Calibration and Sleep Study data side-by-side.

## 5.4 Setting Lights Off/On Time

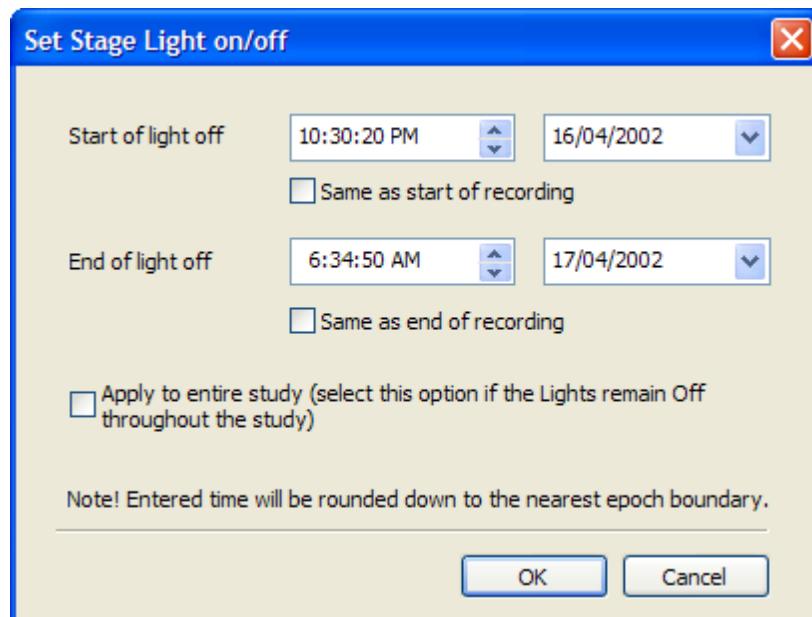
Setting the Lights Off and Lights On time is essential for correct generation of statistics, both for the Statistics window and generating reports.

The light status is tracked via a virtual trace named Stage Light. You can display the Stage Light status in the Trend.

In most cases Stage Light should be configured as a Manual Input for study acquisition (see the PSG Config help file for more details).

### **Setting Lights Off and Lights On for the start and end of the study**

To set the initial Lights Out and the final Lights On time, open the Stage Light dialog from the menu (Edit > Stage Light > Set stage light on/off time). The Set Stage Light on/off dialog opens:



Select the start and end of light off times and dates. You can choose to select the same time as the start and/or end of the recording by checking the relevant boxes.

If you check the box *Apply to entire study* option, Stage Light will be set to Off for the entire period selected. This will overwrite any periods of Lights On that occur between the specified time. If the study contains marked periods of Lights On (for example restroom breaks or MSLT studies) do not check this option.

Stage Light is marked on a per epoch basis.

## ***Setting Lights On periods within the study***

Stage Light can also be edited from the Trend window:

- Open the Trend window.
- Right click and drag across the range of epochs you want to edit.
- Use the Edit > Sleep Staging or Edit > Stage **Light** menu, or keyboard shortcuts, to edit the sleep stage. The default keyboard shortcuts are F8 for Lights On, and F9 for Lights Off.

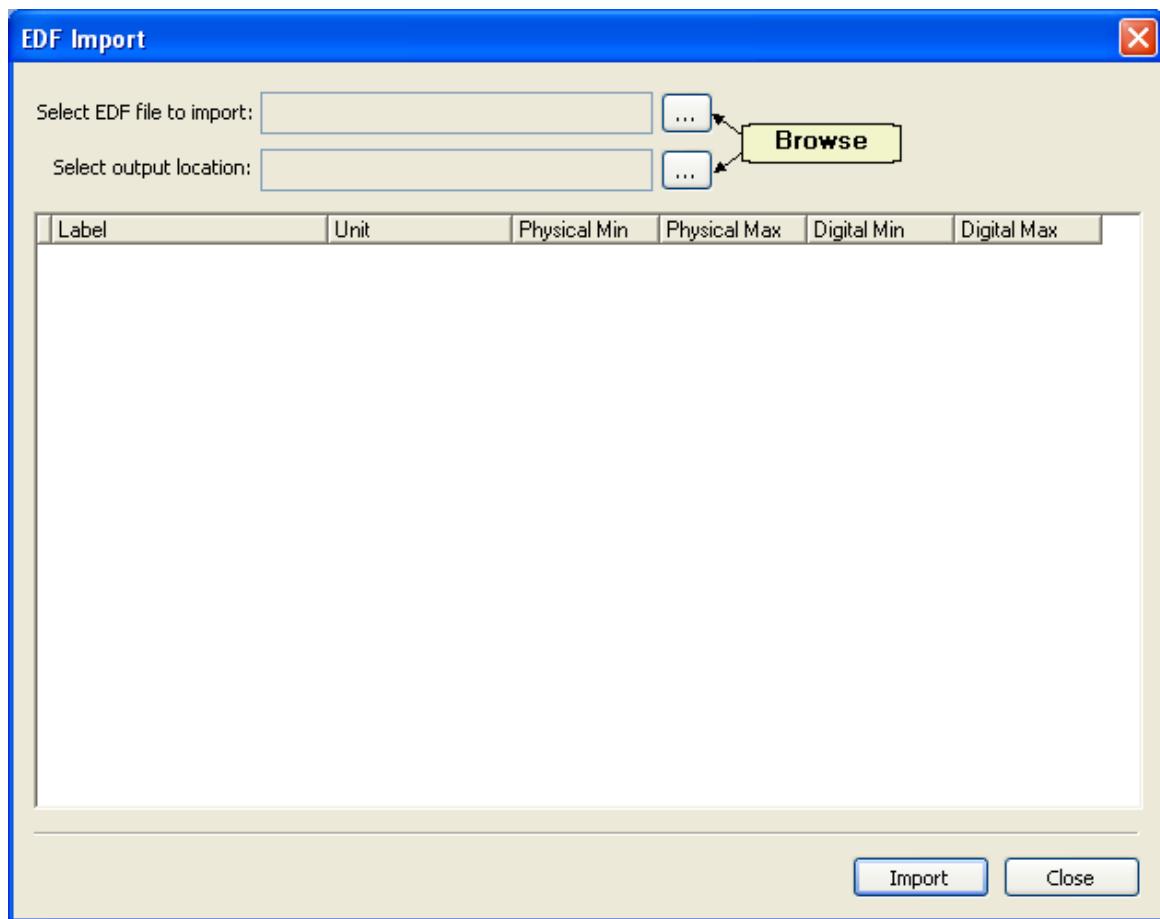
## **5.5 Import from EDF**

To import a study that is in European Data Format (EDF), use the Study Manager (for non-neXus users), or the neXus EDF Import application.

### ***From Study Manager***

Open Profusion Study Manager.

Select **Tools > Import EDF Study**



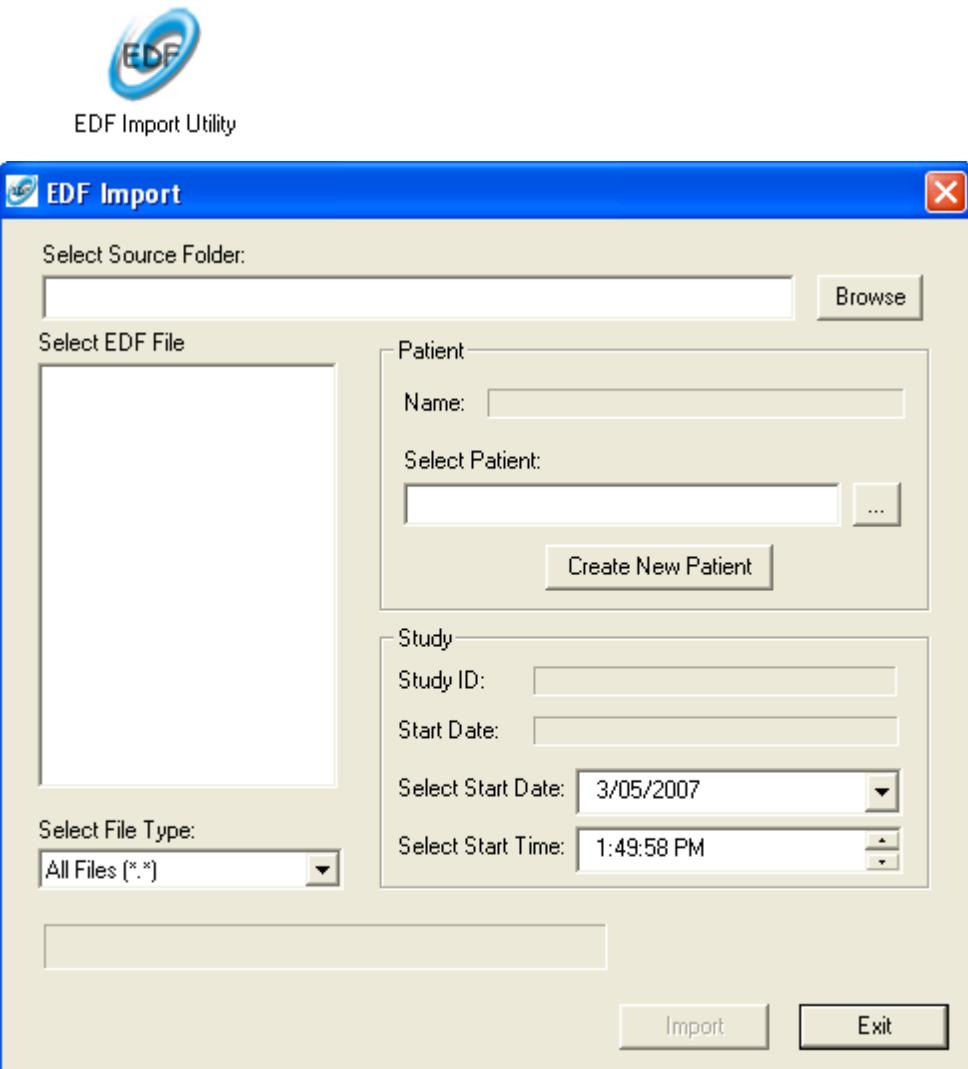
Using the Browse buttons, select the EDF file to import, and the output location.

Once a valid EDF file has been selected, a list of the traces in that EDF file will be displayed.

Click Import to convert the study into Profusion PSG 3 format. The study can then be opened in Profusion PSG 3.

## From neXus Control

From the neXus Control Application list, open EDF Import Utility.



Use the Browse button to select the EDF file to import.

Any associated study details will be displayed.

Use the Patient pane to select a patient, or create a new patient. When the study is imported it will be assigned to this patient.

Click Import to convert the study into **Profusion PSG 3** format, and included the study in the neXus database. The study can then be opened in **Profusion PSG 3**.

## 5.6 Closing Studies

### ***Close the current study***

1. Select **Study > Close**; or
2. Right-click over the Study tab, located at the top of the Trace Workspace, and select **Close**; or
3. Click the  button, located at the top-right hand side of the Study Tab. This will close the current tab, which will close the study if it is the last active tab for that study.

### ***Close all studies and exit Profusion PSG***

1. Select **Study > Exit**; or
2. Click the Close Application button , located at the top-right hand side of the Profusion PSG application window. All views associated with the study will be closed and all changes will be saved automatically, except for the Report Window, which will prompt to save changes prior to closing.

### ***Closing studies recorded using a neXus database***

After using the same steps as per above, a prompt offers the user the option of advancing the status of the study. When scoring and reporting have been completed, it is necessary to select these items from the list.

Archiving functions are performed using the neXus Control application.



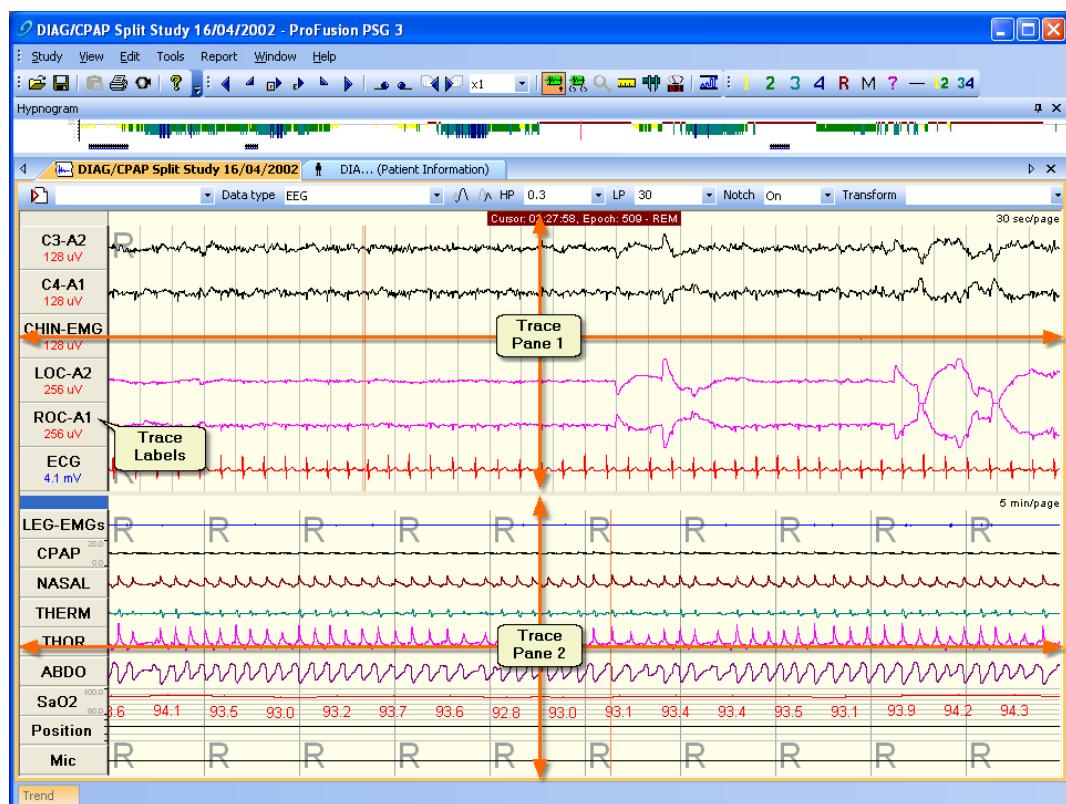
**Info** Once the study status has been set to Closed, the study can only be re-opened in Read Only mode.

Refer to the neXus Control Online Help for further information on study status settings and study archiving.

## 6 Trace Display

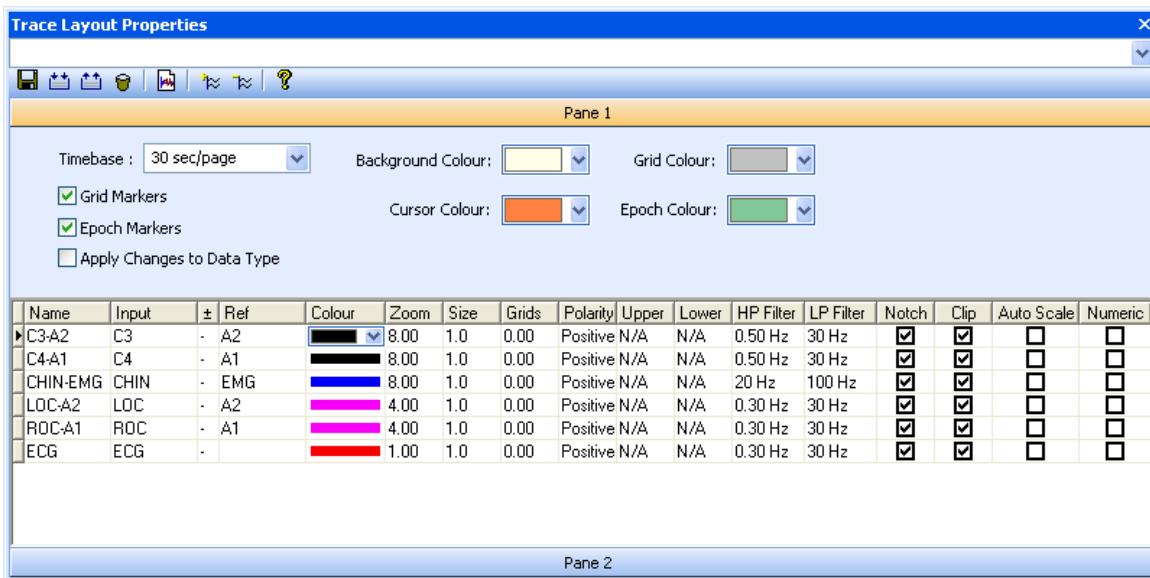
The main Trace Display window can be customised to display the recorded data exactly as you need to.

The Trace Layout defines the look of the main Trace Window, including how the recorded data is displayed. The inputs displayed, whether they are referenced to other inputs, the order of traces and trace properties are all configured in the Trace Layout. The Trace Layout can be changed as required, and you can save the most often used layouts for use in any study.



## 6.1 Configuring Trace Layout

Open the Trace Layout Properties window from the menu (**View > Trace Layout Properties**), or use a keyboard shortcut (default F4).



To add a new Trace Pane, click the *Add New Trace Pane* icon:

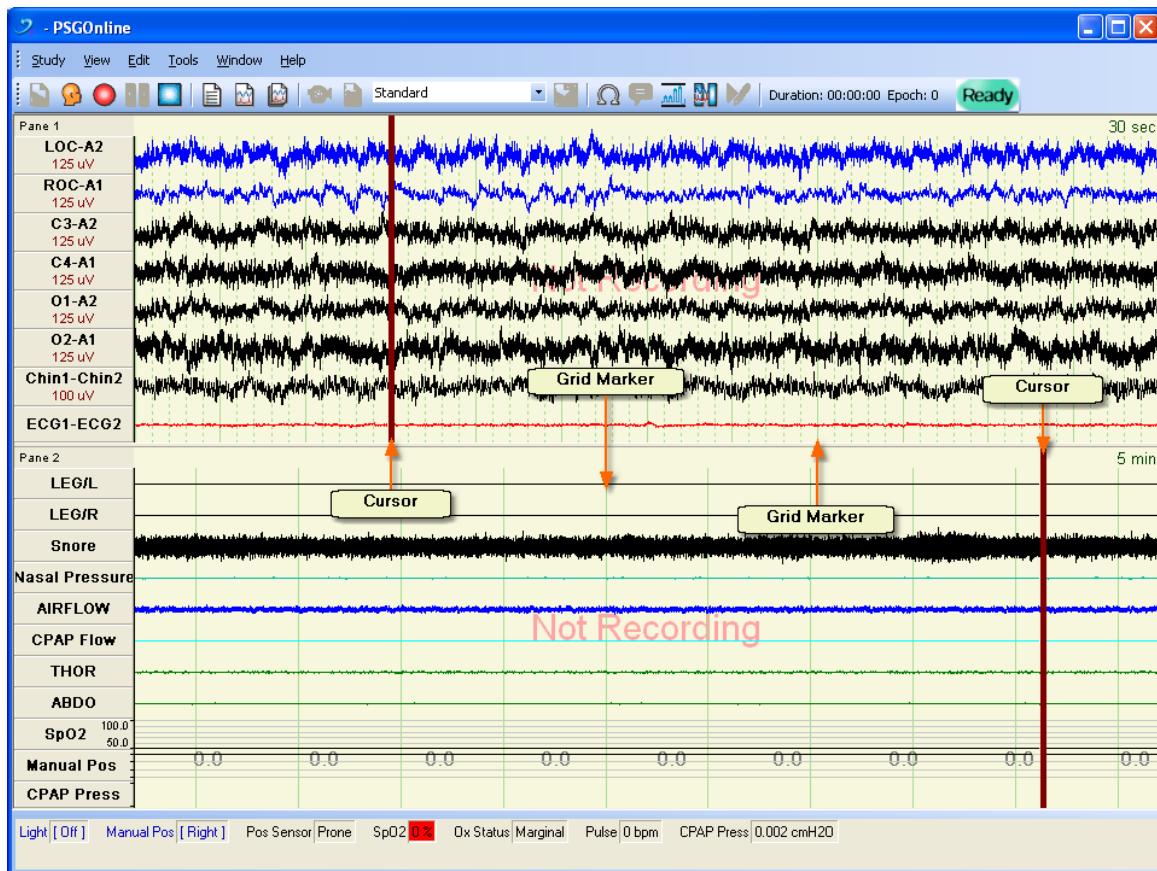
To delete a Trace Pane, select the Trace Pane to be deleted and click the *Delete Current Trace Pane* icon:

The traditional use for multiple Trace Panes is to group inputs by timebase so that usable data is viewed in each. Rapidly changing signals such as EEG need a fast timebase, and are often set to 30 seconds. Moderately frequently changing signals such as airflow can be set to a 2 minute timebase Trace pane, while slowly changing signals such as oxygen saturation might be assigned to a 5 minute timebase Trace Pane. Assigning inputs to the appropriate Trace Pane enables the optimum balance of viewing the current data for integrity and analysis versus viewing recent data to observe changes.

At the top of each Pane configuration window, there are a variety of options for the overall display configuration of the selected Pane:

- **Timebase** - The timebase sets how many seconds (or minutes) are displayed in the Trace Pane.
- **Grid Markers** - Apply vertical markers across the Trace Pane. These can be configured in **Tools > Options > Timebase Options**
- **Epoch Markers** - In Page Back mode and Profusion PSG 3, epoch markers place a vertical marker and an icon of the sleep stage at the start of each epoch.
- **Apply Changes to Data Type** - Any changes to a trace property will be applied to other traces that share the same Data Type.

- **Background Colour** - Set the background colour of the Trace Pane.
- **Cursor Colour** - Set the colour of the cursor. In PSG Online the cursor moves along the Trace Pane to indicate data as it arrives. In Page Back mode and Profusion PSG 3, the cursor can be used to find the corresponding point in Trace Panes with different timebases.
- **Grid Colour** - Set the colour of the Grid Markers.
- **Epoch Colour** - Set the colour of the Epoch Markers.



## 6.2 Configuring Traces

### Adding Traces

With the Trace Layout Properties window open, right click under the Name column and select Insert Trace. A blank trace will be added.

From the drop-down lists, select the Input to display. If required, also select a Reference input and the operator to use (+/- summed or differential). Inputs with the same Sampling Rate and Sensitivity can be referenced to each other. The Trace Name is set automatically as the Input and Reference are selected, but can be customised (see table below).

Set the Trace Properties:

<b>Name</b>	Enter a custom name for the trace if desired. This feature is particularly useful if the same trace is being displayed more than once but with different filter settings.
<b>Colour</b>	Set the display colour for the trace
<b>Zoom</b>	The Zoom is a simple visual amplification or gain, and is not relative to the other traces in the pane. Doubling the Zoom will double the visual height of the trace
<b>Size</b>	Size refers to the proportional size of the trace compared to the total Size of all the other traces. If the total Size of all traces is 10, then a single trace with a Size of 1 will take up 10% of the vertical height of the Trace Pane, a trace Size of 2 with a total of 10 would take 20% and so on. Size can be entered as a decimal value if required.
<b>Grids</b>	Entering a number $n$ here will place a horizontal grid reference line every $n$ units for that trace. For example, an SpO <sub>2</sub> trace with an upper and lower bound of 75 and 100 and a Grids value of 5 will have a horizontal reference line placed at 75, 80, 85, 90, 95 and 100.
<b>Polarity</b>	Each trace defaults to positive up, negative down. To display a trace as negative up, change the polarity to Negative. This is useful in cases such as traditional EEG or EOG display. Nasal Pressure is also often set to negative up so that an upwards deflection of the trace represents an inhalation (reduction of pressure).
<b>Upper / Lower</b>	A calibrated trace can have upper and lower display bounds set to maximise the usefulness of the displayed area. Setting Upper / Lower bounds do not alter the recorded data in any way, only the visual display. Values beyond the Upper / Lower bounds will be displayed as being at the boundary.
<b>HP / LP Filter</b>	Set the high and low pass filters for display. Setting filters here do not alter the recorded data in any way, only the visual display. Filters can be altered during recording in <b>PSG Online</b> as required.
<b>Notch</b>	Apply the notch filter to the trace (the notch filter frequency is set in <b>Tools &gt; Options &gt; General Options</b> ).
<b>Clip</b>	Ticking the Clip box will prevent the trace from moving above or below the top and bottom of the trace label box. This can be useful in preventing occasionally noisy traces such as EMG from obscuring neighboring traces.
<b>Auto Scale</b>	When checked, the trace can have Auto Scaling applied by clicking the Auto Scale icon in PSG Online 3 or Profusion PSG 3
	 <b>Auto Scale</b>

	 <b>Tip</b> Uncalibrated traces without Auto Scale checked can be Auto Scaled on demand by right-clicking the trace label and selecting Auto Scale
<b>Numeric</b>	When checked, calibrated inputs will have a numeric value displayed below the trace. You can choose to either have a numeric value displayed at set intervals, or to have the numeric values displayed at the peak and trough values. This is set in the User Settings section of the Options..

 **Tip** If the *Apply changes to Data Type* box is checked, any changes made to any trace that is associated with a Data Type will automatically be applied to all other inputs of the same Data Type. This can be useful to use the same settings, for example filters, for all traces of the same Data Type.

 **Info** Remember that the Trace Properties only affect the display of the traces. The parameters for the recorded data are not changed.

## ***Deleting Traces***

Right click the name of the Trace to delete and select *Delete Trace*.

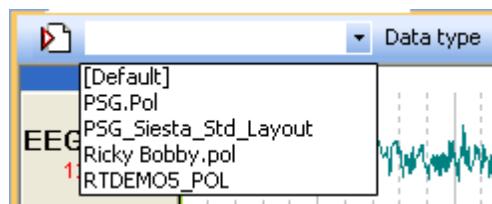
## 6.3 Managing Trace Layouts

### Saving Trace Layouts

Once the Trace Layout has been configured correctly, you can save it. From the Trace Layout Properties window, click the Save icon: . Enter a name for the Trace Layout and click OK to save.

### Loading Trace Layouts

From the Trace Layout quick list, select the Trace Layout that you want to apply to the study.



Trace layouts that match the recording configuration will be highlighted. Other trace layouts are grayed-out, but can still be selected. If you select a greed-out trace layout you will likely encounter errors in the display.

### Display as Recorded

To view the traces exactly as they were recorded, click the *Display as Recorded* icon: .

This locks all the trace display options. To change trace properties again, click the icon to disable the *Display as Recorded* option.



**Info** The Display as Recorded feature can only be used for studies recorded with PSG Online 3.

### Saving as Default

From the Trace Layouts Properties window, click the *Save as Default* icon: .

This will set the current Trace Layout as the default layout for the open study.

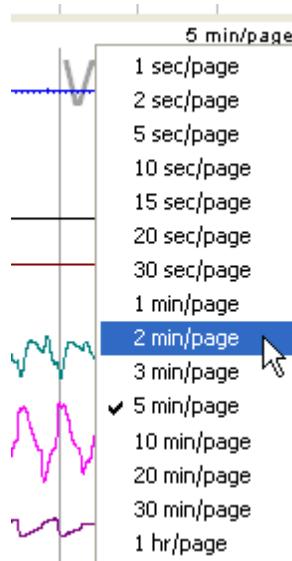
## ***Reload Default***

If you make changes to the Trace Layout, and then need to revert to the default layout, open the Trace Layout Properties window and click the *Reload Default* icon: 

## 6.4 Shortcuts

### Changing Timebases

Quick changes can be made to the timebase for a pane by selecting a new timebase from the drop down list at the top right corner of each pane:



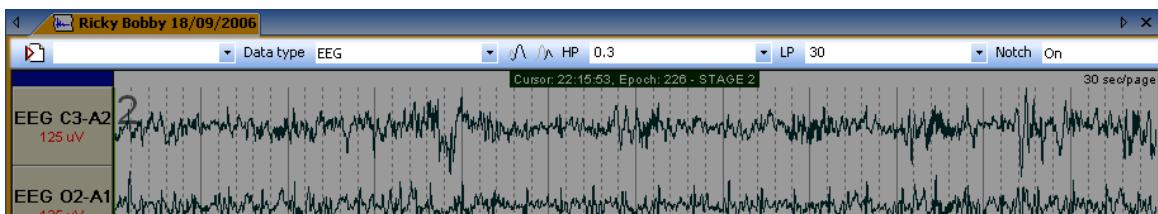
You can also use the Increase and Decrease Timebase options from the View menu to move to the next or previous timebase. For easier access to these options you can [customise keyboard shortcuts](#)<sup>[197]</sup>.

### Changing Individual Trace Properties

- Double-click on the trace label to open the properties window for that trace
- Place the cursor over a trace and press the up or down arrow keys to increase or decrease zoom
- Place cursor over trace label and use mouse scroll wheel to increase or decrease zoom
- Right-click trace label to select Auto Scale on demand, regardless of whether the trace properties has Auto Scale enabled
- Select the Auto Scale icon to auto scale all traces enabled in trace properties

### Changing Data Type Trace Properties

Changes can be made to all traces with the same data type from the Rawdata toolbar.



Select the Data type. Changes made to the Zoom, HP, LP and Notch filters will be applied to all traces in the selected Data type.

## Drag and Drop Traces

The order of individual Traces in the Trace Display can be changed by dragging and dropping the trace labels. Combinations of keystrokes and dragging perform the following functions:

Function	Command
Add Trace	<b>Click and drag</b>
Replace trace	<b>Ctrl+click and drag</b>
Reference to existing trace*	<b>Shift+click and drag</b>
Delete trace	<b>Click trace label and drag off screen</b>
Move trace	<b>Click trace label and drag to existing trace</b>
Replace existing trace	<b>Ctrl+click trace label and drag to existing trace</b>



**Tip** The Reference to existing trace drag and drop method only works by dragging input names from the Study Configurations window. All other drag and drop methods can also be used from this window.

## Adding and Deleting Traces

From the main Trace Display, right-click any Trace Label to select Append, Insert or Delete Trace.

- Append - Inserts a Trace at the bottom of the selected Trace Pane
- Insert - Adds a Trace above the Trace Label that is clicked on
- Delete - Deletes the selected Trace (or use the drag-and drop method to delete)

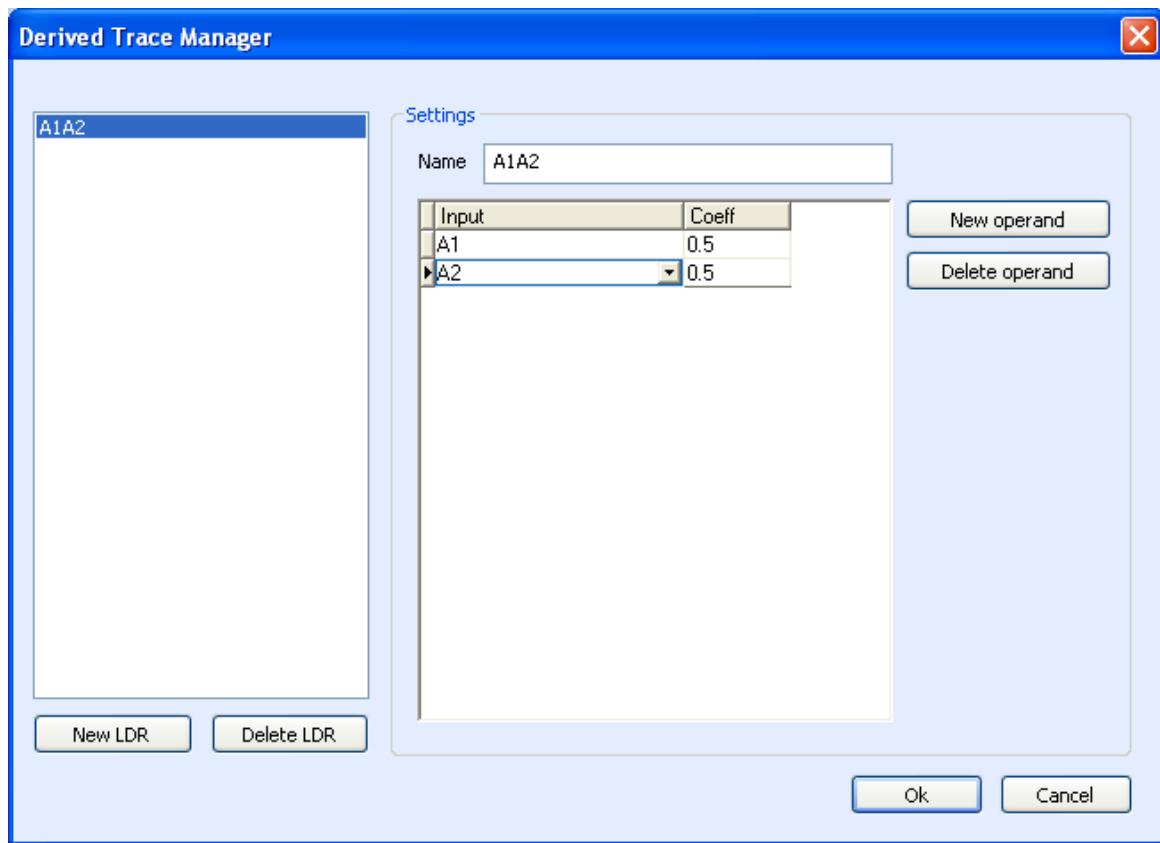
When a new Trace is Appended or Inserted, double click the new Trace Label to define the input(s) to be displayed and set the trace properties.

## 7 Derived Traces

Derived Traces can be created for display as another input. A Derived Trace creates a weighted average of two (or more) recorded inputs.

**Info** Only inputs with a data type of EEG can be used for creating Derived Traces. If you want to use derived traces, make sure you create a data type name of "EEG" in PSG Config, and apply it to the inputs you want to use for derived traces.

Derived Traces are managed from the Trace Layout Properties window (**View > Trace Layout Properties**). Click the Derived Trace Manager icon:



To enter a new LDR (linear derivation), click the New LDR button.

In the Settings pane, enter a Name for the Derived Trace.

For each input to be used, click the New Operand button.

- Select the desired Input
- Select the weighting Coefficient to be applied to the input

Repeat for the next input(s).

For example, to create an A1-A2 derived trace, select inputs A1 and A2, and set a coefficient of 0.5 for each.

The Derived Trace will be added to the inputs list, and can be viewed or used as a reference for other inputs with a data type of EEG.

## 8 Study Analysis

**Profusion PSG 3** contains powerful tools for the analysis of sleep studies. The default settings for each study are determined by the Recording Configuration, defined in the **PSG Config** program.

There are two methods of analysis available, Manual and Automatic. The events detected by the Automatic Analysis can be manually edited, or the study can be completely manually scored.

In order to analyse a study (manual or automatic), it is necessary to configure some settings. These determine which inputs will be analysed as part of the automatic analysis, and where marked events will be displayed. These settings also define basic criteria for the analysis, such as whether you want to mark central, mixed and obstructive hypopneas, or just have a generic hypopnea classification.

In order to report a study, the **Summary** analysis must be performed (during or after acquisition). The other automatic analysis modules are optional. The Profusion reporting tools allow for templates to be configured that will automatically include the desired information from the study.

There are settings for the following analysis groups:

### Sleep

- Sleep staging
- Arousals

### Respiratory

- Events
- Oximetry
- PTT
- EtCO<sub>2</sub>

### Limb movements

- Individual movements
- PLM episodes

### Cardiology

- ECG
- Heart Rate

### pH

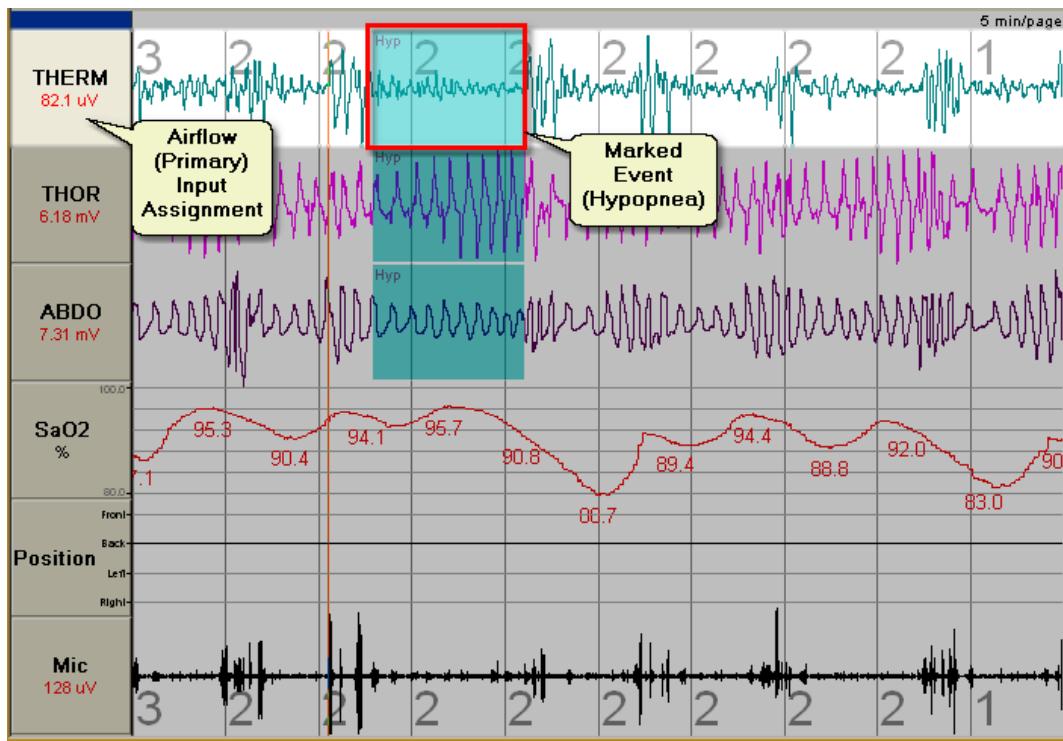
## 8.1 Analysis Settings

For each of the analysis groups, there are a variety of settings that need to be configured. The Input Assignments define which inputs are used for analysis and marking of events. The other settings are for general options related to study analysis.

The Input Assignments and other settings apply to manual and automatic analysis. The automatic analysis can be customised to better match your scoring criteria and methods.

### **Input Assignments**

The Input Assignments define which inputs are used for analysis and marking of events. Some input assignments also determine which inputs will be used for generating report statistics. For example, if the Apnea detection input is set as a thermistor input, the thermistor will be analysed for apneas, and they will be displayed and can be edited on the thermistor trace. In the example below, this trace is named *Therm*.



For each input in the three categories (Sleep, Respiratory and Other), select the Input channel, and where required the Reference channel, High and Low Pass filters, Notch filter and Lag Time.

The assignments in the Arousals category define which arousal types are available for marking and which input they will be marked on, and the pre-defined arousal types to be used if the [Automatic Arousal Association](#)<sup>[187]</sup> is enabled.

Most of the Automatic Analysis algorithms are performed on a single input. However, for some of the Sleep and Respiratory analyses more than one input is used.

Input Assignments need to be configured for the following groups:

- [Sleep](#)<sup>[44]</sup>
- [Respiratory](#)<sup>[48]</sup>
- [Arousal](#)<sup>[54]</sup>
- [Other](#)<sup>[64]</sup> (includes Limb Movements)

## Other Settings

Settings need to be configured for the following groups:

- [Respiratory](#)<sup>[48]</sup>
- [Arousal](#)<sup>[54]</sup>
- [Limb Movements](#)<sup>[62]</sup>

### 8.1.1 Scoring Mode

Profusion PSG 3 now allows you to select the **AASM Mode**, which applies the scoring rules contained in *The AASM Manual for the Scoring of Sleep and Associated Events*. If you wish to use the *Rechtschaffen and Kales* sleep staging rules for manual and automatic analysis, select the **R&K mode**.

To select the Scoring Mode, open the Study Configurations window (**View > Study Configurations**), and select the Scoring Mode that you wish to use.

The differences between the two scoring modes are shown below, along with the relevant AASM recommendations:

AASM Recommendation	AASM Mode	R&K Mode
Alpha detected using occipital EEG derivation	Detected on dedicated input: <i>EEG for Alpha Detection</i>	
Sleep spindles detected using central derivation	Detected on dedicated input: <i>EEG for Spindle Detection</i>	All EEG features detected on single <i>EEG</i> input
K complexes detected using frontal derivation	Detected on dedicated input: <i>EEG for Slow Wave and K complex Detection</i>	
Slow wave activity detected using frontal derivation	Detected on dedicated input: <i>EEG for Slow Wave and K complex Detection</i>	
Sleep stages: W, N1, N2, N3, REM	Automatic sleep analysis marks W, N1, N2, N3, REM	Automatic sleep analysis marks W, NREM1, NREM2, NREM3, NREM4, REM
Stage N2 and Stage R continuation rules – score same as previous stage until change of stage or arousal noted	Stages N2 and R continue to be scored as previous stage until change of stage or arousal noted	Stage reverts to N1 after 3 minutes without K complexes or sleep spindles (for stage N2), or rapid eye movements (for stage REM)

Apneas detected on oronasal thermal sensor	Detected on dedicated input: <i>Apnea Detection</i>	Apneas and hypopneas detected on single <i>Primary</i> respiratory input
Hypopneas detected on nasal air pressure transducer	Detected on dedicated input: <i>Hypopnea Detection</i>	
Limb movements defined by a minimum amplitude above resting EMG	Limb movements detected by amplitude above moving window average of preceding EMG	Limb movements detected by peak-to-peak amplitude

## Sleep staging

Sleep stages available in AASM mode (Adult) are:

- Wake
- N1 (NREM1)
- N2 (NREM2)
- N3 (NREM3)
- R (REM)

In addition the epoch stage markers Unsure and Artifact are maintained.

Input Assignments available for alpha detection, sleep spindle detection, and slow wave and K complex detection (typically occipital, central and frontal derivations respectively)

Automatic Analysis uses the AASM sleep stages.

Sleep stage continuation rules comply with the AASM recommendations.

## Respiratory events

Input Assignments available for Apnea and Hypopnea detection (typically thermal and pressure sensors respectively).

Default Automatic Analysis parameters for respiratory events comply with the AASM recommendations.

For Adult and Child studies, the *Periodic Breathing* marker has been renamed *Cheyne Stokes Breathing*.

## Limb Movements

Automatic Analysis detects signal increases above resting level, rather than a peak-to-peak amplitude.

Default Automatic Analysis parameters for limb movement events comply with the AASM

recommendations.

### 8.1.2 Study Type

The Study Type can be set for Adult, Child or Infant scoring. The selected type determines the sleep stages available for marking, and the types of Automatic Analysis modules available.

To select the Study Type, open the Study Configurations window (**View > Study Configurations**), and select the Study Type that you wish to use.



**Info** If you change the Study Type after sleep staging has already been performed, all previously marked sleep staging data will be deleted.

#### Sleep Stages Available:

Adult		Child		Infant
AASM	R&K	AASM	R&K	AASM and R&K
W	Wake	W	Wake	I (Indeterminate)
N1	NREM1	N (NREM)	NREM1	Q (Quiet)
N2	NREM2	N1	NREM2	A (Active)
N3	NREM3	N2	NREM3	Movement
R	NREM4	N3	NREM4	Wake
	REM	R	Stage 1/2	
	Movement		Stage 3/4	
			Movement	

#### Automatic Analysis Modules Available:

Analysis Module	Adult	Child	Infant
Summary	✓	✓	✓
Sleep Staging	✓	✗	✗
Arousal	✓	✗	✗
Respiratory	✓	✓	✓

PLM/Limb Movement			
PTT Event Detection			
pH Event Detection			
EtCO2 Peak Detection			

### 8.1.3 Sleep

The **EEG**, **EMG** and both **EOG** inputs (as defined by the Input Assignments) are analysed to determine the sleep stage and arousals. The Automatic Analysis parameters for sleep staging and arousals are based on the AASM sleep staging rules, and if required can be changed to use the R&K sleep staging rules by changing the [Scoring Mode](#)<sup>[41]</sup>. The Automatic Analysis looks at the frequency spectrum of the EEG for each 30 second epoch, and features such as sleep spindles, K-complexes, EMG amplitude and eye movements to determine the sleep stage and arousals. The **Light** input is used to determine which epochs are to be included in reports.

The EEG spectrum can also be used to assist in manual sleep staging.

### Input Assignments

**Info** The Sleep Input Assignments are found in Tools > Options > Input Assignments > Sleep.

#### EEG for Spindle detection (AASM Mode)

#### EEG (R&K Mode)

##### Assignments:

- Input - Select a Central EEG electrode (AASM recommendation is C4).
- Reference - Assign the correct reference electrode for the selected Central EEG input (AASM recommendation is M1).
- Filter Settings - Recommended settings are High pass = 0.3Hz, Low pass = 35Hz, Notch = On. Adjust these to account for any signal artefact (eg: sweat).

##### Analysis:

In AASM Mode, the **Summary** (available in both **PSG Online 3** and **Profusion PSG 3**) analyses the assigned central EEG input to detect sleep spindles, and generates a frequency spectrum to determine EEG frequencies other than alpha, slow waves and K complexes.

In R&K Mode, the **Summary** analyses the assigned EEG input to build up a frequency

spectrum, and detect alpha activity, sleep spindles, K complexes and delta activity. The spectrum and features are then used for automatic ***sleep staging*** and ***arousal analysis***.

