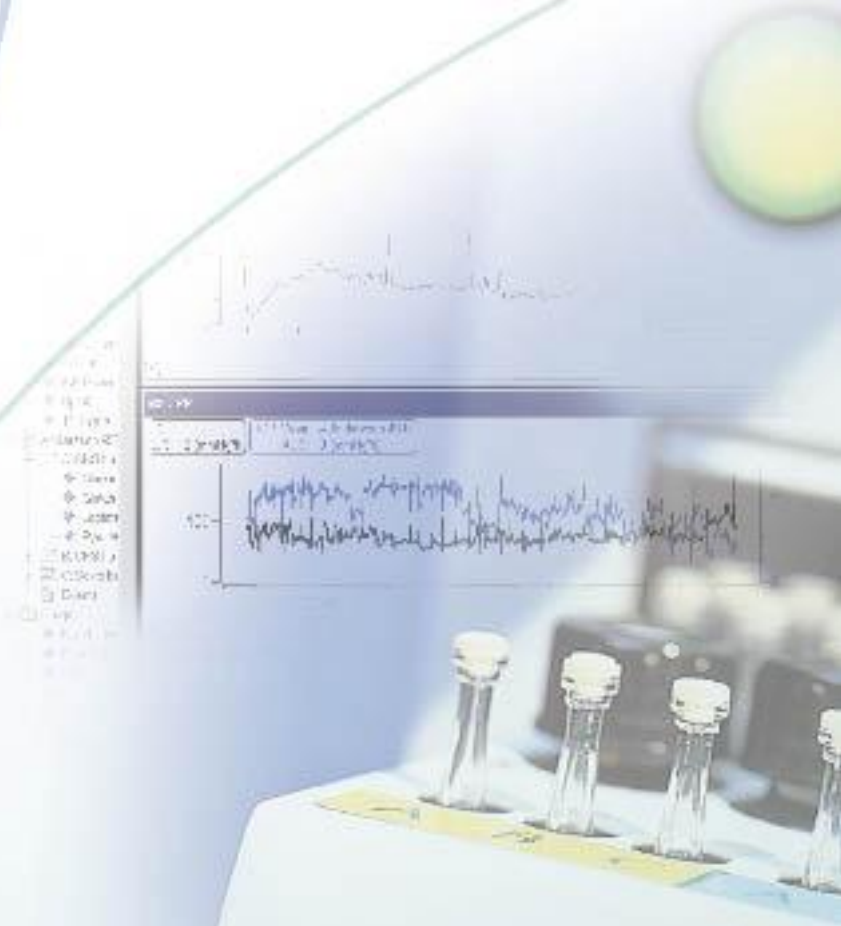
User's Manual

ICU pilOt

DATA navigation in the ICU



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Precautions

- The system handles several patients simultaneously and the operator must always verify, that the data displayed is from the intended patient. Please check section 15.1 for details of switching presentation between patients.
- When changing a series caption ensure that the new caption clearly indicates the content of the series.
- Please be observant that the time scales may be different in different graphs. When comparing different series put them in the same graph to ensure that the time scales are the same.
- When a series has a caption with a strike through font, please note that this series is presented with a time offset.
- When more than one Y-axis is used, please double check that you are reading the values correctly. By using the Display value tool (see section 7.2) this is easily checked in the caption.
- If changing the presentation unit for a parameter please note that ICUpilot will present the data with another unit than the original one.
- Please be observant that the color of a series is determined by its order, not the parameter

Table of Contents

1. Introduction

1.1. Introduction

ICUpilot is an extraordinary new tool for fast analysis of time-related data. ICUpilot simplifies your data analysis into drag and drop of graphs. ICUpilot is designed to support your thinking.

- It works like your brain - with pictures not numbers.
- It is as fast as your brain - formulate a hypothesis and test it in minutes.
- It promotes co-operation - analyze data in real time together with your team.

ICUpilot has the possibility to collect data from a number of external devices, such as patient monitors, ventilators and infusion pumps.

The latest information on ICUpilot is always available on the ICUpilot home page **http://www.ICUpilot.com**
If you are connected to the Internet you can reach it from within ICUpilot.

1.2. Intended Use

ICUpilot is intended as a supplement to existing equipment for monitoring of patient data. It provides a mechanism for presenting multiple parameters and patients in combined views. ICUpilot shall not be used as the sole means for diagnosis and archiving of patient data.