## EEG for Alpha detection (AASM Mode)

### Assignments:

- Input - Select an Occipital EEG electrode (AASM recommendation is O2).
- Reference - Assign the correct reference electrode for the selected Occipital EEG input (AASM recommendation is M1).
- Filter Settings - Recommended settings are High pass = 0.3Hz, Low pass = 35Hz, Notch = On. Adjust these to account for any signal artefact (eg: sweat).

### Analysis:

The **Summary** (available in both **PSG Online 3** and **Profusion PSG 3**) analyses the assigned occipital EEG input to detect alpha frequencies.

## EEG for Slow wave and K complex detection (AASM Mode only)

### Assignments:

- Input - Select a Frontal EEG electrode (AASM recommendation is F4).
- Reference - Assign the correct reference electrode for the selected Frontal EEG input (AASM recommendation is M1).
- Filter Settings - Recommended settings are High pass = 0.3Hz, Low pass = 35Hz, Notch = On. Adjust these to account for any signal artefact (eg: sweat).

### Analysis:

The **Summary** (available in both **PSG Online 3** and **Profusion PSG 3**) analyses the assigned frontal EEG input to detect K complexes and slow wave activity.



**Info** In AASM Mode, the Automatic Sleep Staging analysis looks at all three EEG inputs, and uses the EEG features from each to assist in determining the sleep stage.

### Reporting

Statistics from manual or automatic sleep staging are available as report fields. The hypnogram can be included as a graph.

## EMG

### Assignments:

- Input - Select one of the chin EMG electrodes.
- Reference - Select a second chin EMG electrode. If you are recording three chin EMG signals, select the most reliable two as the Input and Reference.
- Filter Settings - Recommended settings are High pass = 10Hz, Low pass = 100Hz, Notch = On. Adjust these to account for any signal artefact.

**Analysis:**

The **Summary** analysis calculates an average EMG amplitude per epoch. The assigned EMG input is used by the automatic **sleep staging** and **arousal analysis** for assisting in detection of arousals, sleep onset, and stage REM.

**Event Marking:**

Bruxism can be marked on the chin EMG input.

**Reporting**

No report fields are available for the EMG input.

## EOG (Left), EOG (Right)



**Tip** The analysis of stage REM works best when the EOG is configured such that vertical eye movements are in phase and horizontal eye movements are out of phase. This is most easily achieved by placing both EOG electrodes lateral and inferior to the outer canthus, and referencing both to a common referential electrode at Fpz (which is the recommended placement of the Reference electrode for E-series and Siesta devices).

**Assignments:**

- Input - Select the Left and Right EOG inputs.
- Reference - Leave blank to use the common reference described in the tip above, or select a traditional reference (eg: A1, A2).
- Filter Settings - Recommended settings are High pass = 0.3Hz, Low pass = 35Hz, Notch = On. Adjust these to account for any signal artefact (eg: sweat).

**Analysis:**

The **Summary** analysis detects eye movements and rapid eye movements. Each EOG is analysed for eye movements. These movements are then compared to the other EOG input to look for in-phase, anti-phase and singular movements. The detected movements are used by the automatic **sleep staging** to assist in detection of REM and Wake.

**Event Marking:**

The following features will be marked on the Left and Right EOG inputs:

- Eye movement (Singular) - movements that occur in one EOG without a corresponding movement in the other EOG.
- Eye movement (Anti-phase) - movements that are a positive deflection in one EOG and a negative deflection in the other EOG.
- Eye movement (In-phase) - movements that are positive or negative deflections in both EOG inputs.



**Tip** The display preferences for these features can be configured through the [Trace Window](#) 186 preferences.

**Reporting**

No report fields are available for the EOG inputs.

## Light

**Assignment:**

- Input - Select an input to be used to mark whether the lights are On or Off. This can be a manual input.

**Analysis:**

Only epochs with Stage Light set to Off will be included in report statistics.

**Event Marking:**

No events are marked on the Light input.

**Reporting**

Stage Light is available as a graph, and the Light input is used for calculation of the lights out and lights on times.

## 8.1.4 Respiratory

Many different types of respiratory events can be marked in **Profusion PSG 3**:

- Obstructive Apnea\*
- Central Apnea\*
- Mixed Apnea\*
- Hypopnea\* (can choose to mark hypopneas as Central, Mixed and Obstructive if required)
- Unsure Respiratory event\*
- Respiratory Artifact
- Respiratory Paradox
- Periodic Breathing
- RERA

\*These events can be detected and marked by the Automatic Analysis. The parameters can be customised to best match your scoring criteria and marking preferences. See the [Respiratory Analysis](#)  section for more details.

In addition, up to four other respiratory event types can be defined.

**SpO<sub>2</sub> events** (desaturation and artifact) can be marked, and associated with respiratory events.

**Snores** can be marked and included in reports.

**TcCO<sub>2</sub>** and **EtCO<sub>2</sub>** can be reported, and automatic EtCO<sub>2</sub> event detection is available.

## Settings

The settings for respiratory analysis can be found by going to the Scoring Options window (**Tools > Options > Preferences > System Settings > Scoring**).

### Hypopnea Classification

When this is set to **Yes**, respiratory events can be marked as **Central**, **Mixed** or **Obstructive Hypopneas**, in addition to the other respiratory event types.

When this is set to **No**, only a general **Hypopnea** classification is available, in addition to the other respiratory event types.

### Default Respiratory Length

The Default Respiratory length defines the duration of respiratory events marked by a single right-click on the assigned input (requires the [Standard Event Marking mode](#)  to be

selected). The default setting is 10 seconds.

## Default Snore Length

The Default Snore length defines the duration of snores marked by a single right-click on the assigned input (requires the [Standard Event Marking mode](#)<sup>104</sup> to be selected). The default setting is 1 second.

## Input Assignments

 **Info** The Respiratory Input Assignments are found in Tools > Options > Input Assignments > Respiratory.

### Hypopnea Detection (AASM Mode)

#### Assignments:

- Input - Select a pressure sensor recording input. This may be a nasal cannula or pressure monitoring from a CPAP device.
- Filter Settings - Recommended settings are High pass = 0.1Hz, Low pass = 15Hz, Notch = On. Adjust these to account for any signal artifact.

#### Analysis:

The **respiratory analysis** uses the Pressure input to detect decreases in flow indicating hypopneas.

### Apnea Detection (AASM Mode)

#### Assignments:

- Input - Select a thermal sensor recording input. This may be a thermocouple or thermistor.

 **Info** For CPAP studies, or studies without a thermal sensor, assign a pressure input or other appropriate measure of flow. Both the Thermal and Pressure input assignments must be defined for the Automatic Analysis to detect both apneas and hypopneas.

- Filter Settings - Recommended settings are High pass = 0.1Hz, Low pass = 15Hz, Notch = On. Adjust these to account for any signal artifact.

#### Analysis:

The **respiratory analysis** uses the Thermal input to detect decreases in flow indicating apneas. This is then compared to the Effort 1 and Effort 2 inputs to determine the type of event (obstructive, mixed or central).

### Primary (R&K Mode)

#### Assignments:

- Input - Select an airflow recording input. This may be a thermocouple, pressure signal or other appropriate measure of flow.
- Filter Settings - Recommended settings are High pass = 0.1Hz, Low pass = 15Hz, Notch = On. Adjust these to account for any signal artefact.

**Analysis:**

The **respiratory analysis** uses the Primary input to detect decreases in flow indicating apneas and hypopneas. This is then compared to the Effort 1 and Effort 2 inputs to determine the type of event (obstructive, mixed or central).



**Tip** Events marked on the Primary input are also marked on the Effort 1 and Effort 2 inputs.

## Effort 1 & 2

### Assignments:

- Input - Select two respiratory effort inputs. These may be piezo respiratory belts or RIP belts (eg: Summit IP), or other appropriate measure of respiratory effort. Typically, set Effort 1 to a thoracic belt and Effort 2 to an abdominal belt.
- Filter Settings - Recommended settings are High pass = 0.1Hz, Low pass = 15Hz, Notch = On. Adjust these to account for any signal artefact.

### Analysis:

The **respiratory analysis** uses the Effort inputs to classify Primary input decreases as obstructive, mixed or central events.

## Event Marking:

In **AASM Mode**, respiratory events can be marked on any of the inputs assigned for Hypopnea detection, Apnea detection, Effort 1 or Effort 2.

In **R&K Mode**, respiratory events can be marked on the Primary, Effort 1 or Effort 2 inputs.

See the [Marking Events](#)<sup>103</sup> section for more details.

Once marked, the event marker will be displayed on all of the respiratory inputs. The following respiratory events can be marked on these inputs:

- Obstructive Apnea\*
- Central Apnea\*
- Mixed Apnea\*
- Hypopnea\* (can choose to mark hypopneas as Central, Mixed and Obstructive if required)
- Unsure Respiratory event\*
- Respiratory Artifact
- Respiratory Paradox
- Cheyne Stokes Breathing (AASM Mode)
- Periodic Breathing (R&K Mode)
- RERA

\*These events can be detected and marked by the Automatic Analysis.



**Tip** The display preferences for these features can be configured through the [Trace Window](#)<sup>186</sup> preferences.

## Reporting

A wide variety of respiratory event statistics and graphs can be included in reports.

## Sound

### Assignments:

- Input - Select a sound sensor input. These can be any valid measure of sound, for example microphone, SPL meter (decibels), the filtered snoring signal from nasal pressure monitoring, or the derived Snore input available from the Somté PSG.
- Filter Settings - The recommended filter settings depend on the type of input:

➤ Microphone	HP = 10Hz, LP = 100Hz, Notch On
➤ SPL	DC input, filters not required
➤ Filtered nasal pressure	HP = 10Hz, LP = 100Hz, Notch On
➤ Snore (Somté PSG)	Derived input, filters not required

### Analysis:

The **respiratory analysis** uses the sound input to detect deviations from the baseline, indicating snores. The baseline is calculated as a moving window average.

### Event Marking:

Individual snores can be marked on this input.



**Tip** The display preferences for these features can be configured through the [Trace Window](#) 186 preferences.

### Reporting

Snore statistics and graphs can be included in reports.

## SpO2

### Assignments:

- Input - Select the oximeter input.
- Lag Time - The SpO2 lag time defines the maximum time between the end of a respiratory event and the minimum SpO2 reading. The default setting is 30 seconds, but may need to be changed depending on the characteristics of the oximeter being used, and the recording location.

### Analysis:

The **summary** analysis uses the SpO2 input to detect decreases from the baseline, which is calculated as a moving window average. Parameters can be set to differentiate between desaturations and artifact. Desaturations can be used as part of the respiratory event criteria. The minimum and maximum SpO2 values for each epoch are calculated.

### Event Marking:

SpO2 desaturations and artifact can be marked on this input.



**Tip** The display preferences for these features can be configured through the [Trace Window](#) 186 preferences.

### Reporting

SpO2 statistics and graphs can be included in reports.

## CPAP

### Assignments:

- Input - Select an input for CPAP. This may be a direct pressure from a CPAP machine or a Manual Input.

**Analysis:**

The **Summary** analysis calculates an average CPAP value for each epoch.

**Event Marking:**

No events are marked on the CPAP input.

**Reporting**

CPAP statistics and graphs can be included in reports, including information about respiratory events at different CPAP levels.

## Position

**Assignments:**

- Input - Select an input for position. This may be a position sensor or a Manual Input.

**Analysis:**

The **Summary** analysis calculates an average position value for each epoch.

**Event Marking:**

No events are marked on the position input.

**Reporting**

Position statistics and graphs can be included in reports.

## TcCO<sub>2</sub>

**Assignments:**

- Input - Select an input for TcCO<sub>2</sub>.

**Analysis:**

The **Summary** analysis calculates an average TcCO<sub>2</sub> value for each epoch.

**Event Marking:**

No events are marked on the TcCO<sub>2</sub> input.

**Reporting**

TcCO<sub>2</sub> statistics and graphs can be included in reports.

## EtCO<sub>2</sub>

**Assignments:**

- Input - Select an input for EtCO<sub>2</sub>.

**Analysis:**

The **EtCO<sub>2</sub> Peak Detection** analysis calculates the peak EtCO<sub>2</sub> value of each respiratory cycle.

**Event Marking:**

The peak value is marked for each cycle by the **EtCO<sub>2</sub> Peak Detection** analysis.



**Tip** The display preferences for these features can be configured through the [Trace Window](#) [186] preferences.

**Reporting**

EtCO<sub>2</sub> statistics and graphs can be included in reports.

## User Defined 1-4

There are four optional User-defined event types that can be configured. If you enter input names for these, they will appear in the popup dialog box when a new respiratory event is marked.

**Assignments:**

- Input - Enter a name for each User-defined event type.

**Analysis:**

No analysis is performed on the user-defined event types.

**Event Marking:**

Each User-defined event that has been assigned an input name will be available for marking on the Primary, Effort 1 and Effort 2 inputs.

**Reporting**

User defined event statistics and graphs can be included in reports, available from the Report Script category in the Profusion PSG Report Wizard.

### 8.1.5 Arousal

Up to five different arousal types can be defined, and each of these can be marked on a different input. The Input Assignments define where the various arousal types are marked.

The inputs used for the Automatic Analysis of arousals are configured in the [Arousal Parameters](#) <sup>[70]</sup> section. Only one EEG input and the EMG input are automatically analysed for arousals.

Arousals can be classified manually.

To speed up the classification process, the Automatic Arousal Association tool can be used. This will classify arousals (both manually marked arousals and those marked by the automatic analysis) based on whether respiratory events and/or limb movements are present before the arousal.

- If you want to classify every arousal yourself, see the [Manual Classification](#) <sup>[56]</sup> section for information on configuring the Arousal settings and Input Assignments.
- If you want to have **Profusion PSG 3** automatically assign the correct arousal type depending on the presence of respiratory events and/or limb movements, see the [Automatic Arousal Association](#) <sup>[58]</sup> section.

## Settings

Regardless of whether you choose Manual Classification or Automatic Arousal Association, there are some settings to configure for Arousals. These are found by going to the Scoring Options window (**Tools > Options > Preferences > System Settings > Scoring**).

## Arousal Overlapping

Set this to *No* to prevent different arousal types from overlapping. In most cases this should be set to *No*.

## Default Arousal length

The Default Arousal length defines the duration of an arousal marked by a single right-click on the assigned input (requires the [Standard Event Marking mode](#)<sup>[104]</sup> to be selected). The default setting is 3 seconds.

### 8.1.5.1 Manual Classification

For each Arousal Type that is to be classified manually, the Type, Input and a Label need to be assigned.

## Input Assignments



**Info** The Arousal Input Assignments are found in Tools > Options > Input Assignments > Arousal.

### Arousal 1-5

#### Assignments:

- Type - Select User defined (the other options are used for the Automatic Arousal Association feature).
- Input - Select the input on which each arousal type will be marked and displayed.
- Label - Enter a descriptive label for each arousal type. This label will appear in the event marker.



**Tip** Although different inputs can be selected for each Arousal Type, it is recommended to assign only one or two inputs. Doing so will make reclassification of events easier.

#### Analysis:

No automatic analysis is performed on these inputs. The Arousal Analysis module has its own options for setting the input to analyse for arousal detection.

#### Event Marking:

See the [Event Marking](#) <sup>[106]</sup> section for details on marking and editing arousals.

Each Arousal Type will be marked on its respective input. Marked arousals can be reclassified to other types only if each arousal type has the same input.

#### Reporting

Arousal statistics and graphs can be included in reports.

## Example

If the Arousal Input Assignments are configured as shown in *Figure 1*, the 5 Arousal Types can be marked as shown in *Figure 2*.

Property	Value
<b>Arousal 1</b>	
Type	User defined
Input	C4
Label	Unknown
<b>Arousal 2</b>	
Type	User defined
Input	C3
Label	Obstructive
<b>Arousal 3</b>	
Type	User defined
Input	C3
Label	Leg
<b>Arousal 4</b>	
Type	User defined
Input	C3
Label	RERA
<b>Arousal 5</b>	
Type	User defined
Input	C4
Label	Other

Figure 1 - Arousal Input Assignments

In this case, Arousal Types 2, 3 and 4 can be marked on the C3 input (even if it is referenced to another input, as shown here), and can be reclassified to the other types with the same input.

Likewise, Arousal Types 1 and 5 can be marked on the C4 input and reclassified to the other type.

However an arousal marked as Type 2, 3 or 4 cannot be reclassified as a Type 1 or 5 arousal, except by deleting the first arousal and marking another on the correct input.

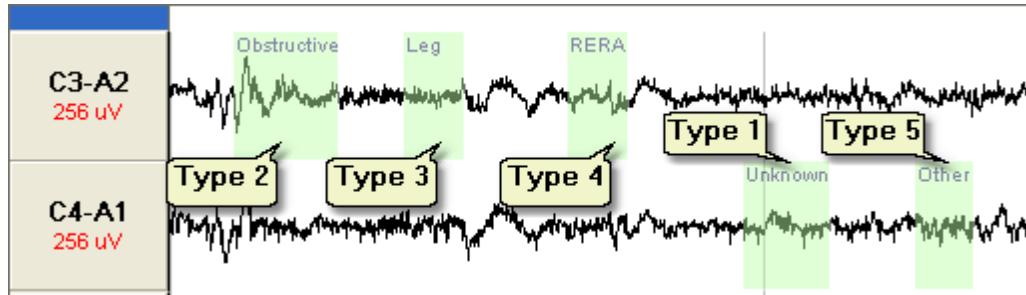


Figure 2 - Marked Arousal events

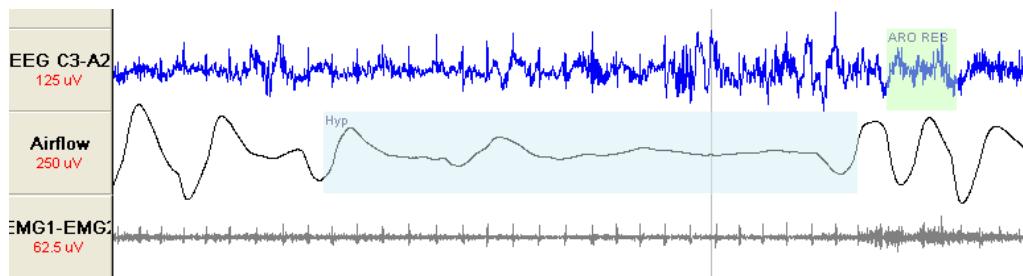
**Info** The events marked in the above example are not arousals, but have been shown to demonstrate the input assignment concept.

### 8.1.5.2 Automatic Classification

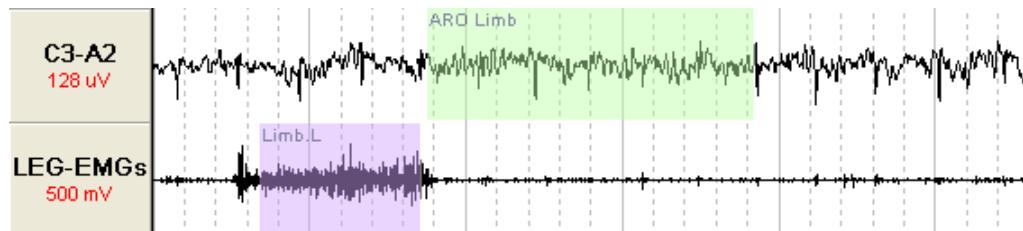
When using the Automatic Arousal Association feature, arousals will be marked as Spontaneous, Respiratory or Limb Movement arousals depending on the presence of events. This feature can be used to aid manual analysis, and can also be used to classify arousals when running the Automatic Analysis.

Arousals marked on the assigned input will be classified as either a Respiratory arousal (ARO RES) or Limb Movement arousal (ARO Limb) when the following criteria are met:

- **Respiratory** – the arousal begins before or after the *end* of the respiratory event, within the specified respiratory event association time.



- **Limb Movement** – the arousal begins after the *start* of the limb movement event, within the specified limb movement association time.



- If both a Respiratory Event and a Limb Movement Event precede the marked arousal within the respective time periods then the arousal will be categorized as a Respiratory Arousal.
- If neither condition is met for a Respiratory or Limb Movement category the arousal will be marked as Spontaneous.

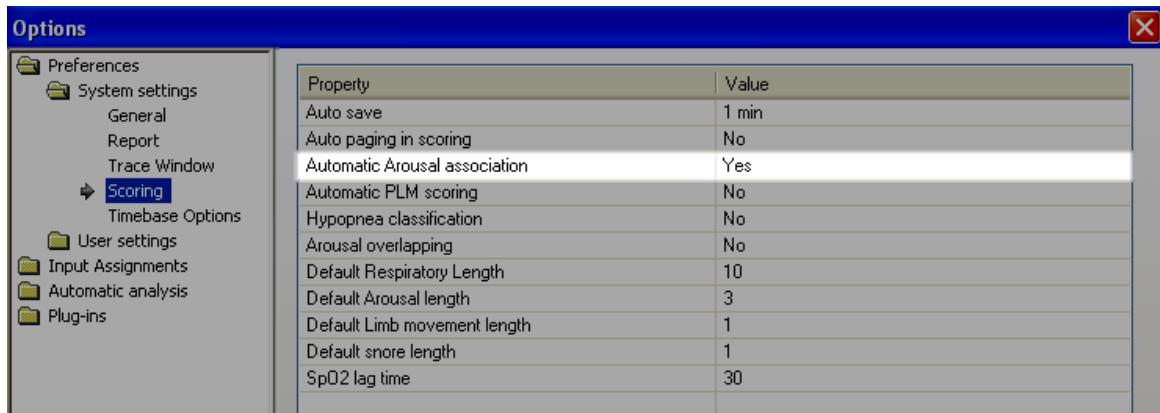
The automatic arousal association will dynamically update whenever new arousals, respiratory events and limb movements are marked, so it doesn't matter whether arousals or respiratory and limb movements are marked first, or whether the arousals are marked manually or by the Arousal detection analysis.



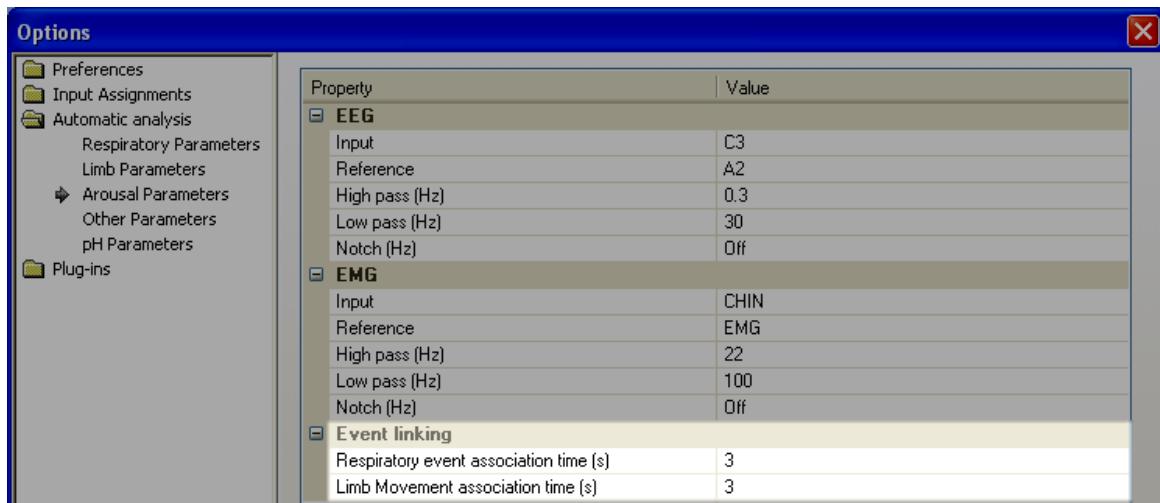
**Tip** Arousal events that have been automatically classified can still be reclassified to other arousal types that have the same input assignment.

## Settings

In order to use the Automatic Arousal Association feature, go to the Scoring Options window (**Tools > Options > Preferences > System Settings > Scoring**) and set **Automatic Arousal Association** to Yes.



To set the Arousal Association times, go to the Arousal parameters section of the Automatic Analysis (**Tools > Options > Automatic Analysis > Arousal Parameters**). Set the Event Linking times for Respiratory and Limb Movement arousals.



**Tip** If you are working with a long timebase (eg: 5 minutes), a 3 second association time requires very precise marking of events. Try a longer association time if you find that the Automatic Arousal Association is not reclassifying arousals when it should.

## Input Assignments



**Info** The Arousal Input Assignments are found in Tools > Options > Input Assignments > Arousal.

Each Arousal Type that is to be classified automatically needs to be assigned a Type, Input and Label. There are three Automatic Arousal Types, and there are specific requirements for the configuration of these.

### Analysis:

The Automatic Arousal Association will check each arousal as it is marked to see if it has a preceding respiratory event or limb movement within the association time, and classify the arousal accordingly. If a preceding respiratory event or limb movement is added or deleted, the associated arousal will be reclassified accordingly.

### Event Marking:

See the [Event Marking](#)<sup>[106]</sup> section for details on marking and editing arousals.

The arousals will be marked on the assigned input. Arousals classified by the Automatic Arousal Association feature can be reclassified to other types.

### Reporting

Arousal statistics and graphs can be included in reports.

## Example

The order of Input Assignments described below is the recommended configuration, however a different order can be used if required.

### Arousal 1

#### Assignments:

- Type - Select Respiratory.
- Input - Select the input on which Respiratory arousals will be marked and displayed. The same input must be used for all of the Automatic Arousal types.
- Label - The label will be blank. When an arousal is automatically associated with a respiratory event, the arousal marker label will be ARO RES.

### Arousal 2

#### Assignments:

- Type - Select Limb Movements.
- Input - Select the same input as Arousal 1. This is the input on which Limb Movement arousals will be marked and displayed. The same input must be used for all of the Automatic Arousal types.
- Label - The label will be blank. When an arousal is automatically associated with a limb movement, the arousal marker label will be ARO Limb.

### Arousal 3

#### Assignments:

- Type - Select Spontaneous.
- Input - Select the input on which Spontaneous arousals will be marked and displayed. The same input must be used for all of the Automatic Arousal types.
- Label - The label will be blank. When an arousal without respiratory events or limb movements within the association times is marked, the arousal marker label will be ARO SPONT.

## Arousal 4, 5

If required, Arousal types 4 and 5 can be configured for [Manual Classification](#)<sup>56</sup>. This allows other arousal types to be defined, such as RERA or Other.

### 8.1.6 Limb Movements

Limb movements and Periodic Limb Movement (PLM) episodes can be marked manually, and detected automatically by the **PLM / Limb Movement Analysis** module. Manually marked limb movements can also be monitored as they are marked to automatically detect PLM episodes.

The configuration of the settings and input assignments depends on your recording configuration and scoring preferences.

### Recording Considerations

Limb movements can be recorded using a variety of recording methods:

- Piezo limb sensors
- EMG - One electrode per limb (not recommended)
- EMG - Two electrodes per limb

The recording configuration for each method is defined by the Physical Inputs section of **PSG Config**.

The Input Assignments for each recording method are described below.

### Settings

The settings for Limb Movement analysis can be found by going to the Scoring Options window (**Tools > Options > Preferences > System Settings > Scoring**).

#### Automatic PLM scoring

When this is set to Yes, the PLM episode detection module will monitor marked limb movements to see if they meet the PLM criteria as defined by the [PLM analysis](#) settings. As limb movements are marked or deleted, the PLM episodes will be dynamically updated to reflect the changes.

When this is set to No, PLM episodes must be marked manually.

#### Default Limb Movement Length

The Default Limb Movement length defines the duration of individual limb movement events marked by a single right-click on the assigned input (requires the [Standard Event Marking mode](#) to be selected). The default setting is 1 second.

### Input Assignments



**Info** The Limb Input Assignments are found in Tools > Options > Input Assignments > Other.

#### Leg (Left/Right)

Assignments:

**Piezo limb sensor:**

- Input - Select the left or right limb sensor respectively.
- Reference - No reference required.
- Filter Settings - Recommended settings are High pass = 1Hz, Low pass = 20Hz, Notch = On. Adjust these to account for any signal artefact.

**One EMG electrode per limb:**

- Input - For the Leg (Left) Input, select the Left EMG electrode.
- Reference - For the Leg (Left) Reference, select the Right EMG electrode.
- Filter Settings - Recommended settings are High pass = 10Hz, Low pass = 100Hz, Notch = On. Adjust these to account for any signal artefact.



**Info** For one EMG electrode per limb, only configure the Input Assignment for one Leg (suggested to use the Leg (Left) assignment). Leave the other assignment blank.

**Two EMG electrodes per limb:**

- Input - For the Leg (Left) and Leg (Right) Inputs, select the first Left or Right limb EMG electrode respectively.
- Reference - For the Leg (Left) and Leg (Right) References, select the second Left or Right limb EMG electrode respectively.
- Filter Settings - Recommended settings are High pass = 10Hz, Low pass = 100Hz, Notch = On. Adjust these to account for any signal artefact.

**Analysis:**

The **PLM / Limb movement analysis** uses both the left and right leg inputs to detect individual limb movements and PLM episodes. If the Input Assignments have been configured for only one leg, only that leg will be looked at for analysis.

**Event Marking:**

Individual limb movements and PLM episodes can be marked on the Left and Right leg inputs. Individual movements will be classified as Limb Movement (Left) or Limb Movement (Right).



**Tip** The display preferences for these features can be configured through the [Trace Window](#)<sup>186</sup> preferences.

**Reporting**

Statistics and graphs for individual limb movements and PLM episodes can be included in reports.

### 8.1.7 Other

A variety of other input assignments can be configured for analysis and event marking.

The following inputs are configured in the Other tab:

- Pleth
- Heart Rate
- ECG
- Leg (Left and Right) - See the [Limb Movements](#) 182 Settings section for details
- pH (Distal and Proximal)
- Blood Pressure
- Body Temperature

## Input Assignments



**Info** The Other Input Assignments are found in Tools > Options > Input Assignments > Other.

### Pleth

#### Assignments:

- Input - Select a plethysmography input. For example, channel 58 of the E-Series is dedicated as a Pleth input.

#### Analysis:

The **Generate PTT analysis** uses the Pleth input and ECG to derive a Pulse Transit Time trace (PTT). The PTT trace can be analysed to **Detect PTT Events**.

#### Event Marking:

No events are marked on the Pleth trace, but events can be marked on the derived PTT trace.



**Tip** The display preferences for these features can be configured through the [Trace Window](#) 186 preferences.

#### Reporting

No report fields are available for the Pleth input, however PTT statistics and graphs can be included in reports.

### Heart Rate

#### Assignments:

- Input - Select a heart rate input. This may be the Derived Heart Rate or the Pulse input

from a pulse oximeter.

#### **Analysis:**

No analysis is performed on the Heart Rate input.

#### **Event Marking:**

No events are marked on the Heart Rate trace.

#### **Reporting**

The Heart Rate input is used for all the report fields and Trend graphs related to Heart Rate.

## **ECG**

#### **Assignments:**

- Input - Select one of the ECG electrodes.
- Reference - If two ECG electrodes are used, select the second ECG electrode.
- Filter Settings - Recommended settings are High pass = 0.3Hz, Low pass = 70Hz, Notch = On. Adjust these to account for any signal artefact.

#### **Analysis:**

The **Summary analysis** uses the ECG input to derive a heart rate. This is a beat to beat heart rate, rather than an averaged heart rate as obtained from a pulse oximeter. The **Generate PTT analysis** uses the Pleth input and ECG to derive a Pulse Transit Time trace (PTT). The PTT trace can be analysed to **Detect PTT Events**.

#### **Event Marking:**

Bradycardia and tachycardia events can be marked on the ECG input.



**Tip** The display preferences for these features can be configured through the [Trace Window](#) 186 preferences.

#### **Reporting**

Bradycardia and tachycardia events, including their association with respiratory events, can be included in reports.

## **Leg (Left and Right)**

See the [Limb Movements](#) 62 section for details.

## **pH (Distal and Proximal)**

#### **Assignments:**

- Input - Select the distal and/or proximal pH inputs respectively.

#### **Analysis:**

The **pH Event Detection analysis** uses either the distal or proximal pH inputs to detect pH events.

#### **Event Marking:**

pH events can be marked on the distal or proximal inputs, and will be classified as Distal or Proximal pH events respectively. The **pH Event Detection analysis** will mark events only on the input assigned for analysis.



**Tip** The display preferences for these features can be configured through the

[Trace Window](#)<sup>186</sup> preferences.

#### **Reporting**

Statistics and graphs for pH trends and events can be included in reports.

### **Blood Pressure**

#### **Assignments:**

- Input - Select a blood pressure input.

#### **Analysis:**

No analysis is performed on the Blood Pressure input.

#### **Event Marking:**

Blood pressure artifact can be marked on this input

#### **Reporting**

No report fields are available for the Blood Pressure input.

### **Body Temperature**

#### **Assignments:**

- Input - Select a body temperature input.

#### **Analysis:**

No analysis is performed on the Body Temperature input.

#### **Event Marking:**

Body temperature artifact can be marked on this input

#### **Reporting**

No report fields are available for the Body Temperature input.

## 8.2 Automatic Analysis

The Automatic Analysis feature can be used to automatically mark sleep stages, arousals, respiratory events (including SpO<sub>2</sub> desaturations and snoring), limb movements and PLM episodes. The Automatic Analysis can be performed online during data acquisition, or during study review. All automatically marked features can be edited or deleted.

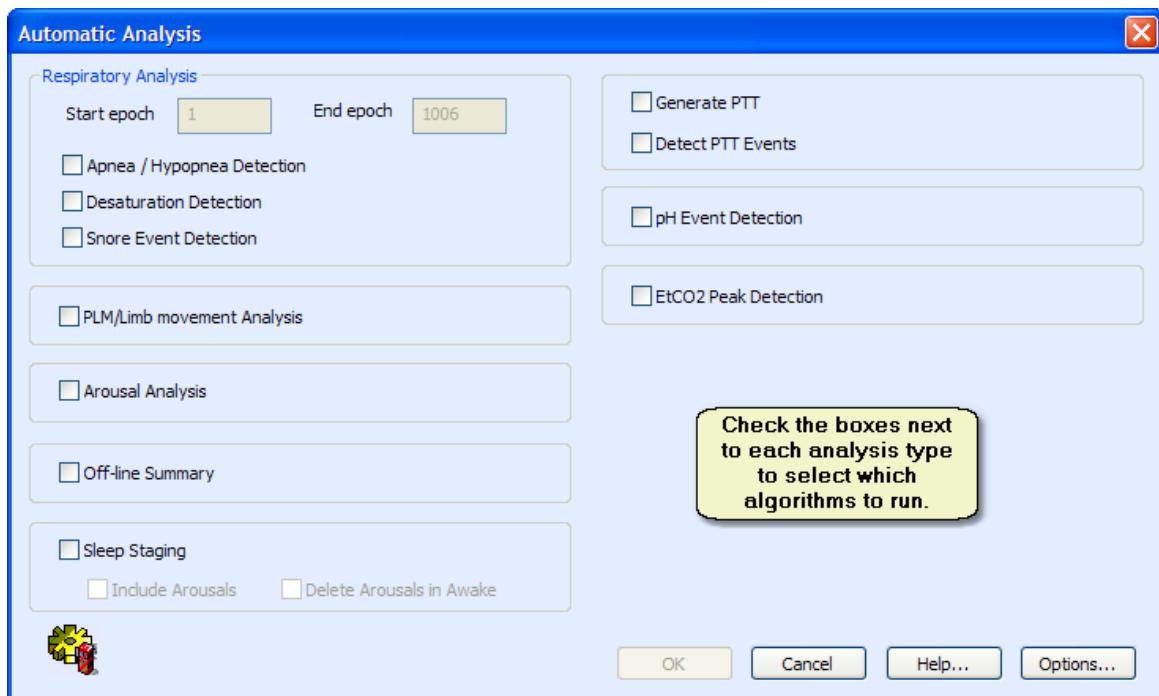
The aim of the Automatic Analysis is to approximate laboratory scoring, and to assist in manual scoring of studies. Each Automatic Analysis algorithm can be run individually.

The inputs analysed by the various algorithms are configured in [Input Assignments](#)<sup>38</sup>.

 **Tip** There are minimum sampling rates required for data acquisition in order for the Automatic Analysis to operate correctly. Click here to view these sampling rates.

The default Automatic Analysis parameters are configured in PSG Config. These parameters define the analysis performed during data acquisition, and the default parameters for study review in Profusion PSG 3. These parameters can be changed and the Automatic Analysis run again in Profusion PSG 3.

The different Automatic Algorithms can be run by selecting **Tools > Automatic Analysis**. Check the boxes next to the analysis modules that you want to run, and click OK.



Click the **Options** button to configure the Automatic Analysis parameters.



**Tip** If the study has been automatically or manually analysed previously and you don't want to lose the existing analysis markers, or want to compare results between different analyses, start a new [Data Set](#)<sup>[17]</sup>.

## 8.2.1 Sleep Analysis

The analysis parameters for sleep staging are based on either the AASM or the R&K sleep staging rules, depending on the [Scoring Mode](#)<sup>41</sup>. The Automatic Analysis looks at the frequency spectrum of each 30 second epoch, and features such as sleep spindles, K-complexes, EMG amplitude and eye movements to determine the sleep stage.



**Info** Automatic sleep staging is only available for studies with the Study Type set to Adult.

To run the Automatic Sleep Staging analysis, go to **Tools > Automatic Analysis** and check the Sleep Staging box. To include automatically marked arousals as part of the staging rules (recommended), check the *Include Arousals* box. Check the *Delete Arousal in Awake* to delete any marked arousals that are found to lie in epochs marked as Wake.

Check the **Arousal Analysis** box to run the arousal detection along with the sleep staging. This is recommended if you check the *Include Arousals* option for automatic Sleep Staging.

Click OK to run the analysis.



**Tip** For the most accurate sleep staging results, run both automatic Sleep Staging (using the *Include Arousals* option) and Arousal Analysis modules.

## 8.2.2 Arousal Analysis

The parameters for automatic Arousal Analysis are based on either the AASM or the R&K rules, depending on the [Scoring Mode](#)<sup>41</sup>. The analysis looks at the selected EEG and EMG inputs to detect alpha activity in association with chin EMG increases as an arousal marker.

For the EEG, set the input and reference channels. It is recommended to use a central derivation for best results. The recommended filter settings are High pass = 0.3Hz, Low pass = 35Hz, Notch = On. Adjust these to account for any signal artefact (eg: sweat).



**Tip** The EEG used for Arousal Analysis can be different to the EEG input used for Sleep Staging.

For the EMG, set the input and reference channels. These should be two chin EMG inputs. The recommended filter settings are High pass = 10Hz, Low pass = 100Hz, Notch = On. Adjust these to account for any signal artefact.

The event linking options are used by the [Automatic Arousal Association](#)<sup>58</sup> feature.



**Tip** For the most accurate sleep staging results, run both automatic sleep staging and arousal detection. This is the default setting for online analysis. Staging analysis can be performed in Profusion PSG 3 without including arousals.

To run the automatic Arousal Analysis, go to **Tools > Automatic Analysis** and check the Arousal Analysis box.

Click OK to run the analysis.

## 8.2.3 Respiratory Analysis

Automatic respiratory analysis can be used to detect apneas (obstructive, mixed and central), hypopneas and snoring. SpO<sub>2</sub> desaturations can be detected, and used as part of the criteria for defining respiratory events. The parameters for respiratory analysis can be altered to provide optimal results.

The following inputs are used for the automatic detection and classification of respiratory events:

- [Hypopnea Detection](#)<sup>[73]</sup> (AASM Mode, typically pressure sensor)
- [Apnea Detection](#)<sup>[73]</sup> (AASM Mode, typically thermal sensor)
- [Primary Input](#)<sup>[73]</sup> (R&K Mode, typically thermal or nasal pressure)
- [Effort Inputs](#)<sup>[81]</sup> (two inputs, usually thoracic and abdominal respiratory effort)
- [SaO<sub>2</sub> Input](#)<sup>[84]</sup> (used for detecting desaturations)

In addition, desaturation artifact can be detected and excluded from analysis, and the Sound Input can be analysed for snoring.



**Info** Respiratory events marked by the automatic analysis can be edited or deleted manually, and new events can be marked manually.

To run the automatic Respiratory Analysis, go to **Tools > Automatic Analysis** and check the Respiratory Analysis box.

If you only want to analyse a particular section of the study, enter the desired Start and End epochs.

Click OK to run the analysis.

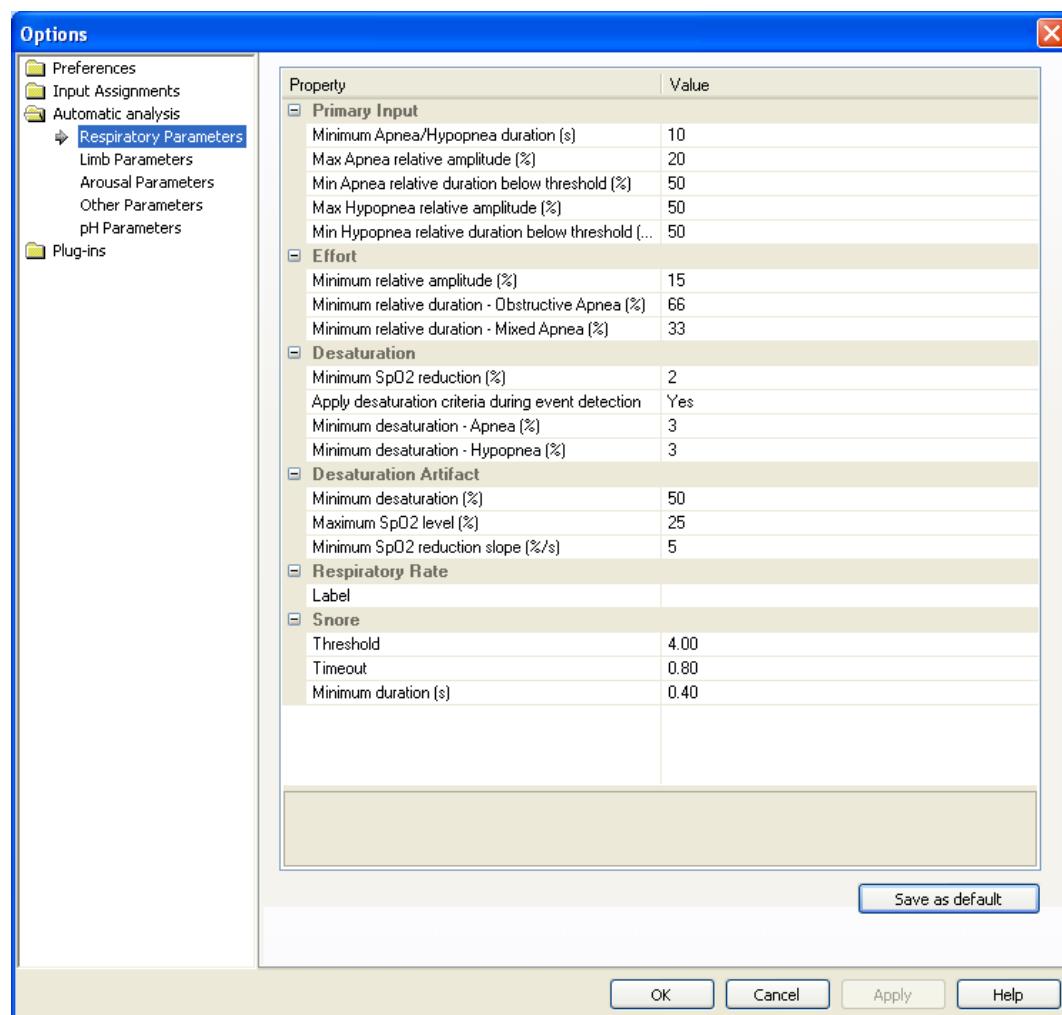


**Tip** To customise the Respiratory Analysis to best match your scoring criteria and methods, open a study with a variety of respiratory events in Profusion PSG 3. Manually score the respiratory events for a range of representative epochs (100-200 epochs). Create a new [Data Set](#)<sup>[17]</sup>, and run the Respiratory Analysis over the same epoch range. Use the Scoring Comparison feature to compare the results of the Respiratory Analysis to your scoring. If there are significant differences, adjust the Respiratory Parameters using the suggestions for each section and run the Respiratory Analysis again. Perform another Scoring Comparison, and continue to adjust the respiratory parameters to more closely match your scoring. Once the Respiratory Parameters have been optimised, transfer these settings to the recording configuration in PSG Config. The Online analysis will give a more accurate analysis, and make tools such as the Decision Assistant even more powerful.

### 8.2.3.1 Respiratory Parameters

The Respiratory Parameters define the Automatic Analysis settings for all respiratory-related features, including respiratory events and SpO<sub>2</sub> events. These can be adjusted as required.

To view and change the Respiratory parameters, go to **Tools > Options > Automatic Analysis** and click on Respiratory Parameters. The default settings are shown below.



#### 8.2.3.1.1 Apnea/Hypopnea detection parameters

These parameters are used to determine whether signal decreases in the airflow signals, as set in the Input Assignments, are hypopneas or apneas. In the AASM Mode, the apnea parameters are applied to the Apnea Detection input, and the hypopnea parameters to the Hypopnea Detection input. In R&K Mode, the apnea and hypopnea parameters are both applied to the Primary respiratory input.

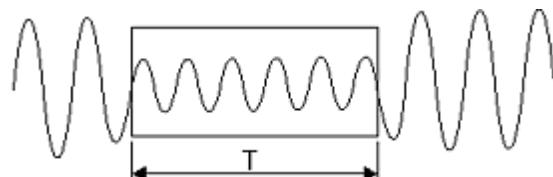
The following parameters can be adjusted for best automatic event detection and classification performance:

- [Minimum event duration](#)<sup>74</sup>
- [Maximum relative amplitude](#)<sup>75</sup>
- [Minimum apnea relative duration](#)<sup>77</sup>

#### 8.2.3.1.1.1 Minimum Apnea/Hypopnea duration (seconds)

This value sets the minimum duration for an event to be classified as an apnea or hypopnea. The automatic analysis measures the start and end point of events as the waveform crosses the 0 line.

For example, if this value is set at 10 seconds, then any event that the computer finds that is less than 10 seconds will generally not be marked. Occasionally events of less than 10 seconds duration may be marked, due to adjustments by the analysis program for timing differences in the respiratory cycle.



Type: Apnea, Hypopnea

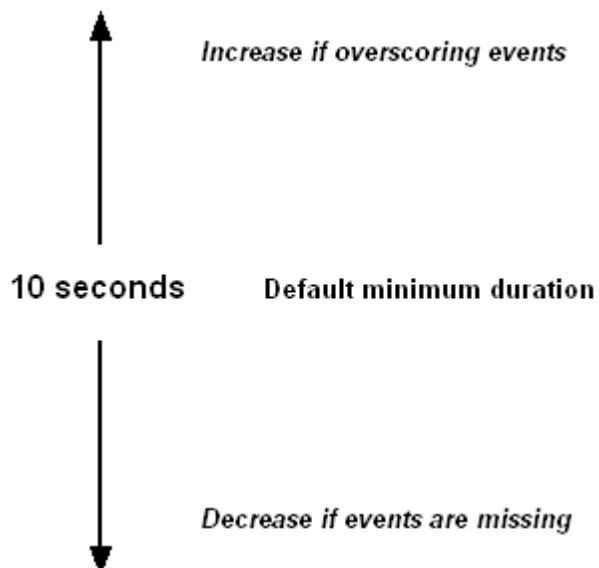
Default Setting:  $T = 10$  seconds

### Adjustments

You may want to change the minimum duration value from the default setting of 10 seconds to reflect your measurement technique.

If you want Automatic Analysis to mark:

- more events: *decrease* minimum duration
- less events: *increase* minimum duration

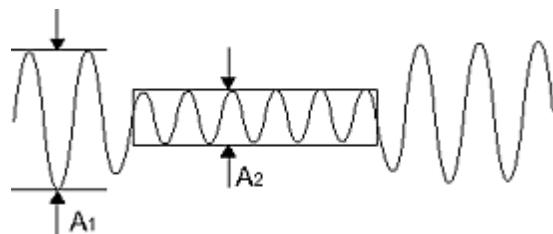


#### 8.2.3.1.1.2 Max Apnea relative amplitude (%)

Set the amplitude threshold for apneas, relative to the preceding 3-6 breaths. The length of this window depends on breathing stability.

This sets the threshold of the peak-to-peak amplitude of the Apnea Detection (or Primary) flow trace relative to the preceding amplitude for an event to be classified as an apnea.

For example, if this maximum relative amplitude was set at 20%, then every event that is found to have an amplitude of 20% or below of the preceding data will be classified as an apnea.



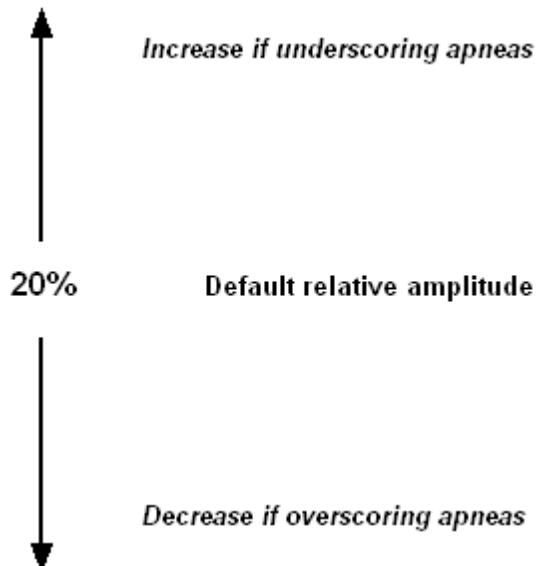
Type: Apnea

Default Setting:  $A2 / A1 \leq 20\%$

### Adjustments

You may want to change the maximum relative amplitude value from the default setting of 20% to reflect your measurement technique.

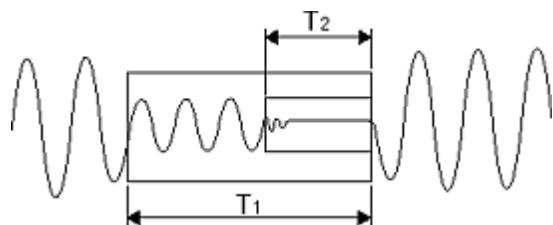
- Automatic Analysis is marking events as apneas that I would call hypopneas: *decrease relative amplitude*
- Automatic Analysis is marking events as hypopneas that I would call apneas: *increase relative amplitude*



### 8.2.3.1.1.3 Min Apnea relative duration below threshold

The minimum relative duration is the proportion of the event for which the signal amplitude must be below the threshold level to be classified as an apnea. This parameter is set to allow tolerance for brief amplitude changes during an event.

The minimum relative duration is the proportion of the event for which the signal amplitude must be below the threshold level to be classified as an apnea. This parameter is set to allow tolerance for brief amplitude changes during an event.



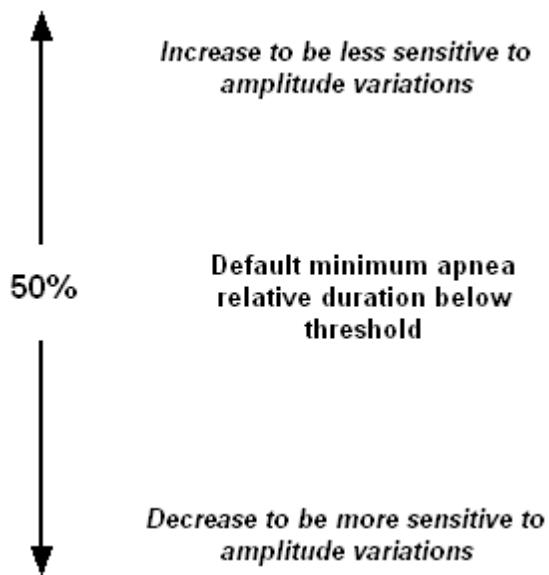
Type: Apnea

Default Setting:  $T_2 / T_1 \geq 50\%$

## Adjustments

You may want to change the minimum apnea relative duration below threshold value from the default setting of 50% to reflect your measurement technique.

- I want Automatic Analysis to be less sensitive to amplitude variations for apneas:  
*increase* minimum relative duration below threshold
- I want Automatic Analysis to be more sensitive to amplitude variations for apneas:  
*decrease* minimum relative duration below threshold

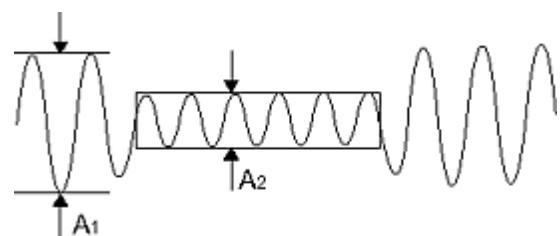


#### 8.2.3.1.1.4 Max Hypopnea relative amplitude (%)

Set the amplitude threshold for hypopneas, relative to the preceding 3-6 breaths. The length of this window depends on breathing stability.

This sets the threshold of the peak-to-peak amplitude of the Hypopnea Detection (or Primary) flow trace relative to the preceding amplitude for an event to be classified as a hypopnea.

For example, if this maximum relative amplitude was set at 50%, then every event that is found to have an amplitude of 50% or below of the preceding data will be classified as a hypopnea.



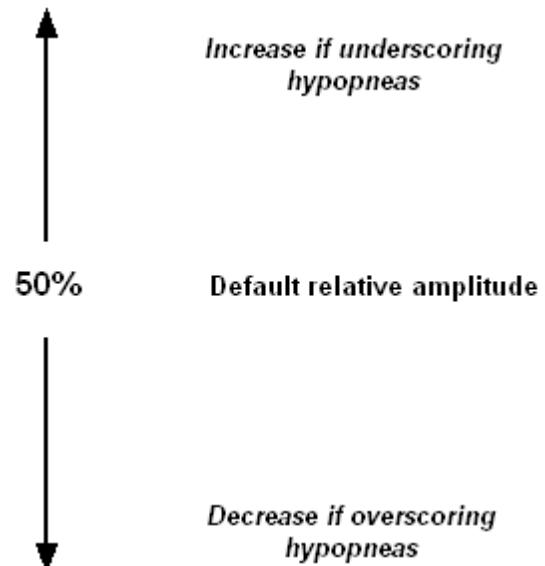
Type: Hypopnea

Default Setting:  $A2 / A1 \leq 50\%$

### Adjustments

You may want to change the maximum relative amplitude value from the default setting of 50% to reflect your measurement technique.

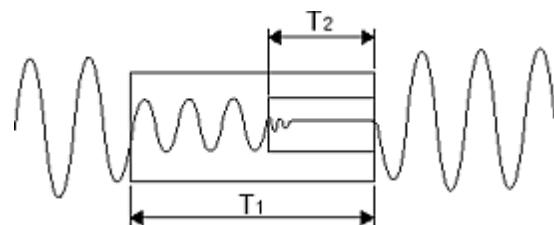
- Automatic Analysis is marking events as hypopneas that I would not score:  
*decrease relative amplitude*
- Automatic Analysis is not marking events that I would score as hypopneas:  
*increase relative amplitude*



#### 8.2.3.1.1.5 Min Hypopnea relative duration below threshold

The minimum relative duration is the proportion of the event for which the signal amplitude must be below the threshold level to be classified as a hypopnea. This parameter is set to allow tolerance for brief amplitude changes during an event.

The minimum relative duration is the proportion of the event for which the signal amplitude must be below the threshold level to be classified as a hypopnea. This parameter is set to allow tolerance for brief amplitude changes during an event.



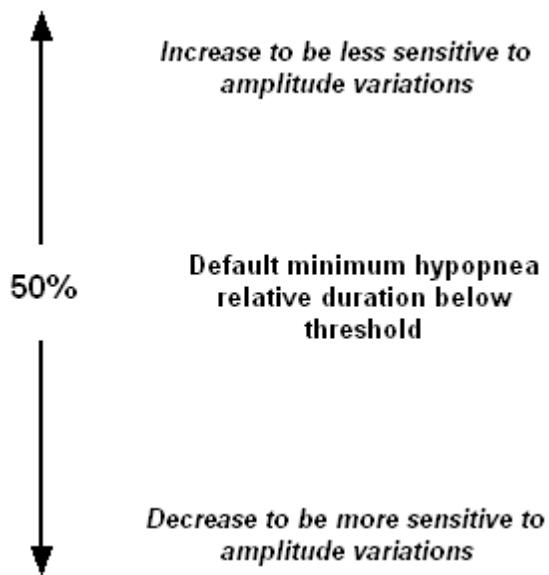
Type: Hypopnea

Default Setting:  $T_2 / T_1 \geq 50\%$

### Adjustments

You may want to change the minimum hypopnea relative duration below threshold value from the default setting of 50% to reflect your measurement technique.

- I want Automatic Analysis to be less sensitive to amplitude variations for hypopneas: *increase* minimum relative duration below threshold
- I want Automatic Analysis to be more sensitive to amplitude variations for hypopneas: *decrease* minimum relative duration below threshold



### 8.2.3.1.2 Apnea Classification parameters

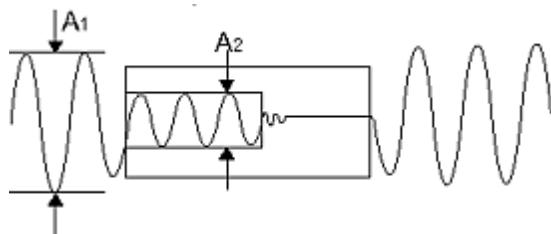
These criteria are used to determine the type of apnea (obstructive, central or mixed) and are applied to the **Effort 1** and **Effort 2** traces as defined in Input Assignments. These should be some measure of respiratory effort, typically piezo respiratory belts or RIP bands.

The algorithms look at the effort on either trace, with no priority given to either.

#### 8.2.3.1.2.1 Minimum relative amplitude (%)

Used to determine the relative amplitude of effort during a respiratory event that is to be classified as no effort. The relative amplitude refers to the amplitude of the trace relative to the amplitude during the previous 3-6 breaths. The length of this window depends on breathing stability.

If, for example, this is set at 15%, then all selected respiratory effort traces need to fall below 15% of the preceding movement in order for an apnea to be classed as a central type.



Type: Central, Mixed, Obstructive Apnea

Default Setting:  $A2 / A1 \geq 15\%$

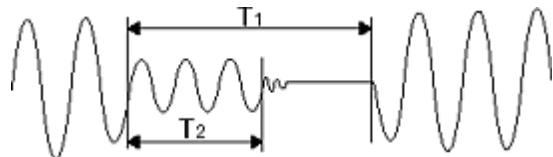
## Adjustments

You may want to change the minimum relative amplitude value from the default setting of 15% to reflect your measurement technique.

- Automatic Analysis is marking events as obstructive apneas that I would call mixed or central apneas: *increase* minimum relative amplitude
- Automatic Analysis is marking events as mixed or central apneas that I would call obstructive apneas: *decrease* minimum relative amplitude

### 8.2.3.1.2.2 Minimum relative duration (%) - Obstructive Apnea and Mixed Apnea

These parameters define what proportion of the event should have respiratory effort present (as set by the effort *minimum relative amplitude*) in order to classify events as Obstructive, Mixed or Central apneas.



Type: Central, Mixed, Obstructive Apnea

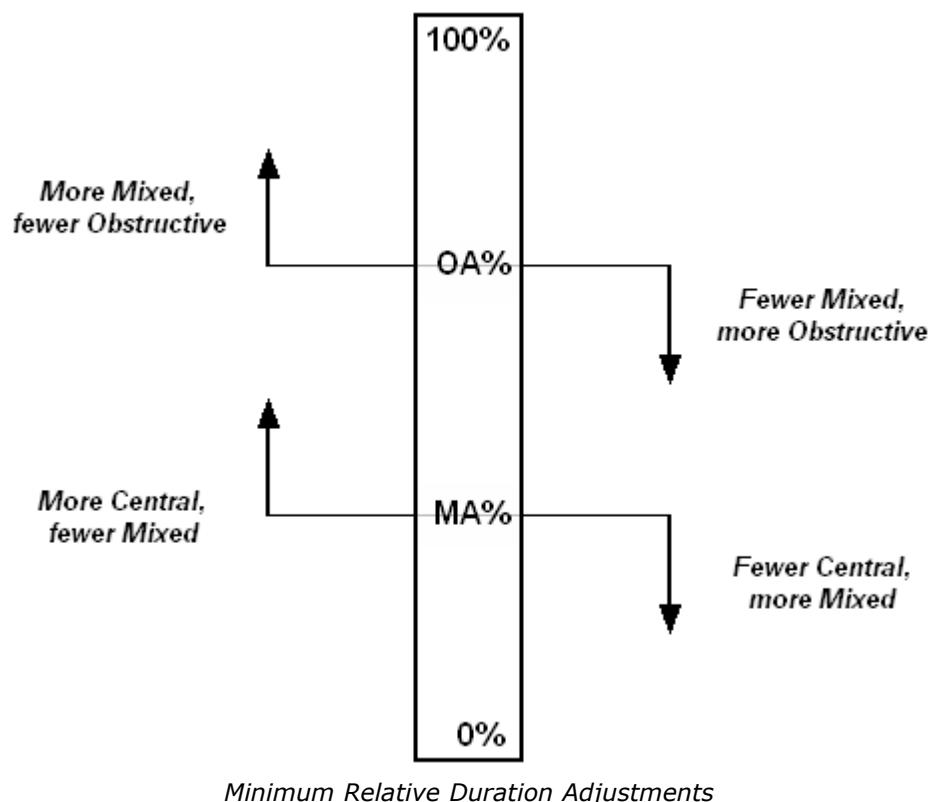
Default Settings:

- **Obstructive Apnea (OA):**  $T_2/T_1 \geq 66\%$
- **Mixed Apnea (MA):**  $66\% > T_2/T_1 \geq 33\%$
- **Central Apnea (CA):**  $T_2/T_1 < 33\%$

### Adjustments

You may want to change the minimum relative duration values from the default settings to reflect your measurement techniques.

- I want Automatic Analysis to mark more MAs and fewer CAs: *decrease MA%*
- I want Automatic Analysis to mark more CAs and fewer MAs: *increase MA%*
- I want Automatic Analysis to mark more OAs and fewer MAs: *decrease OA%*
- I want Automatic Analysis to mark more MAs and fewer OAs: *increase OA%*



### 8.2.3.2 Desaturation parameters

These determine the handling of SpO<sub>2</sub> desaturations and whether they are part of the event criteria.

The input analysed is set in the Input Assignments.

#### **Min SpO<sub>2</sub> reduction (%)**

Determines the minimum SpO<sub>2</sub> reduction that will be classified as a desaturation. Desaturation events are marked on the SpO<sub>2</sub> trace.

#### **Apply desaturation criteria during event detection**

Set whether desaturations should be included as part of the criteria for respiratory events. The specific criteria for apneas and hypopneas are set in the subsequent two parameters.

#### **Min desat: Apnea / Hypopnea (%)**

Applies only if the *Apply desaturation criteria during event detection* (described above) is enabled. Set the desaturation criteria for each event type. Only events meeting all the defined [Primary](#)<sup>[73]</sup> and [Effort](#)<sup>[81]</sup> input parameters will be marked.



**Info** The Min SpO<sub>2</sub> reduction and the Minimum desaturations can be different values. For example, if the Min SpO<sub>2</sub> reduction is set at 2% and the Minimum desaturations are both set at 3%, all SpO<sub>2</sub> reductions of 2% or greater will be marked, but only respiratory events with accompanying reductions of 3% or greater will be marked. Respiratory events meeting all criteria (as defined by the Primary and Effort parameters) except for the desaturation criteria will be marked as Unsure events.

### 8.2.3.3 Desaturation Artifact

These parameters define desaturations that are to be marked as artifact rather than physiological desaturations.

The input analysed is set in the Input Assignments.

#### **Minimum desaturation (%)**

Set the minimum desaturation from baseline required before marking as artifact. Any desaturation greater than this will be marked as artifact.

#### **Max SpO<sub>2</sub> level (%)**

Set the maximum SpO<sub>2</sub> level that is to be considered physiological. Anything below this level will be marked as artifact.

## **Min SpO<sub>2</sub> reduction slope (%/s)**

Set the rate of desaturation that is to be considered physiological, in percentage points per second. Any desaturation rate faster than this will be marked as artifact.

### **8.2.3.4 Respiratory Rate**

The respiratory rate is automatically calculated from the Apnea detection input in AASM mode, and the Primary Input in R&K mode.

In the value field, enter a name to be used for the respiratory rate. When the Summary Analysis is run (either in PSG Online or Profusion PSG 3), the respiratory rate will be calculated. It can be displayed as a trace.



**Tip** Do not select an input from the drop down list. Once you have entered a name for the Respiratory Rate, it will appear in the drop down list.

### **8.2.3.5 Sound**

Set the parameters for snoring detection from the Sound input assignment.

The sound channel is analysed for deviations from the baseline. The baseline is calculated as a moving window average, and snoring can be analysed from microphones, SPL meters (dB) or a filtered snoring signal from nasal pressure monitoring.

## **Threshold**

Because of the variety of inputs that can be analysed for snoring, the threshold for detecting snores is set as the number of standard deviations from baseline. The threshold will depend on the input device.

Recommended settings for different input devices:

- Microphone: Threshold = 0.1
- Calibrated dB meter: Threshold = 3.0
- Piezo snore sensor: Threshold = 0.2
- Somté PSG Sound channel (card-converted studies): Threshold = 4.0
- Filtered Nasal Pressure (10-100Hz): Threshold = 0.1

These recommendations are based on sample studies, and may need to be adjusted for your lab.

## **Minimum time between snores**

Set the minimum time between sounds that meet the sound threshold criteria. If this is too short, snores with a double peak (sounds on inspiration and expiration) may be marked as

two separate snores.

### ***Minimum duration***

Set the minimum duration for snores. If this is too short, isolated spikes in sound may be marked as snores.

## 8.2.4 Limb Analysis

Automatic limb movement analysis can be used to detect individual limb movements, and then mark PLM episodes when the marked limb movements meet the defined criteria.

Both the left and right leg inputs are analysed for limb movements. If only one limb input is being recorded, leave one of the input assignments blank.

Parameters can be adjusted to match your scoring criteria for:

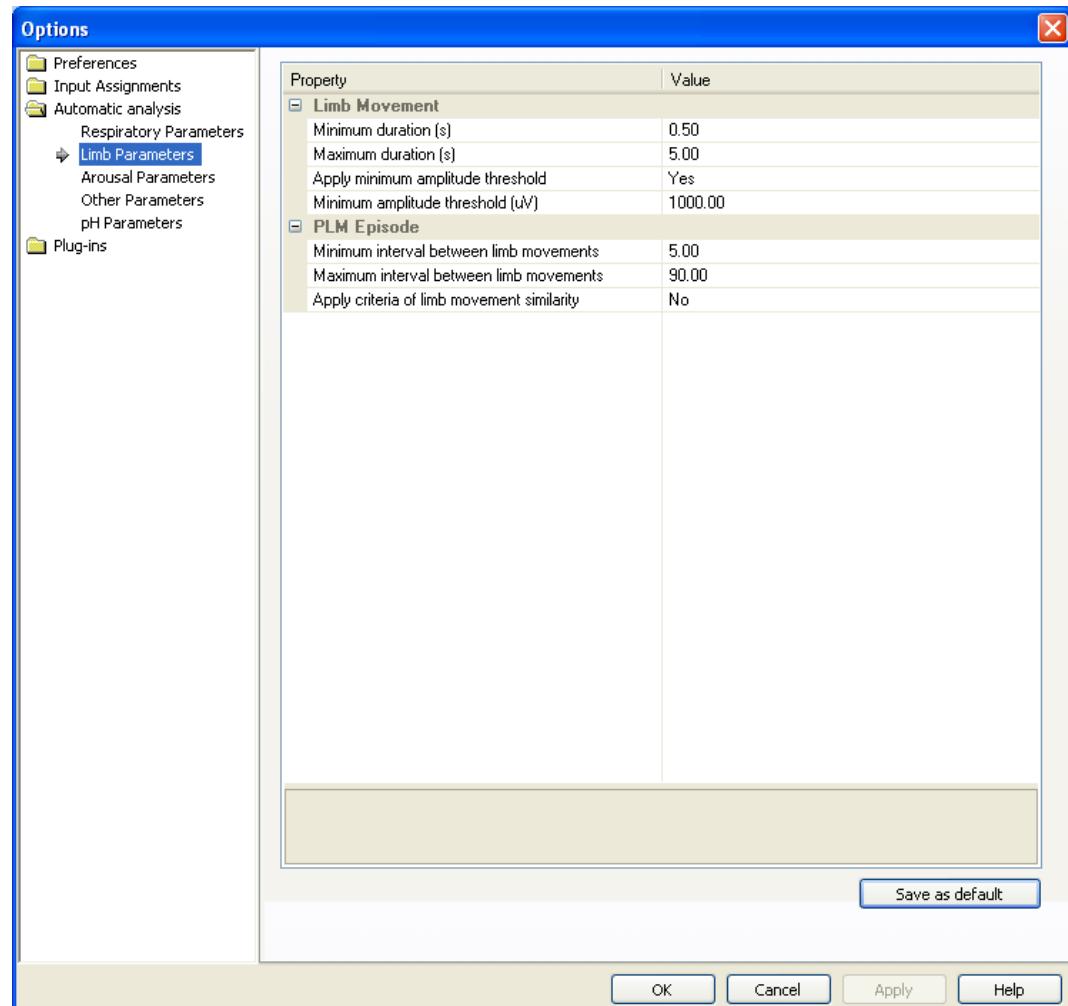
- [Limb movements](#) 
- [PLM episodes](#) 

 **Info** Limb movements and PLM episodes marked by the automatic analysis can be edited or deleted manually, and new movements and PLM episodes can be marked manually.

To run the automatic Limb Movement Analysis, go to **Tools > Automatic Analysis** and check the PLM/Limb movement Analysis box.

Click OK to run the analysis.

To view and change the Limb Movement parameters, go to **Tools > Options > Automatic Analysis** and click on Limb Parameters. The default settings are shown below.



Limb Movement Default Settings

#### 8.2.4.1 Limb movement parameters

These parameters determine the criteria used in marking individual limb movements.

#### **Minimum Duration**

Set the minimum duration for limb movements in seconds. If this is too short, phasic limb movements during REM and ECG artifact may be marked as limb movements.

Default Setting: T = 0.5 seconds

#### **Maximum Duration**

Set the maximum duration for limb movements in seconds. If this is too long, sustained muscle contractions or signal artifact may be marked as limb movements.

Default Setting: T = 10 seconds



**Info** The default minimum and maximum duration settings reflect the AASM criteria for PLM episodes.

### **Apply minimum amplitude increase threshold (AASM Mode)**

Determines whether an amplitude increase criteria is to be used in marking limb movements. Set to "Yes" to use, and define the threshold in the *Minimum amplitude increase threshold* field below.

The Automatic Analysis detects increases above the resting EMG level, which is determined by a moving window average.

#### **Minimum amplitude increase threshold (AASM Mode)**

If the *Apply minimum amplitude increase threshold* setting is "Yes", set the amplitude increase to detect. The AASM recommendation is 8uV. Use the amplitude of limb movements during patient calibrations as a guide. The threshold will depend on the recording technique used (piezo sensors or EMG), and may need to be adjusted to best match the individual study.

### **Apply minimum amplitude threshold (R&K Mode)**

Determines whether an amplitude criteria is to be used in marking limb movements. Set to "Yes" to use, and define the threshold in the *Min amplitude threshold* field below.

The Automatic Analysis detects limb movements that have a peak-to-peak amplitude meeting the minimum amplitude threshold criteria.

### **Minimum amplitude threshold (R&K Mode)**

If the *Apply min amplitude threshold* setting is “Yes”, set the amplitude to be applied. Use the amplitude of limb movements during patient calibrations as a guide. The threshold will depend on the recording technique used (piezo sensors or EMG), and may need to be adjusted to best match the individual study.

#### 8.2.4.2 PLM

These parameters determine the criteria to be used in marking individual limb movements as PLM episodes. The PLM marking algorithm requires at least 4 consecutive limb movements in a PLM episode.

If two limb inputs are analysed, they will be considered as a single input when being analysed for PLM episodes. This is to account for limb movements occurring on separate limbs with a duration shorter than the minimum duration between them. These two movements are considered as one movement in the PLM analysis.

#### **Minimum Duration**

Set the minimum duration between individual limb movements to be included in PLM episodes.

Default Setting: T = 5 seconds

#### **Maximum Duration**

Set the maximum duration between individual limb movements to be included in PLM episodes.

Default Setting: T = 90 seconds



Info

The duration between limb movements is the duration between the end of one movement marker and the start of the next.

#### **Apply criteria of limb movement similarity**

Uses additional criteria for PLM episodes

- Similarity of duration
- Similarity of amplitude
- Similarity of periodicity

This option can be used to mark PLM episodes in studies where the limb movements are very regular and have similar amplitudes. However it should not be used for studies with variations in limb regularity and amplitude.

## 8.2.5 Other Parameters

In addition to Sleep, Arousal, Respiratory and Limb Movement analysis, Automatic Analysis during study review is available for Pulse Transit Time (PTT), EtCO<sub>2</sub> and Derived Heart Rate.

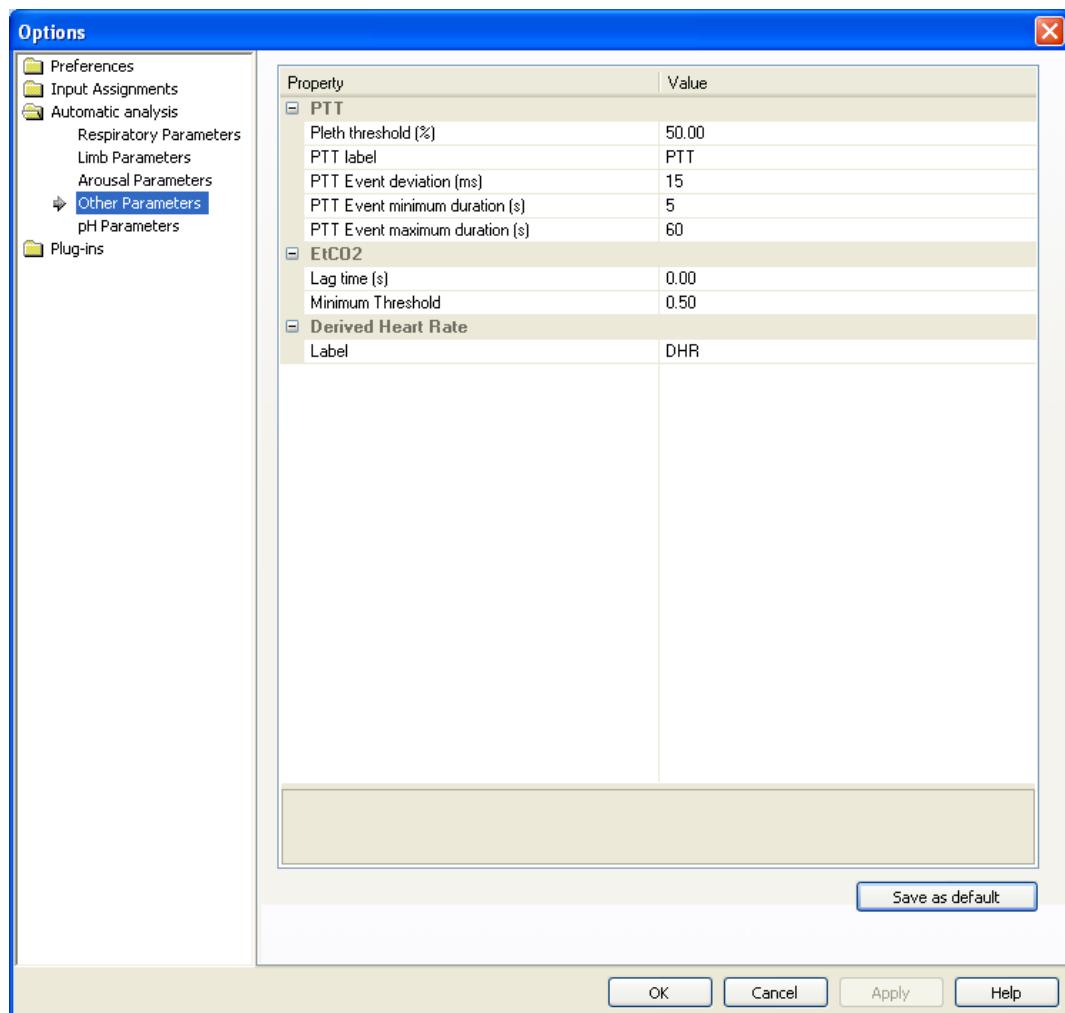
The following Analysis modules can be performed in Profusion PSG 3:

- Generate PTT
- Detect PTT Events
- EtCO<sub>2</sub> Peak Detection

To run these other analysis modules, go to **Tools > Automatic Analysis** and check the appropriate Analysis boxes.

Click OK to run the analysis.

To view and change the parameters for these modules, go to **Tools > Options > Automatic Analysis** and click on Other Parameters. The default settings are shown below.



### 8.2.5.1 PTT

The Pulse Transit Time(PTT) can be used to provide additional information about respiratory events.

Set the Pleth threshold (%) and label for the PTT. The PTT can be displayed as a trace. See below for details on the Pleth threshold value.

The PTT trace can be automatically generated during study acquisition by enabling the PTT analysis in PSG Config. PTT event detection can then be performed in Profusion PSG 3.

The PTT Event Deviation sets the minimum deviation in milliseconds from baseline considered to be significant.

The PTT Event minimum and maximum durations determine the amount of time spent beyond the minimum deviation before a PTT event will be marked.

## PTT Analysis Parameters

Automatic PTT Analysis measures the time interval between the ECG R-point and a designated point on the plethysmographic wave signal from a pulse oximeter capable of producing such a signal. The designated point on the plethysmographic wave is specified as a percentage of the plethysmographic wave variation from the trough (foot) to the peak of the wave. The point is user adjustable with the default value equal to 50%. This value is recommended as the pleth wave is likely to have the largest slope in the middle of its rise from the foot to the peak of the wave and therefore the PTT calculation error is likely to be minimal.



**Tip** The PTT algorithm uses the ECG filter settings from the [Input Assignments](#). Make sure these have been set correctly (default values are 0.3-30Hz) in order to obtain a meaningful PTT signal.

For PTT Event Detection, the parameters for the events must be specified:

- PTT Event Deviation - Set the event threshold for deviation from baseline.
- PTT Event Minimum Duration - Set the minimum time spent above the Event Deviation threshold in order to be marked as an event.
- PTT Event Maximum Duration - Set the maximum time spent above the Event Deviation threshold in order to be marked as an event.

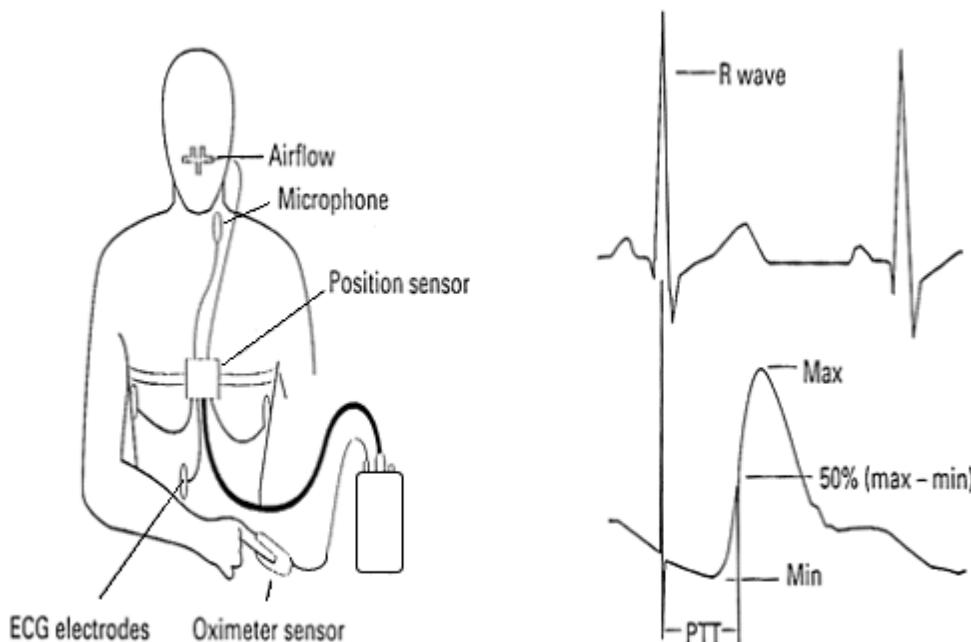
PTT events will be marked when the PTT rises above the threshold (indicating obstruction), and the deviation lasts for a duration between the minimum and maximum event durations.

## What is the PTT?

PTT (Pulse Transit Time) is defined as the time interval that it takes for the blood pressure wave to travel from the heart to a specified measurement point on the body. This destination point is typically a finger.

PTT calculation has two steps:

- The ECG signal analysis is performed to find all R-points.
- For every R-point the nearest subsequent pleth wave threshold crossing point is found:



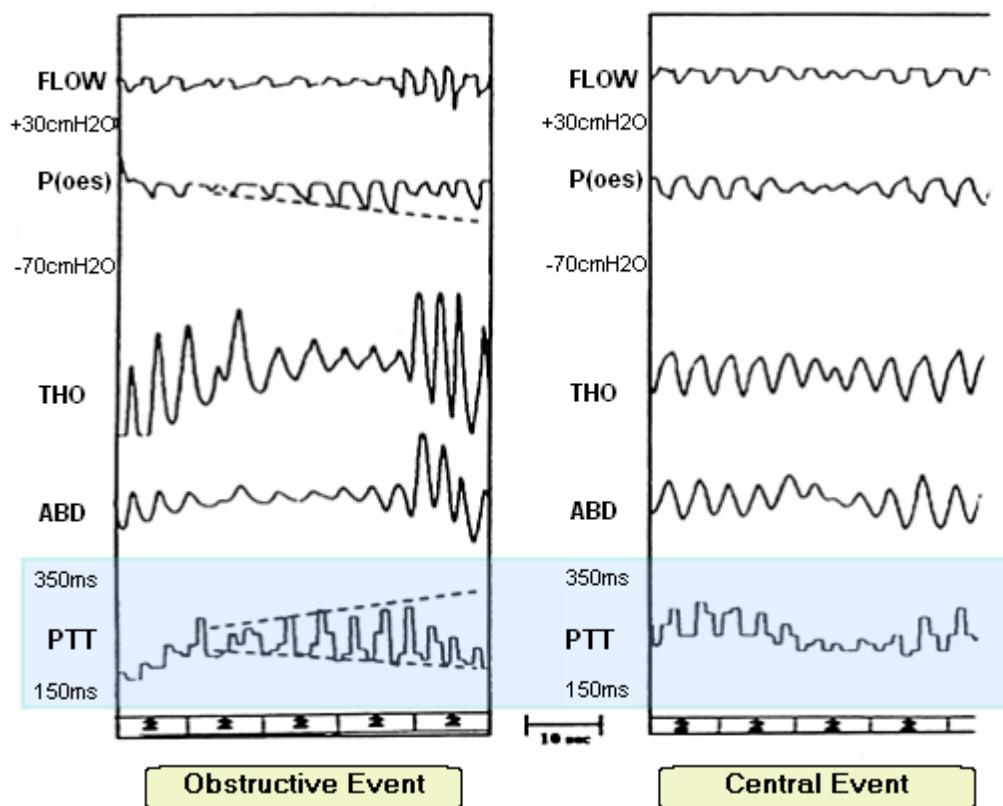
The value of PTT is equal to the interval between the ECG R-point and the pleth wave threshold crossing. The PTT values are presented on screen as discrete traces with the switch points located at respective pleth wave threshold crossings. The typical PTT is 250ms.

The PTT trace can then be analysed to determine significant changes that are usually associated with respiratory events.

## Clinical Application

The clinical application of PTT is twofold:

- PTT (or more specifically its pre-ejection component) is affected by changes in the intra-thoracic pressure and therefore it presents an approximation of the effort signal. By monitoring the profile of the PTT changes in the course of a respiratory event it is possible to discriminate central and obstructive events.



- PTT (or more specifically its vascular component) is affected by blood pressure changes due to autonomic arousals. Episodes of reduction in the PTT value can be used as markers of autonomic arousal activity.

### 8.2.5.2 EtCO<sub>2</sub>

EtCO<sub>2</sub> Peak Analysis detects the peak CO<sub>2</sub> value during a respiratory cycle. Analysis is performed on an exhaled CO<sub>2</sub> waveform (capnography).

The analysis results are used by the Report Generator to represent EtCO<sub>2</sub> Statistics.

Set the lag time (s) and minimum threshold.

To mark the peak of each EtCO<sub>2</sub> cycle, go to Tools > Automatic Analysis and check the EtCO<sub>2</sub> Peak Detection box.

Click OK to run the analysis.

### 8.2.5.3 Derived Heart Rate

The Derived Heart Rate is calculated by the **Summary Analysis** in beats per minute (BPM) from the ECG input.

In the value field, enter a name to be used for the Derived Heart Rate. When the Summary Analysis is run (either in PSG Online or Profusion PSG 3), the Derived Heart Rate will be calculated. It can be displayed as a trace.

This Derived Heart Rate is different from the Heart Rate available from an oximeter. The Derived Heart Rate is a beat-to-beat analysis of the ECG, whereas the Heart Rate from an oximeter is a moving window average of a number of seconds (window time depends on the oximeter being used).

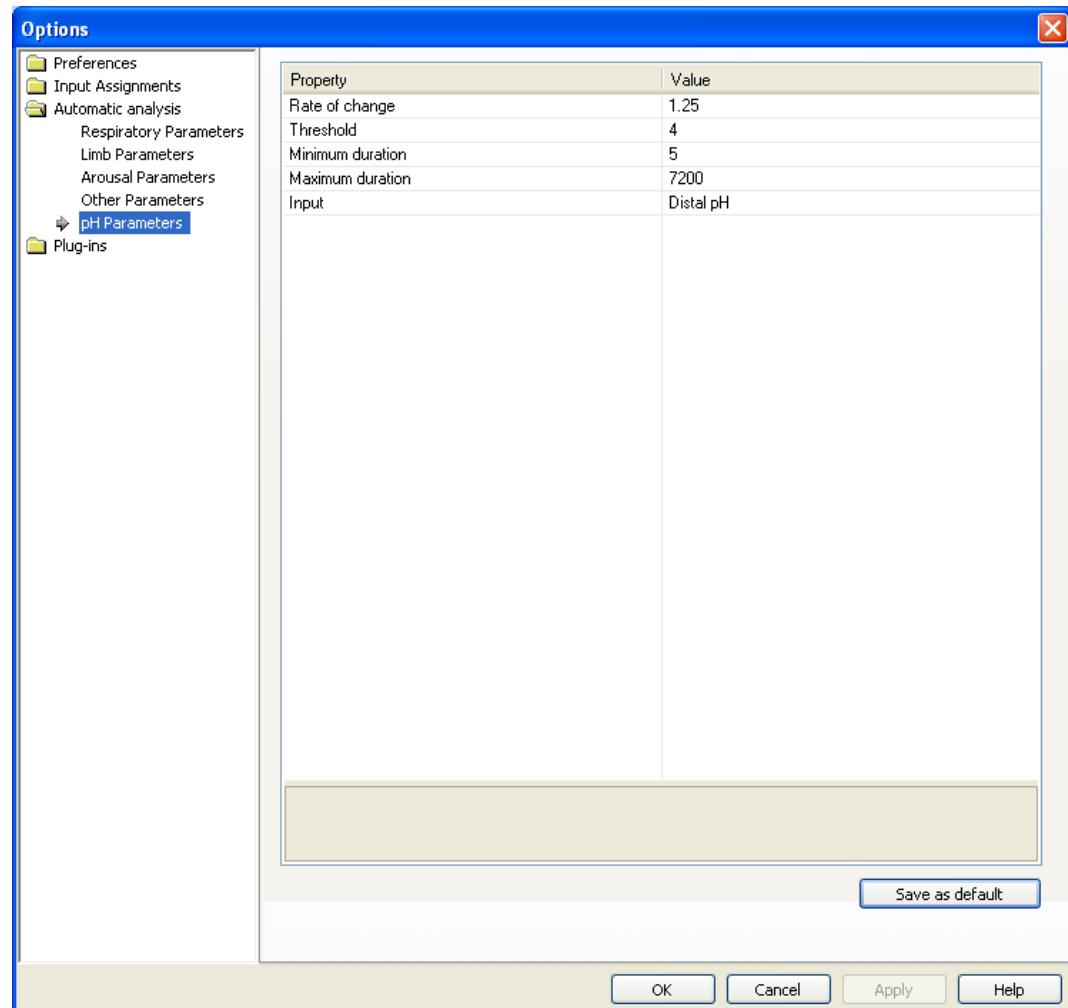
## 8.2.6 pH Parameters

pH events will be marked only when they meet all of the defined criteria.

To run the pH analysis module, go to **Tools > Automatic Analysis** and check the pH Event Detection box.

Click OK to run the analysis.

To view and change the parameters for the pH analysis, go to **Tools > Options > Automatic Analysis** and click on pH Parameters. The default settings are shown below.



### Rate of Change

Set the minimum rate of change for pH events (pH units per second). An event will only be marked when it passes the threshold.

### Threshold

Set the threshold value (pH level) at which events are considered significant.

### Minimum & Maximum Duration

Set the duration range for pH events. Anything outside these ranges will be considered non-physiological and will not be marked.

### Input

Specify which input to use for pH event detection.

## 8.3 Manual Analysis

Once a study has been recorded, it can be manually analysed or edited.

If any Automatic Analysis has been performed on the study (either during acquisition or by using the Automatic Analysis tools of Profusion PSG 3), Automatic Sleep Staging can be edited, and automatically marked events can be edited, deleted, or new events marked.

If no Automatic Analysis has been performed, the study can be analysed completely manually.