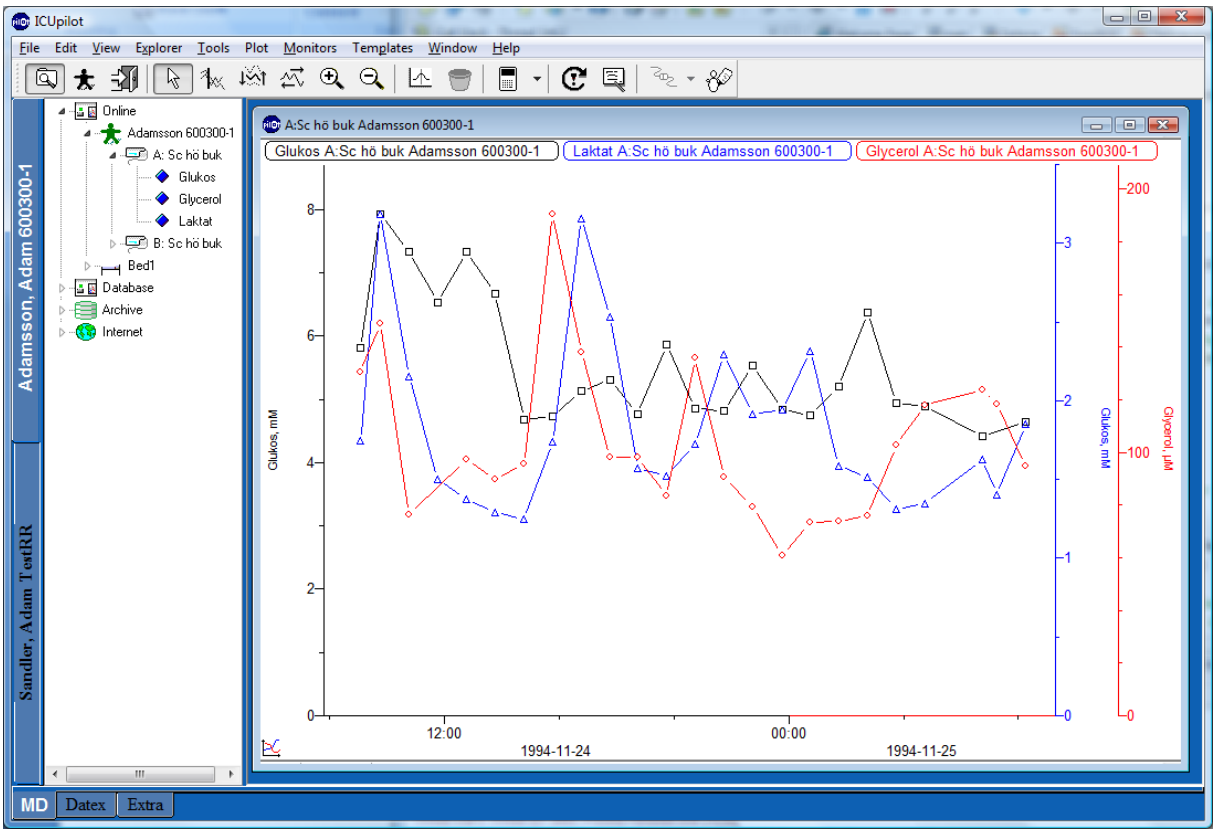
1.3. How to install ICUpilot

Insert the CD into your CD-drive. The CD will start automatically. Follow the instructions on the screen. If the CD does not start automatically, run Go.exe located at the root of the CD.

The installation program creates a folder named ICUpilot on the Start menu. In this folder, you will find a shortcut, which you can click to start ICUpilot.

2. Getting started

2.1. The User Interface



On the left side of the screen is the Data Tree. It contains data files that can be visualized by ICUpilot. Data can be Numerical, Text or Internet pages. On the right side of the screen is the Work Area, where your data are displayed. At the top is a Toolbar with tools used for interacting with your data.