 **Tip** In order to generate reports correctly, the **Summary analysis** must be run.

Study Editing is divided into the following sections:

- [Sleep Staging](#)<sup>[99]</sup>
- [Arousal marking](#)<sup>[106]</sup>
- [Respiratory Event marking](#)<sup>[107]</sup>
- [Limb Movement \(including PLM\) marking](#)<sup>[108]</sup>

The same basic method is used for marking and editing arousals, respiratory events, limb movements and other events, however there are differences in the options available depending on the event type being marked. See the [Marking Events](#)<sup>[103]</sup> section for details on basic marking methods, and the individual event sections ([Arousals](#)<sup>[106]</sup>, [Respiratory Events](#)<sup>[107]</sup>, [Limb Movements](#)<sup>[108]</sup>) for an explanation of the options available for each type.

There are a variety of [Scoring Tools](#)<sup>[116]</sup> available to assist with analysis.

### 8.3.1 Sleep Staging

Sleep staging can be performed automatically (see [Sleep Analysis](#)<sup>181</sup> section for details), or manually. The sleep stages that can be used depend on the Scoring Mode (AASM or R&K) and Study Type (Adult, Child or Infant).

There are four methods for manual sleep staging (or editing of automatic sleep staging).



**Info** There is a fifth method - selecting the sleep stages from the Edit > Sleep Staging menu. However this is a very slow and inefficient method that is not recommended.

### Using the Keyboard

Sleep stages are available for Adult, Child and Infant staging. The Scoring Mode and Study Type are set in PSG Config, but can be changed in the [Study Configuration](#)<sup>191</sup>. Pressing the appropriate key will update the sleep stage for the current epoch, and automatically advance to the next epoch. The hypnogram will also be updated.

Click the Study Type below to see the default keys. These keys can be [customised](#)<sup>197</sup>.

Adult

AASM Mode	R&K Mode	Keyboard	Keypad
Stage W (Wakefulness)	Wake	W or 0	0
Stage N1 (NREM 1)	NREM 1	1	1
Stage N2 (NREM 2)	NREM 2	2	2
Stage N3 (NREM 3)	NREM 3	3	3
	NREM 4	4	4
Stage R (REM)	REM	R or 5	5
	Movement	M or 6	6
Artifact	Artifact	A or 7	7
Unsure	Unsure	?	8
Lights On	Lights On	F8	
Lights Off	Lights Off	F9	

Child

AASM Mode	R&K Mode	Keyboard	Keypad
Stage W (Wakefulness)	Wake	W or 0	0
Stage N1 (NREM 1)	Stage 1	1	1
Stage N2 (NREM 2)	Stage 2	2	2
Stage N3 (NREM 3)	Stage 3	3	3
Stage N (NREM)	Stage 4	4	4
	Stage 1/2	N/A	N/A
	Stage 3/4	N/A	N/A
Stage R (REM)	REM	R or 5	5
	Movement	M or 6	6
Artifact	Artifact	A or 7	7
Unsure	Unsure	?	8
Lights On	Lights On	F8	
Lights Off	Lights Off	F9	

Infant

AASM Mode	R&K Mode	Keyboard	Keypad
Indeterminate	Indeterminate	I	1
Quiet	Quiet	Q	2
Active	Active	A	3
	Movement	M	4
Unsure / Unscorable	Unsure / Unscorable	5	5
Wake	Wake	W or 0	0
Lights On	Lights On	F8	
Lights Off	Lights Off	F9	

The Lights On and Lights Off stages are used to specify which epochs are included in reports. Only epochs marked as Lights Off will be included in report statistics, with the exception of statistics related to the total recording time.

## Using the Toolbar

Pressing the appropriate icon will update the sleep stage for the current epoch, and automatically advance to the next epoch. The hypnogram will also be updated.

The toolbar displayed depends on the Scoring Mode (AASM or R&K) and Study Type (Adult, Child or Infant):

	AASM Mode	R&K Mode
Adult	: <b>N1 N2 N3 R ? W</b>	: <b>1 2 3 4 R M ? W</b>
Child	: <b>N1 N2 N3 N R ? W</b>	: <b>1 2 3 4 R M ? — 12 34</b>

Infant	: I Q A ? W	: I Q A M ? —
--------	-------------	---------------

## Auto Paging

This option is designed to make manual sleep scoring easier by automatically scoring the current epoch with the last scored sleep stage, and advancing to the next epoch. Selecting a different sleep stage will update the stage to be scored and continue auto-paging. The auto-paging can be stopped by pressing the spacebar. Auto Paging during manual scoring is toggled with the **Tools > Options > Preferences > System Settings > Scoring > Auto paging in scoring** check box, and is initiated by pressing a sleep stage key or one of the Auto paging icons.

The Auto Paging icons are found on the navigation toolbar, with the speed of page updates controlled by the drop-down box (available speeds are 0.5, 1, 2, 3 times the recorded speed, or maximum speed):



## Using the Trend

Sleep staging can be performed from the Trend window. Epochs can be staged one-by-one, or multiple epochs can be reclassified at once. To select multiple epochs, open the Trend window (**View > Trend**). Right-click and drag across the region of epochs to classify, and press the keyboard shortcut. The entire selected range of epochs will be given the same sleep stage. This can be used for marking Lights On and Lights Off periods too.

### 8.3.2 Marking events

#### Before You Start

Before marking any events, you must configure the study correctly, particularly the Input Assignments. See the [Analysis Settings](#) section for details.

#### Marking Events

The same basic method is used for marking and editing arousals, respiratory events, limb movements and other events.

Events are marked on the input defined in the [Input Assignments](#).

Events are linked to the Input Assignments as follows:

Input Assignment	Events
Arousal 1-5	Arousals ( <a href="#">manual</a> or <a href="#">automatically associated</a> )
Apnea Detection, Hypopnea Detection, Effort 1, Effort 2.  <i>Note: The R&amp;K Mode has a single input, named Primary, for apnea and hypopnea detection.</i>	Obstructive Apnea Central Apnea Mixed Apnea Hypopneas Unsure Respiratory Events Respiratory Artifact Respiratory Paradox Periodic Breathing RERA User defined events
Sound	Snore
SpO2	Desaturation Artifact
ECG	Bradycardia Tachycardia
Leg (Left, Right)	Limb Movement (Left) Limb Movement (Right) PLM episodes
pH (Distal, Proximal)	Distal pH Event Distal pH Artifact Proximal pH Event Proximal pH Artifact
Blood Pressure	Artifact
Body Temperature	Artifact



Info

Sleep stages are marked per epoch, and do not require an Input Assignment.

Marking of events requires one of the event marking modes to be selected from the Navigation Toolbar:

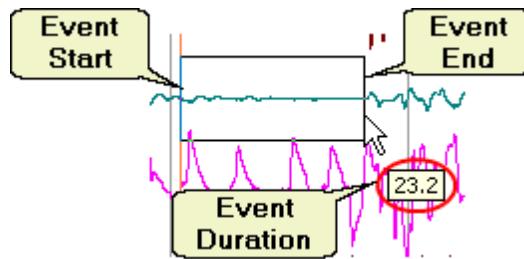


## Standard Event Marking Mode



Right-click on the assigned input and drag the appropriate duration.

The event duration is set by the start and end borders of the event marker. As an event is marked using the Standard Event Marking Mode, the duration will be displayed in a popup box until the mouse button is released.



If the event continues in the following page, the page will scroll when you drag the event marker to the edge of the page.



**Tip** In this mode, you can right-click once at the start of the event to mark an event using the [Default Event Length](#)<sup>187</sup>.

## Click Event Marking Mode



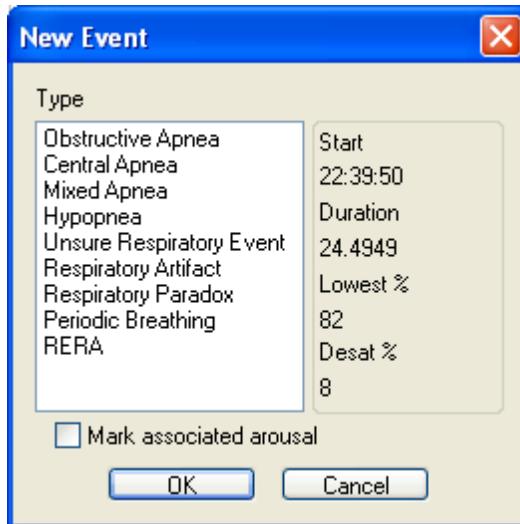
Right-click the start and end of each event on the assigned input.



**Tip** Use the Click Event Marking mode for events that span multiple pages, for example long periods of SpO2 artifact.

## Selecting the Event Type

If there is more than one event type that can be marked on the input, a dialog box will appear once an event has been marked using one of the above modes. Select the correct event type from the box:



This example is for a respiratory event. The event Start Time, and event Duration will be displayed for all event types. For Respiratory Events, the Lowest SpO<sub>2</sub> and total Desaturation will also be displayed.

The *Mark Associated Arousal* box only appears for Respiratory Events. Check this box to mark an arousal at the end of the event (the arousal will be marked on the Arousal input). Alternatively, use a right-click to select an event type and the associated arousal will automatically be marked.

## Reselect Last Event Type

With this feature enabled, the New Event selection box will only appear for the first time you mark an event (for all event types except arousals when using the [Automatic Arousal Association](#)  feature). Each subsequent event type will be the same as this first event until a new event type is selected. To select a new event type, left click an existing event marked and select a new event type from the box.

The default keyboard shortcut for toggling the Reselect Last Event Type mode is F2, or it can be enabled from the Edit menu. The keyboard shortcut can be [customised](#)  if necessary.

The cursor indicates whether the Reselect Last Event Type mode is enabled:

-  Normal cursor
-  Reselect last event type cursor

### 8.3.2.1 Arousal

Up to 5 arousal types can be configured. These can be user-defined or pre-defined types, or a combination of both.

- To manually mark and classify custom arousal types, configure arousals for [Manual Classification](#)<sup>56</sup>.
- The Automatic Arousal association feature allows pre-defined arousal types (Spontaneous, Limb Movement and Respiratory) to be manually or automatically marked, and automatically re-classified when respiratory or limb movements precede the arousal. To use the Automatic Arousal Association, configure arousals for [Automatic Classification](#)<sup>58</sup>.
- See the [Arousal Settings](#)<sup>54</sup> section for more arousal marking options.

To manually mark an arousal, choose one of the [event marking modes](#)<sup>104</sup> and mark the arousal as described for that mode.

Any arousal can be reclassified, including those that have been classified by the Automatic Arousal Association feature.

### 8.3.2.2 Respiratory events

The full range of respiratory events can be marked, with a variety of shortcuts available:

<b>Respiratory Event Shortcuts</b>	<b>Marking events</b>	<b>Reclassifying events</b>
	With reselect last event type disabled, mark event and press key...	Place cursor over existing event and press key (can be <a href="#">customised</a> <sup>[197]</sup> )...
Obstructive Apnea	1	Alt+1
Central Apnea	2	Alt+2
Mixed Apnea	3	Alt+3
Hypopnea	4	Alt+4
Central Hypopnea*	5	Alt+5
Mixed Hypopnea*	6	Alt+6
Unsure Respiratory Events	7	Alt+7



**\*Central and Mixed Hypopneas can only be marked by setting Hypopnea classification to Yes. Go to Tools > Options > Preferences > System Settings > Scoring to enable this option.**

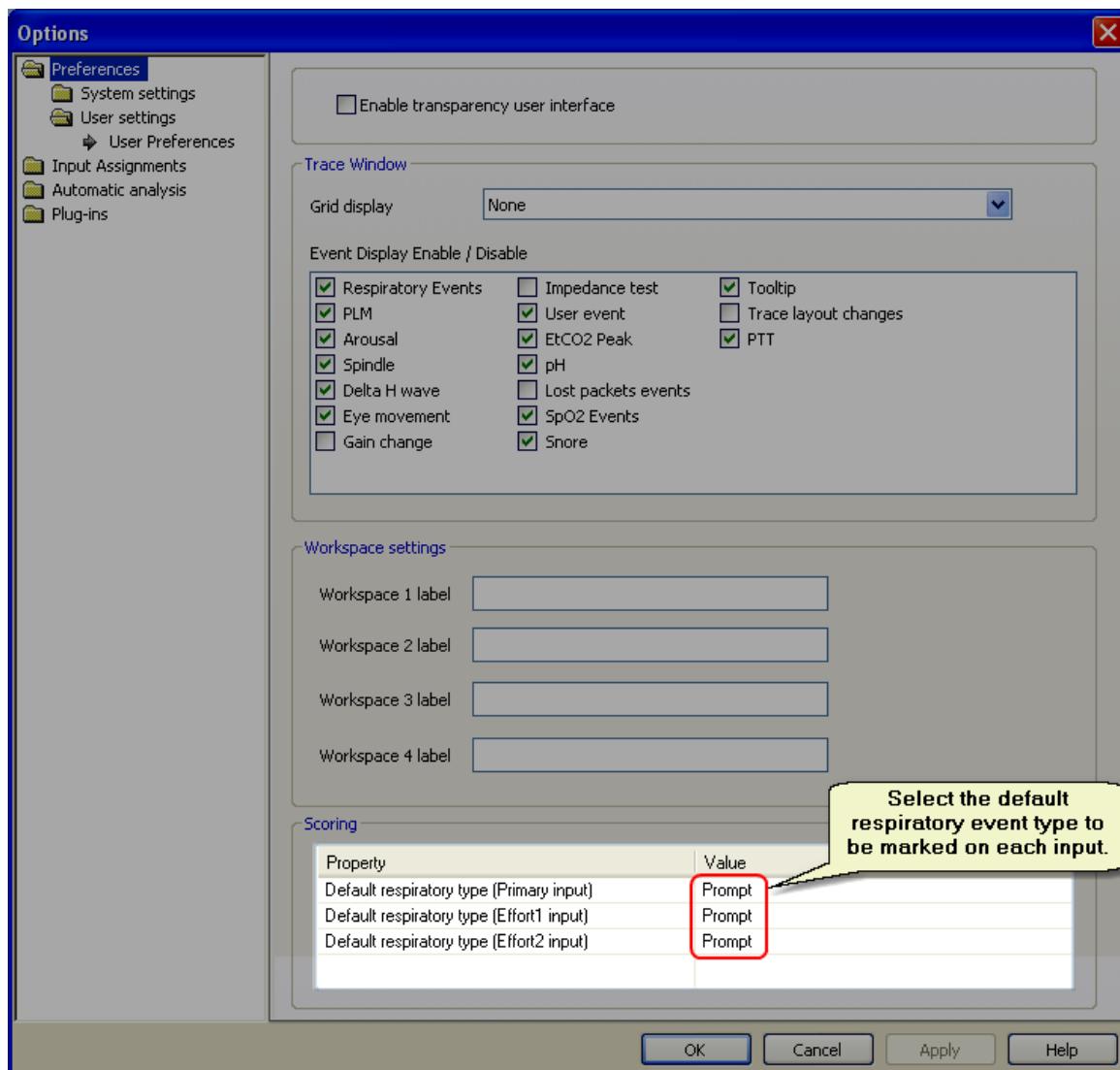
Events can also be marked for RERA, Respiratory Paradox, Periodic Breathing and Respiratory Artifact. These event types are available in the dialog box shown when a new event is marked (with reselect last event type disabled) or when you left-click on an existing event.

In addition, up to 4 custom respiratory event types can be defined. See the [Respiratory Analysis Settings](#)<sup>[54]</sup> section for details.

Respiratory events can be marked on the inputs assigned for Hypopnea Detection, Apnea Detection (or the Primary input in R&K Mode), Effort 1 or Effort 2, and the event markers are displayed on all these traces.

## Default Respiratory Event Types

These are configured in Tools > Options > Preferences > User Settings > User Preferences.



### 8.3.2.3 Limb Movements and PLM Episodes

Individual limb movements and PLM episodes can be marked. Criteria can be defined for automatic PLM episode detection, including detection of episodes for manually marked movements. See the [Automatic Analysis](#) <sup>91</sup> section for details.

## Marking Individual Limb Movements

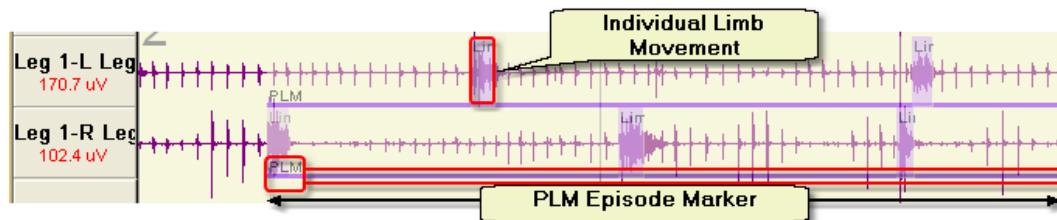
If two limb inputs have been recorded, both left and right limb movements can be marked. This is defined by the [Input Assignments](#) <sup>39</sup>. Movements marked on the Left limb input will be classified as *Limb movement (Left)*, and movements marked on the Right limb input will

be classified as *Limb movement (Right)*.

 **Tip** Using the [standard Event Marking Mode](#)<sup>104</sup>, single right-click on the left or right limb input to mark a movement with the [Default Limb Movement Length](#)<sup>62</sup>.

## Marking PLM episodes

PLM episodes are marked in the same way and on the same input as individual limb movements, except that at least two individual limb movements must be marked before a PLM marker is used.



PLM episodes can be marked manually. However, the Automatic PLM scoring feature allows manually marked limb movements to be analysed as they are marked or deleted. When the individual limb movements meet the criteria defined by the PLM Episode parameters, a PLM episode marker will automatically be inserted.

## Deleting Limb Movements within PLM episodes

Special care must be taken when deleting individual limb movements within PLM episodes. You need to make sure that the Limb Movement marker is highlighted, and not the PLM marker, before pressing the Delete key. To make sure you delete the Limb Movement and not the PLM marker, either left-click the Limb Movement and then press Delete, ensuring that the Scored Event Info box describes a Limb Movement, or enable [Tooltips](#)<sup>188</sup> Tooltips to have a popup box appear when the mouse is over the event.

### 8.3.2.4 Bruxism

Bruxism events can be marked on the input assigned as the Chin EMG input in the [Sleep](#)<sup>144</sup> section of the Input Assignments. These events can be reported, with the report fields contained under the heading Bruxism in the Report Wizard.

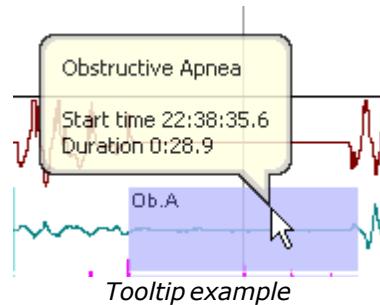
## 8.3.3 Editing Events

Manual analysis can consist of either a complete manual process, or editing of Automatic Analysis. See the [Analysis Settings](#)<sup>139</sup> section for details on configuring the study for Manual analysis.

### 8.3.3.1 Changing Event Duration

Once an event has been marked, the event duration can be changed by left-clicking one of the side borders of the event marker and dragging left or right.

To see the duration of a marked event, left click on the event marker to see information about the event. Alternatively, you can choose to view the Tooltips, which displays a popup information box when you place the cursor over an event marker.



### 8.3.3.2 Changing Event Types

Once an event has been marked, it can be changed to another event type (if there are multiple event types available for the input).

Left-click the event marker and select the new event type. This will change the event type marked when using the reselect last event type feature

OR

For respiratory events, place the cursor over the marker and use the keyboard shortcuts. This will not change the event type marked when using the reselect last event type feature.

These are the default shortcuts for quick editing of respiratory events. They can be [customised](#)<sup>197</sup> if required.

Alt + 1: Obstructive Apnea

Alt + 2: Central Apnea

Alt + 3: Mixed Apnea

Alt + 4: Hypopnea (Obstructive Hypopnea if [Hypopnea Classification](#)<sup>187</sup> enabled)

- Alt + 5: Central Hypopnea (only if Hypopnea Classification enabled)
- Alt + 6: Mixed Hypopnea (only if Hypopnea Classification enabled)
- Alt + 7: Unsure Respiratory Event
- Alt + 8: RERA

### 8.3.3.3 Deleting Events

Left-click the event marker and select Delete from the dialog box

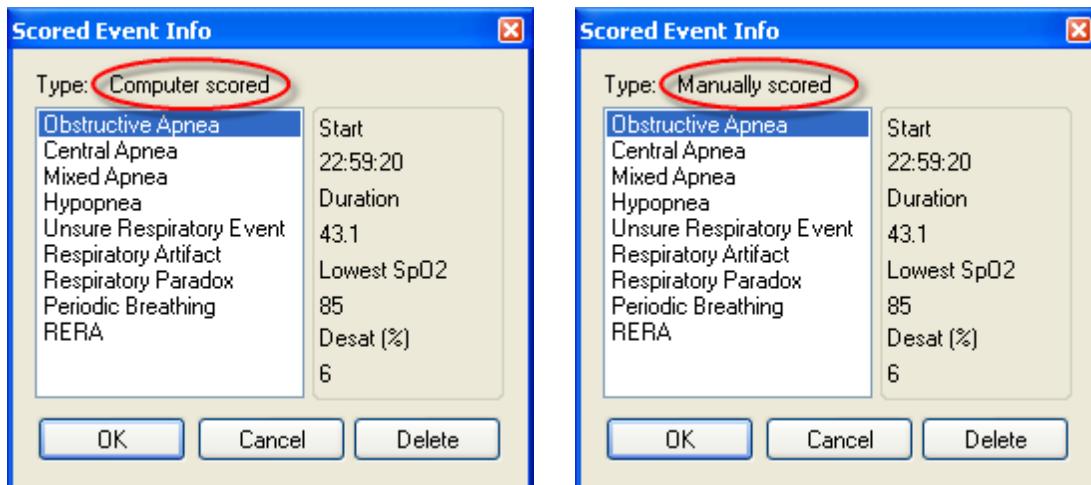
OR

Place the cursor over the marker and press the delete key.

### 8.3.3.4 Verifying Automatic Events

All events are classified as either Computer Scored or Manually Scored. All events marked by the Automatic Analysis will be classified as Computer Scored. When the event is verified, it will be changed to a Manually Scored event.

To change an event from Computer Scored to Manually Scored, simply right-click the event and press OK. The event will be reclassified to Manually Scored.



There are two reasons why you would want to verify Computer Scored events:

1. When using the Delete Scored Events feature, you can choose to delete only Automatic events. This will only delete Computer Scored events.
2. Report fields are available that include all events, Computer and Manually scored, during sleep, and ONLY Manually Scored events during wake. This allows you to include events that occur during epochs that are staged as Wake, which can be particularly useful when dealing with high levels of sleep fragmentation.

### 8.3.4 Managing Scored Events

To see all the events scored, either automatically or manually, open the Scored Events window (**View > Scored Events**). The drop down list allows you to select which events will be displayed in the window. Some events have associated icons.

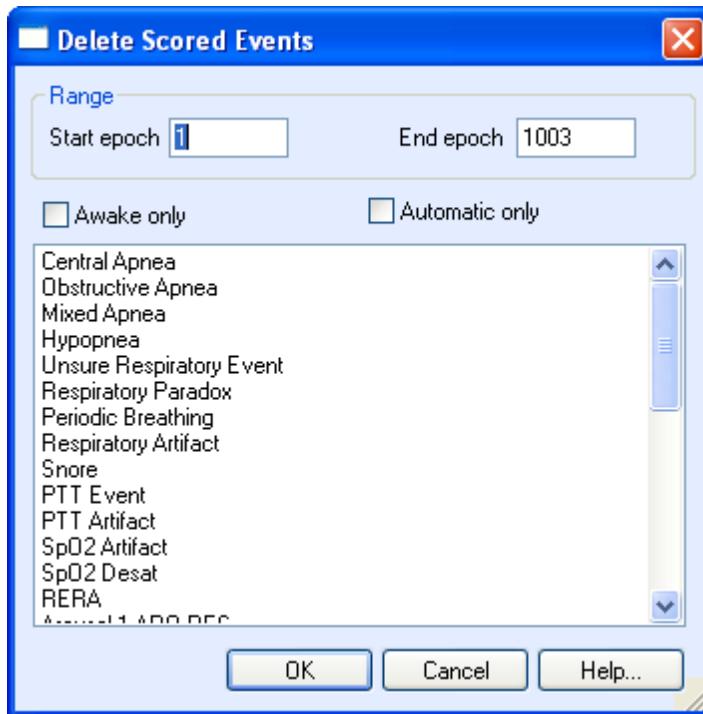
Event Category	Icon	Event Type
<i>Respiratory Events</i>		Apneas
		Hypopneas
		Respiratory Artifact
		Unsure Respiratory Events
		RERAs
		Periodic Breathing
		Respiratory Paradox
<i>Snores</i>		
<i>Arousal</i> s		All arousal types
<i>Limb Movements</i>		Individual limb movements
		PLM movements
<i>pH Events</i>		
<i>SpO<sub>2</sub> Events</i>		Desaturations
		SpO <sub>2</sub> Artifact
<i>EtCO<sub>2</sub>/TcCO<sub>2</sub> Artifacts</i>		
<i>ECG Events</i>		Bradycardia
		Tachycardia
		HR Artifact
<i>PTT Events</i>		PTT Event
		PTT Artifact
<i>Sleep related events</i>		Eye movements (in-phase & anti-phase)
		Delta waves
		Spindles

For each event, the start time, start epoch, sleep stage of the epoch and event duration is displayed. For some event types relevant details are also displayed (for example desaturations associated with respiratory events).

Clicking on an event will display the page containing the event in the trace panes.

#### 8.3.4.1 Delete Scored Events

To delete multiple scored events, open the Delete Scored Events window from the **Edit** menu.



Enter the start and end epochs if events are only to be deleted from a specific range of epochs. Otherwise events are deleted from the entire study.

Check the Awake Only box to delete only events that occur during epochs marked as Wake.

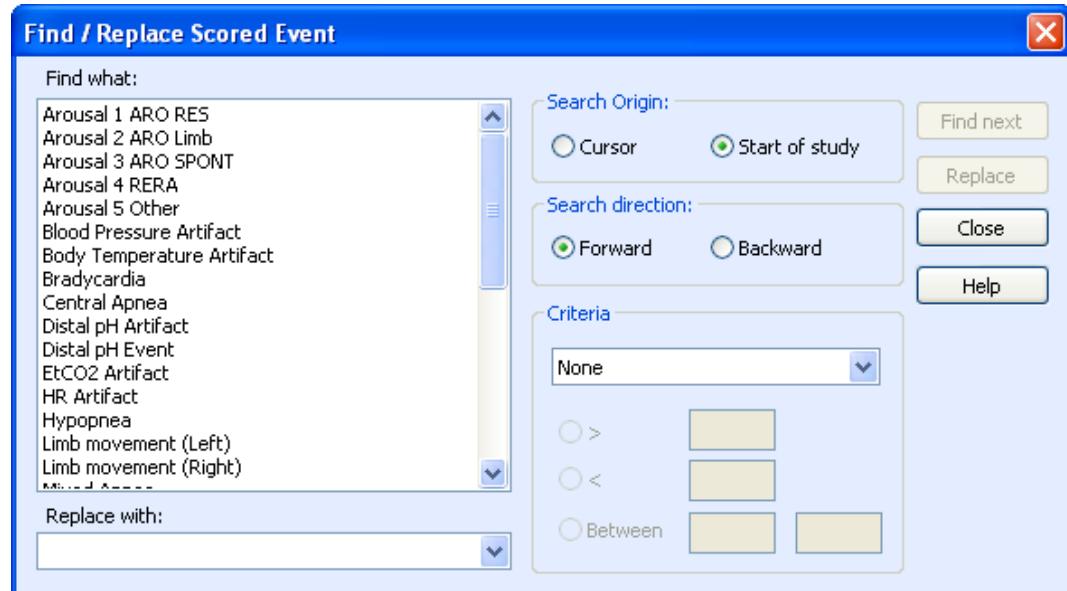
Check the Automatic Only box to delete only events classified as Computer Scored<sup>[112]</sup>.

Select the event type(s) that you wish to delete. Use the Ctrl key to select multiple event types.

Press OK to delete the selected event types from the specified epoch range.

#### 8.3.4.2 Find / Replace

To find events of a particular type, open the Find / Replace Scored Events window from the Edit menu.



Use the Find / Replace feature to search for specific event types, and replace them with another type if necessary. Use the Search Origin and Search Direction to determine the search pattern.

Use the Criteria to search for event types that match your requirements. Search parameters can be set based on Duration, Desaturation or Lowest SpO<sub>2</sub>. For example, you could find only Obstructive Apneas with desaturations in the range 70-80% using the Between criteria.

If you want to Replace an event with another event type, select the event type to be replaced from the Find What list, choose the event to replace it with from the Replace With list, and set any search criteria required. Click Find Next, and then Replace. When you press Replace, the event will be replaced with the selected type, and the next event matching your search will be found. Click Replace again to continue the process.



**Tip** If you choose to replace an event with an event type that is assigned to a different input (see [event table](#))<sup>[103]</sup> the event will be moved to that input.

## 8.4 Scoring Tools

There are a wide variety of scoring tools available for use in analysis. These tools range from those that give information about the instantaneous value of individual inputs, to those that provide a summary of the entire night.

## 8.4.1 Rawdata Tools

The Rawdata Tools are enabled from the Scoring Toolbar. These tools determine the function of a right mouse click on a trace. The active mode will be highlighted in orange.



Icon	Function	Description
	<a href="#">Event marking mode</a> <sup>[104]</sup>	<p>Use for right-click and drag event marking.</p> <p><b>Tip</b> Dragging past the end of the page will scroll the window.</p>
	<a href="#">Click event marking mode</a> <sup>[104]</sup>	Right-click start and end of event.
	Zoom mode	Right-click and drag to zoom in on the selected trace. See the <a href="#">Zoom</a> <sup>[118]</sup> topic for more information.
	Ruler mode	<p>Right-click on any trace to place a calibrated ruler, indicating 75uV amplitude and 1 or 10 second time (depending on pane timebase).</p> <p><b>Tip</b> Use to check amplitude of slow frequency waveforms in EEG signals to determine presence of NREM 3&amp;4.</p>
	Caliper mode. This works in harmony with the Caliper Duration Counter:	<p>Right-click and drag between two points to see relative amplitude and time between points. The duration is also displayed in the Caliper Duration Counter in the toolbar. This counter accumulates the selected durations, allowing you to track the total amount of a particular feature (for example the total amount of SWS in an epoch).</p> <p><b>Tip</b> Use to check amplitude of respiratory traces before and during events to assist in classifying event type.</p>

	Meter mode	Right-click over any trace to see signal value at that point.
		 <b>Tip</b> Use to check peak snore level when using a dB meter.

### 8.4.2 Zoom

Use the Zoom tool to look at traces in more detail. To enable the Zoom mode, select the Zoom icon from the toolbar. 

To zoom in on an input, right-click and drag across the input (as if you were marking an event). The zoom window will open, and a marker is displayed on the selected trace to indicate the zoomed section. You can click and drag the edge of this marker to fine-tune the displayed zoom section.

 **Info** The zoom window will use the current filter settings for the selected trace.

To move the zoomed section, left-click and drag within the zoom window. You can move the zoomed section to the limits of the displayed page.

To increase or decrease the amplitude of the zoomed section, use the mouse scroll wheel with the cursor. A scale on the right-hand side of the zoom window indicates the displayed amplitude range.

To measure a specific feature, right-click and drag to access the caliper. The amplitude and time between the start and end of the caliper is displayed.



While the zoom window is open, you can right-click and drag on a different trace to swap

the zoom window to that trace.

Paging up or down will automatically close the zoom window.

### 8.4.3 Properties

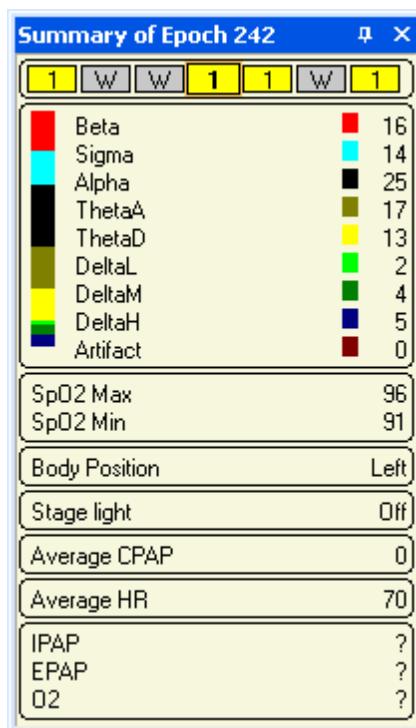
Displays the properties of the active window or trace. Click on a trace or window to make it active. The properties that can be viewed and edited depend on the window or trace. Once the Properties pane is open, click on another trace or window to see its properties.



**Tip** To view or change the properties of a window or trace, double click the title bar or trace label.

#### 8.4.4 Epoch Summary

A summary of each epoch is available, containing the stages scored for the three epochs either side of the current epoch, a breakdown of the percentages of each frequency in the EEG spectrum, and details of the SpO<sub>2</sub> minimum and maximum values, body position, stage light, average CPAP and heart rate, and IPAP, EPAP and supplemental O<sub>2</sub> levels for the current epoch.



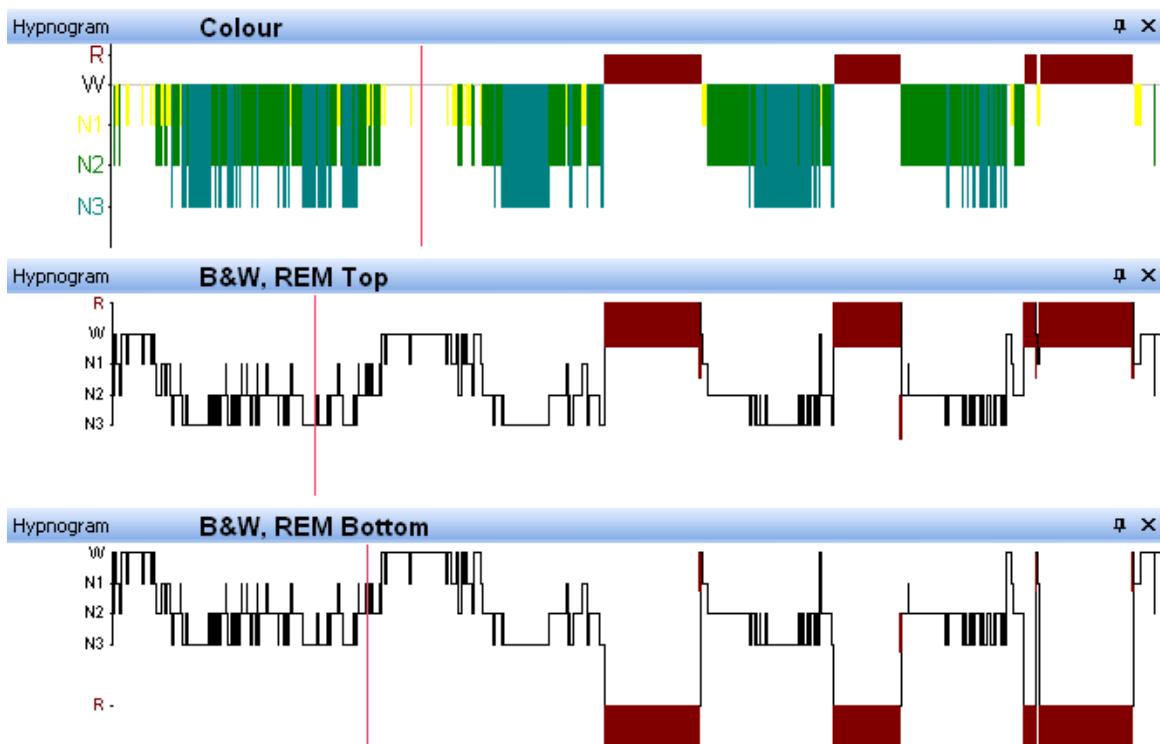
To open the Epoch Summary, select **View > Epoch Summary**.

### 8.4.5 Hypnogram

The hypnogram graphically represents the progression of sleep stages across the night. It can be displayed as a separate window, and as part of the [Trend](#)<sup>[122]</sup>. To open the Hypnogram, select **View > Hypnogram**.

Three display types are available for the hypnogram, accessed through the Properties window:

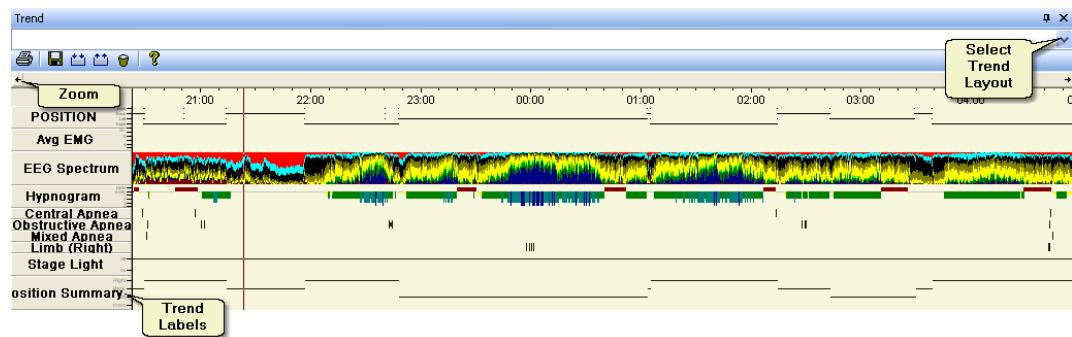
- **Colour:**
  - Awake – Light Grey
  - N1 / NREM 1 – Yellow
  - N2 / NREM 2 – Green
  - N4 / NREM 3 – Cyan
  - NREM 4 – Dark Blue (R&K Mode only)
  - R / REM – Red
  - Artifact – Dark Grey
- **Black & White (REM at the top)**
- **Black & White (REM at the bottom)**



### 8.4.6 Trend

The Trend window displays a graphical summary of various inputs. Correct trend data will be displayed only if the correct Input Assignments have been set, and many of the graphs available require the Summary analysis to be run.

To view the Trend window, select View > Trend. The Trend layout to be displayed can be selected from the drop down list, and different individual trend graphs can be added or deleted.



You can also choose to display a second Trend graph (View > Trend 2). This Trend graph is designed to display a couple of simple trends, but any Trend layout can be loaded.

The Zoom arrows can be used to look at sections of the Trend in more detail. Click on one of the zoom arrows and drag towards the centre of the window to zoom in. You can then click and drag the zoom scrollbar to move through the Trend.

## Trend Properties

You can change the properties of the Trend window by opening the Properties window, then clicking on the Trend graph. You can change the Layout, background colour and other features.

The Toolbar, comprising the drop-down layout selection dialog, and icons for printing and managing Trend layouts can be disabled.

The Zoom scrollbar can also be disabled.

Disabling the Toolbar and Zoom scrollbar can be useful when you want to minimise the amount of space the Trend window occupies.

## Insert a Trend Graph

To insert a trend graph, right click on a trend label and select *Insert Trend*. Choose the Trend graph that you want to insert. The available trends are grouped according to type.

## Delete a Trend Graph

To delete a trend graph, right click the trend label to be deleted and select *Delete Trend*.

## Edit Body Position, Sleep Stage

The body position can be edited from the Trend window:

- Open the Trend window.
- Right click and drag across the range of epochs you want to edit.
- Use the Edit > Body Position menu, or keyboard shortcuts, to edit the position.

The sleep stage, including Stage Light (Lights On / Lights Off), can be edited from the Trend window:

- Open the Trend window.
- Right click and drag across the range of epochs you want to edit.
- Use the Edit > Sleep Staging or Edit > Stage **Light** menu, or keyboard shortcuts, to edit the sleep stage.

## Managing Trends

Once a trend has been selected, it can be saved as the default Trend to use by pressing the Save Trend as default icon: 

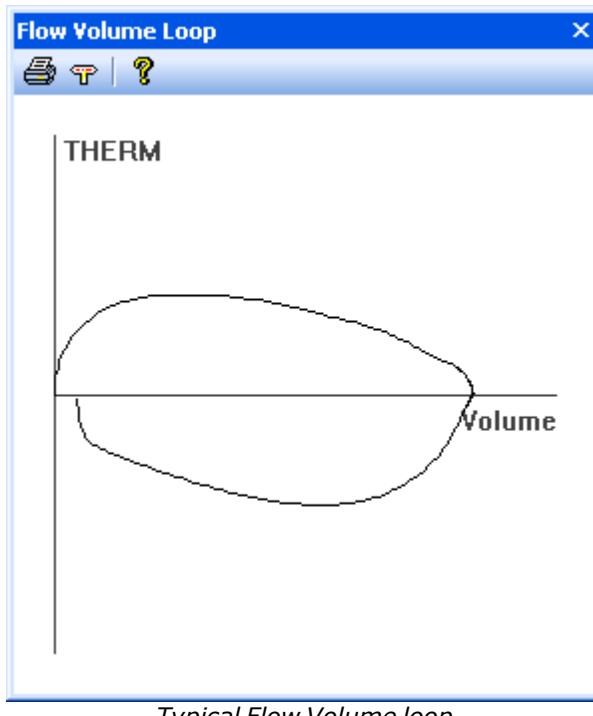
If changes are made to the Trend and you want to reload the default, press the Reload Default icon: 

The selected trend can be deleted from the disc by pressing the Delete Trend icon: 

## 8.4.7 Flow Volume loops

Flow Volume loops plot the flow (the Apnea detection input in AASM mode, or the Primary input in R&K mode, as set in [Input Assignments](#)) against the integral of the flow (area under the curve). The resultant loop can be a useful tool in determining the level of respiratory obstruction.

To view the Flow Volume loop, select **View > Flow Volume Loop**



*Typical Flow Volume loop*

### 8.4.7.1 Properties

To open the Flow Volume Loop Properties, click the window title bar and select **View > Properties**.

- **No of Breaths:** The loop is displayed for the number of breaths set (number of seconds in PSG Online)
- **Zoom Y:** Set the vertical zoom



**Tip** The Flow Volume loop can be zoomed by placing the cursor over the window and using the mouse scroll wheel to zoom.

- **Show Ref Breath:** Set whether a reference breath is displayed.

 **Tip** To set the reference breath, navigate to a period of stable respiration (for example during patient calibrations), and press the reference breath icon

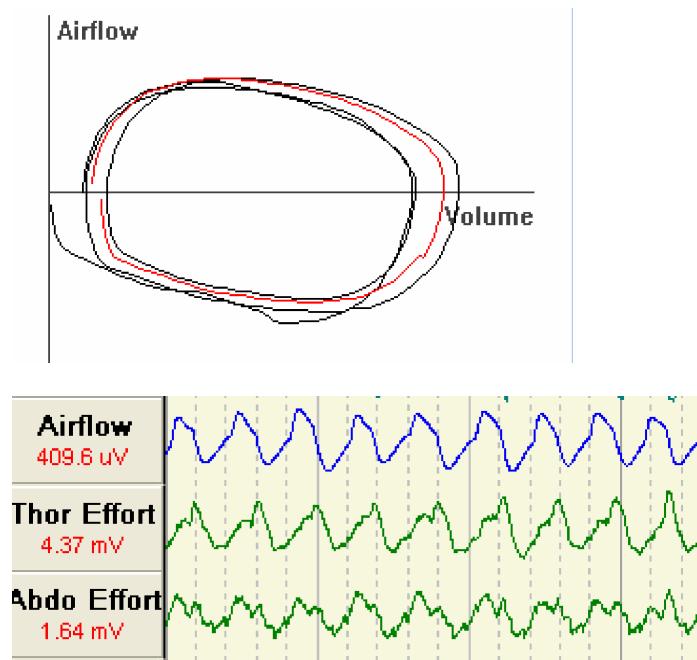
 **Tip** Set the Reference Breath Colour to one that can easily be distinguished from the Background and Graph colours.