2.2. Displaying data

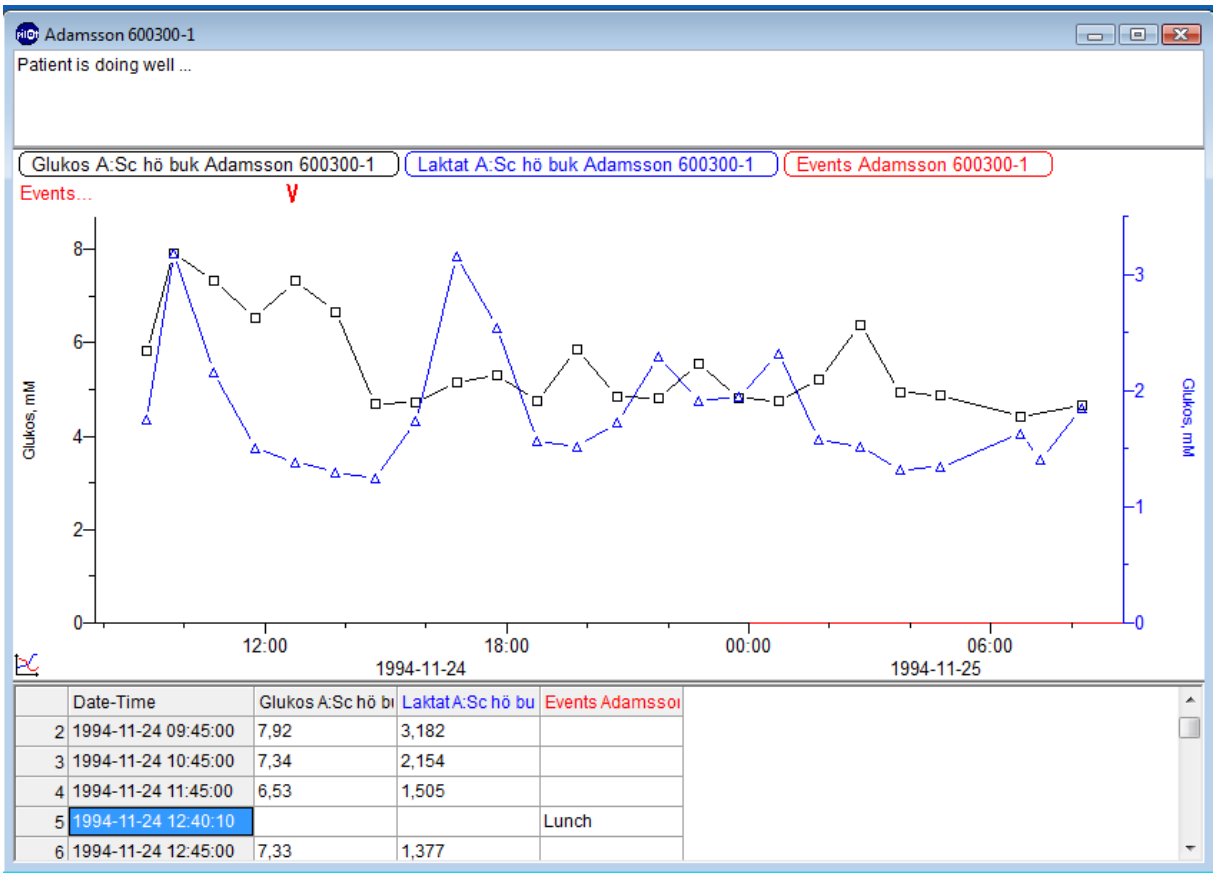
To display data:
1. Select an icon in the Data Tree.
2. Drag it into the Work Area by clicking on the left mouse button, holding the button down while moving the arrow/pointer.
3. Drop it by releasing the button when the arrow is somewhere in the work area, and your data will appear instantaneously as a graph or a text.

If you want to look at several data files, simply repeat this drag and drop operation.

If you drag the file to an empty spot on the Work Area, you will get a new chart.

If you drop the file on an existing chart, you will add a new curve with a separate y-axis in that chart. It is possible to have several curves in the same chart, each with a separate y-axis.

2.3. The chart window

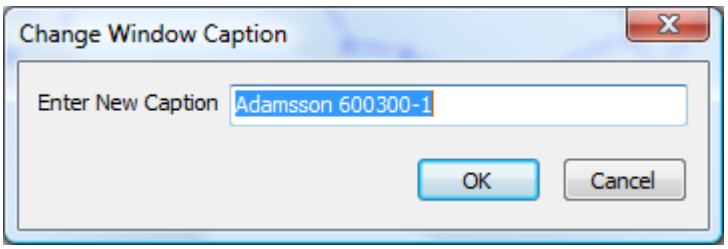


In the chart above there are three data series. Two numerical series and one text (Event) series. Each series has the same color of the marker, the line, the y-axis and the label. The color depends on if it is the first, second, third etc series that was created in the plot. The name in the label is used to identify the series.

The Text Editor at the top of the plot allows you to comment the data in the chart.

The Spreadsheet at the bottom allows you to view and edit the series consisting of numbers or text. To open the text editor or the spreadsheet click **Edit | Comment** or **Edit | Spreadsheet** respectively**.**

2.4. Changing the Window Caption



Each window has a caption. The caption can be changed by clicking **Plot | Change Window Caption**. Initially the caption reflects the names of the series in the chart.

2.5. Adding new series to a chart

You can add as many series as you like to a chart by dragging and dropping files into the chart window. ICUpilot will give each series a new color and a different data mark. The series label will be added one after the other.