- **Apply Fading:** When set to Yes, the Flow Volume loop will fade previous loops when updating

 **Info** The shape of the Flow Volume loop will depend on the type of sensor used for the flow input signal.

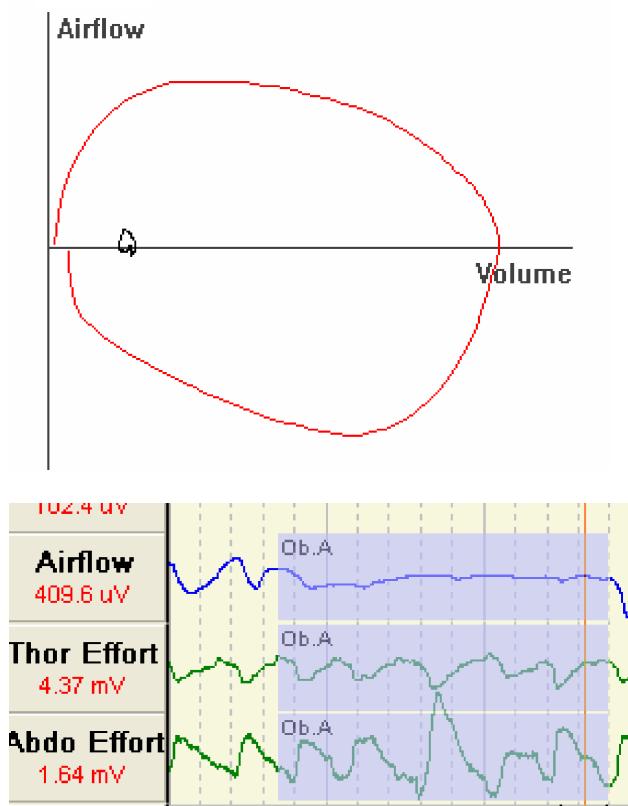
#### 8.4.7.2 Normal Breathing

Flow Volume loops for normal respiration show a consistent loop starting and ending at or near the zero point of the x-axis. The reference loop is the red loop:



#### 8.4.7.3 Obstructed Breathing

Flow Volume loops for obstructed breathing show a reduced or deformed loop. In this example there is almost no flow or volume despite respiratory effort (the reference loop is the red loop):

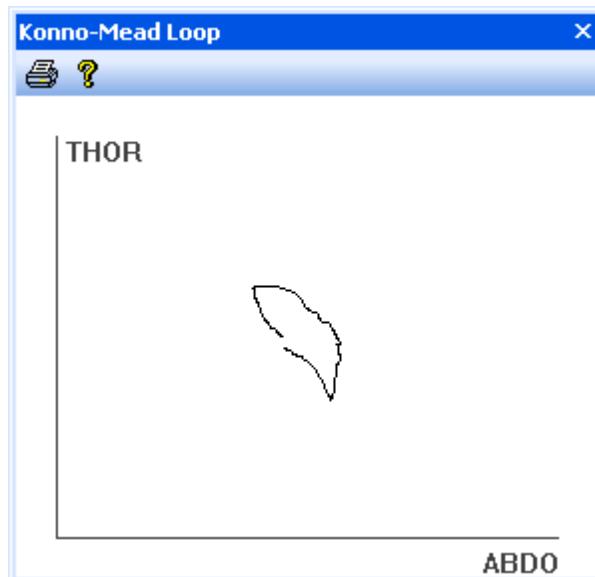


#### 8.4.8 Konno Mead loops

Konno Mead loops plot the Effort1 input against the Effort2 input (as configured in [Input Assignments](#)<sup>[49]</sup>).

The resultant loop can be a useful tool in determining changes in respiratory effort.

To view the Konno Mead loop, select **View > Konno Mead Loop**



*Typical Konno Mead loop  
(showing slight phase shift)*

Konno Mead loops will be an almost flat loop at a positive 45° angle for [normal respiratory effort](#)<sup>[128]</sup>.

An open loop is displayed when there is a phase shift between abdominal and thoracic effort, usually indicating some airway resistance.

A shift to a negative angle indicates [paradox respiratory effort](#)<sup>[129]</sup>.

#### 8.4.8.1 Properties

To open the Konno Mead Loop Properties, click the window title bar and select View > Properties.

- **Zoom X:** Set the horizontal zoom
- **Zoom Y:** Set the vertical zoom

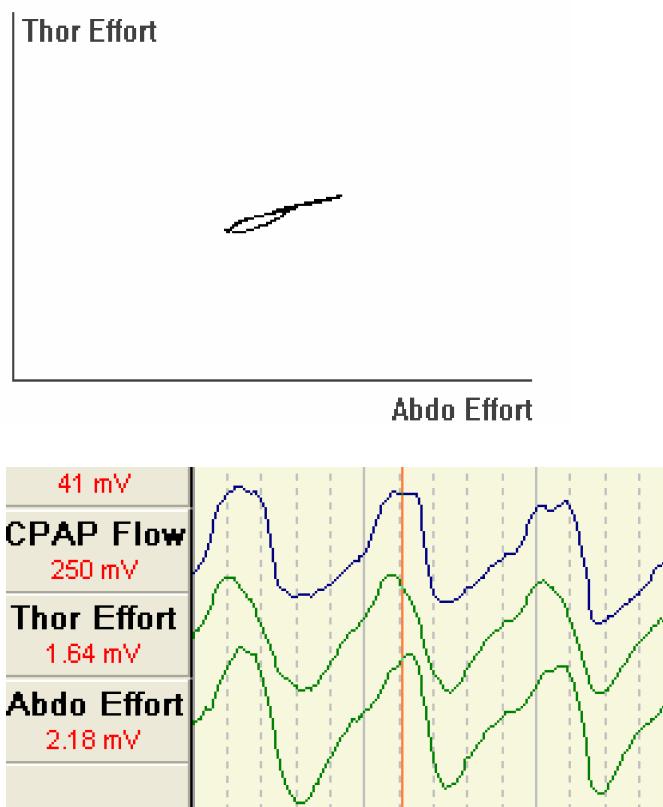


**Tip** The Flow Volume loop can be zoomed by placing the cursor over the window and using the mouse scroll wheel to zoom. This zooms the X & Y axes at the same time.

- **Window Size:** Set the size of the window in seconds. The curve is plotted for the window size, previous to the current point.

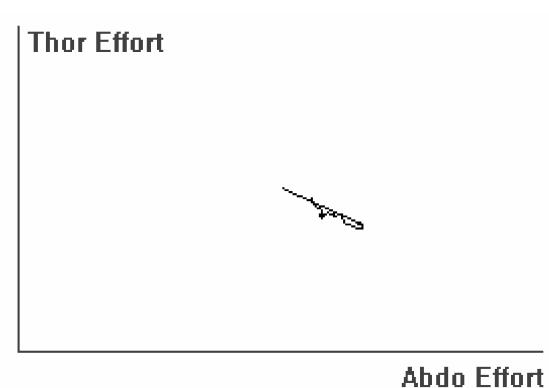
#### 8.4.8.2 Normal Breathing

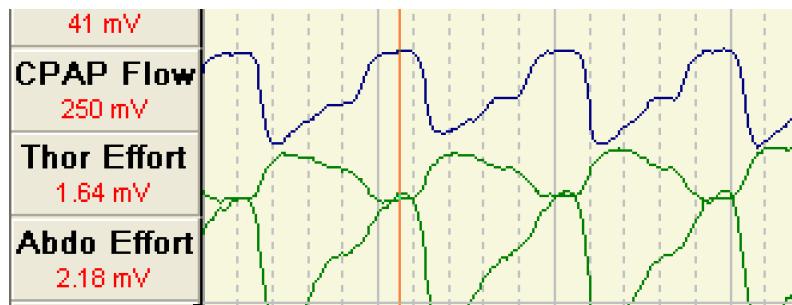
Konno Mead loops for normal respiration show a flat curve at a 45° angle:



#### 8.4.8.3 Obstructed Breathing

Konno Mead loops for obstructed breathing show an open loop, and for respiratory paradox effort the loop will be at a negative angle:

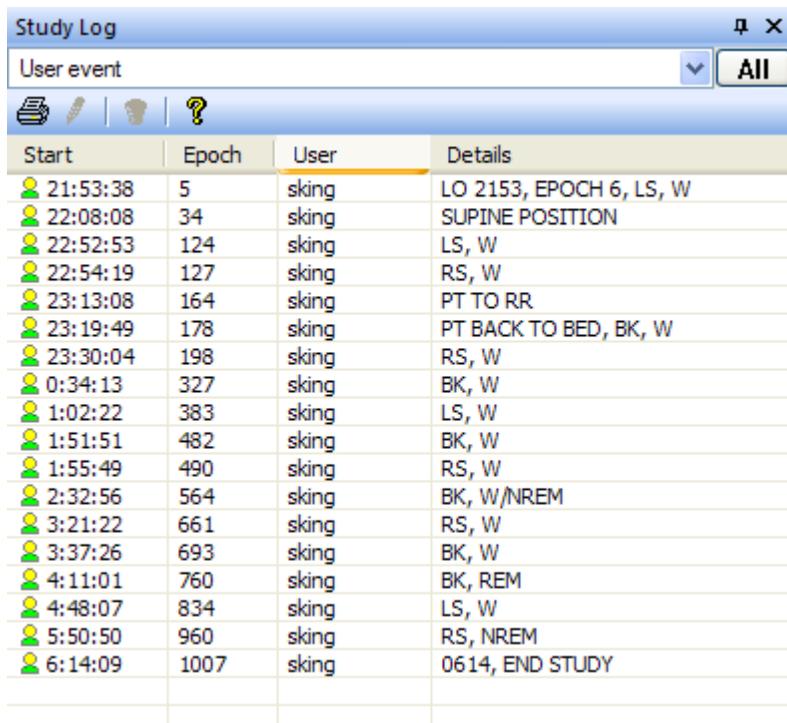




### 8.4.9 Study Log

The study log contains details of User Events (technician notes) and hardware events (lost data, impedance checks etc).

To view the Study Log, select **View > Study Log**.



The screenshot shows a software window titled "Study Log". At the top, there is a dropdown menu set to "User event" and a button labeled "All". Below the title bar is a toolbar with four icons: a printer, a pencil, a trash can, and a question mark. The main area is a table with four columns: "Start", "Epoch", "User", and "Details". The "User" column is highlighted with an orange background. The table lists 20 entries, each with a small green and yellow icon in the "Start" column. The "Epoch" column contains values like 5, 34, 124, etc. The "User" column shows "skiing" for all entries. The "Details" column contains various text descriptions such as "LO 2153, EPOCH 6, LS, W", "SUPINE POSITION", "LS, W", "RS, W", "PT TO RR", "PT BACK TO BED, BK, W", "RS, W", "BK, W", "LS, W", "BK, W", "RS, W", "BK, W/NREM", "RS, W", "BK, W", "BK, REM", "LS, W", "RS, NREM", and "0614, END STUDY".

Start	Epoch	User	Details
21:53:38	5	skiing	LO 2153, EPOCH 6, LS, W
22:08:08	34	skiing	SUPINE POSITION
22:52:53	124	skiing	LS, W
22:54:19	127	skiing	RS, W
23:13:08	164	skiing	PT TO RR
23:19:49	178	skiing	PT BACK TO BED, BK, W
23:30:04	198	skiing	RS, W
0:34:13	327	skiing	BK, W
1:02:22	383	skiing	LS, W
1:51:51	482	skiing	BK, W
1:55:49	490	skiing	RS, W
2:32:56	564	skiing	BK, W/NREM
3:21:22	661	skiing	RS, W
3:37:26	693	skiing	BK, W
4:11:01	760	skiing	BK, REM
4:48:07	834	skiing	LS, W
5:50:50	960	skiing	RS, NREM
6:14:09	1007	skiing	0614, END STUDY

Each entry contains the time that the entry was made (Start time), the Epoch number, the logged-in user (if Security settings are enabled) and the Details. For Technician comments, the Details are the entered text. Other logged event types (for example impedance checks) will have the value or other description in the Details column.

Clicking on a log entry will display the page containing the event in the trace pane display.

The drop-down list at the top of the Study Log window can be used to filter the displayed event types (User Event, Gain Change, Impedance Test, Lost Packets events, Trace Layout changes).

Use the icons at the top of the window to manage User Events (tech notes):

Print the Study Log.

Edit the highlighted log entry. If Security settings are enabled, editing an entry will change the User column to the currently logged-in user.

Delete the highlighted log entry (Ctrl + click to select multiple entries).



**Tip** User Events (Technician comments) can be included in a report by adding the field [@58] into your report template.

### 8.4.10 Statistics

A calculation of statistics can be accessed for quick checking of the analysis without having to generate a report.

To open the Statistics window, select **View > Statistics**.

The Statistics window displays three main sections:

- Staging Summary:**

Total Recording Time (min)	501.4	Time Available for Sleep (min)	311.0
Number of Awakenings	10	Total Sleep Time	4:20.0
Wake Time After Sleep Onset (min)	51.5	Sleep Efficiency (%)	83.6
Sleep Onset Latency (min)	5.5	Stage REM Latency (min)	212.0
Sleep onset time	22:35:50		
- Respiratory Events Summary:**

	REM	NREM	Sleep
Apneas	0	136	136
Hypopneas	0	42	42
Apneas + Hypopneas	0	178	178
Duration in Apnea (min)	0.0	62.7	62.7
Duration in Hypopnea (min)	0.0	20.9	20.9
Duration in Apnea + Hypopnea (min)	0.0	83.6	83.6
AHI	0.0	81.2	41.1
- Respiratory Event Details:**

Longest Apnea	70.6
Longest Hypopnea	64.6
Largest SpO <sub>2</sub> desaturation	15

It is recommended that the Statistics window is updated manually. Press the Recalculate statistics icon to refresh the window on demand:

The Statistics can also be set to automatically recalculate at a set interval. Use the Properties window to change the Auto update frequency, and select whether the statistics are to be calculated for the whole study or for a range of epochs.

Fields in Blue can be clicked on to take you to the matching epoch.



**Tip** Each time the statistics are recalculated the entire range of epochs selected must be processed. Setting the statistics window to Auto update may cause your system to slow down.



**Info** The Statistics template can be customised. See your Compumedics representative for details.

### 8.4.11 Observation Chart

The Observation Chart can be viewed if one was configured for the recording. All automatic and manual entries will be displayed.

To open the Observation Chart, select **View > Observation Chart**.

The Observation Chart can be printed from Profusion PSG 3 by clicking the Print icon at the top of the Observation Chart window.

See the PSG Config Help for details on configuring the Observation Chart.

### 8.4.12 Bookmarks

Bookmarks can be used to mark pages of interest in the study. These bookmarks can then be exported to external applications via the Windows clipboard, or included in reports generated by Profusion PSG 3 using a simple report field.

#### ***Adding Bookmarks***

A bookmark can be added at any time, regardless of whether the Bookmark window is open. The default keyboard shortcut is Ctrl+C, and as with other keyboard shortcuts this can be customised<sup>[197]</sup>. You can also add a new bookmark by selecting Edit > New Bookmark from the menu.

Adding a new bookmark takes a screen capture of the current trace display. All displayed panes are included.

To view the list of saved Bookmarks, open the Bookmark Window (View > Bookmark Window).



By default, new bookmarks are given a caption corresponding to the epoch in which the cursor is currently active. You can rename bookmarks by a slow left-click on the caption.

## Including Bookmarks in Reports

To include Bookmarks in reports, the field [@127] must be added to your report template (this is listed as Screen Capture under the Graphs category in the Report Wizard plugin for Microsoft Word). You can tag a maximum of 8 bookmarks for inclusion in a report.

Only tagged Bookmarks will be included when you generate a report. To tag a Bookmark, click on the desired Bookmark in the Bookmark Window and select the *Tag/Untag screen capture for reporting* icon . Alternatively, the Spacebar will toggle tagging for the selected Bookmark. Tagged Bookmarks are indicated in the Bookmark Window by a yellow circle with a tick in the top right corner. In the above example, only the Epoch 1 Bookmark is tagged for inclusion in reports.

**Tip** If you use the Bookmark report field in a report template, two bookmarks will be inserted per page in portrait orientation, and one per page in landscape.

**Tip** Bookmarks are sent to the report as bitmaps, each about 7.5MB in size. After generating a report, click Save within Word to compress the images and reduce the report file size.

## Exporting Bookmarks to other applications

Bookmarks can be copied to the Windows Clipboard for insertion in other applications, such as word processors.

To copy a Bookmark to the Clipboard, click on the desired Bookmark from the Bookmark Window and select the *Copy to Clipboard* icon .

Open the external application, and Paste from the Clipboard. The Bookmark screen capture will be inserted. You can copy one Bookmark at a time.



**Tip** When pasting a screenshot into Microsoft PowerPoint, the image may be too large to fit on a single slide. For landscape slides, editing the image properties to display at 60% will scale the screenshot properly to take up the entire slide without any cropping.

### 8.4.13 Manual Input Editing

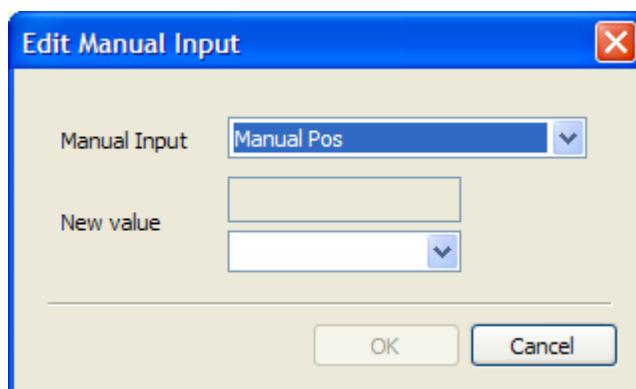
Manual Inputs can be edited in Profusion PSG 3 after the study has been recorded. This is done via the Trend window.



**Info** Studies must be recorded with PSG Online 3.1 or later to be able to edit the Manual Inputs.

To edit a Manual Input, open the Trend window (the window must be pinned open). Right-click and drag across the epochs that you want to change.

Once the correct epoch range is selected, go to the Edit menu and select Manual Inputs (note that this option will only be available when an epoch range is selected in the Trend). The Edit Manual Input dialog will open:



All Manual Inputs will be listed in the drop-down box. Select the Manual Input you wish to change:

- For Upper/Lower Manual Inputs, enter the new value for the selected epoch range. The unit of measurement will be displayed.
- For Step Manual Inputs, use the second drop-down list to select the new step to

apply to the selected epoch range.

#### 8.4.14 Bi-level Entries

IPAP and EPAP levels, and supplemental O<sub>2</sub> levels as entered during acquisition can be viewed, edited and added by opening the Bi-Level Pressure window.

To open the Bi-Level Pressure window, select Edit > Bi-Level Entries.

The screenshot shows a Windows-style dialog box titled "Bi-Level Pressure". On the left is a table with columns: Epoch, Date, Time, IPAP, EPAP, and O2. The table contains eight rows of data. On the right side of the dialog are six buttons: Goto, Edit..., Delete, Add..., Help..., and Close. The "Delete" button is highlighted with a blue border.

Epoch	Date	Time	IPAP	EPAP	O2
281	17/04/2002	12:34:10 AM	6	0	0.0
330	17/04/2002	12:58:24 AM	7	0	0.0
382	17/04/2002	1:24:40 AM	8	0	0.0
433	17/04/2002	1:50:05 AM	9	0	0.0
461	17/04/2002	2:03:52 AM	10	0	0.0
529	17/04/2002	2:38:18 AM	11	0	0.0
565	17/04/2002	2:55:55 AM	12	0	0.0
684	17/04/2002	3:55:20 AM	13	0	0.0

Click on an entry to highlight it, then press Goto, Edit or Delete to perform the function.

To add a new Bi-Level entry, set the cursor at the point of the pressure change before opening the Bi-Level Pressure window. When you select Add from the Bi-Level Pressure window, the new entry will be added at the cursor point.

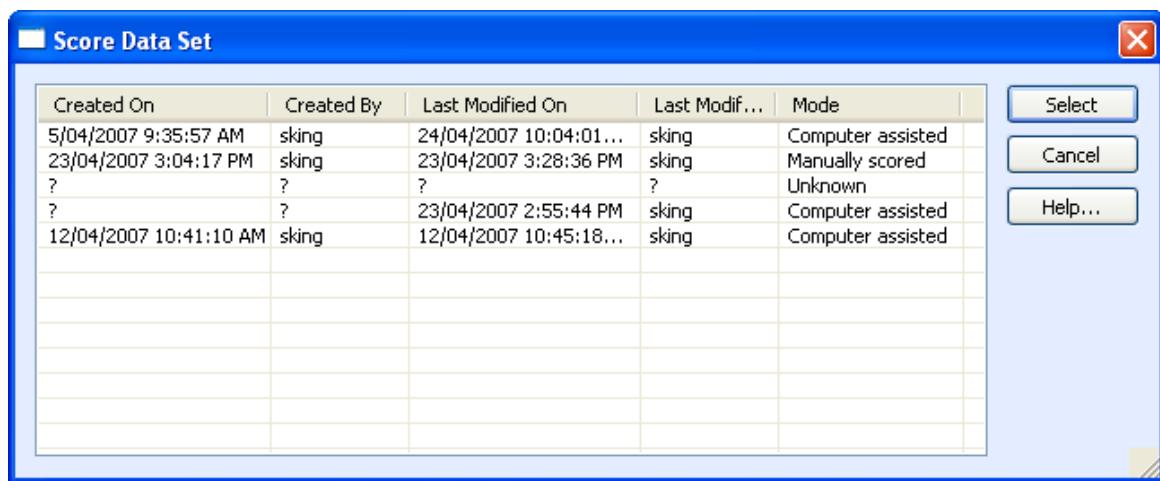
#### 8.4.15 Scoring Comparisons

If more than one data set has been scored for the study, the two can be compared for training and quality assurance purposes. See the [Data Set](#)<sup>17</sup> topic to learn how to create new data sets.

To open the Scoring Comparison window, select View > Scoring Comparisons.

If you need to compare an epoch range (for example to compare 200 epochs of a study for QA purposes), click the Range link to select the desired range.

Click the [Score Set 1](#) link to select the first data set. The details of each score set are displayed.



Repeat for the [Score Set 2](#) link.

Three comparisons are available:



## Sleep Statistics

Displays the hypnograms from the two data sets, and a variety of numerical comparisons between the two data sets.



## Event Statistics

Displays a side-by-side comparison of respiratory events and statistics, arousals, limb movements and cardiac events. Check the *Highlight Differences* box to display variations between the two data sets in red.



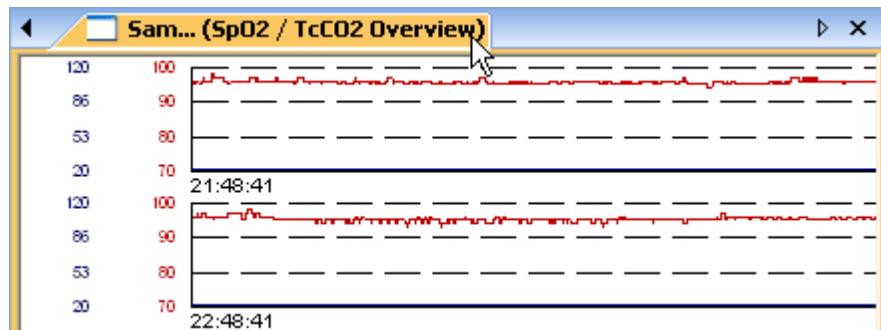
## Epoch Comparison

Displays a side-by-side comparison of the scored sleep stage for all epochs. Check the *Show Differences Only* box to display only non-matching epochs. Clicking on the underlined Epoch number will display that epoch in the trace panes.

The Scoring Comparison window can only be displayed as a tabbed window. To display this window and the trace panes at the same time, right-click the tab title and select *New Horizontal or Vertical Tab Group*. To return to the default display, right-click the tab title and select *Move to Previous Tab Group*.

### 8.4.16 SpO<sub>2</sub>/TcCO<sub>2</sub> Overview

The SpO<sub>2</sub>/TcCO<sub>2</sub> Overview Window displays an SpO<sub>2</sub> and/or TcCO<sub>2</sub> trend graph for the entire study. Data is displayed at the rate of one hour per row.



To view the SpO<sub>2</sub>/TcCO<sub>2</sub> overview:

- Select View | SpO<sub>2</sub>/TcCO<sub>2</sub> overview
- To change the scale (Graph Ranges), select the Properties bar and select the graph required in the drop-down box. Alter the ranges as required

Properties	
	Name
Property	SaO2
Upper limit	100
Lower limit	70
Colour	<span style="background-color: black; color: black;">█</span>

**Info** The overview may take a while to be displayed depending on the computer system used and length of the study.

## 9 Digital Video

### 9.1 Viewing Digital Video

Select the Digital Video Icon to open the Digital Video Display Window:



The controls allow the video to play at normal speed, play frame-by-frame, pause, fast forward and reverse.



#### Synchronisation

Once invoked, the Digital Video review feature stays in synchronisation (accurate to 100ms) with the cursor position on the Trace Window.

Selecting Play on the Digital Video window will track the cursor along the Trace Window.

Using the variety of available navigation tools within ProFusion PSG (see Trace Window Navigation) to move the cursor to a different position will cause the Digital Video display to re-synchronise itself to the new cursor position automatically.

If the cursor is at a position where the study has no digital video, the video pane will be blacked out. The Hypnogram bar displays both the cursor and available video and can be used to determine those locations with and without video.

#### Zooming

The video Image can be zoomed by clicking on the image and dragging a box around the image section that is to be zoomed. The selected image will then be drawn in the display window.



The image may also be zoomed by rolling the wheel of a wheel mouse. The placement of the mouse pointer determines the center point for zooming the image.

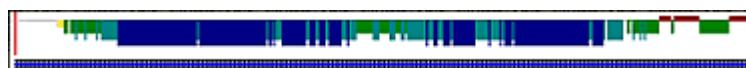
Double-clicking the left mouse button in the video display window will return the image to its original size.

### Panning

Once the video image is zoomed it may be panned by pressing the Ctrl key and the left mouse button. If using a wheel mouse the wheel may be pressed down and used to pan the image.

## 9.2 Editing Digital Video

When a study with digital video is first opened, the section of the study with recorded digital video will be indicated by a blue bar displayed beneath the hypnogram.



It is possible to retain all, part or none of the recorded digital video.

Nothing needs to be done to store all recorded video with the study. If the study will be archived, the digital video will be stored with the study. However, if the digital video files are too large to fit on the archive medium then the digital video must be edited to reduce the size of the file.

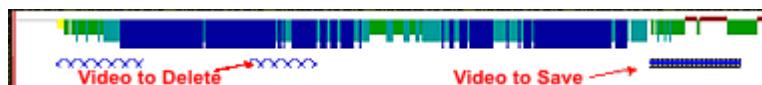
### Deleting the entire digital video recording

To delete the entire associated digital video recording, click the right mouse button with the pointer on the digital video bar then select Delete Digital Video from the pop-up menu.

A confirmation message will occur when closing the study to confirm the deletion of the associated video files.

### Selecting the digital video segments to Save

A section or multiple sections of the digital video may be selected to store permanently with the sleep study. To select a section of video to save with the study, hold the Ctrl key down while pressing the left mouse button and dragging the mouse pointer over the section of video to save. Repeat this process for all sections of video to be saved.

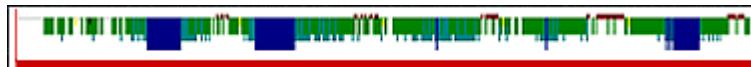


A confirmation message will appear when closing the study indicating that the unselected sections of video will be deleted. Deletion of unwanted video is non-reversible once the study

has been closed.

## Digital Video Unavailable

When the digital video status bar is red, this means that the digital video is unavailable.



This may be for the following reasons:

- Digital Video files are stored on a separate Digital Video server, and the server is offline
- Digital Video files are corrupted, or have been independently deleted from the study folder
- Digital Video client software is not installed on the review PC
- The study has been moved using applications other than Compumedics Study Manager, without prior consolidation of the video files

## 10 Reporting

Reports can be generated once a study has been analysed, with data taken from the open score [Data Set](#)<sup>[17]</sup>. Reports can be viewed using an internal viewer or Microsoft Word. Report statistics can also be exported to an external database. Information in reports can be raw figures and graphs. Rules can be set to manipulate the data and even generate pre-formatted text based on the statistics.

**Profusion PSG 3** includes a number of default report templates that can be used immediately. These templates can be customised using the **Profusion PSG Report Wizard**, and new report templates can be created from scratch.

Templates can also be created for exporting data into external third-party applications.

To create or customise report templates, see the [Report Configuration](#)<sup>[145]</sup> section.

To generate a report form a study, see the [Report Generation](#)<sup>[166]</sup> section.

To export data for use in third party programs, see the [Exporting Data](#)<sup>[172]</sup> section.

## 10.1 Report Configuration

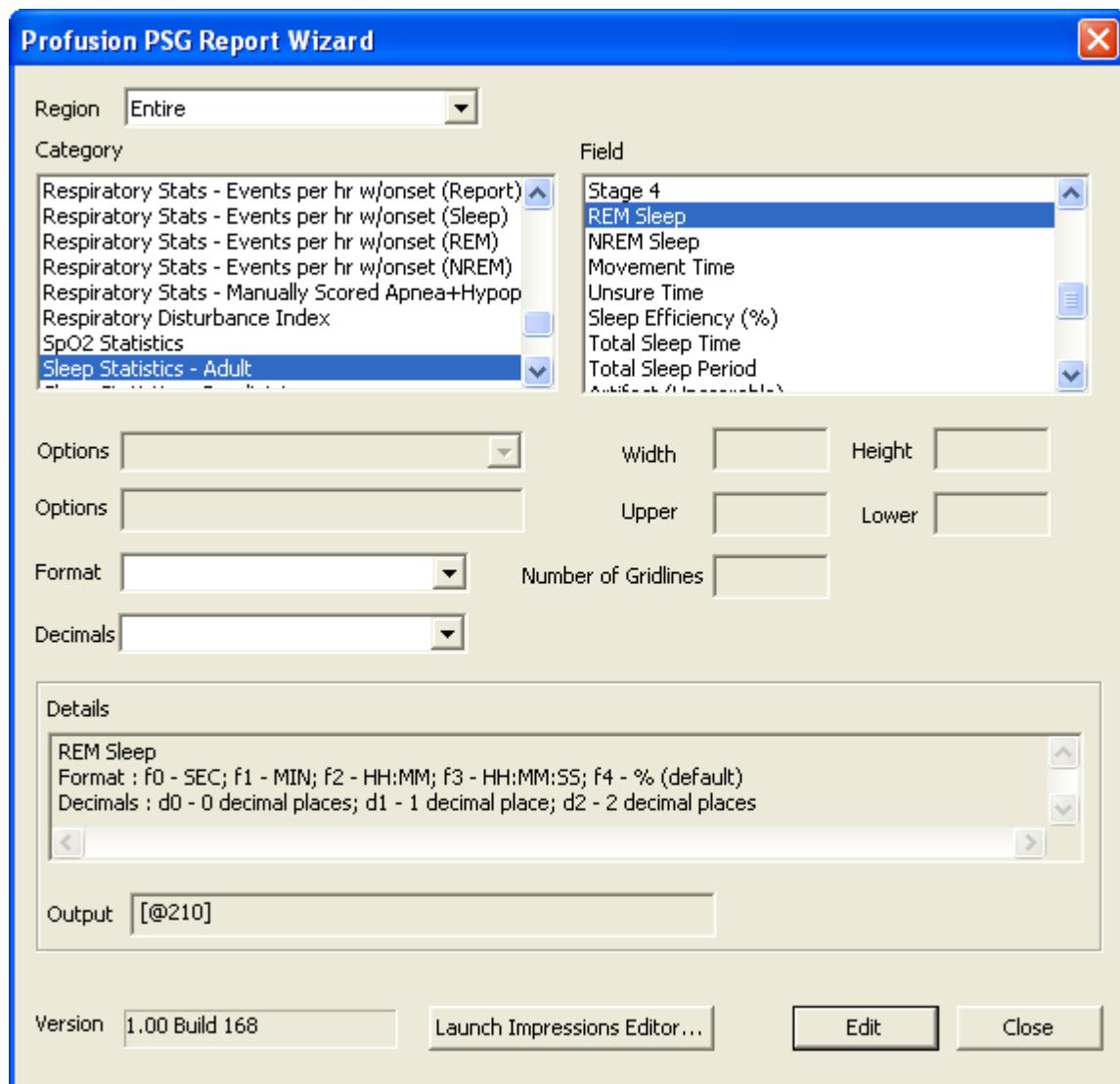
Configuring a report requires entry of field codes for each statistic or figure to be included. The [Profusion PSG Report Wizard](#)<sup>[145]</sup> is installed in Microsoft Word to assist with configuring reports. This wizard allows report fields and graphs to be searched by category and name, and then inserts the correct field code into the report.

### 10.1.1 Profusion PSG Report Wizard

To use the **Profusion PSG Report Wizard**, open Microsoft Word and click the wizard icon:



The **Profusion PSG Report Wizard** window will open:



The Region is used to select statistics for Split Night reports

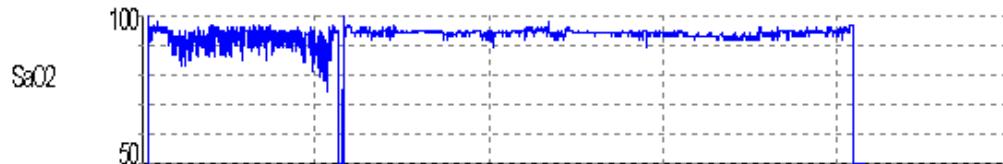
- **Entire:** Generates statistics from the entire range of epochs selected when a new report is generated.
- **Diagnostic:** Select Diagnostic, Treatment I or Treatment II to use statistics from a specified range of epochs when generating Split Night reports. For example, use Diagnostic for the non-treatment part of the night, and Treatment I for the CPAP part. If supplemental O<sub>2</sub> is sometimes added to CPAP treatment, this part of the night could be set as Treatment II.

Select the Category of statistic you wish to add. The available fields appear in the Field menu.

Select the Field you wish to add. The display and format options available for that field will be available through the drop-down menus, with descriptions of the options in the Details window.

For graphs, specify the width and height (in inches), upper and lower limits and number of

gridlines to be displayed. For example, selecting the SpO<sub>2</sub> graph with width = 6, height = 1, upper and lower limits = 100 and 50 respectively and 5 gridlines will insert the report field [@111, 100 50 5 w=6 h=1], resulting in the following graph when the report is generated:

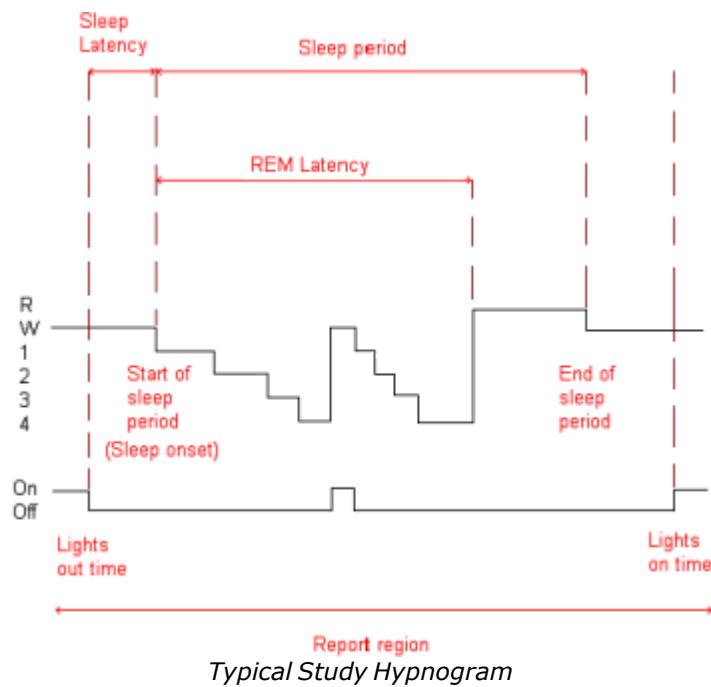


The Output window shows the code as it will be inserted into the report.

Once a field has been entered, the report can be edited without closing the Report Wizard, so that explanatory text can be included before another field is inserted.

Other text or graphics can be inserted into the report template as desired.

### 10.1.1.1 Report Definitions



Report Descriptor	Definition
<b>Time Available For Sleep</b>	The total time the Stage Light is OFF.  Stage Light is usually set up as a Manual Input. All the sleep and respiratory/sleep statistics will be zero if the stage light is ON for the whole study. The time available for sleep would be also be zero.
<b>Sleep Latency</b>	The time from lights out to Sleep Onset, as defined by the rule selection set in Report Preferences.
<b>REM Latency</b>	The time from sleep onset to the first REM epoch.
<b>Start of SLEEP Period</b>	Time of sleep onset.
<b>End of SLEEP Period</b>	The end time of the last sleep epoch.

<b>Total Time Awake During SLEEP Period</b>	The total time of awake epochs within the SLEEP period.
<b>Stage N1 Sleep</b>	The sum of all Stage N1(NREM1) sleep time within the SLEEP period.
<b>Stage N2 Sleep</b>	The sum of all Stage N2 (NREM2) sleep time within the SLEEP period.
<b>Stage N3 Sleep</b>	The sum of all Stage N3 (NREM3) sleep time within the SLEEP period.
<b>Stage 4 Sleep (R&amp;K Mode only)</b>	The sum of all Stage NREM4 sleep time within the SLEEP period.
<b>REM Sleep</b>	The sum of all REM sleep time within the SLEEP period.
<b>NREM Sleep</b>	The sum of stages 1, 2, 3 (and 4 in R&K Mode) within the SLEEP period.
<b>Total Sleep Time</b>	The sum of REM and NREM time within the SLEEP period.
<b>Sleep Efficiency</b>	Total number of epochs scored as any stage of sleep divided by the time available for sleep (lights off time) during the report period
<b>Total SLEEP Period</b>	End of SLEEP period - Start of SLEEP period.
<b>Artifact (Unscorable)</b>	Total time scored as artifact.
<b>Total Number of Awakenings</b>	Sum of the number of awakenings (transition from a sleep epoch to a wake epoch) within the sleep period.
<b>Wake after Sleep Onset</b>	Total awake time from sleep onset to lights on (includes any wake time after the last epoch of sleep).
<b>SWS (Slow Wave Sleep)</b>	Total time spent in Stage N3 (+ Stage 4 in R&K mode).
<b>Events in SLEEP time</b>	Includes events that occur during epochs marked as asleep, within the specified epoch range of the report

<b>Events in REPORT time</b>	Includes all events within the specified epoch range of the report, regardless of sleep stage
<b>MANUALLY SCORED events</b>	Includes all events that occur during epochs marked as sleep, plus any events manually scored during epochs marked as awake, within the specified epoch range of the report

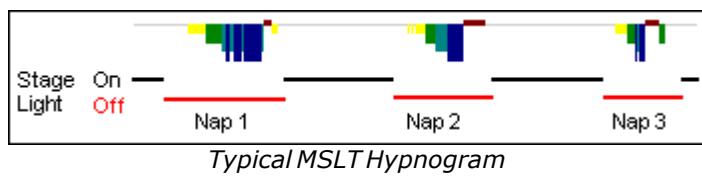
 **Info** For Child studies set to the AASM scoring mode, Stage N (NREM) can be reported, and is included in the total NREM statistics (NREM = Stage N + Stage N1 + Stage N2 + Stage N3).

For Child studies set to the R&K scoring mode, Stages 1/2 and 3/4 can be reported, and are included in the total NREM statistics.

### 10.1.1.2 MSLT Report Definitions

It is possible to produce an MSLT (Multiple Sleep Latency Test) Report. The report generator produces a range of statistics based on the nap study and the associated PSG study conducted on the previous night.

Each nap is manually defined by the stage light setting. Where the stage light is set to off, this corresponds to the patient napping. To select or de-select individual naps for inclusion in the MSLT report, set or adjust the lights out and lights on points for the nap. For example, if the lights are set to on for the duration of a nap, the nap will be ignored by the report generator.



<i>Report Descriptor</i>	<i>Definition</i>
<b>Sleep Latency</b>	<p>The time from Lights Out until the Sleep Onset criteria are met. If during a 20-minute period following Lights Out the subject does not meet the Sleep Onset criteria the Sleep Latency value is reported as 20 Minutes (NOT zero Minutes).</p> <p>If the subject falls asleep the nap period extends to 15 minutes past the onset of sleep, even if the subject falls asleep at 19:45 past the Lights Out point. Therefore the theoretical maximum nap time is 35 Minutes.</p>
<b>Mean Sleep Latency</b>	<p>The mean value of all naps, with a maximum value of 20 minutes, keeping in mind that naps with no sleep onset are reported as 20 Minute Sleep Latencies.</p>
<b>REM Latency</b>	<p>The time from Sleep Onset until the first epoch of REM. This is a relative value based on Sleep Onset, not Lights Out. If the first epoch of Sleep is REM the REM Latency is zero. If there is no REM during a nap than the REM Latency has NO VALUE, i.e., it is NOT given a value equal to the nap</p>

	time.
<b>Mean REM Latency</b>	The mean value of all REM Latencies for naps that have REM. If a nap does not contain a REM period it is NOT used in the calculation of the Mean REM Latency value.
<b>Time of Nap</b>	Reports the clock time of the start of the nap (Lights Out time).
<b>Nap Duration</b>	Reports the duration of the nap period from Lights Out till Lights On or the end of the recording, if Lights On does not occur. The Lights On criteria must be followed because some labs will record post-test cals after the end of the actual nap. The user would have to use a Light Sensor or adjust the Stage Light setting in the Trend Display for the nap to have this function correctly.
<b>Sleep Time</b>	Usually reported as % or minutes, it is the total amount of sleep during the nap, even if the Sleep Onset Criteria are not met. If there are scattered epochs of Stage 1 sleep these must be added into the Sleep Time.
<b>Awake Time</b>	Usually reported as % or minutes, it is the total amount of wake time during the nap, including time after Sleep Onset. As a percentage the % Sleep Time and % Wake Time should add up to 100%.
<b>Sleep Onset Rules</b>	<p>There are three sets of rules for determining Sleep Onset:</p> <ol style="list-style-type: none"> <li>1. 3 epochs of any stage of Sleep.</li> <li>2. 1 Epoch of any Stage of Sleep.</li> <li>3. 3 epochs of Stage 1 or 1 epoch of any other Stage.</li> </ol> <p>Rule 3 is a special set that has a subset of criteria, they are:</p> <ol style="list-style-type: none"> <li>3a. 3 epochs of Stage 1 in a row.</li> <li>3b. 1 epoch of Stage 2, 3, 4 or REM.</li> </ol>

	<p><b>3c.</b> 1 or 2 epochs of Stage 1, if followed by 1 or more epochs of Stage 2, 3, 4, or REM.</p> <p>The MSLT Report should contain some results from the previous nights PSG study (almost 100% of MSLT studies are done the day after a full night PSG). These values include, Lights Out Time, End of Study Time (Rise Time), Total Sleep Time, Sleep Efficiency, Sleep Latency, REM Latency.</p>
<b>SOREM</b>	Sleep Onset REM. Any naps that contain REM sleep within the 20 minutes following sleep onset.

### 10.1.2 Impressions Editor

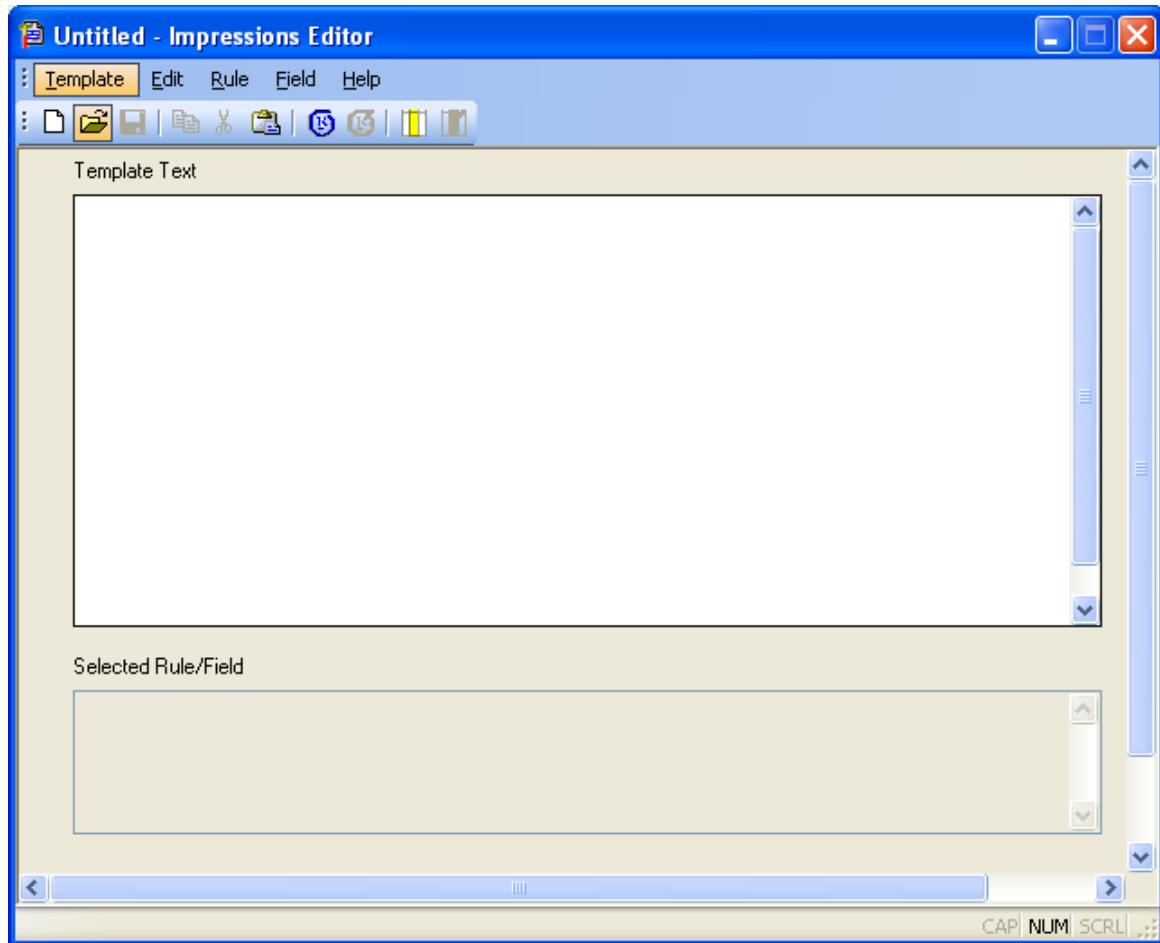
The Impressions Editor allows for user-defined text to be added to a report, with rules configured that will insert comments based on the values of report fields. The Impressions Editor is launched from the Profusion PSG Report Wizard. Each block of text to be added by using the Impressions Editor is created separately, and saved as an Impression Script. These Impressions Scripts can then be added to a full report.