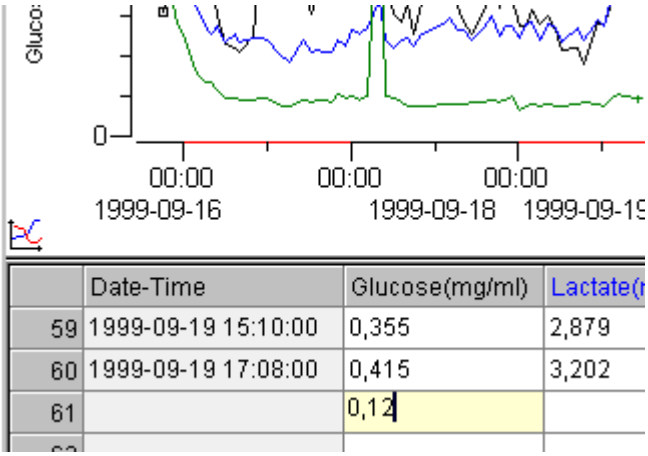
A new y-axis will be created for each series and added on the right side of the plot. The axis will have the same color as the series. You can highlight the series that belongs to a particular y-axis by clicking on the axis. All other curves will then become grey, making it easy to see the curve belonging to the axis. The reverse is also possible: Select a series and the axis belonging to that series is highlighted in the same way.

The x-axis displays the values corresponding to the first series of the chart. Series that are added later will be offset a number of days if the interval of the new series does not match the interval of the plot. If a series has an offset, the name of the new series is written with a strikethrough font indicating that the series has been moved in time. In this way it is possible to plot series collected at different times in the same chart.

3. Entering Numerical Data

3.1. Entering data using the data spreadsheet

At the bottom of every chart window there is a spreadsheet. The spreadsheet is opened by any of the following ways:



	Date-Time	Glucose(mg/ml)	Lactate(r
59	1999-09-19 15:10:00	0,355	2,879
60	1999-09-19 17:08:00	0,415	3,202
61		0,12	

- clicking and dragging the spreadsheet border upwards
- right clicking in the chart and then selecting **Spreadsheet**
- clicking **Edit | Spreadsheet**
- the spreadsheet can be used to view, enter or edit data. The plot is linked to the data and is updated as soon as any changes occur.

The spreadsheet is designed for serial data. When a new value is appended to a series using the spreadsheet and there is no corresponding x-value, an x-value will be extrapolated from the previous x-values.

3.2. Entering data using copy/paste

Data from common spreadsheet programs, such as Microsoft Excel, can be pasted right into ICUpilot if the copied data follow some simple rules:

- The data must be arranged in columns with the first column denoting the x-value and the following columns denoting y-values.
- The first row must hold the names of the series.

The format of the x-data can be *date-time*, *elapsed time* and *values.*

- The *date-time* format must be the same as the settings in MS Windows. Example 2002/04/23 12:43:00
- The *elapsed time* must have the format HHH: MM: SS where HHH is the hours, MM is the minutes and SS is the seconds. ":" is the time separator. Example 37:55:12
- The *Value* format must use the same decimal separator as MS Windows.

Sample of text data.

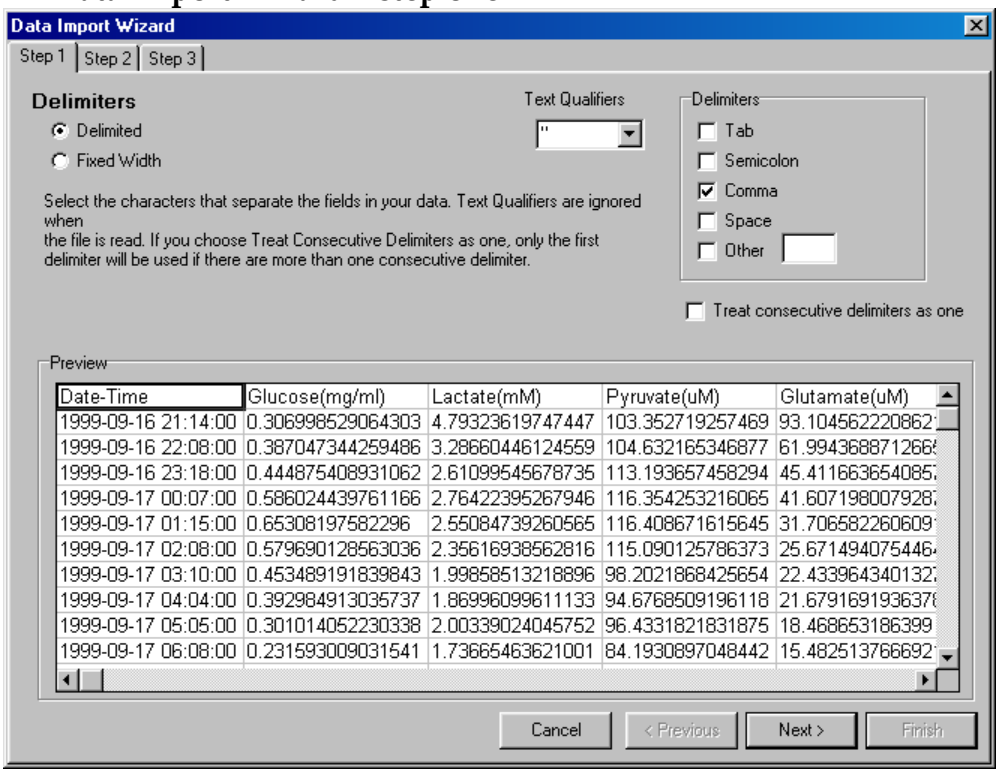
Date-time	**Series 1**	**Series 2**	**Series 3**
2002/04/23 6:21	12.12	123.41	321
2002/04/23 7:40	6.68	229.1	227
2002/04/23 9:27	9.91	111.8	65
2002/04/23 11:21	5.12	235.23	256
etc			

The *date, time* and *decimal* separator settings in windows can be altered using the **Regional settings** in the **Control Panel**. If the copy/paste method described above fails the Data Import Wizard is automatically utilized (See below).

3.3. Entering data using the Data Import Wizard

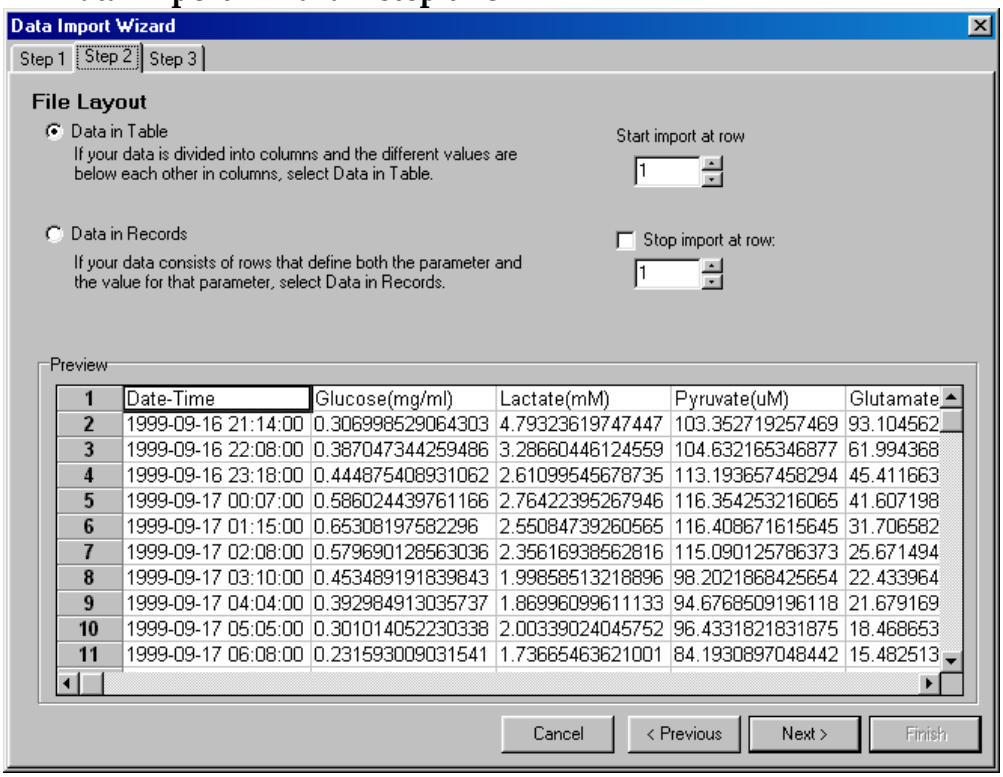
The Data Import Wizard guides you through the process of interpreting general text based data. The wizard is utilized when you try to open a non-native ICUpilot text-file with the file open command, or when a text-based paste command fails.