If you are using Compumedics Nexus, Impressions can be automatically added to the Service Details for the study.

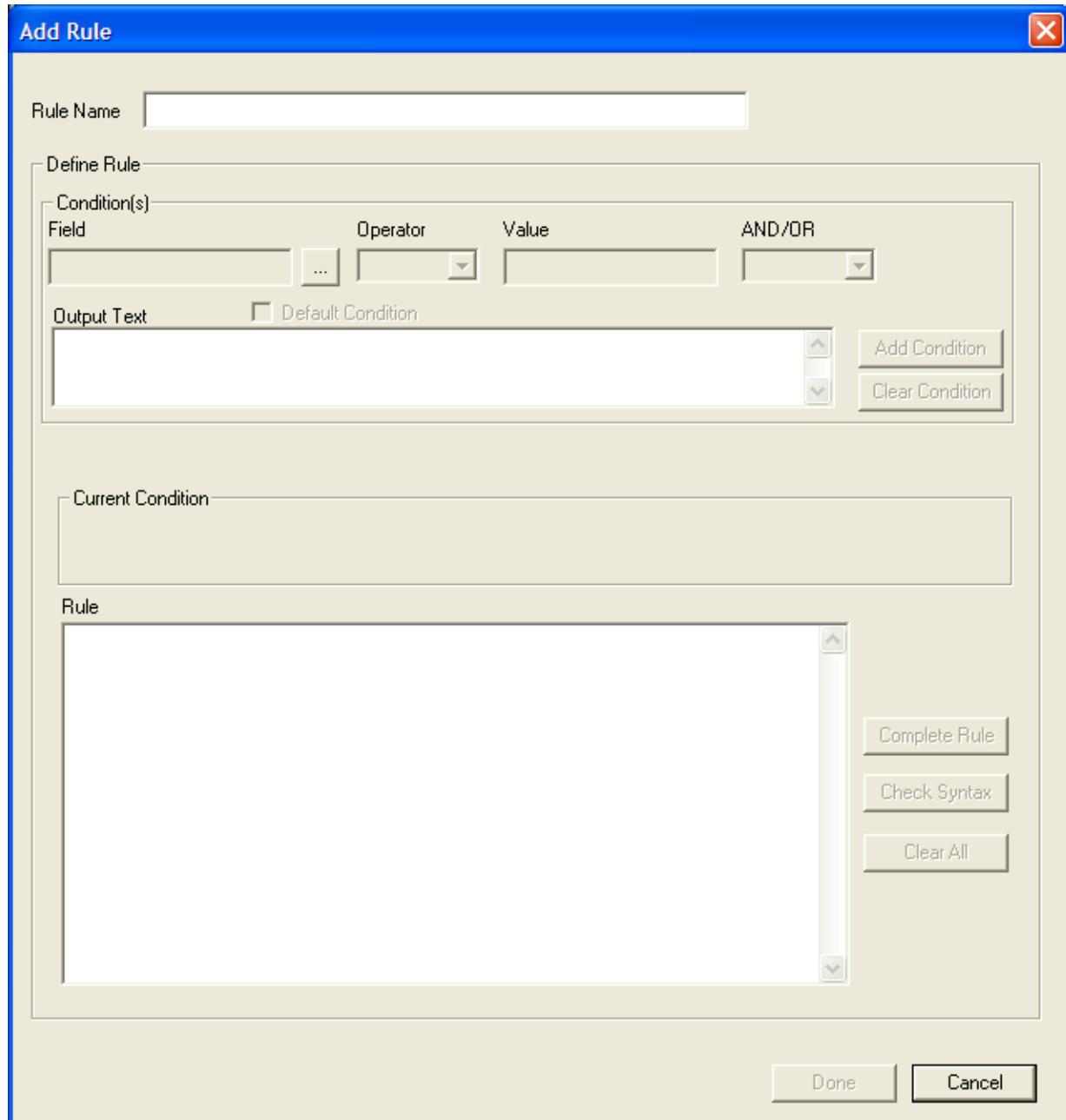
 **Info** Graphs cannot be added using the Impressions Editor.

#### *Adding an Impression*

Open the [Profusion PSG Report Wizard](#)<sup>[146]</sup> from Microsoft Word. Click *Launch Impressions Editor*.



1. Select **Rule > Add**, or click the New Rule icon: , which will open the Add Rule window:

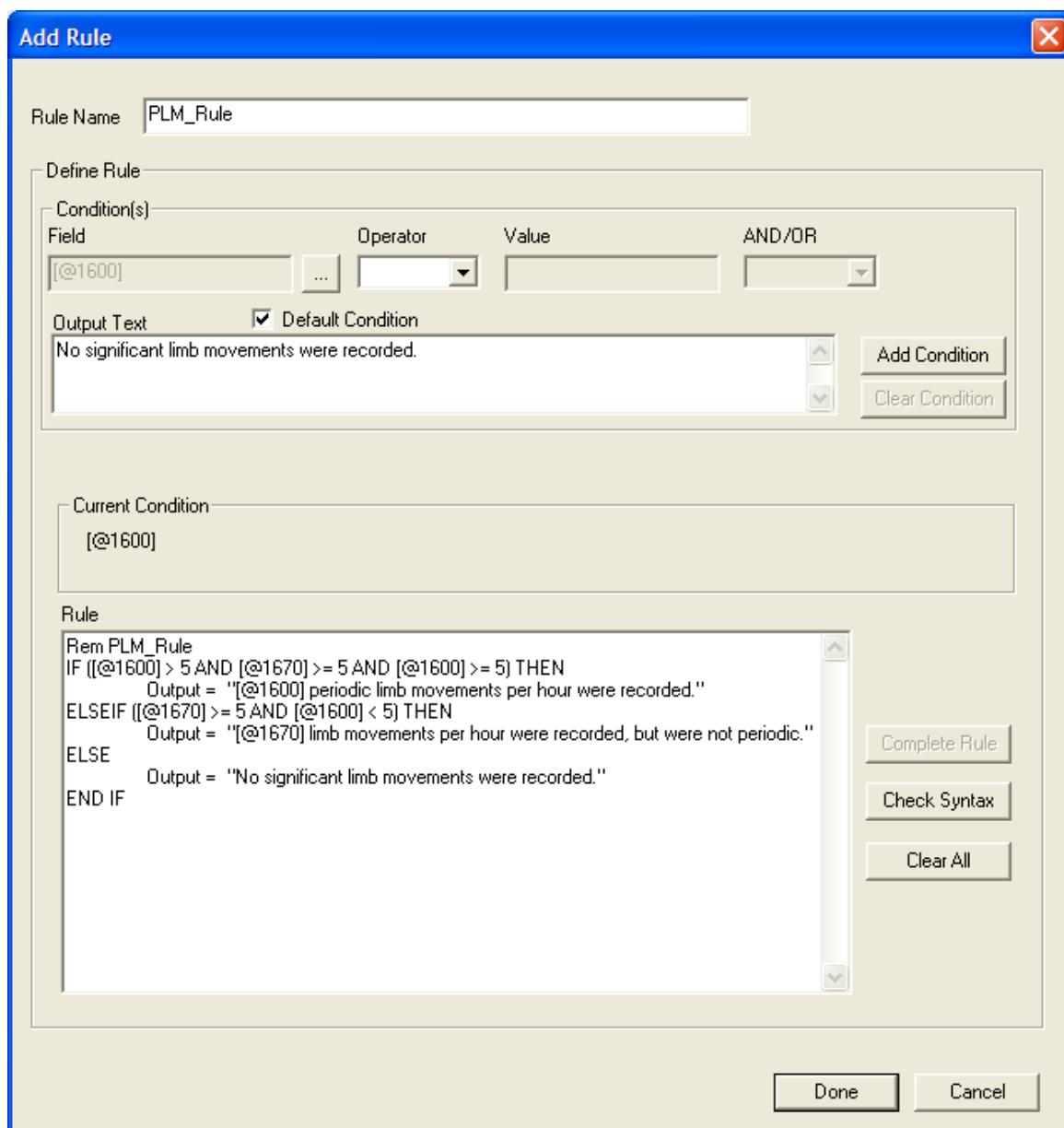


2. If required, enter a name for the Rule. This can be used to identify the rule later.
3. Click the Browse button to select the first report field. Navigate to the appropriate category and field. Press Select
4. The field will be inserted in the Field box. Select the operator for the field. As each part of the condition is entered, the Current Condition box will be updated. Press Clear Condition

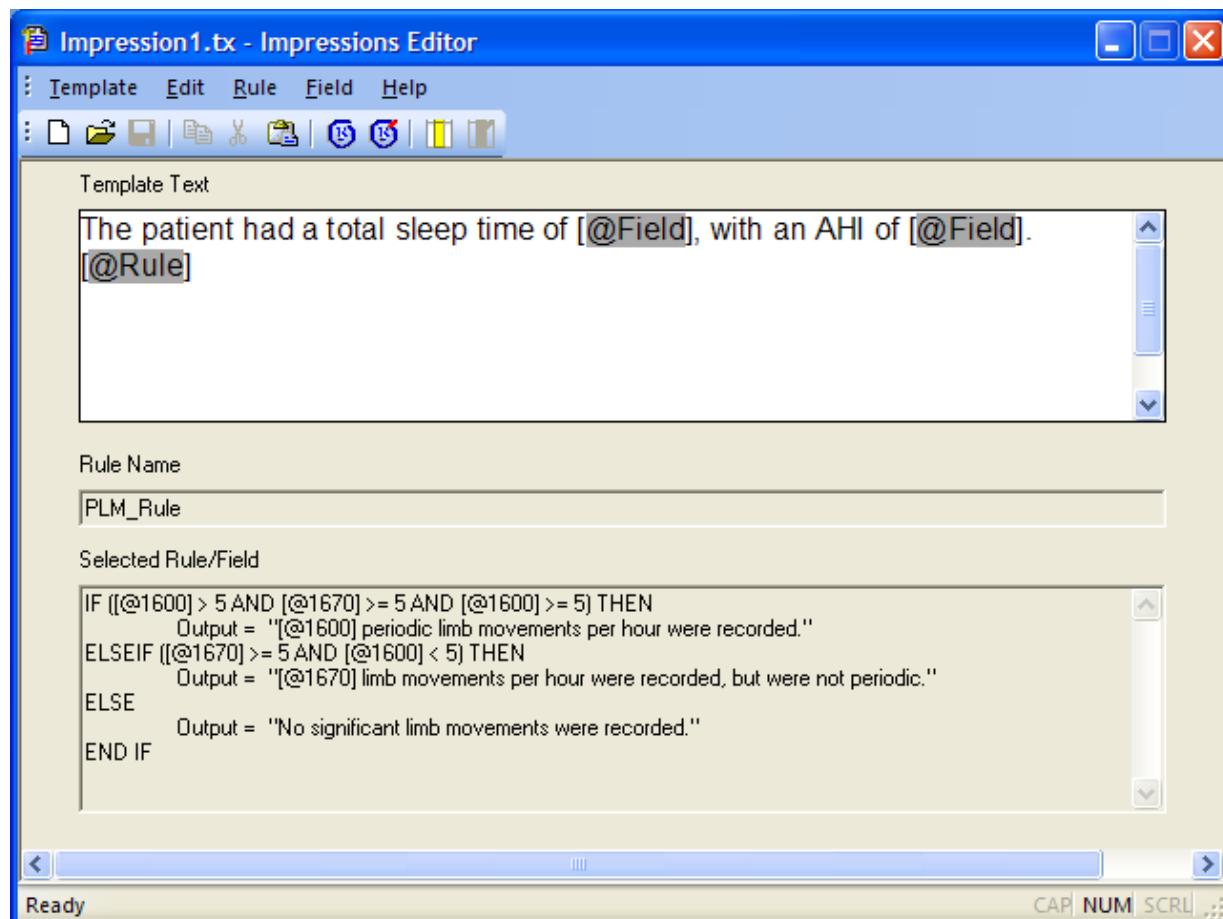
- to start again
5. Set the value for this condition
  6. Select the operator
  7. Enter the Output Text for each condition
  8. Click Add Condition to add this condition to the rule
  9. Repeat steps 3-5, for subsequent conditions
  10. Default text can be inserted if none of the conditions are met. Click the Default Condition checkbox and enter the default text.
  11. When all conditions have been added, click Complete Rule to add the final code to the rule. Once the rule has been completed, you can click Check Syntax to make sure the rule is valid
  12. Press Done to add the rule to the Impressions Editor template

### **Example**

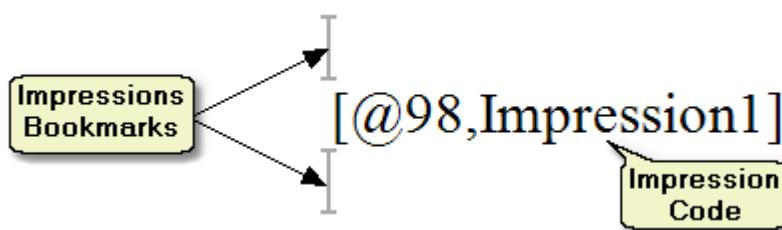
The rule shown will insert appropriate text based on the number of limb movements and periodic limb movements per hour:



The Impressions Editor template text can contain standard text for a report, with rules defining text that varies depending on the conditions. Individual fields can also be included in a template. Within the Editor, clicking on a Rule will display the Rule Name and details of the selected rule. Clicking on a field shows the report code of that field.



Each Impressions template is saved with a name, and can be selected through the Profusion PSG Report Wizard (Category = Impression Scripts). The Impression Script is added to the report as a field, within a set of bookmarks (the bookmarks are invisible when printed).



Due to limitations within Word, only one Impression script can be added from the Report Wizard. You can however manually insert more than one Impression script. Use the Report Wizard to check the correct format of the code, then manually type in the code. This can be within the Impressions bookmarks, or at any other point in the report template.

**Info** Impressions Scripts must be saved to the \Impression Text Templates folder that is found under the Report folder. The default path is C:\Documents and Settings\All Users\Application Data\Compumedics\ProFusion Sleep\Report\Impression Text Templates. If you

change the Report directory (under Tools > Options > Preferences > System Settings > General), you will need to create the \Impression Text Templates folder in that same path.



**Tip** An Impression Script may contain many lines of text, and needs to have enough space allocated to it when formatting the overall report. The amount of text generated by an Impression Script may also depend on the rules that are activated.

## ***Adding Impressions to Nexus***

To automatically export your Impressions to Nexus, you must insert an Impression script via the Report Wizard in Microsoft Word. When the report is generated, the text within the Impression will be sent to Nexus.

Only text within the Impressions bookmarks are sent to Nexus. If you manually insert Impressions outside the bookmarks the text will generate, but not be sent to Nexus.



**Info** You do not need to have Nexus installed in order to use Impressions.

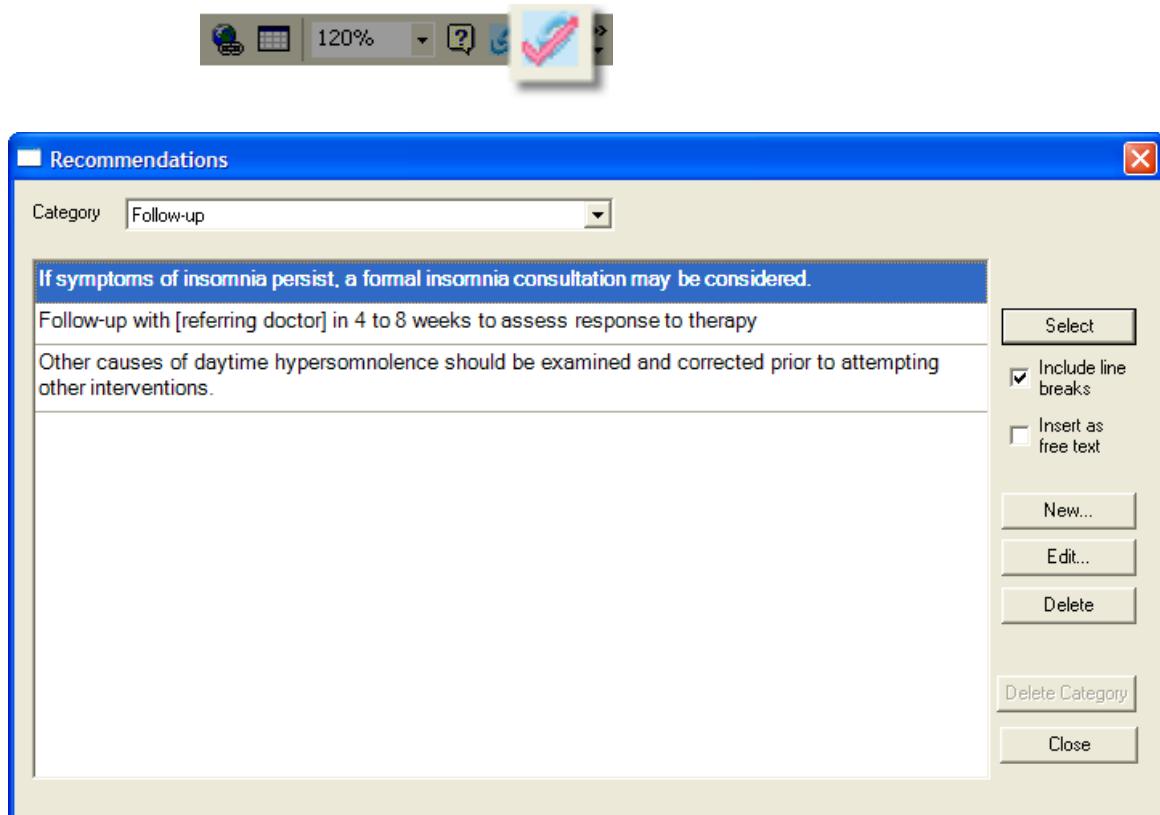
### 10.1.3 Recommendations

The Recommendations editor allows for comments to be defined that can be added to reports or letters on demand. Different categories of recommendations can be defined, with a variety of comments for each category.

To use a pre-defined Recommendation in a report, a section must first be inserted into your report template using the *Recommendations Section* field from the Profusion PSG Report Wizard. This will insert a set of Bookmarks into the report template (the bookmarks are invisible when printed).



Once the report has been generated, click in the Recommendations section and open the Recommendations Wizard to select the required comments.



To insert the desired Recommendation, select the text and click *Select*. The text will automatically be inserted inside the Recommendations bookmarks in the report. Any text within the Recommendations section will be added to the Recommendations section of the Service Details in Nexus (if installed).

 **Info** You do not need to have Nexus installed in order to use the Recommendations.

### ***Adding Recommendations as Free Text***

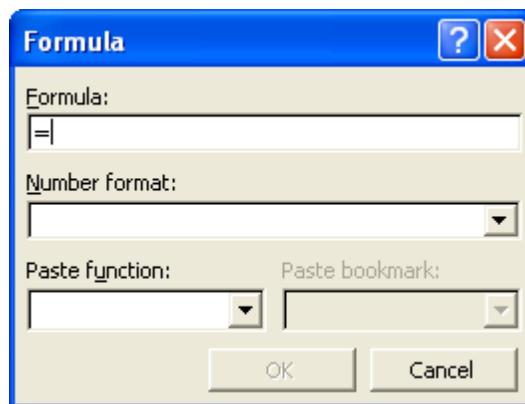
Recommendations can be inserted anywhere in a report (ie: outside the Recommendations bookmarks) by checking the Insert as free text box. When you click *Select*, the text will be inserted at the cursor point in the report.

Recommendations added outside the bookmarks will not be exported to Nexus.

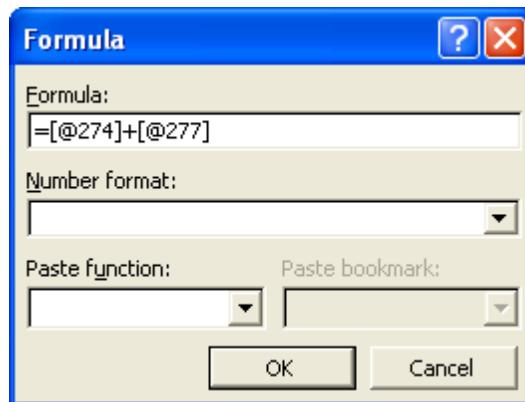
#### 10.1.4 Adding a Simple Formula to a Report Template Using Word

Manipulation of report fields can be performed using the Formula function of Microsoft Word, allowing for calculation of parameters that are otherwise not available. Note that this will require an additional step to have Word perform the calculation after the report has been generated.

1. Determine the formula needed to perform the calculation. For our example we will calculate the number of Obstructive Apneas and Hypopneas per hour throughout the reported time.
2. Determine the corresponding codes to be used in the formula from the Profusion PSG Report Wizard. In our example:  
Number of Obstructive Apneas per hour: [@274]  
Number of Hypopneas per hour: [@277]
3. Access the report template to be modified. Set the cursor at the point in the template where the formula is to be inserted.
4. Select **Table > Formula**. The following window will be displayed.



5. Type in the formula after the equal sign using (+) for plus, (-) for minus, (\*) for multiply and (/) for divide.





6. Select OK. The following will appear in the report template where the formula was inserted:

**!Syntax Error, [**

7. Save the template in `.rtf` format after all of the formulae have been inserted. Launch **Profusion PSG 3** and run a report using the new template. At each place a formula was inserted, the same Syntax Error message will appear. Right click on the Error message and select Update Field. The field will be updated with the correct calculation.



**Tip** If several formulae have been inserted, first select the entire report by selecting Edit > Select All (shortcut **ctrl+A**). Then press the **F9** function key on the keyboard.

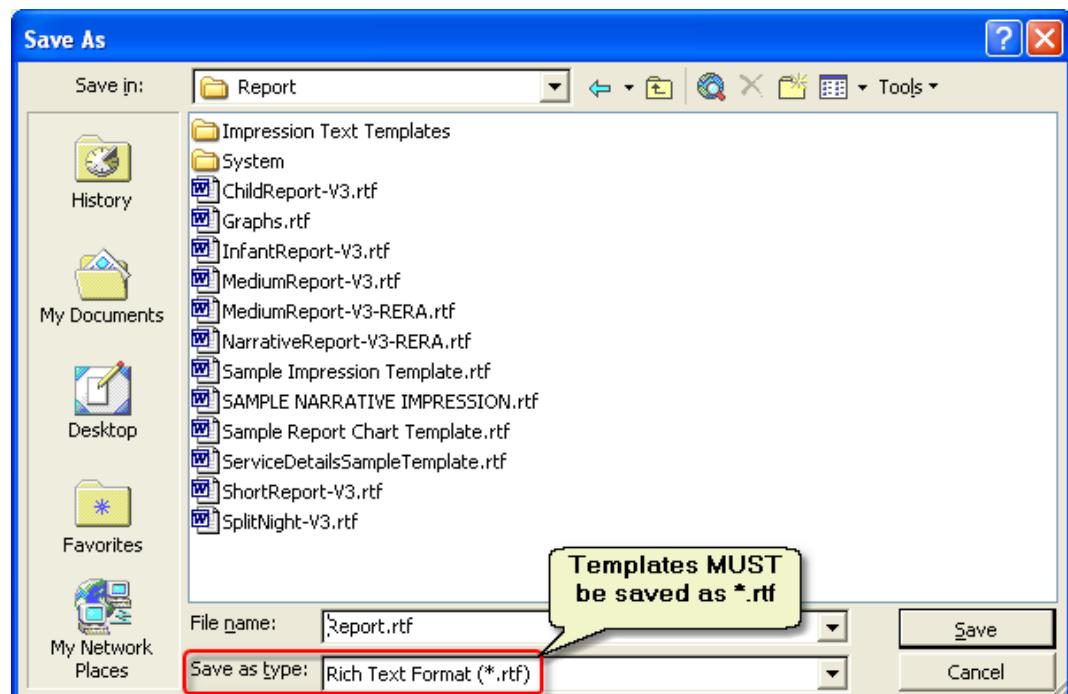
If you need complex report calculations, you may want to speak to your Compumedics Sales Representative about the higher level report scripting software that is available. Note that using this program requires knowledge of programming in Visual Basic.

### 10.1.5 Saving Report Templates

Once the report has been configured, it **must be saved in Rich Text Format (rtf)** in the directory path specified under **Tools > Options > Preferences > System Settings > General**.

**Info** MSLT and MWT reports must be named **MSLT.rtf** or **MWT.rtf** respectively, and should be stored in **C:\Documents and Settings\All Users\Application Data\Compumedics\ProFusion Sleep\Report\System**, or the folder named **System** under the specified **Report Template Folder**<sup>[184]</sup>.

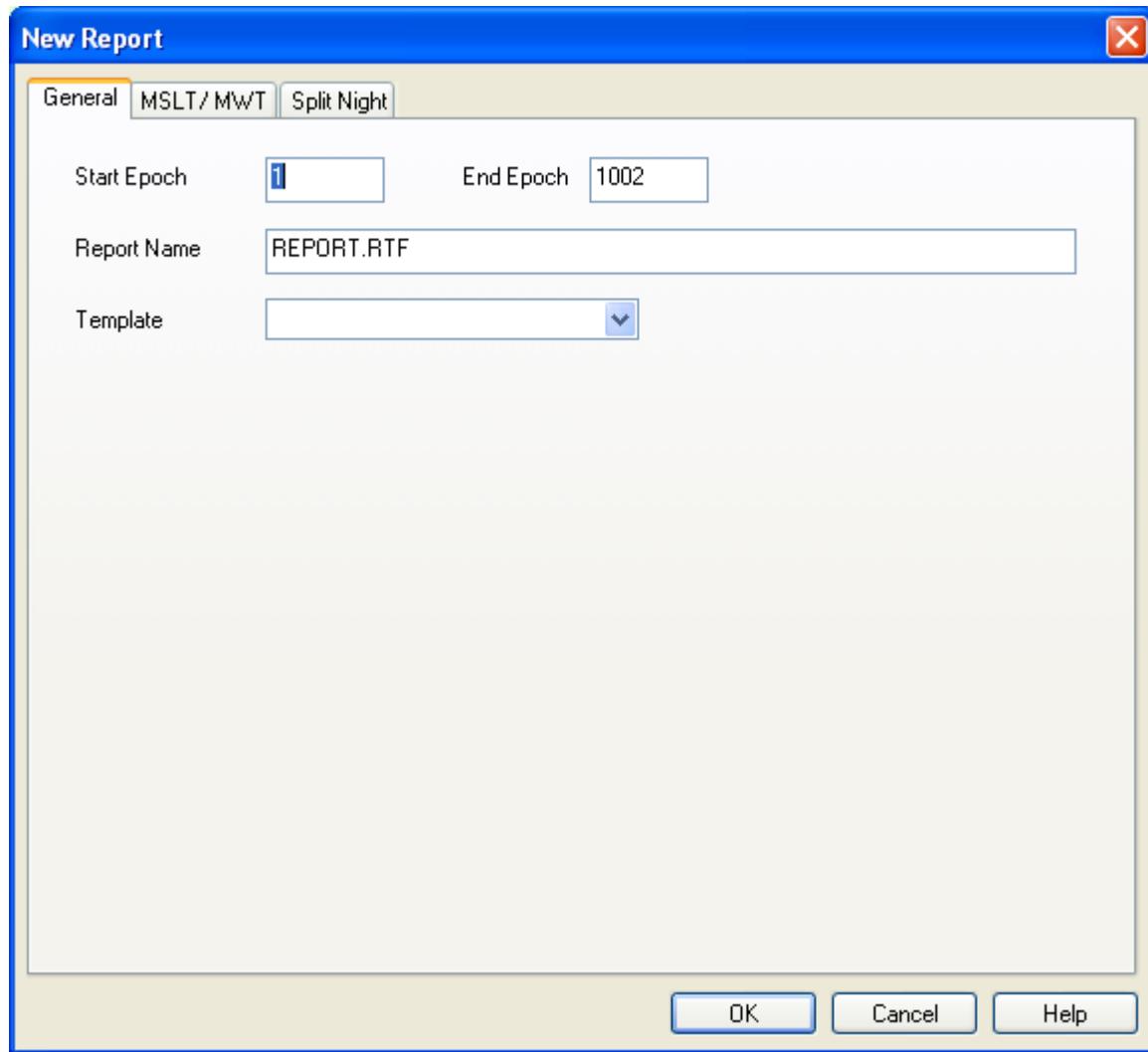
**Tip** Make sure you select **\*.rtf** as the **Save as type** when saving your template:



## 10.2 Report Generation

Reports can be generated and then viewed in the Profusion PSG 3 internal viewer or Microsoft Word (the Viewer can be selected in **Tools > Options > Preferences > System Settings > Report**).

To generate a report, select **Report > New**. The New Report window will open:



Three report styles are available (select the desired report type from the tabs):

- [General](#)
- [MSLT / MWT](#)
- [Split Night](#)



**Tip** In order to generate reports correctly, the Summary analysis must be run.

Once each report has been generated, it can be edited as a normal document. It is recommended to use Microsoft Word as the report viewer, but if this is not available the Profusion [Internal Report Viewer](#)<sup>[169]</sup> can be used.

 **Info** For all report types, statistics are generated from all data marked as Stage Light = Off.

## General Reports

Generates a report using statistics from between the specified Start and End epochs. Each report file is named by sequential numbers (REPORT.RTF, REPORT01.RTF etc), and can be given a unique name if required. The Template menu lists all RTF (Rich Text Format) report templates in the specified [Report Template Folder](#)<sup>[184]</sup>.

## MSLT / MWT Reports

Generates reports for MSLT or MWT studies. Select the associated overnight study from the list to include statistics from that study in the report. For MWT reports the length of each trial (study duration) should be entered.

 **Info** If you can't generate MSLT or MWT reports, check that the templates for these reports are named correctly, and saved in the correct place. See the [Saving Report Templates](#)<sup>[165]</sup> section for details.

 **Tip** Before generating MSLT and MWT reports, ensure the period between each nap opportunity has been marked as Stage Light = On.

## Split Night Reports

Select the Start and End epoch for the entire study, edit the Report Name if desired and select a Split Night template. The start and end epochs for each of the conditions determines the range of epochs that will be used for each study segment, and relate to the *Region* that was set in the report template.

### 10.2.1 Internal Report Viewer

Profusion PSG 3 has its own Report Viewer that can be used if Microsoft Word is not available. The built-in Report Viewer has a series of basic functions available to the user.

Mouse Command	Function
Click	Moves cursor to point of click or selects an image
Shift+Click	Extends the selection to the point of click
Double-click	Selects the word that is clicked on, or opens a dialog box to select an image
Single-click and drag	Selects text from point of button down to point where button is released
Double-click and drag	Extends the selection from word to word
Triple-click and drag	Extends the selection from row to row

Keyboard Command	Function
PgUp	Moves the cursor up to the next visible region
PgDn	Moves the cursor down to the next visible region
HOME	Moves the cursor to the beginning of the line
END	Moves the cursor to the end of the line
(Left Arrow)	Moves the cursor one character to the left.
(Right Arrow)	Moves the cursor one character to the right
(Up Arrow)	Moves the cursor one line up
(Down Arrow)	Moves the cursor one line down

CTRL + (Left Arrow)	Moves the cursor to the beginning of the current word
CTRL + (Right Arrow)	Moves the cursor to the beginning of the next word
CTRL + HOME	Moves the cursor to start of text
CTRL + END	Moves the cursor to end of text
CTRL + ENTER	Inserts a new page
SHIFT + ENTER	Creates a line feed
CTRL+(-)	Inserts an end-of-line hyphen
DEL	Deletes selected text
SHIFT + DEL	Copies selected text to the Clipboard and deletes the selection
CTRL + INS	Copies selected text to the clipboard
SHIFT + INS	Inserts text from the clipboard
CTRL+SHIFT+(Spacebar)	Inserts a non-breaking space
CTRL+(Backspace)	Deletes the previous word

## 10.3 Viewing Reports

If a report has been generated and then closed, it can be opened for viewing and editing using the Profusion Internal report viewer or Microsoft Word. The report viewer can be selected in **Tools > Options > Preferences > System Settings > Report**.

### **To view a report**

1. Select **Report > Open**.
2. Select the desired Report name from the Report Selection area.
3. Select OK to view the report.

## 11 Exporting Data

Recorded data can be exported in a number of formats:

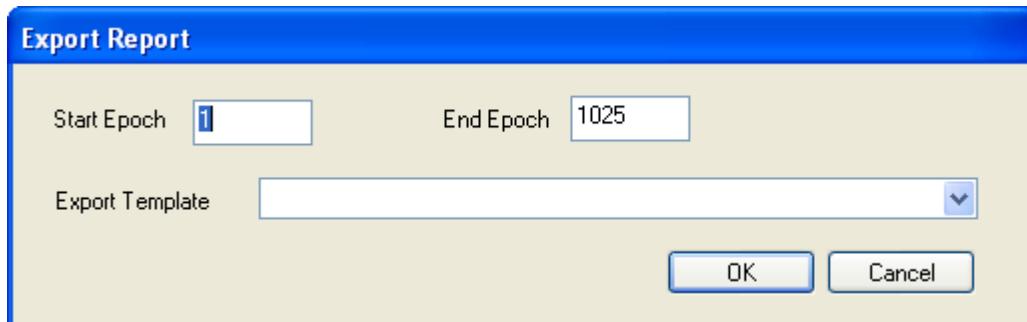
- To a [database](#)<sup>[172]</sup>
- In [ASCII](#)<sup>[179]</sup> format
- In European Data Format ([EDF](#))<sup>[181]</sup>

### 11.1 Export to Database

Statistics can be exported for use in external programs, for example Microsoft Access. To use this feature, a suitable template for the external program must be configured, using report fields as described in the Profusion PSG 3 Report Wizard. The format of this template will depend on the program to be used.

 **Tip** Templates for data export are contained in the Report Statistics Export Template Folder.

To export data, select Report > Export.



Enter the start and end epochs, and select the export template to be used. Press OK and the data will be exported for use in the external program.

### Database Configuration

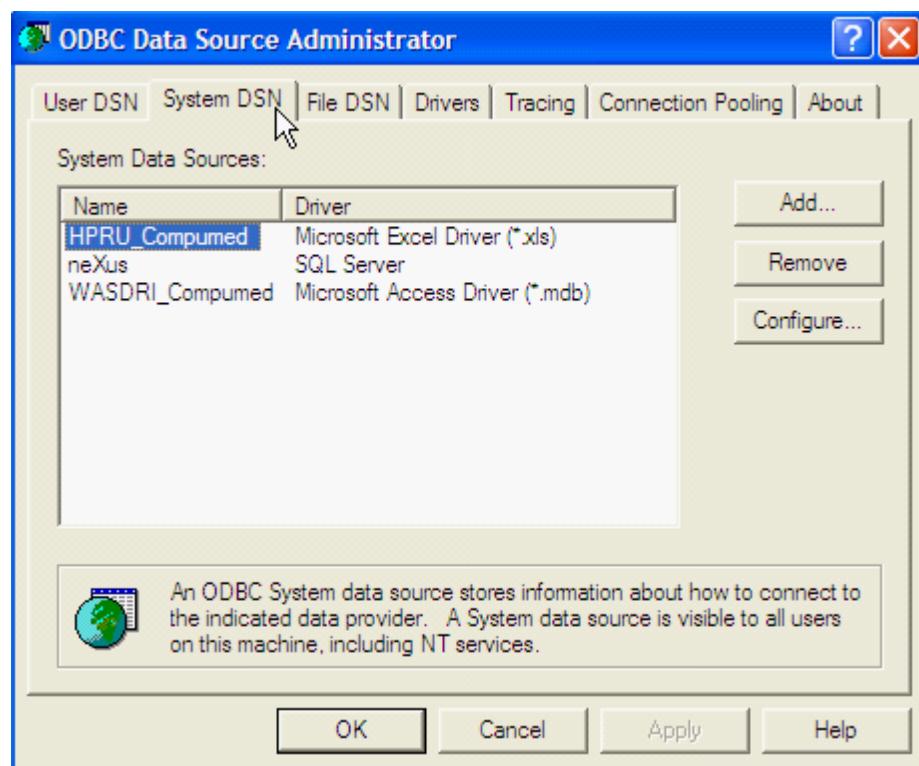
In order to export to a database, the database itself must be formatted correctly. There are also settings that need to be applied for the computer.

### ODBC Configuration

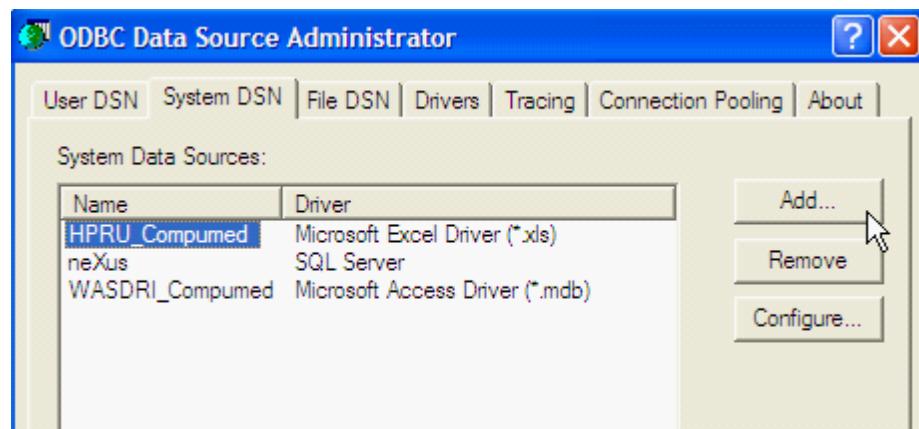
ODBC (Open Database Connectivity) is required to be configured to transfer data correctly.

To open the ODBC configuration dialog, go to the Windows Control Panel, select Administrative Tools, then Data Sources (ODBC). Note that you will need admin rights on the computer to do this.

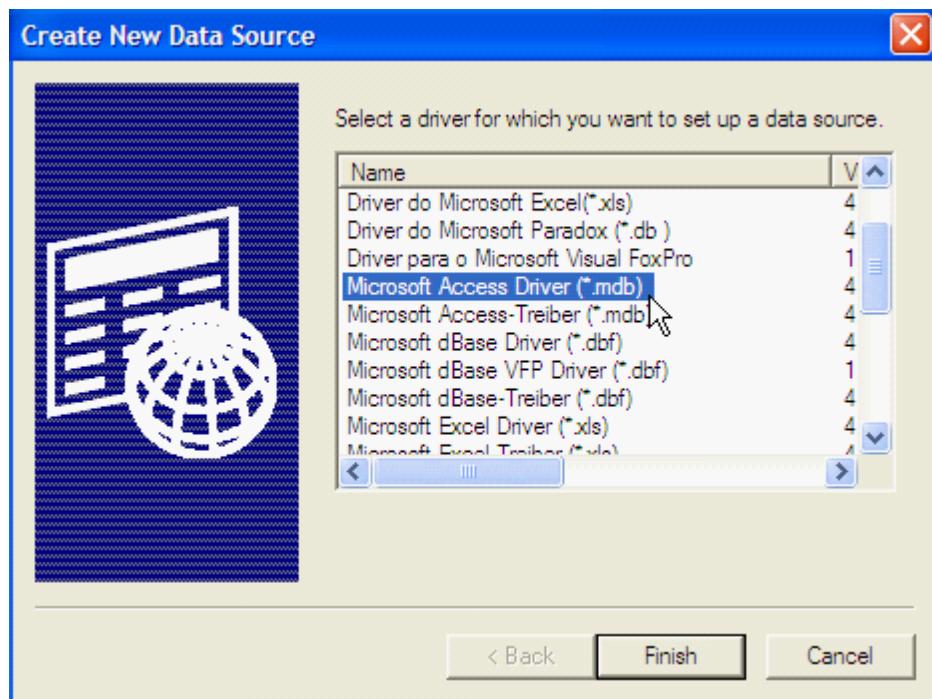
Select the System DSN tab:



Select "Add"



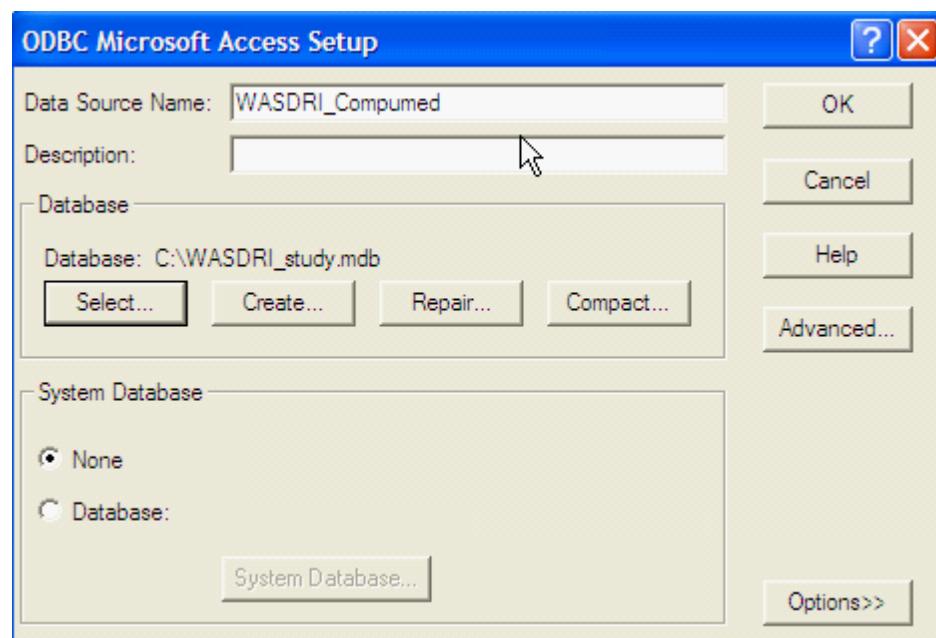
Select "Microsoft Access Driver" from the list below.



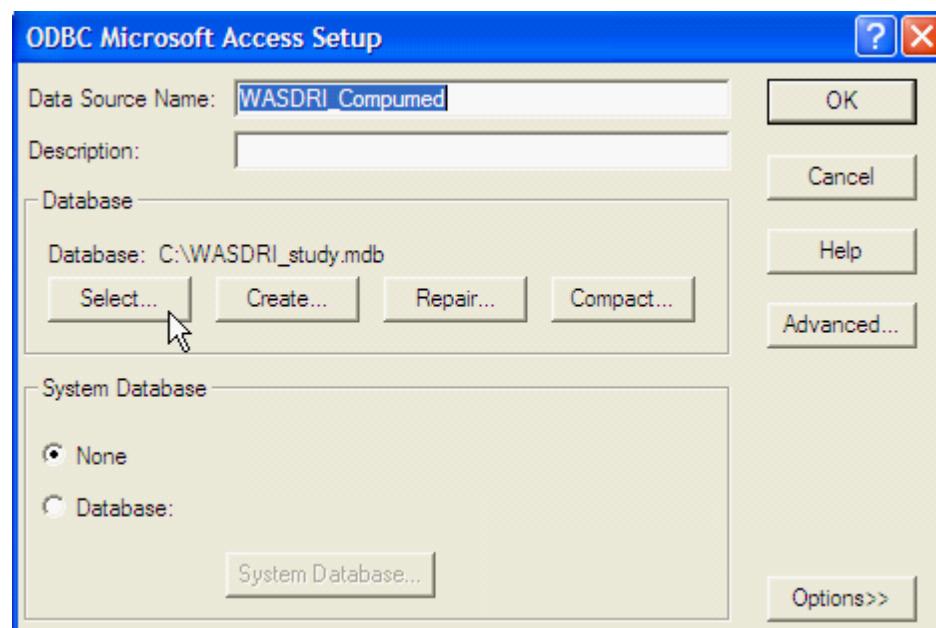
Using the DSN name in the script file, insert this name as the DSN in the setup window.

```
CompumedicsDB_test - Notepad
File Edit Format View Help
[Connect]
DSN=WASDRI_Compumed
Database=c:\WASDRI_study.mdb
UID=Admin
Password=

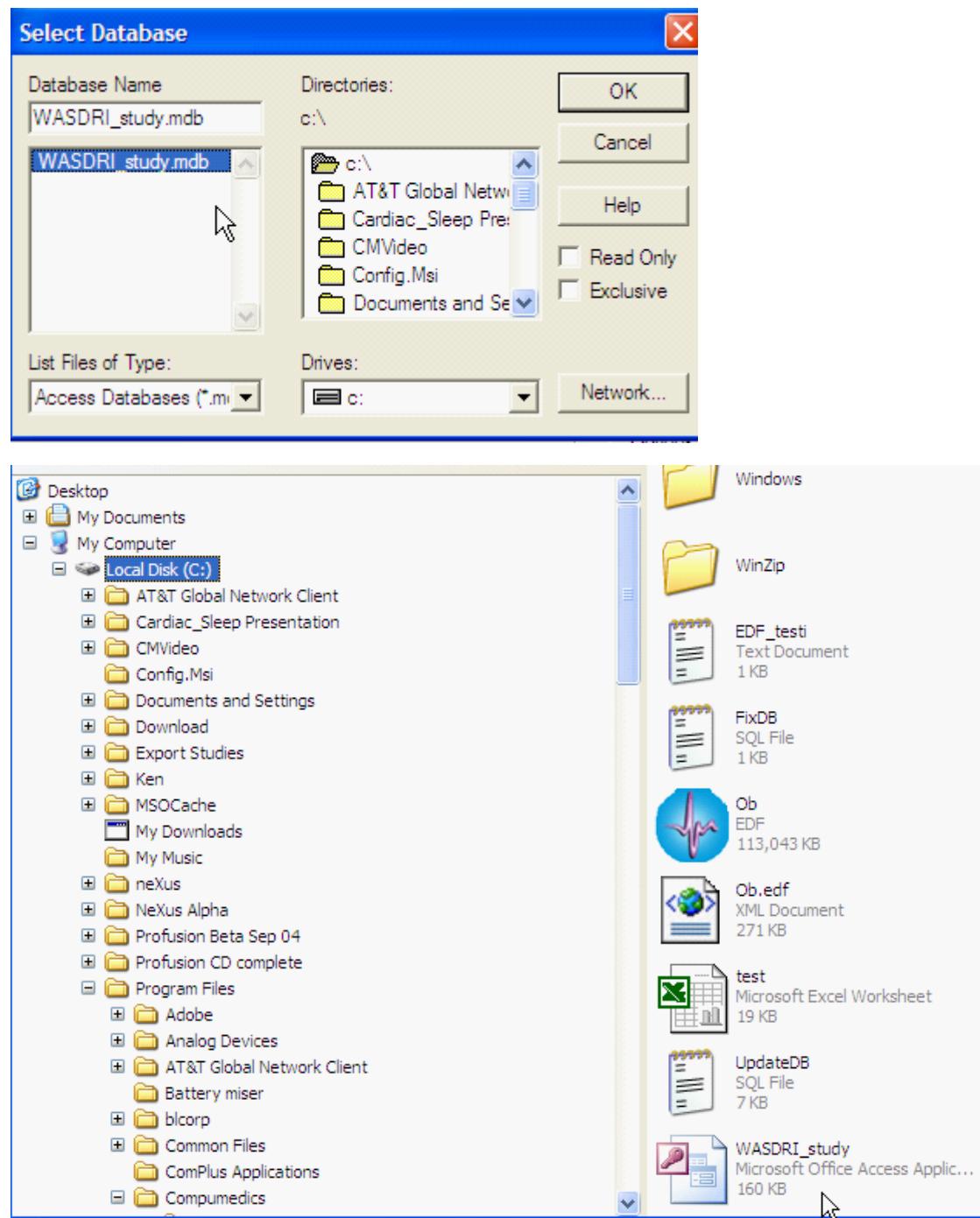
[Fields]
Method=Append
TargetTable=Compumed
Numberoffields=10
```



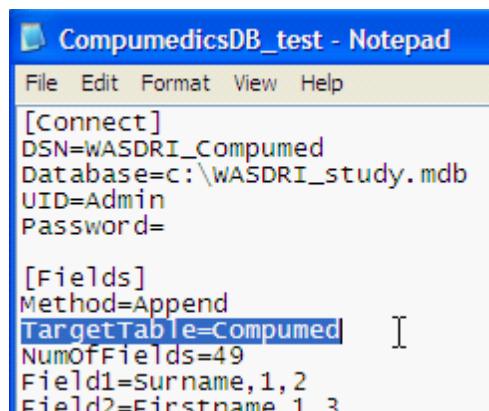
Select the Database to use.



In this example the Database is located in the C:/ directory.



Also create the “Table” name the same as in the script.



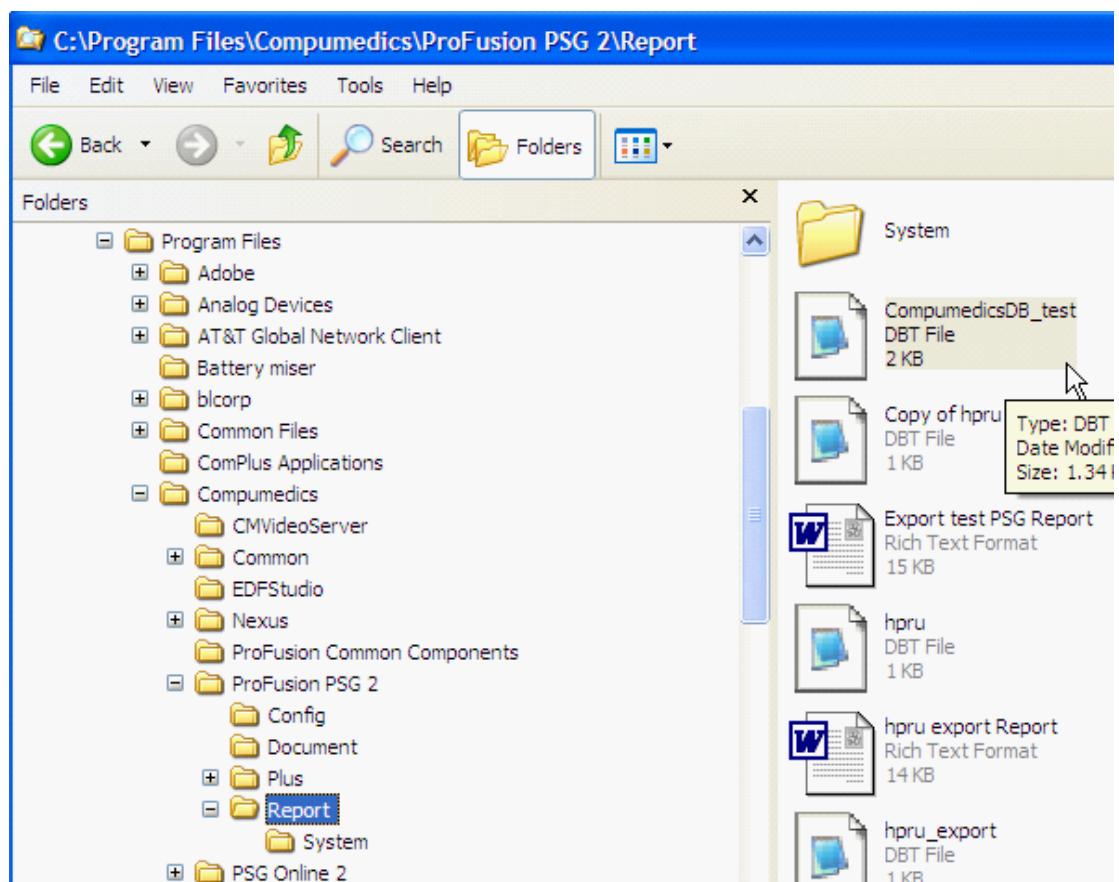
```

CompumedicsDB_test - Notepad
File Edit Format View Help
[Connect]
DSN=WASDRI_Compumed
Database=c:\WASDRI_study.mdb
UID=Admin
Password=

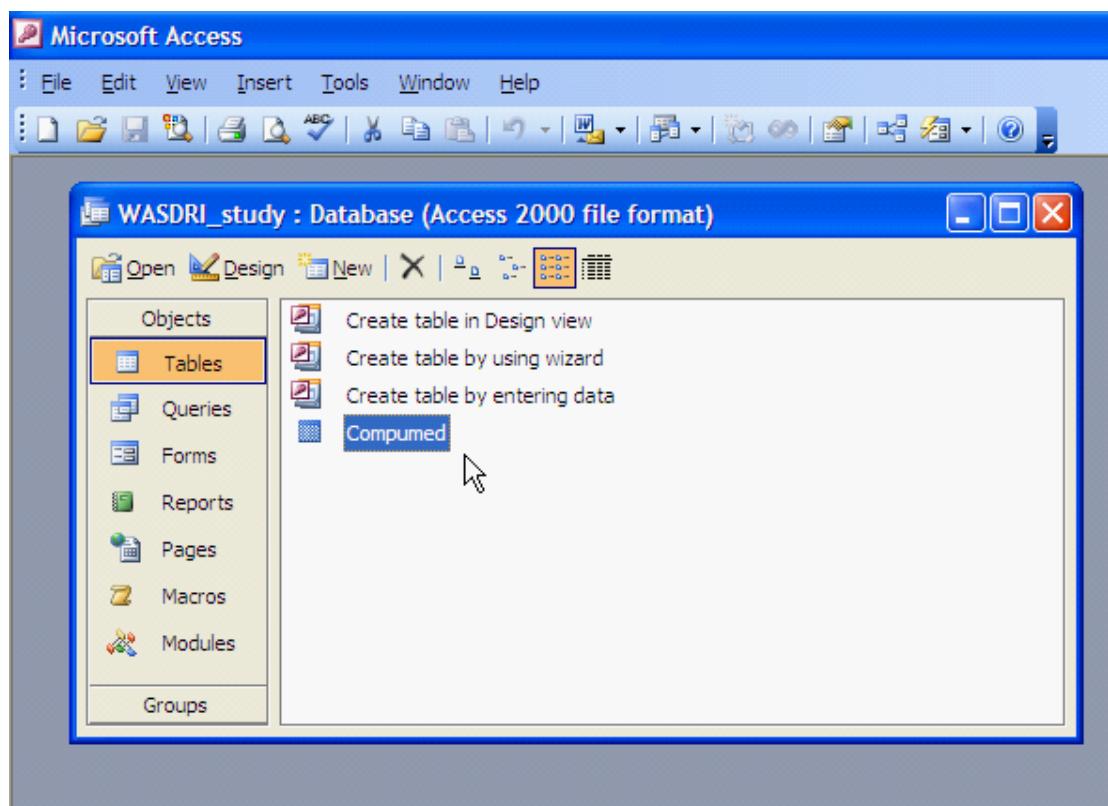
[Fields]
Method=Append
TargetTable=Compumed
NumOfFields=49
Field1=Surname,1,2
Field2=Firstname,1,3

```

The Script is to be located in the “/Compumedics/Profusion PSG 2/Report” directory.



Access Database used as same.



The screenshot shows the Microsoft Access application window titled "WASDRI\_study : Database (Access 2000 file format)". The menu bar includes File, Edit, View, Insert, Format, Records, Tools, Window, and Help. The toolbar contains various icons for database management. On the left, a navigation pane lists "Objects" such as Tables, Queries, Forms, Reports, Pages, Macros, and Modules. The "Tables" option is highlighted with a yellow selection bar. To the right of the navigation pane, there is a list of table creation options: "Create table in Design view", "Create table by using wizard", "Create table by entering data", and "Compumed". The word "Compumed" is highlighted with a blue selection bar. The main area displays the "Compumed" table in Datasheet view. The table has columns: ReportID, ReferenceID, Surname, Firstname, StudyDate, DOB, Sex, and RefDoc. The data includes rows for Wilkinson (Kathleen) with ReportID 1-6, Armstrong (Stuart) with ReportID 7-8, and other entries like L (T), H (M), D (B), etc. The last row is an AutoNumber entry.

	ReportID	ReferenceID	Surname	Firstname	StudyDate	DOB	Sex	RefDoc
1	A2019501	Wilkinson	Kathleen			17/04/1925	F	-
2	A2019501	Wilkinson	Kathleen			17/04/1925	F	-
3	A2019501	Wilkinson	Kathleen			17/04/1925	F	-
4	A2019501	Wilkinson	Kathleen			17/04/1925	F	-
5	A2019501	Wilkinson	Kathleen			17/04/1925	F	-
6	A2019501	Wilkinson	Kathleen			17/04/1925	F	-
7	D0260714	Armstrong	Stuart			20/12/1956	Male	-
8	D0260714	Armstrong	Stuart		20/02/2004	20/12/1956	Male	D Hillman
9	L	T			4/02/2002	21/03/1951	Male	Dr N Man
12	H	M			5/02/2002	4/04/1941	Female	Dr D Lang
13	D	B			10/12/2001	23/03/1933	Female	
14	081016	subject1b	autoset		26/04/2004	19/04/1966		
15	reference	E-SERIES	CPAP		10/12/2001	12/02/1949	female	
16	PAH1	OSA CSA MIXE	1		2/02/1996	5/10/1954	M	
17		Obstructive Apr			28/10/2003	27/12/1966	Male	
18		Obstructive Apr			28/10/2003	27/12/1966	Male	
*	(AutoNumber)							

## 11.2 Export to ASCII

Rawdata for any single input can be exported to an ASCII file or to the clipboard in ASCII format for manipulation by third party applications. The data is exported from individual inputs.

For example, you can export data from the SpO2 input for an epoch or range of epochs. After extraction, when the data is read in a third party spreadsheet the data will appear as in the figure below:

	A	B
1	SpO2 Rate: 10Hz	
2		98.5
3		98.8
4		98.8
5		98.5
6		98.3
7		98.8
8		98.5
9		98.8
10		99
11		99
12		98.8
13		98.8
14		98.8

*Data extracted from the SpO2 input and viewed in a spreadsheet*

Further, ProFusion PSG3 allows you to specify a decimal value for a closer proximity. However, the decimal facility is included only for DC calibrated inputs and not other inputs.

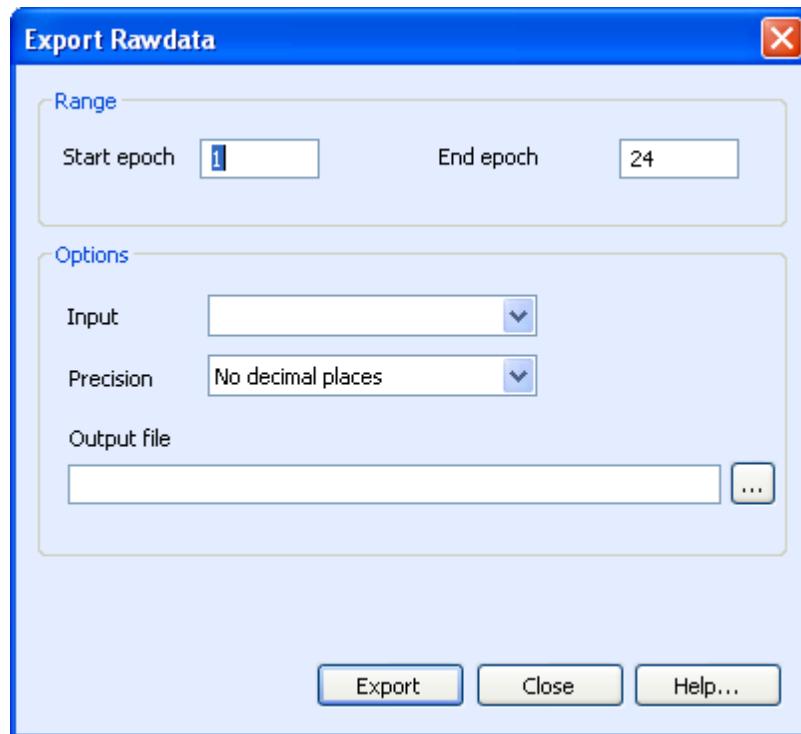


**DC Input data (Position, SpO2, or CPAP) is represented in the unit of measure used when recording the input.**

Input	Data Description	Precision
Amplitude calibrated	Data extracted is in volts	Ignored
Uncalibrated	Data extracted is in A/D value	Ignored
DC Calibrated	Data extracted is in the specific equipment's unit of measurement e.g. %, mmHg	Included
Stepped calibrated	Data extracted is in the exact step label e.g. Left, Right, Front, Back	Ignored

## To export an input

1. Select **Tools > Export as ASCII...** The Export Rawdata dialogue box appears:

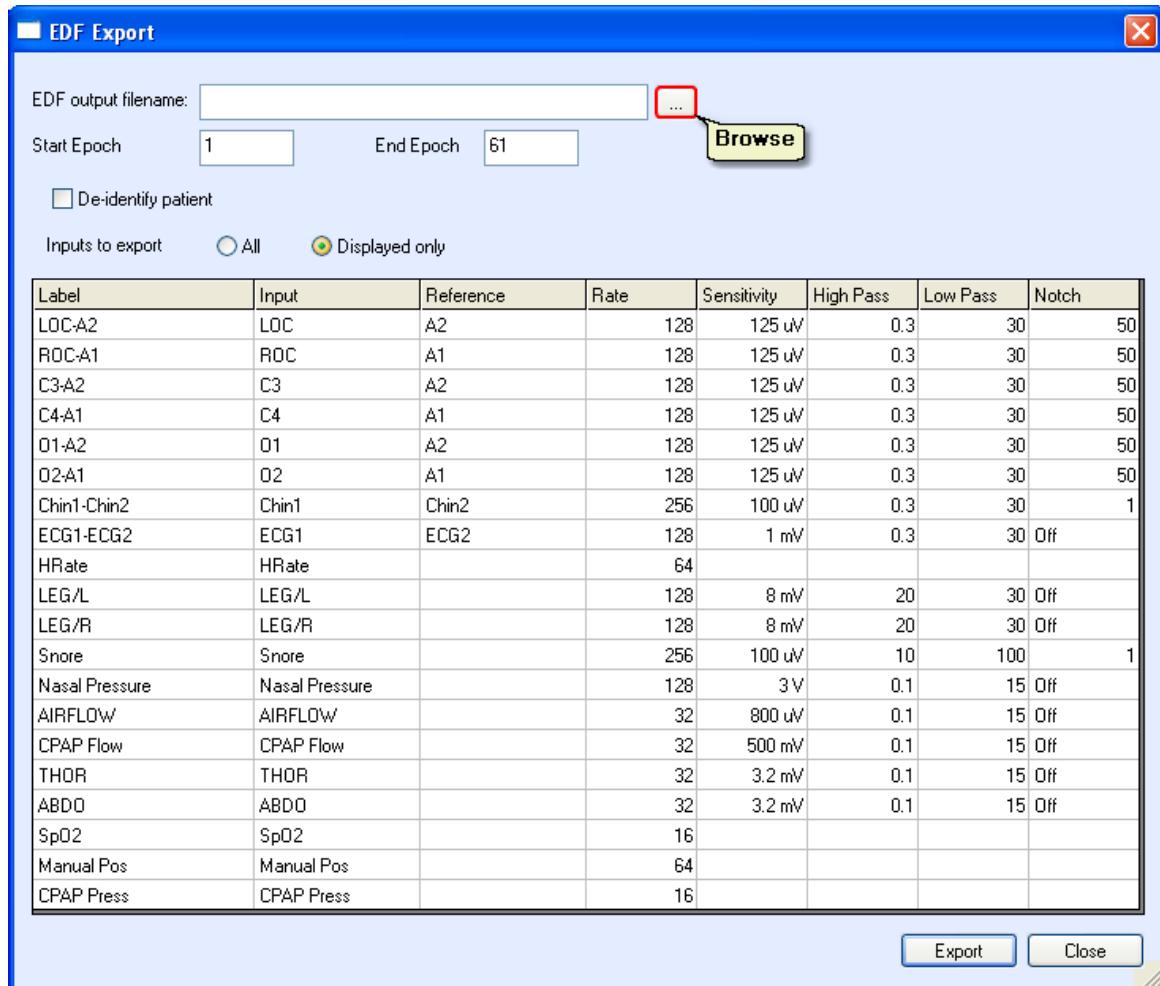


2. Enter the epoch range in the Start and End fields, if required
3. Select the input to be exported
4. Select the decimal place in the Precision field if applicable
5. Enter an output filename. Use the Browse button to select the directory to save to
6. Select Export to extract the data

## 11.3 Export to EDF

Rawdata can be exported in EDF for use in non-Compumedics PSG readers.

To export to EDF, select **Tools > Export as EDF...** The EDF Export dialogue box appears:



Enter an EDF output filename, using the browse button to select the output directory.

If only a range of epochs are required, define the Start and End epochs.

Checking the De-identify patient checkbox will remove all identifying information from the study in the output file.

Check one of the *Inputs to Export* boxes:

- **All** - All recorded inputs will be exported as monopolar signals (ie: unreferenced). No filters will be applied to the recorded data.
- **Displayed only** - Data will be exported as it is currently displayed (defined by the Trace Layout). Any referenced signals will be exported with the reference applied, and

display filters and sensitivities will be applied to the data before export.



**Tip** You can select a new sampling rate for any input to re-sample the input.

Click *Export* to perform the EDF export. The output file can be found in the selected directory.



**Info** To [Import an EDF](#)<sup>[23]</sup> file into Profusion, use the Profusion Study Manager, or neXus EDF Import Utility.

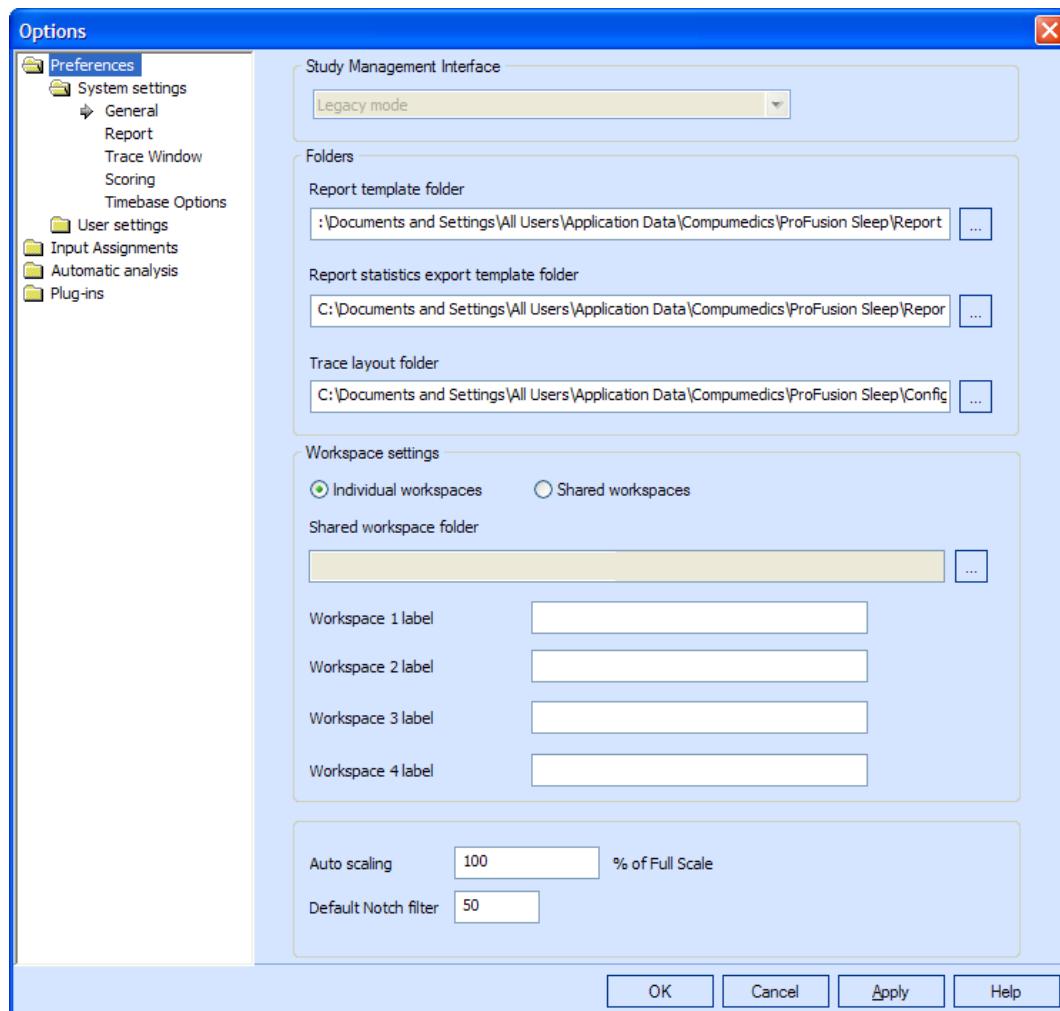
## 12 Options

The Options for Profusion PSG 3 can be opened by selecting **Tools > Options** from the menu.

The Options window will open. The initial view will be the [General](#)<sup>[184]</sup> Options, with further items for:

- [Report](#)<sup>[186]</sup>
- [Trace Window](#)<sup>[186]</sup>
- [Scoring](#)<sup>[187]</sup>
- [Timebase Options](#)<sup>[188]</sup>

Click on the required item to open the relevant options.



Initial Options view

## 12.1 System Settings

These are settings that apply globally to each computer. The System Settings are separated into the following categories:

**General** - Settings for Study Management Interface, Workspace Settings, Configuration Folders and basic display options.

**Report** - Settings for Report Viewer and reporting options

**Trace Window** - Settings for event marker display properties

**Scoring** - Advanced scoring options

**Timebase Options** - Display options for gridlines

### 12.1.1 General

The General Options are settings that apply to all studies opened on this workstation.

#### Study Management Interface

If you have Compumedics Nexus management system installed, select Nexus Mode to use the Nexus management system. To access studies that have not been migrated into Nexus, select Legacy Mode.

If you are not using Nexus, this option will not be available.

#### Report Template Folder

Select the folder where your report templates are saved. The default directory is C:\Documents and Settings\All Users\Application Data\Compumedics\ProFusion Sleep\Report

This can be set to a shared network folder to make the same templates available to all users.



**Info** MSLT and MWT reports need to be named MSLT.rtf and MWT.rtf, and must be saved in a folder named System, which needs to be under the specified Report Template Folder. The default directory is C:\Documents and Settings\All Users\Application Data\Compumedics\ProFusion Sleep\Report\System. If a different directory path is specified, create a folder named System under that directory and save your MSLT and MWT reports there.



**Info** Report templates must be saved in Rich Text Format (.rtf). See the [Report Configuration](#)<sup>145</sup> section for details.

## Report Statistics Export Template Folder

Select the folder where templates for exporting data to external third-party applications are saved. The default directory is *C:\Documents and Settings\All Users\Application Data\Compumedics\ProFusion Sleep\Report*

This can be set to a shared network folder to make the same templates available to all users.

## Trace Layout Folder

Select the folder where trace layouts are saved. The default directory is *C:\Documents and Settings\All Users\Application Data\Compumedics\ProFusion Sleep\Config*

This can be set to a shared network folder to make the same trace layouts available to all users.

# Workspace Settings

## Individual Workspaces

Check the Individual Workspaces box if you want each user to be able to define their own Workspaces. The labels for Individual Workspaces are then set under the [User Preferences](#) [188] options.

## Shared Workspaces

Check the Shared Workspaces box if you want all users on this workstation to use the same Workspaces.

Set the Shared Workspace Folder (This can be set to a shared network folder to make the same Workspaces available to all users across the network).

Enter labels for each of the Workspaces to be used.

## Autoscale

Sets the Autoscale percentage. When the Autoscale button is clicked, the appropriate traces are rescaled to make their minimum and maximum values display across this percentage of the Trace label's size. This setting applies to PSG Online (including Page Back) and Profusion PSG 3.

## Notch Filter Frequency

The Notch Filter Frequency should be set to the mains frequency in the country of recording (50/60Hz). This setting applies to PSG Online (including Page Back) and Profusion PSG 3.

## 12.1.2 Report

### Viewer

Choose whether to use Microsoft Word, or the Profusion Internal Viewer, for viewing and editing reports. Reports can be edited using the normal Microsoft Word features, or using the [Internal Viewer controls](#)<sup>[169]</sup>.

### Heart Rate

Choose the sample population size to be used during heart rate calculations for inclusion in reports (100%, 99%, 95% or 68%)

### Standard Sleep Onset Rule

Choose the rule that you want to use for calculation of the sleep onset time:

- **3 epochs of any stage of sleep**
- **3 epochs of stage 1 or 1 epoch of any other**
- **1 epoch of any stage of sleep**

### MSLT / MWT Sleep Onset Rule

Choose the rule that you want to use for calculation of the sleep onset time in MSLT and MWT reports:

- **3 epochs of any stage of sleep**
- **3 epochs of stage 1 or 1 epoch of any other**
- **1 epoch of any stage of sleep**

## 12.1.3 Trace Window

The Trace Window options define how marked events are to be displayed.

### Event Display Properties

The appearance of the listed events (in Pageback mode, and Profusion PSG3) can be defined here. The background colour and text colour can be defined by clicking in the colour bar and selecting a new colour from the drop-down box. Ticking the Outline box changes the appearance of the event from a filled box to a thin outline box in the Trace Window.

## 12.1.4 Scoring

The Scoring Options are settings for both the Pageback mode in PSG Online 3, and for study review in Profusion PSG 3.

### Auto Save

**Profusion PSG 3** can automatically save your work at 1, 2, 5 or 10 minute intervals. Set the Auto Save interval.

The Auto Save feature can also be turned off, but this is not recommended.

### Auto Paging in Scoring

This option is designed to make manual sleep scoring easier by automatically scoring the current epoch with the last scored sleep stage, and advancing to the next epoch. Selecting a different sleep stage will update the stage to be scored and continue auto-paging. The auto-paging can be stopped by pressing the spacebar. Auto Paging during manual scoring is initiated by pressing a sleep stage key or on of the Auto paging icons.

The Auto Paging icons are found on the navigation toolbar, with the speed of page updates controlled by the drop-down box (available speeds are 0.5, 1, 2, 3 times the recorded speed, or maximum speed):



### Automatic Arousal Association

Set to **Yes** to turn on Automatic Arousal Association. Click [here](#) for details on how this feature works.

### Automatic PLM Scoring

The Automatic PLM scoring feature allows manually marked limb movements to be analysed as they are marked or deleted. When the individual limb movements meet the criteria defined by the PLM Episode parameters, a PLM episode marker will automatically be inserted.

### Hypopnea Classification

When this is set to **No**, the only hypopnea classification available for respiratory events will be a general *Hypopnea*.

When this is set to **Yes**, hypopneas can be classified as *Obstructive*, *Mixed* or *Central Hypopnea*.

### Arousal Overlapping

Set to **No** to prevent different arousal types from overlapping.

### Default Respiratory Length

Set a default length (seconds) for respiratory events when single-click event marking is

used. Requires the [Standard Event Marking Mode](#)<sup>[104]</sup> to be selected. The default settings is 10 seconds.

### Default Arousal Length

Set a default length (seconds) for arousals when single-click event marking is used. Requires the [Standard Event Marking Mode](#)<sup>[104]</sup> to be selected. The default settings is 3 seconds.

### Default Limb Movement Length

Set a default length (seconds) for individual limb movements when single-click event marking is used. Requires the [Standard Event Marking Mode](#)<sup>[104]</sup> to be selected. The default settings is 1 second.

### Default Snore Length

Set a default length (seconds) for snores when single-click event marking is used. Requires the [Standard Event Marking Mode](#)<sup>[104]</sup> to be selected. The default settings is 1 second.

## 12.1.5 Timebase Options

Configure the vertical grid markers for each timebase.

### Set the Minor Interval

A dashed vertical marker will display at this interval.

### Set the Number of Minors per Major

A solid vertical marker will be displayed at this rate.

For example, for a 30 second timebase:

- Minor Interval = 1s => dashed marker every second
- No of Minors per Major = 15 => solid marker every 15 seconds.

## 12.2 User Settings

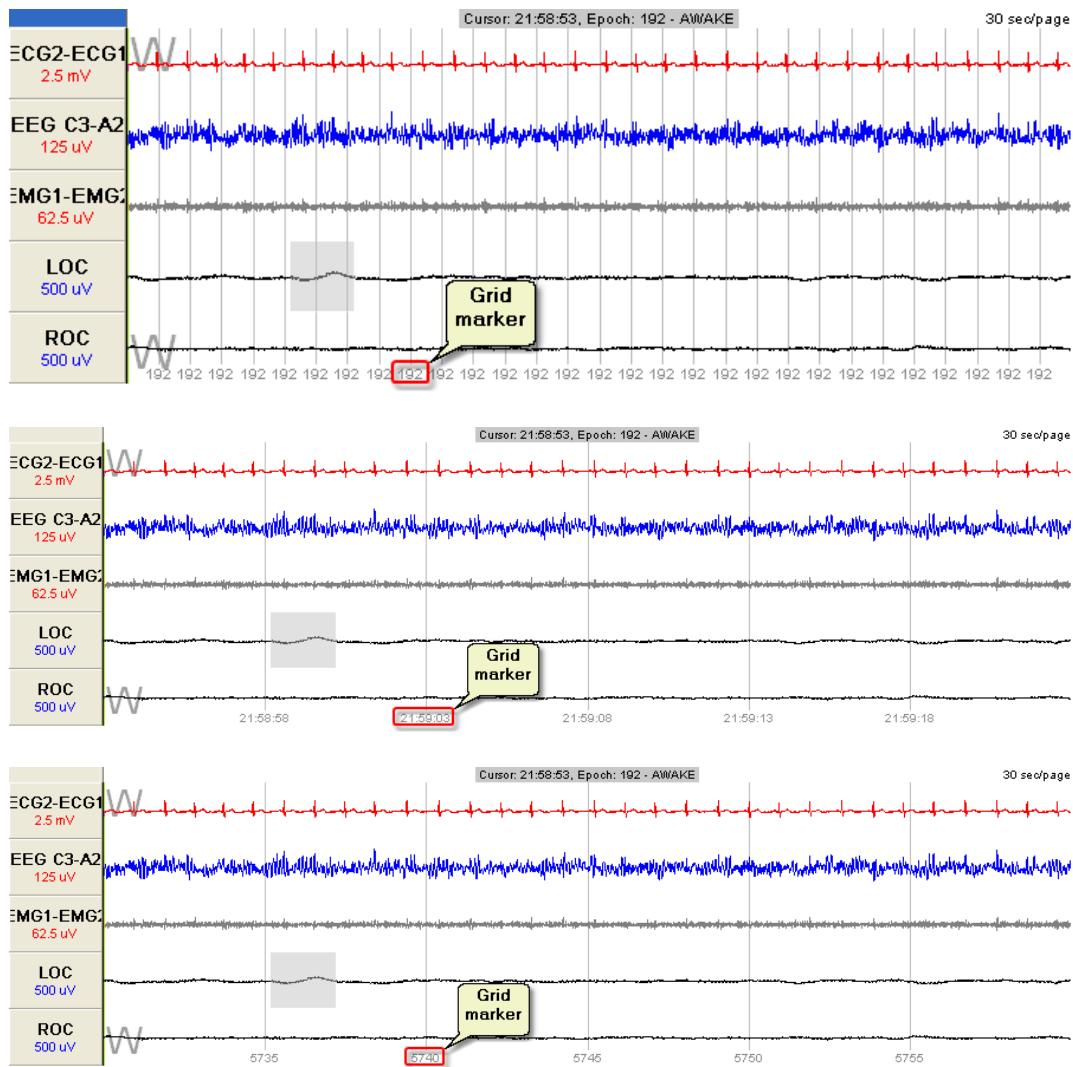
The User Preferences are settings that apply to the current Windows login, allowing different users to set certain personal preferences.

### Enable Transparency User Interface

Check this box to set transparency for New Event boxes and the Epoch Summary window.

### Grid Display

Toggles the type of gridlines displayed in the Trace Window, marked by Epoch number, Time of Day, or number of Seconds From Start of Study. Click the images below to see the different grid markers.



## Peak Point Detection

Calibrated inputs can be displayed with a numeric value (enabled through the properties window or the Trace Layout configuration).

If this option: *Detect peak points when displaying numeric values on Upper/Lower traces*, is enabled, the software will attempt to display numeric values only at the high and low points of that trace.

If this option is not selected, a numeric value will be displayed at a regular interval, determined by the screen resolution and the timebase.

## Rawdata Horizontal Scroll Bar

If this option is enabled, a horizontal scrollbar will be displayed at the bottom of each trace pane. This can be used for navigation through the study.

## Smooth Drawing

If this option is enabled, anti-aliasing techniques are applied to the traces to make them appear smoother. Note that this option applies the smoothing as each page is displayed and will slow the page update significantly.

## Event Display Enable/Disable

Ticked boxes allow each type of event to be shown in the Trace Window. The appearance of the events is a [System Setting](#).

The following events can be toggled on/off:

- Respiratory Events - can be displayed and edited
- PLM episodes
- Arousals
- Spindles - Sleep spindles can be displayed but not edited
- Delta H waves - High amplitude delta waves ( $>75\mu V$ ) can be displayed but not edited
- Eye movements - Eye movements can be displayed but not edited
- Gain Changes - for S-Series devices only.
- Impedance tests
- User events
- EtCO<sub>2</sub> Peaks
- pH events
- Lost packets events
- SpO<sub>2</sub> events
- Snores
- Tooltips
- Trace layout changes
- PTT events

## Workspace Settings

If the Workspace has been set for Individual Workspaces (in the General Options window), enter the names for each of the Workspaces. This can be used if different users on the same computer need to have different names and settings for their Workspaces.

## Scoring

Each respiratory input can be assigned a default respiratory event type. When you mark an event on that input, the type defined here will automatically be used (regardless of whether the *Select last event type* feature is on).



Info

In AASM Mode, there are four respiratory inputs: Hypopnea detection, Apnea detection, Effort1 and Effort2.

**In R&K Mode, there are three respiratory inputs: Primary, Effort1 and Effort2.**

Set the respiratory event type to be marked on each of the respiratory inputs (as set in Input Assignments).

When set to *Prompt*, a popup box will appear each time an event is marked, from which the event type is selected (unless *Reselect last event type* is enabled).

## 12.3 Input Assignments

The Input Assignments define which inputs are used for analysis and marking of events. For example, if the Hypopnea Detection input is set as a nasal pressure input, that nasal pressure signal will be analysed for hypopneas, and hypopnea events will be displayed and can be edited on the nasal pressure trace.

For each input in the three categories (Sleep, Respiratory and Other), select the Input channel, and where required the Reference channel, High and Low Pass filters, Notch filter and Lag Time. In the Arousals tab, select either a User Defined type, or one of three pre-defined types (Respiratory, Limb Movements, or Spontaneous). When pre-defined event types are used, arousals will be correctly classified when associated with respiratory or limb movements according to set rules. See the [Study Analysis](#)  section for more details on Automatic Arousal Association.

Most of the Automatic Analysis is performed on a single input. However, for some of the Sleep and Respiratory analyses more than one input is used.

For more details on Input Assignments, see the [Study Analysis](#)  section.

### Sleep

The EEG, EMG and both EOG inputs (as defined by the Input Assignments) are analysed to determine the sleep stage and arousals. The Automatic Analysis parameters for sleep staging and arousals are based on the AASM sleep staging rules, and if required can be changed to use the R&K sleep staging rules by changing the [Scoring Mode](#) . The Automatic Analysis looks at the frequency spectrum of each 30 second epoch, and features such as sleep spindles, k-complexes, EMG amplitude and eye movements to determine the sleep stage and arousals.

The input assignment for Light is most often going to be a Manual Input. Only epochs with the Light input set to Off will be included in statistics.



**Tip** The analysis of stage REM works best when the EOG is configured such that vertical eye movements are in phase and horizontal eye movements are out of phase. This is most easily achieved by placing both EOG electrodes lateral and inferior to the outer canthus, and referencing both to a common referential electrode at Fpz.



**Tip** For the most accurate sleep staging results, run both automatic sleep staging and arousal detection. This is the default setting for online analysis. Staging analysis can be performed in Profusion PSG 3 without including arousals.

## Respiratory

Detection of events is performed using the inputs assigned for Apnea detection, Hypopnea detection, Effort 1 and Effort 2 (in R&K mode the same input (named Primary) is analysed for apneas and hypopneas). The analysis parameters can be customised to best match your scoring criteria and marking preferences. See the [Analysis Parameters](#)<sup>72</sup> section for more details.

## Arousal

Up to five different arousal types can be defined. The Input Assignments specifies on which input each arousal type will be marked. If the [Automatic Arousal Association](#)<sup>58</sup> feature is to be used, it is recommended that the same input is set for all pre-defined arousal types. If user-defined arousal types are to be used, these can be configured to be marked on unique inputs if you want. A combination of pre-defined and user-defined arousal types can be configured eg:

- Pre-defined - Spontaneous  
Respiratory  
Limb Movements
- User-defined - RERA (Respiratory Effort Related Arousal)  
Other

## 12.4 Automatic Analysis

These are the parameters for Automatic Analysis. Click the links to view the information on configuring the parameters for each section:

- [Respiratory Parameters](#)<sup>72</sup>
- [Limb Parameters](#)<sup>87</sup>
- [Arousal Parameters](#)<sup>70</sup>
- [Other Parameters](#)<sup>92</sup>
- [pH Parameters](#)<sup>96</sup>

## 12.5 Plugins

If you have **ECGFree** or **Profusion PSG Plus** installed, you can configure the settings for these here. Refer to the documentation for these products for details.

## 13 My Workspace

The latest Compumedics software suite introduces the concept of My Workspace™, which allows you to customise the layout and configuration of the display for **PSG Online 3** and **Profusion PSG 3**. These Workspaces can be saved and recalled at any time. The trace layout is also saved as part of the Workspace, so for example you can define different Workspaces for Diagnostic and CPAP studies, and the traces will be displayed as desired without having to open the trace layout manager. A Workspace can extend over dual monitors.

**PSG Online 3** allows one Workspace to be saved per device (E-series, Siesta, and SomtéPSG).

**Profusion PSG 3** allows up to four Workspaces to be saved. These Workspaces can either be shared by all users, or set up as individual Workspaces which are automatically loaded when you login to Windows. This can be configured in **Tools > Options > General**.

**Info** If you choose to share Workspaces, you must enter a shared workspace folder. This can either be on the local workstation, or a network path. To prevent changes being made to shared Workspaces, open the specified folder from My Computer and set the Workspace files to read-only format.

Below is a diagram with the various elements that can be used in a Workspace highlighted. See the Online Help for more details.



## 13.1 Configuring My Workspace

A Workspace comprises several elements, or windows, which can be selected from the **View** menu. Using the Trace window as the core window, all other windows can be moved around by the drag and drop method. A variety of display options for individual windows are available:

### Floating Windows

Windows can be placed anywhere in the Workspace and resized. The window must be pinned open first.

- Click the drawing pin icon to pin open.
- Click and drag the title bar to move the window. To restore a floating window to its previous position, double click the title bar.



**Tip** For dual monitor setups, floating windows can be placed on either monitor.

### Docked Windows

Windows can be fixed to the top, bottom or either side of the main Workspace or other window, and either pinned open or set to Auto Hide.

- Click and drag the title bar and move the cursor over one of the positioning icons. As the cursor moves over different windows, these icons will change position to indicate where the window can be docked. A blue overlay shows where the window will dock.

### Auto Hide

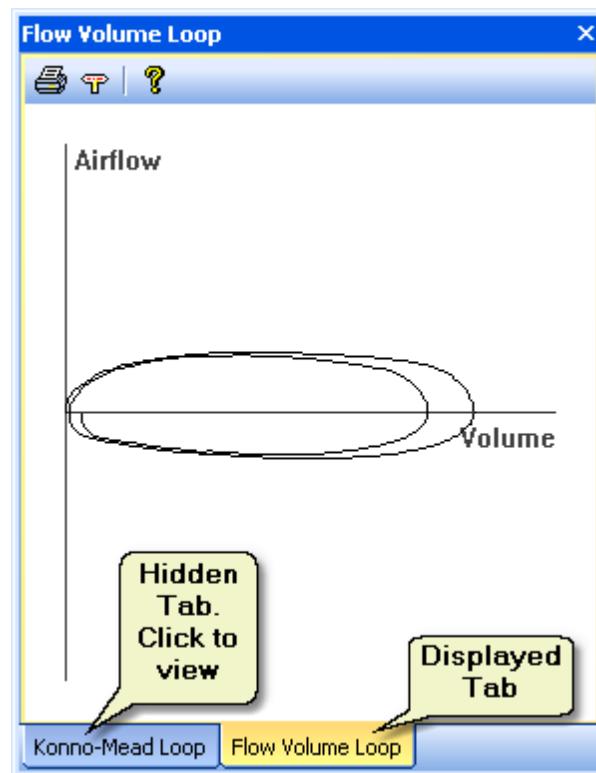
Docked windows (and the Epoch Summary window while floating) can be set to automatically hide when not in use, but still be readily accessible. When hidden, docked windows will display a small text box on the edge of the Workspace close to where you have docked the window. Floating windows will display just the title bar in its usual location.

- To unhide a window, simply place the cursor over either the docked text box or the title bar, and the window will open. Moving the cursor away from the window will auto hide it again.
- To keep the window open, click inside the window. This will keep the window open until you click in another window.
- To set a window to auto hide, click the drawing pin icon in the title bar. Click again to pin the window open.