- **Data Import Wizard – step one**



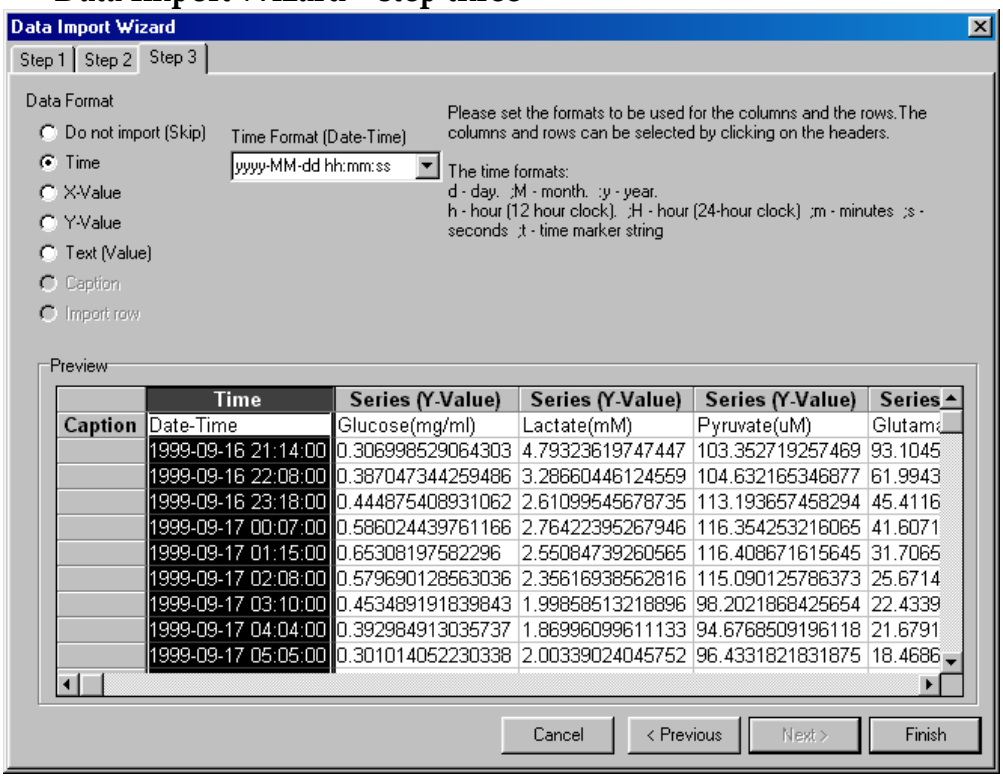
In the first step, the delimiters that split the rows into cells are defined.

- **Data Import Wizard – step two**



In step two the layout of the data table is decided. There are two possible formats. The data can either be in an ordinary table where the data is located in columns, or it can be a record based layout. In the record based layout the data points are completely defined by one row that contains the name of the series as well as the x- and the y-value.

- **Data Import Wizard – step three**



The actual data format is decided. This includes how date-times are interpreted and what decimal separators that are to be used.

The format codes are:

d-day:

"d"	Day of month as digits with no leading zero for single-digit days.
"dd"	Day of month as digits with leading zero for single-digit days.
"ddd"	Days used for elapsed time. Days exceeding 31 allowed.

M-month:

"M"	Month as digits with no leading zero for single-digit months.
"MM"	Month as digits with leading zero for single-digit months.
"MMM"	Month as a three-letter abbreviation.
"MMMM"	Month as its full name.

y-year:

"yy"	Year as last two digits with leading zero for years less than 10.
"yyyy"	Year represented by full four digits.

s-seconds:

“s”	Seconds with no leading zero for single-digit seconds
“ss”	Seconds with leading zero for single-digit seconds
"sss"	Seconds exceeding 59 allowed. Used for elapsed time.

m-minutes:

“m”	Minutes with no leading zero for single-digit minutes
“mm”	Minutes with leading zero for single-digit minutes
“mmm”	Minutes exceeding 59 allowed. Used for elapsed time.

h-hour (12 hour clock):

“h”	Hours with no leading zero for single-digit hours; 12- hour clock
“hh”	Hours with leading zero for single-digit hours; 12-hour clock
“hhh”	Hours exceeding 12 allowed. Used for elapsed time.

H-hour (24 hour clock):

“H”	Hours with no leading zero for single-digit hours; 24- hour clock
“HH”	Hours with leading zero for single-digit hours; 24-hour clock
“HHH”	Hours exceeding 23 allowed. Used for elapsed time.

t-time marker string:

"t"	One character time marker string, such as A or P
"tt"	Multi character time marker string, such as AM or PM

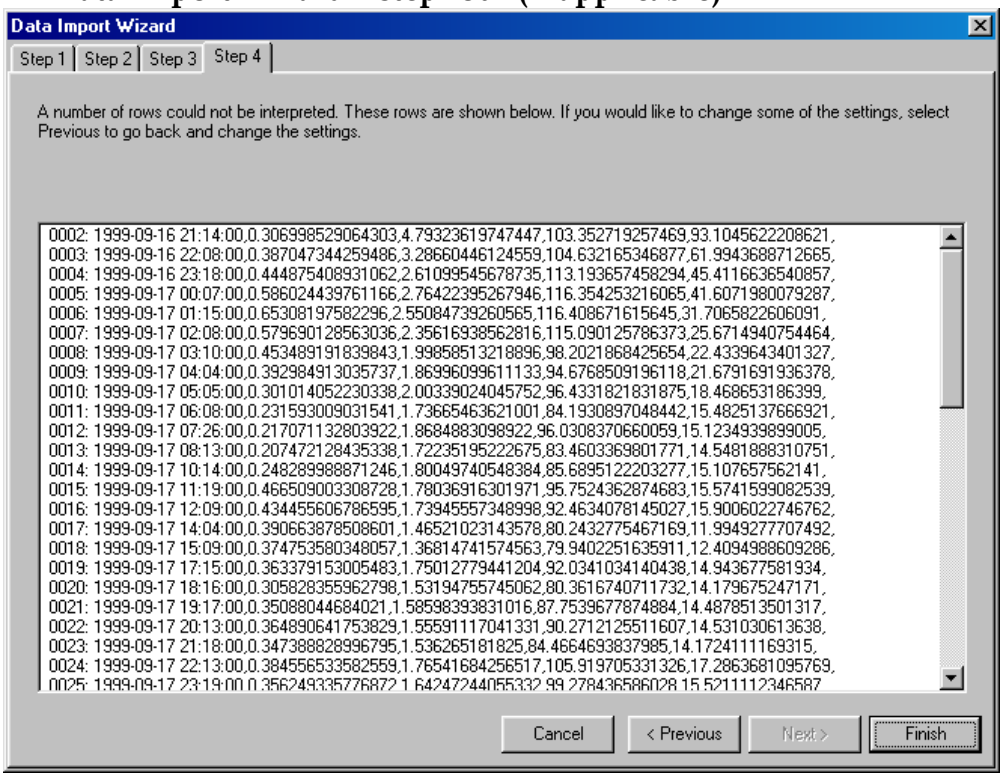
Example:

Depending on the format of your x-values use the following format code:
Date-time:
2002/01/21 13:32:03 yyyy/MM/dd HH:mm:ss

Elapsed time:

35:23:00	HHH:mm:ss (three HHH allows more than 24 hours)

- **Data Import Wizard – step four (if applicable)**



If some lines could not be interpreted according to the settings in step one to three, an additional step is introduced. This step shows the lines that could not be interpreted and allows you to go back and change some settings if necessary.

4. Entering Text data

4.1. Entering Events

You can add Events at different time points in your graphs. Events are displayed as V-marks at the top of a graph. When you point to a V-mark the Event text is displayed. Events are text kept in Event series. These series are similar to ordinary series, except that they have no y-axis. The events are added using the event tool that can be found in the Tools menu.
This type of events are not automatically stored, you need to actively store the graph containing the events.

4.2. Entering comments

Comment files
If you want to add more information about curves than is suitable to put in an event series you can add comment files. (See 2.3)

A Comment file is a rich text document that you can view as a separate window in ICUpilot, just like the charts.

There is also a comment text editor attached to all charts in ICUpilot. This text can only be saved along with the entire chart.

5. The Data Tree

5.1. About the tree view

The data files are organized in a tree structure on the left side of the screen. (If the tree is not visible on your screen, make sure that the "explore" menu item in the *view* menu is checked).