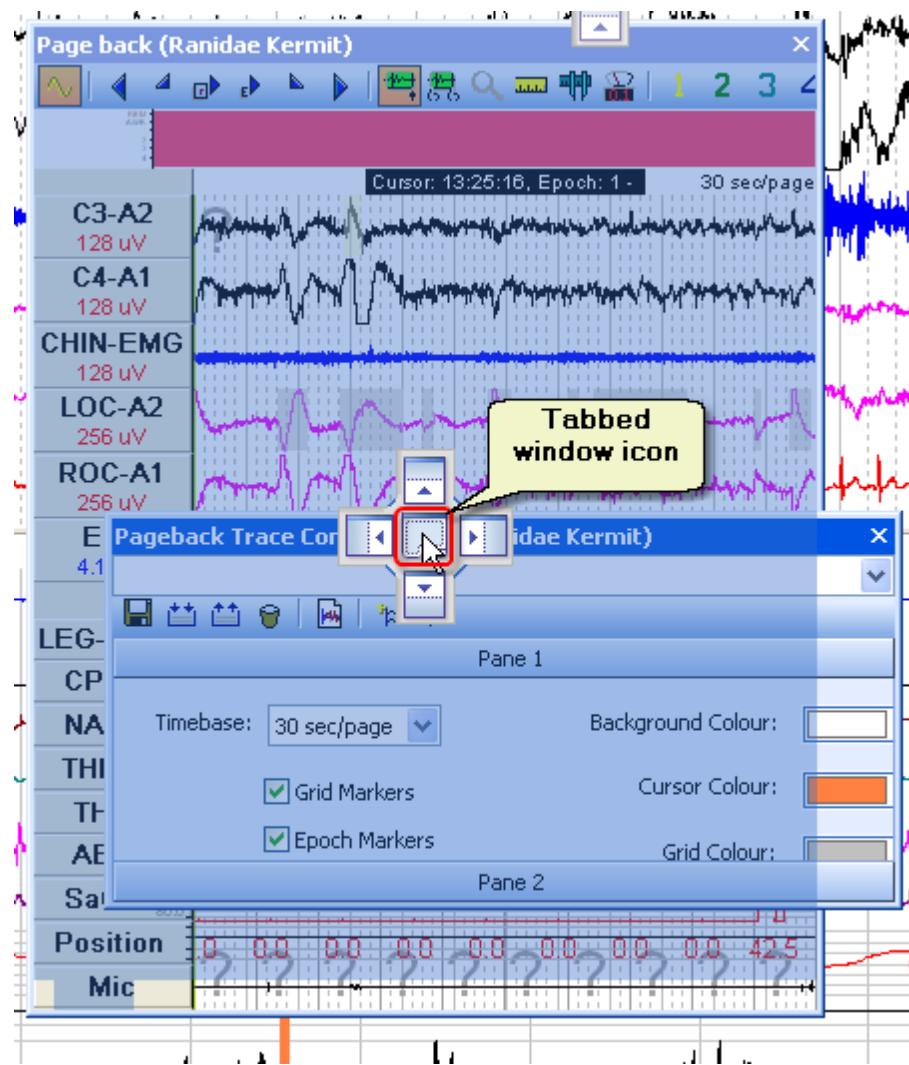
Auto hide	
Pinned open	

## Tabbed Windows

Some windows can be docked to other windows in a tabbed format.



To create tabbed windows, use the central positioning icon when docking one window to another.



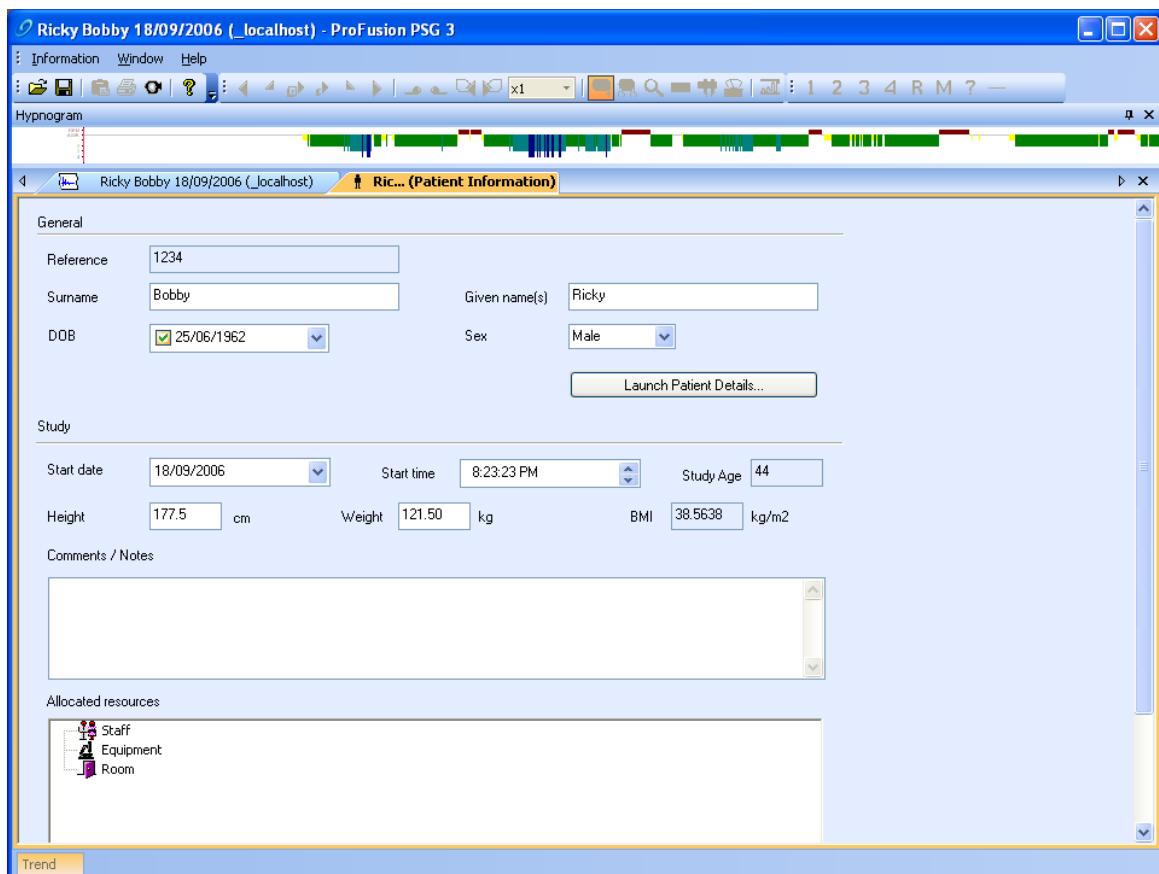
To remove a window from a tabbed format, click the tab and drag it away from the other windows. It can then be positioned using any of the other Workspace options.

## Tabbed Documents

Some windows can be displayed as tabbed documents, with the tabs appearing at the top of the trace panes window.

Some windows can only be displayed as Tabbed Documents.

- Right-click on the title bar and select *Tabbed Document*. Note that not all windows can be displayed this way.
- Tabbed windows can be displayed in a new group, either vertically or horizontally. Right-click the tab title bar to select either of these options.



## 13.2 Keyboard Customisation

All keyboard commands for PSG Config, PSG Online 3 and Profusion PSG 3 can be customised to your preferences. These keyboard commands are saved as part of My Workspace™, so different shortcuts can be configured for each Workspace.

### To customise a keyboard shortcut

1. Select Tools > Customise
2. Click the **Keyboard** tab
3. Select the command Category
4. Select the Command
5. Set the Accelerator for Profusion PSG 3. Any current key assignment for that command will be displayed
6. Click in the *Press New Shortcut Key* box, and press the desired shortcut key
7. Press **Assign** to set the customised key

## To remove a keyboard shortcut

- 1-5. Follow steps 1-5 above to select the correct shortcut
1. Select the **Current Key**
2. Click *Remove* to remove the shortcut



**Info** To restore the default keyboard shortcuts, open Tools > Customise, and select the Keyboard tab. Press Reset All. A dialog will ask you to confirm that you want to reset the keyboard shortcuts.

Current keyboard shortcuts can be viewed and printed for reference: **Help > Show keyboard shortcuts**

Select the Category, or All Commands



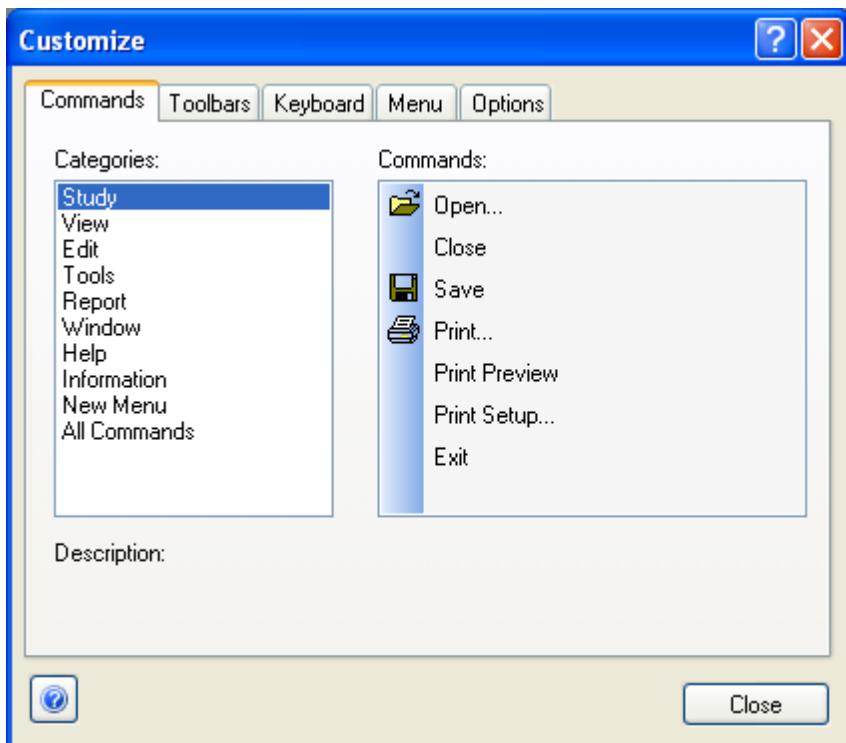
Print the keyboard shortcuts



Copy the keyboard shortcuts to the clipboard.

### 13.3 Other Customisation

Select **Tools > Customise** to open the Customise options dialogue box. The tabs in the Customise box contain settings to enable the user to alter the interface as desired.



#### Commands

With this tab open, the Toolbar can be customised by dragging icons about. The Toolbar is 'unlocked' and the icons already on it may be dragged to a different location, or removed from the toolbar by dragging the icon off it. To add a function to the Toolbar, find that function in the menus in the Commands tab and drag it to the Toolbar.

#### Toolbars

Text labels can be added to the buttons on the Toolbar by ticking the Show Text Labels checkbox. The box can also be used to create an entirely new Toolbar, however this functionality is reserved for future expansion.

#### Keyboard

A shortcut key can be defined for commonly used functions. Find the command for the keyboard shortcut in the left column. Click on the Press New Shortcut Key text box to focus the cursor in it, then press the key desired for the shortcut. Click the Assign button. Keyboard moderators (Ctrl, Alt, Shift) can be combined with regular keys for shortcuts. See the [Keyboard Customisation](#)<sup>[197]</sup> section for more details.

## Menu

The Menu Shadows and Menu Animations box allows the user to alter the appearance of the menus. The other functions on this tab are reserved for future expansion.

## Options

Ticking Show ScreenTips on Toolbars makes a descriptive text label to appear when the mouse hovers over a button on the Toolbar. Large Icons increases the scale of the icons on the Toolbars, enhancing their visibility.

## 13.4 Saving My Workspace

Once you have setup your Workspace it can be saved for future use.

### **Save as Default Workspace**

You can save the configured Workspace as a default layout. One default Workspace can be saved per workstation, and once a default Workspace is saved it will be loaded every time a study is opened on the workstation.

To save the current Workspace, select **Window > Save current workspace as default** from the menu.

### **Saving Custom Workspaces**

Four different Workspaces (apart from the default) can be saved and subsequently loaded in Profusion PSG 3. These are then available for use with any study.

Before saving Workspaces, you need to check whether the workstation has been configured for Individual or Shared Workspaces. Go to **Tools > Options > General** and check the Workspace Settings.

If the system has been set for Shared Workspaces, then all users of the computer will access the same Workspaces, and the Workspace configuration files will be saved in the specified folder. Labels for each of the four custom Workspaces can be entered.

If the system has been set for Individual Workspaces, then each user can define their own Workspaces (the Workspaces are loaded when logging in). The labels for Individual Workspaces are entered in the User Settings window.

To save a custom Workspace, select **Window > Save Workspace**, and then select one of the four Workspaces.

 **Tip** The keyboard shortcut for saving each Workspace is shown in the menu.

### **Loading Custom Workspaces**

To load one of the custom Workspaces, select **Window > Load Workspace**, and select one of the available Workspaces. If labels have been defined, the Workspace Label will appear in the **Load Workspace** menu.

 **Tip** The keyboard shortcut for loading each Workspace is shown in the menu.

## 14 Menu Items

### ***Study Menu***

#### **Open...**

Opens the Open Study dialogue box. Most menu options are not available until a study has been opened.

#### **Close**

Closes the currently active study

#### **Save**

Saves any changes made to the current study.

#### **Print...**

Prints the currently active view in the Trace Window.

#### **Print Preview**

Shows a preview of how the above print will appear.

#### **Print Setup...**

Opens the Print Setup dialogue box, where printing options can be adjusted.

### ***View Menu***

#### **Toolbars**

Toggles the appearance of the toolbar indicated.

#### **Review Windows**

Toggles the appearance of various sub-windows involved in scoring studies:

##### **Hypnogram**

Displays sleep staging and associated video

##### **Trend**

Displays selected trace summaries

##### **Epoch Summary**

Opens the Epoch Summary window

**Scored Events**

Lists scored events in the study. Event types can be toggled on and off via the drop-down box at the top of the window

**Study Log**

Displays the list of User and Hardware Events for the study

**Trace Layout Properties**

Describes the overall layout of the Trace Window

**Digital Video**

Displays the digital video for the time point marked by the cursor

**Flow Volume Loop**

Displays airflow vs volume to assist in identifying respiratory events

**Konno-Mead Loop**

Displays thoracic vs abdominal effort to assist in respiratory assessment

**Properties**

Displays individual properties for the selected component, updates when a new component (eg trace label) is clicked

**Statistics**

Displays summary statistics of the study

**Study Configurations**

Displays the recording configuration used for the study

**Observation Chart**

Displays the Observation Chart

**Patient Calibration**

Displays the Patient Calibration recording, allowing the reviewer to assess the quality of the calibration

**Patient / Study Information**

Displays the Patient / Study Information window

**Scoring Comparison**

Displays the Scoring Comparison window, which describes the concordance between selected score sets.

**SpO<sub>2</sub>/TcO<sub>2</sub> Overview**

Displays saturation values, compressed to facilitate viewing long time periods.

## Custom Views

If you have Profusion Plus installed, you can select the FFT view or the Continuous Wavelet view.

## Navigation Controls

Allow navigation through the study through the menu system.

## *Edit Menu*

### Score Data Set

Allows the reviewer to manage the Score sets:

#### New

Creates a blank data set, ready for a new analysis

#### Select...

Select an existing data set from a list for this study

#### Details...

Show details of the current data set

#### Import...

Import an external data set into this study

#### Export...

Export the current data set to file

#### Delete...

Delete a data set from a list for this study

## Find / Replace Scored Events

Similar to the function in a word processor, this allows events of a certain kind to be found in the study, and replaced with a new event if required. Multiple event types can be selected.

## Clear Hypnogram

Blanks the current hypnogram. A confirmation box is presented to avoid accidental selection.

## Delete Scored Events

Opens a dialogue box in which all events of a certain kind can be deleted between given epoch numbers. Deleted events can also be limited to awake epochs or automatically scored events.

**New User Event...**

Opens the New Event dialogue, allowing the reviewer to annotate the study.

**Bi-Level Entries**

Opens the Bi-Level Pressure dialogue box.

**Reclassify scored event to...**

Allows the active scored event to be changed to a different event.

**Sleep Staging**

Score the current pane 1 epoch as a particular stage.

**Body Position**

Alters the body position of the current epoch

**Stage Light**

Alters the Stage Light setting of the current epoch

**Digital Video**

Can reset selection of video for trimming, or delete video completely.

**Tools Menu****Automatic Analysis**

Opens the Automatic Analysis dialogue box. Select desired components of the Automatic Analysis to be performed.

**Export as ASCII / EDF**

Opens the Export Data dialogue box, allowing data to be shared between labs which use different software.

**Options**

Opens the Options dialogue box

**Customize**

Opens the Customize box which allows for the customization of certain features such as which toolbars are shown and which hotkeys are assigned to a function.

## **Report Menu**

### **New...**

Opens the New Report dialogue box where the kind of report and template can be selected.

### **Export...**

Allows a report to be exported

### **Open...**

Open an existing report from a list

### **Delete...**

Delete an existing report from a list

## **Window Menu**

### **Window**

Opens a new tab in the Trace Window, allowing an additional view of the active study.

### **Save Current Workspace As Default**

Saves the current arrangement of Profusion PSG3 so that it presents itself this way when it is next opened.

### **Save / Load Workspace**

Save up to four Workspace layouts which can be later loaded as required.

### **Windows...**

Select from the series of tabbed windows in the main Trace Window. There is also an individual list of windows in the menu where the window can be directly selected without going through this option.

## **Help Menu**

### **Contents...**

Opens this help documentation.

### **Index...**

Opens this help documentation to the keyword Index.

**Search...**

Opens this help documentation to the keyword search panel.

**About PSG Config...**

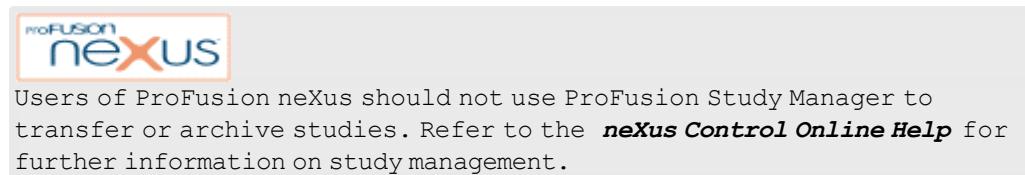
Opens an information box which displays the current version and build number of the PSG software.

## 15 Study Manager

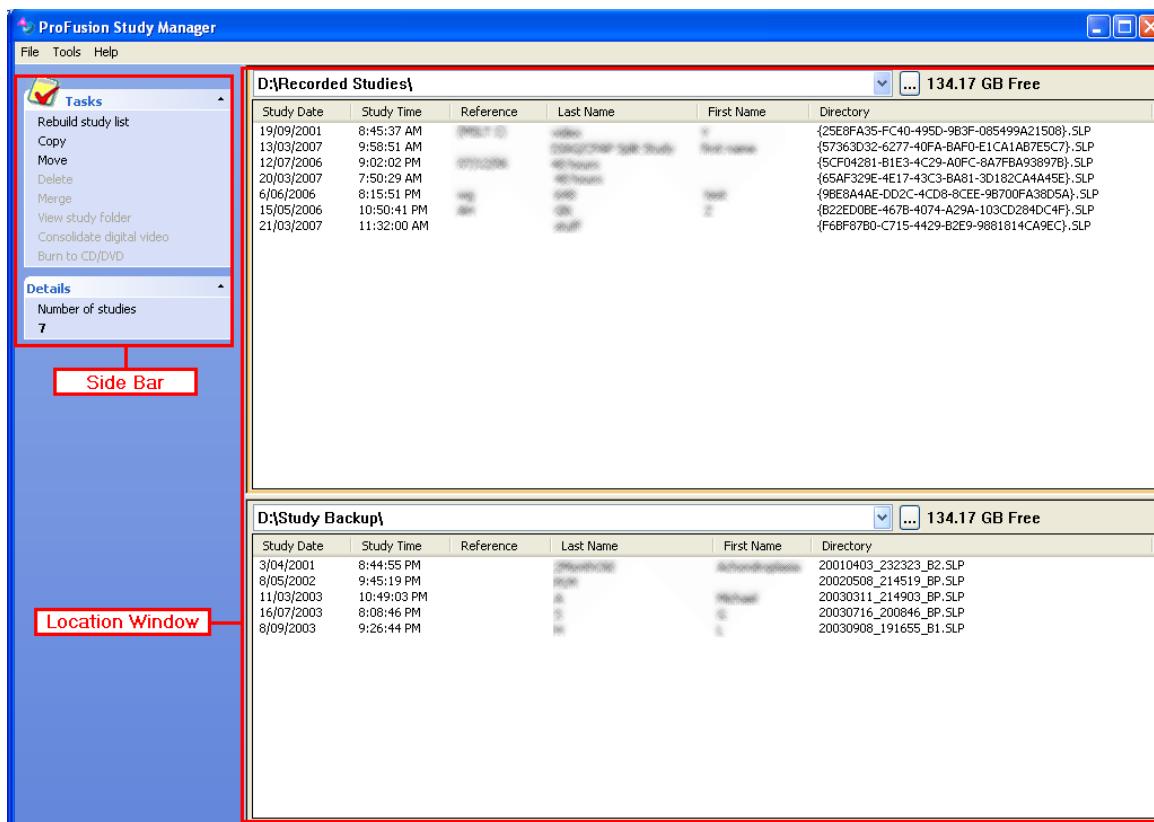
**Profusion Study Manager** provides a number of useful functions for users to manage their Compumedics PSG studies stored on their workstation and local area network.

The user has the option to copy or move studies to archive media or network backup locations, delete unwanted studies, merge components of interrupted studies, and consolidate video to the current study location. The user also has the option to import EDF study data for viewing studies from laboratories that do not use Compumedics software.

Profusion Study Manager may be open and in use at the same time as ProFusion PSG. Studies may be managed in Profusion Study Manager at any time, unless the study in question is currently open in Profusion PSG.



Profusion Study Manager has two panes: the [Location Window](#)<sup>[209]</sup> and the [Side Bar](#)<sup>[211]</sup>.



## 16 Location Window

The Location Window is used to select the studies that you wish to manage. Management tasks can be selected from the [Side Bar](#)<sup>21†</sup> or the individual studies can be dragged from one location to another to copy them.

The Location Window is split into two panes, each referring to an independent location. This location may be a folder on the local drive or any visible network location. Each pane will display valid **Profusion PSG** studies that are stored within the indicated location. These studies can then be managed using the [Tasks](#)<sup>21†</sup> in the Side Bar.

The screenshot shows the Location Window interface with two main sections:

- D:\Recorded Studies\**: Displays a list of recorded studies. The columns are Study Date, Study Time, Reference, Last Name, First Name, and Directory. The directory column shows the full path of each study file. The total free space is 134.17 GB.
- D:\Study Backup\**: Displays a list of study backup files. The columns are Study Date, Study Time, Reference, Last Name, First Name, and Directory. The directory column shows the backup paths. The total free space is 134.17 GB.

Study Date	Study Time	Reference	Last Name	First Name	Directory
19/09/2001	8:45:37 AM	00000000			{25E8FA35-FC40-495D-9B3F-085499A21508}.SLP
13/03/2007	9:58:51 AM	00000000			{57363D32-6277-40FA-BAF0-E1CA1AB7E5C7}.SLP
12/07/2006	9:02:02 PM	00000000			{5CF04281-B1E3-4C29-A0FC-8A7FBA93897B}.SLP
20/03/2007	7:50:29 AM	00000000			{65AF329E-4E17-43C3-BA81-3D182CA4A45E}.SLP
6/06/2006	8:15:51 PM	00000000			{9BE8A4AE-DD2C-4CD8-8CEE-9B700FA38D5A}.SLP
15/05/2006	10:50:41 PM	00000000			{B22ED0BE-467B-4074-A29A-103CD284DC4F}.SLP
21/03/2007	11:32:00 AM	00000000			{F6BF87B0-C715-4429-B2E9-9881814CA9EC}.SLP

Study Date	Study Time	Reference	Last Name	First Name	Directory
3/04/2001	8:44:55 PM	00000000	Achenbach	Michael	20010403_232323_B2.SLP
8/05/2002	9:45:19 PM	00000000			20020508_214519_BP.SLP
11/03/2003	10:49:03 PM	00000000			20030311_214903_BP.SLP
16/07/2003	8:08:46 PM	00000000			20030716_200846_BP.SLP
8/09/2003	9:26:44 PM	00000000			20030908_191655_B1.SLP

The study list provides information, where available, on the study properties: Study Date, Study Time, Reference Number, patient's Surname, patient's Given Name, and the Directory which holds the study files.

To select a study, simply left-click on the desired study. The details of the selected study are shown in the [Details](#)<sup>21†</sup> section, and the actions that can be performed on the selected study are shown in the [Tasks](#)<sup>21†</sup> section.

**Info** To select multiple studies, hold the Shift or Ctrl keys while clicking the desired studies.



**Tip** To quickly copy studies from one location to another, click and drag the study (or multiple studies) from one location pane to the other.

## 16.1 Setting Source and Destination

Either pane may be set as the active or source pane by simply clicking anywhere within it. The source pane is indicated by a yellow border. The other pane then becomes the inactive or destination pane. Studies highlighted in the Source pane will be copied or moved to the Destination pane when the relevant action is selected in the Side Bar.

The amount of free space on each Study Path is displayed next to the Browse button.

To enter a new Study Path, select the Browse button to the right of the location box. The user can then manually navigate through the file system to the required location. The location box also keeps a history of previously viewed locations, which can be accessed using the drop-down arrow on the side of the location box.



**Info** If a folder is listed in the drop-down list, but no longer exists, **Study Manager** will ask if you want to remove this folder from the list when you try to select it.



**Tip** If the lower pane is not visible, click at the bottom of the first pane and drag up. The cursor will look like this when you are in the right spot:



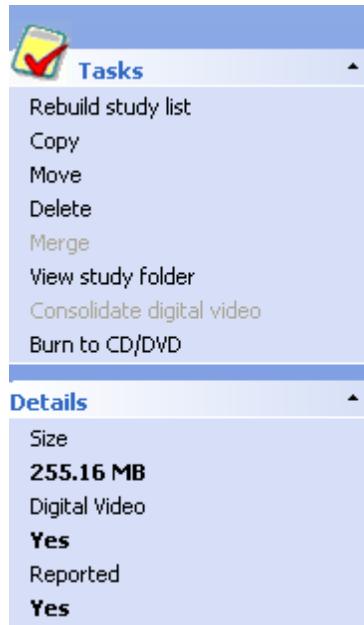
## 16.2 Opening Studies

Any study can be opened from **Study Manager**. Select the drive and folder that the study folder is contained in either the top or bottom location pane.

Double-click the study name to open it in Profusion PSG3 for review or scoring.

## 17 Side Bar

The **Study Manager** Side Bar is split into two sections: [Tasks](#)<sup>[211]</sup> and [Details](#)<sup>[214]</sup>.



The Tasks section allows you to select actions for the selected study or studies.

The Details section displays information about the selected study or studies.

### 17.1 Tasks

The Tasks section lists the tasks available in **Study Manager**. Tasks that are available for the selected location or study are listed in black. Tasks that are not usable for the currently selected location or study are listed in grey.

The tasks that can be performed are:

- [Rebuild Study List](#)<sup>[212]</sup>
- [Copy](#)<sup>[212]</sup>
- [Move](#)<sup>[212]</sup>
- [Delete](#)<sup>[212]</sup>
- [Merge](#)<sup>[213]</sup>
- [View Study Folder](#)<sup>[213]</sup>

- [Consolidate Digital Video](#)<sup>[213]</sup>
- [Burn to CD/DVD](#)<sup>[214]</sup>

## Tasks

### Rebuild Study List

Study Manager creates a list when it first accesses a location, and maintains the list as studies are copied, moved or deleted from the various folders. If another program has been used to copy, move or delete studies (eg: Windows Explorer), the study list will not be correct. If the study you are looking for does not appear in the study list, select this option.



**Info** A separate study list is maintained for each study directory. If the study you are looking for does not appear after rebuilding the study list, check the other study directories (eg: network drives).

### Copy

This option copies the highlighted study in the active/source location pane to the location displayed in the inactive/destination location pane.

If the study has Digital Video, it is consolidated during the copy and resides in the study folder in the new location. The original study location is completely unaltered by the copy process.

### Move

The move function is identical to the copy function, except that after a successful copy, the original study is then deleted from the active/source location.

### Delete

This option deletes the selected studies from the source or destination path. If these studies are stored locally (local drives) and there is sufficient space available in the recycle bin, the software will attempt to move these studies to the recycle bin rather than permanently deleting them. Studies deleted over a network or from the Command Prompt will not be transferred to the Recycle Bin.

Once the studies are located in the recycle bin, you can recover them by double clicking the recycle bin icon on the desktop and selecting required study folder(s) and select File and Restore menu option.

Limit the size of the Recycle Bin to a reasonable amount of Hard Drive space (10 or 20%), periodically empty the Recycle Bin, and ensure that there is enough Hard Drive space to allow for large study files to be transferred to the Recycle Bin. If the Windows Recycle Bin features have been disabled, deletion is final. Data cannot be restored once a study has been deleted from a drive.

## Merge

This option allows two studies with identical setups to be merged. This is most often used for interrupted studies that are later resumed, such as after a brief power outage. The two studies to be merged must have identical input configurations for both actual inputs recorded and sample rates. Multiple studies can be merged sequentially.

If a derived trace such as Derived Heart Rate has been added to one study, it must either be added to the other study or removed from the first to ensure the inputs match.

## View Study Folder

This option opens the study folder in Windows Explorer. This allows the user to easily manage the individual files which comprise the study.



**Info** Copying, moving or deleting studies using Windows Explorer will not update the Study List.

## Consolidate Digital Video

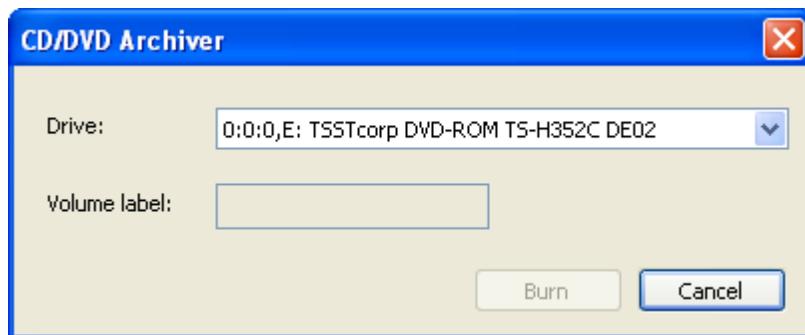
When a study with Digital Video is recorded, the Digital Video is initially kept in a separate location, and can be consolidated to keep the study files together for ease of management. The action of copying or moving a file will move the video files to the destination location.

The Consolidate Digital Video option allows the original study and video to be consolidated together for ease of management on the acquisition system.

## Burn to CD/DVD

This option copies the selected studies to a local CD/DVD burner. Discs are automatically formatted by the Burn to CD/DVD tasks, so only unformatted discs or discs formatted by Profusion Study Manager should be used.

After selecting the tasks, the CD/DVD Archiver dialogue box appears.



If more than one CD/DVD drive is installed, select the appropriate drive from the drop-down list. If required, enter a name for the disc in the Volume Label field.

Select 'Burn' to start the copy.

**Info** Use the **Burn to CD/DVD** task to archive studies to discs. The **Copy** and **Move** tasks are only for non-removable media.

Studies are copied in a multisession format, allowing further studies to be copied at a later date. When the current burn is finished, the CD will be ejected, and is ready for viewing in other CD/DVD drives.

**Info** There is a significant difference in performance between quality CD/DVD blank discs and cheap blanks. Lower quality discs are more likely to produce failed burns and generally have a significantly shorter lifespan. Compumedics recommends using quality discs and maintaining them according to the manufacturer's instructions.

The Burn to CD/DVD option is not selectable if the study is no longer at the location indicated. Rebuild the study list to confirm which studies are present.

## 17.2 Details

The Details section gives a summary of the highlighted study(s) or location. The Details view can take a few seconds to retrieve and interpret the information from the study folders.

When a study location is first selected, the Details section will display the number of studies contained in the location.



When a single study is selected, the Details section will show the size of the selected study, and whether that study has associated video and/or reports.



When multiple studies are selected, the Details section will show the number of studies selected and the total size of all the studies. This can be used to check whether the selected studies will fit on a CD or DVD for archiving.



## 18 Menu Items

The Study Manager menu offers a small selection of functions. The most common functions used in Study Manager are found in the Side Bar.

The following menus are available:

- [File](#)<sup>[216]</sup>
- [Tools](#)<sup>[216]</sup>
- [Help](#)<sup>[219]</sup>

### 18.1 File Menu

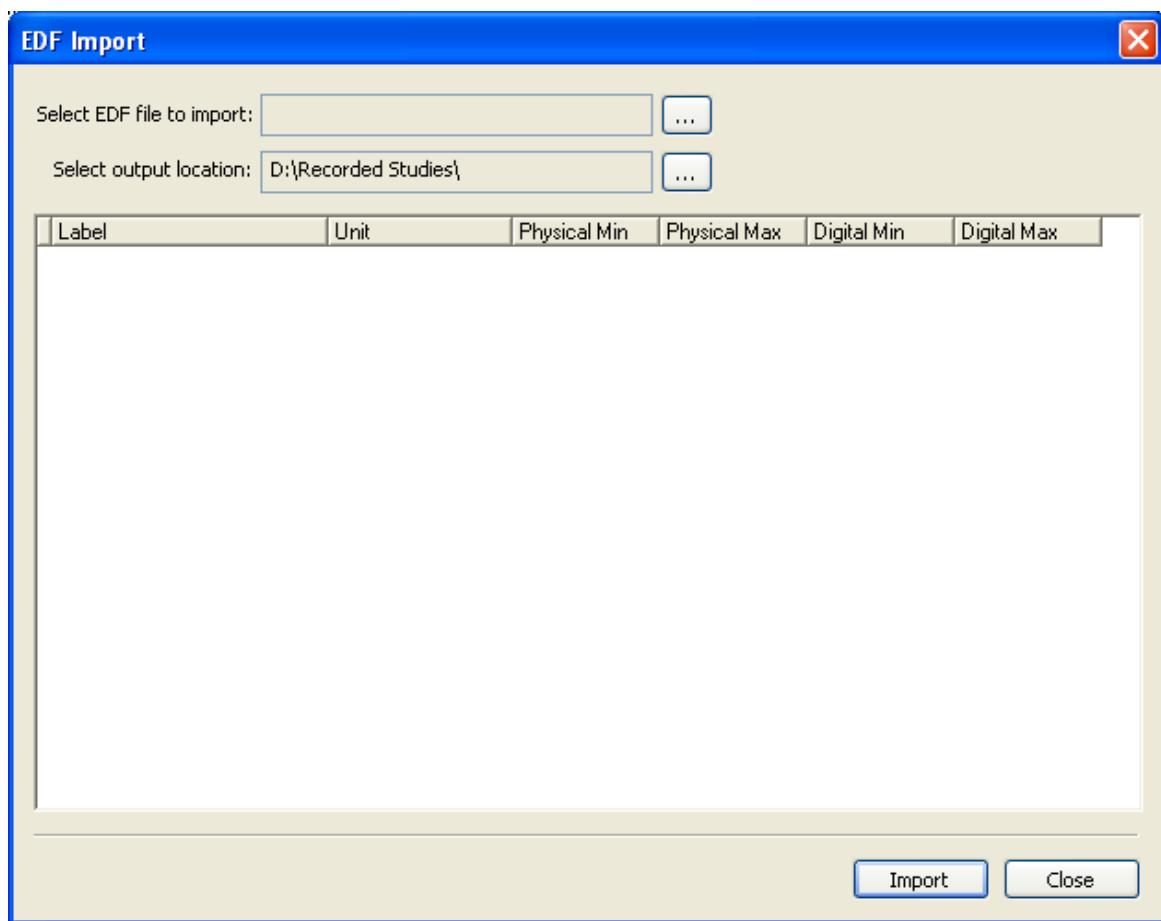
#### Exit

Closes the Study Manager application.

### 18.2 Tools Menu

#### Import EDF study

This function opens the EDF Import dialogue box, which allows the user to import studies which are in the EDF format. The user is required to select the EDF file and a destination location to store the converted study. Click **Import**. The study can now be opened in **Profusion PSG 3**. Click the image below for a screenshot:

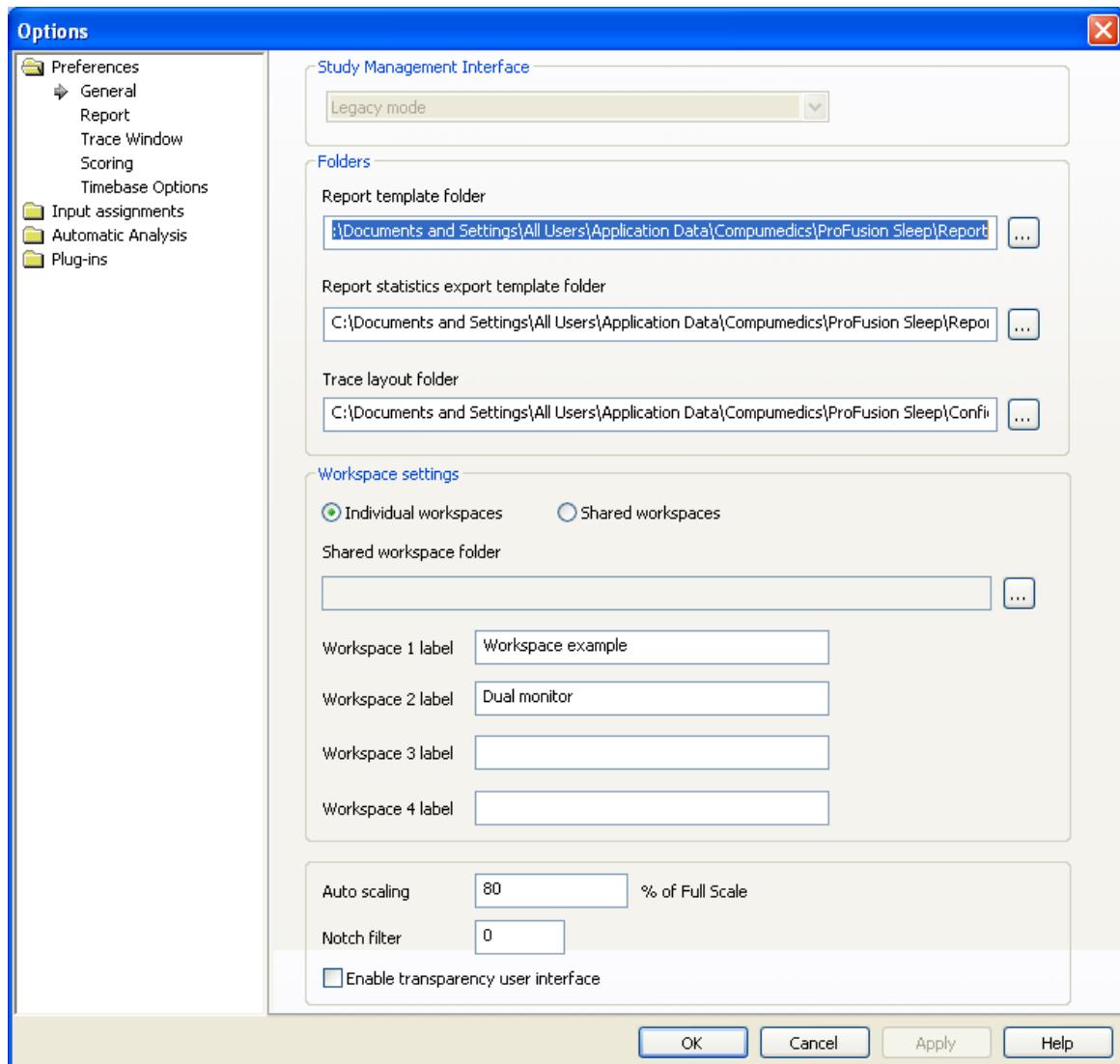


## Export Study List

This function exports the study list for the active folder as a text (\*.txt) or comma separated value (\*.csv) file.

## Options

This item opens the Options window:



The Default Study Path defines which Study Path will be displayed in the top pane when **Profusion Study Manager** is first opened. You can select None, the Last Used path or a User Specified path.

The Study Path drop down list maintains a list of all the previously specified directories. To clear this list, click the Clear History button.

## 18.3 Help Menu

### Contents

Opens this online help file to the Contents page.

### Index

Opens this online help file to the Index page.

### Search

Opens this online help file to the Search page.

### About Study Manager

Displays the About Study Manager information box which displays the software version of Study Manager.

## 19 Product Support

If you have a question regarding the operation of **ProFusion Sleep 3**, first look in this User Guide or consult the Online Help for the solution. To access the Help, press **F1** or select **Contents** from the **Help** menu.

If you are unable to find the answer in your documentation, contact Compumedics Product Support on:

Australia      **1800 244 773**

International    **+61 3 8420 7396**

USA             **1-877-294-1346**

or your authorised representative.

If you call, you should be sitting in front of your computer system with the **ProFusion Sleep 3** software running at the section you have the question on. You should also have this User's Guide at hand. When you call, please provide the following information:

- The version of software and operating system being used
- A description of what happened and what you were doing when the problem occurred
- The exact wording of any messages that appeared on your screen.
- A description of any attempts made to fix the problem

If you need to ship the equipment, pack the equipment and its accessories carefully to prevent shipping damage. All relevant accessories should accompany the equipment.

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**Compumedics E-mail Address**

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[www.compumedics.com](http://www.compumedics.com)

## 20 Troubleshooting

There are troubleshooting guides for:

- [Reviewing studies](#)<sup>[22]</sup>
- [Scoring studies](#)<sup>[224]</sup>
- [Reporting studies](#)<sup>[225]</sup>

## 20.1 Reviewing a Study

Symptom	Possible Cause	Possible Solution
Cannot find a study in Profusion PSG 3	1. Incorrect drive specified 2. Study List out of date	1. Change to correct drive at the bottom of the Select Study dialogue box 2. Click Rebuild Study List
Do not see digital values such as oximetry	1. Numeric display not enabled	1. Double click on trace label and select Numeric Display
Cannot see a trace	1. Wrong Trace Layout configuration file selected 2. Input needs to be added to current display 3. Input was not recorded	1. Select the correct Trace Layout from the Trace Layout List 2. In the Trace Layout Properties dialogue box, select New or Insert to add a trace 2a. Use the drop down menu to scroll to desired input 3. If the Input is not available in above scroll down menu, it was not recorded
Trace is too small or too large	1. Incorrect zoom factor 2. Incorrect Upper /Lower limits	1. Increase / decrease zoom factor by placing mouse cursor on top of trace label and use up and down arrows on keyboard, or the mouse scroll wheel, to adjust zoom 1a. Right-click the trace label and select Autoscale 2. For calibrated traces, open the Properties box (double-click the trace label), and enter new Upper and/or Lower limits
Traces look noisy	1. Incorrect filter settings 2. High electrode impedance	1. Double-click on trace label and adjust filters. For sweat artifact, increase the HP filter. For EMG artifact (in EEG), decrease the LP filter 2. Use appropriate site preparation technique to ensure that impedance is adequately low at the time of recording
Traces do not look crisp	1. Low screen resolution on computer	1. Increase screen resolution in Windows Control Panel, Display Settings (1280x1024 is

	2. Sampling rate too low	recommended) 2. Increase sampling rate for recordings in PSG Config
Cannot access Trend Data	1. Summary not generated	1. Generate Off-line Summary from the Automatic Analysis window
Trend Data incorrect	1. Incorrect Input Assignments	1. Assign proper inputs under <b>Tools &gt; Options &gt; Input Assignments</b>
Takes too long to change data into proper display format	1. Not using a Trace Layout configuration file	1. Configure the desired Trace Layout in the Trace Layout Properties window, then save the Configuration. It can then be accessed from the Trace Layout List
Data always reverts to previous display format	1. Not saving default Trace Layout properties	1. After selecting the appropriate Trace Layout in the Trace Layout Properties window, select Save as Default

## 20.2 Scoring a Study

Symptom	Possible Cause	Possible Solution
Cannot mark an event on the desired trace	Incorrect input assignment	Check input names under <b>Tools &gt; Options &gt; Input Assignments</b>
Automatic arousal association not working	Not activated Not assigned to the same input	Under <b>Options &gt; Preferences &gt; System Settings &gt; Scoring</b> , set Automatic Arousal Association to Yes  Assign all three auto association arousal types to the same input, for example C3 ( <b>Options &gt; Input Assignments</b> )
Automatic Respiratory Analysis is not classifying events correctly	Incorrect parameters set	View parameter definitions and suggested changes

## 20.3 Reporting a Study

Symptom	Possible Cause	Possible Solution
Unable to generate a report	1. No summary present 2. Microsoft Word not installed 3. Report contains code for information not available	1. Generate Off-line Summary under Automatic Analysis 2. Select <b>Options &gt; Preferences &gt; System Settings &gt; Report</b> and select Internal Viewer 3. Be sure all data for report codes, such as EtCO2, that are contained in the template have been recorded
Cannot find correct report template	1. Template not saved as an .rtf file 2. Template not saved in correct folder	1. Open the template in Microsoft Word and save as .rtf (not .doc) 2. Confirm report template is at location specified in <b>Tools &gt; Options &gt; Preferences &gt; System Settings &gt; General</b>
Report field not generating correct information	1. Incorrect report field 2. Incorrect format for report field 3. Incorrect modifier 4. Input Assignment for that field incorrect 5. Stage Light set to On	1. Check report field definitions 2. Format must be [@#] where # corresponds to correct field 3. Use comma after # and insert correct modifier 4. Check the Input Assignments 5. Check in the Trend window that Stage Light is marked as Off for all epochs to be reported
SpO2 minimum values reporting as zero	1. SpO2 artifact not marked in the study	1. Use the Trend to find points the SpO2 trace drops to zero, and mark those periods as SpO2 Artifact. Generate the report again

## 21 Product Support

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