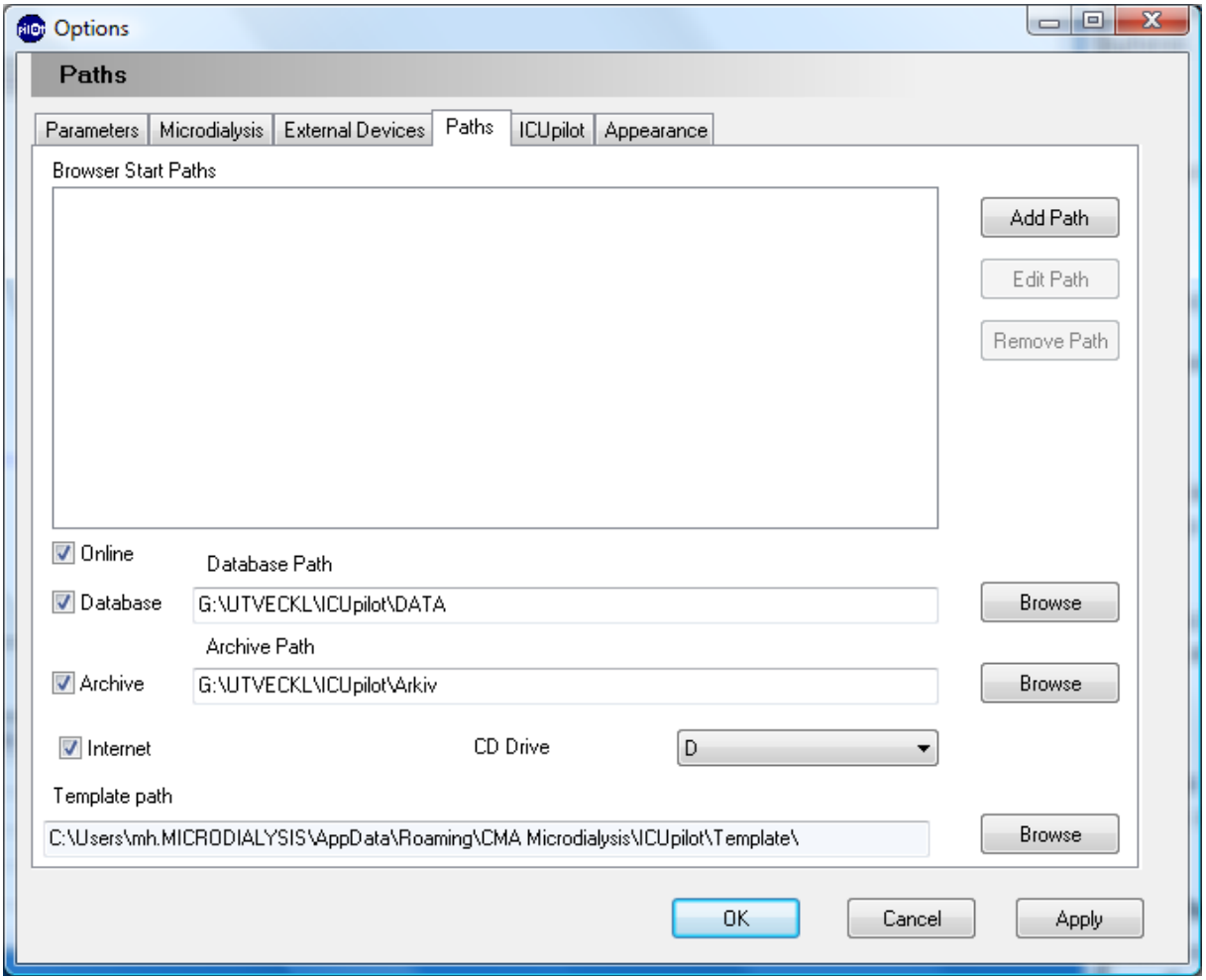
The tree has a number of branches by default and it is possible to add new branches.

The Internet branch enables you to look at web pages across the Internet. One important page is the ICUpilot homepage where you can find the latest information about ICUpilot.

In addition to this branch, you are able to add your own branches that display data from your local computer.

The tree unfolds into folders and variables. At the tip of the tree, you find the variables that can be studied with ICUpilot. There is a great difference from an ordinary tree view (like the Windows Explorer), in that not only the folders are present in the tree view but also the files.

5.2. The Paths page



Settings regarding the data tree is set up in the paths tab which you reach by clicking **View | Options**. You set up new top folders in the Options dialog. You can enter new file paths by pressing the Add Path button.

If Internet is checked, the Internet branch of the data tree will be visible.

You can add your custom branches to the data tree. Pressing the Add Path does this. When the Add Path button is pressed, a dialog appears that lets you choose a folder in the computer where ICUpilot should look for data. This enables you to make up your own data structure. One suitable branch could be C:\My Documents.

5.3. More about the tree view

Branches
The first branches are always the fixed ones, like the Internet branch, followed by a number of user-defined branches. To expand the tree, just press on the small + sign

to the left of the symbol. The tree view mirrors your file structure just like the Windows Explorer, except that it does not only display the folders, but also the files in the tree.

Folders.
Folders are displayed in the tree view just like they are in for instance Windows Explorer.

Event series
Series of (text) events can be stored in event series.

Variables

Variables are displayed as dots

or displayed as diamonds depending on if they are read only or not.

Saved charts
Saved charts contain not only the actual values of the series in the chart, but also the settings of the axes and the attached comment.

Comment files (Rich text document).
Comments can be stored separately in rich text format (extension .rtf).

Unknown files
If a file has a format unknown to ICUpilot, that file is displayed as a document or by its registered symbol.

5.4. Creating Custom branches

In addition to the default branches, you can add your own branches. These branches work much like the Windows Explorer and reflect the file structure of your hard disc or network. You can browse through your files starting from the folder you define. To add a new branch click **Explorer | Add Branch**. Or just right click in the Explorer field and select **Add Branch** from the pop up menu. To remove a branch, first select the branch and then click **Explorer | Remove Branch** or click **Remove Branch** in the pop up menu.

By adding several branches, it is easy to organize your data in different groups.
A suitable approach is to create sub folders for different groups of data or maybe to create folders for different users of the program.

If you want a new folder for your data, mark the folder in which you want your new folder to be located then click **Explorer | New | New Folder**, or faster, right click and select **New | New Folder**.

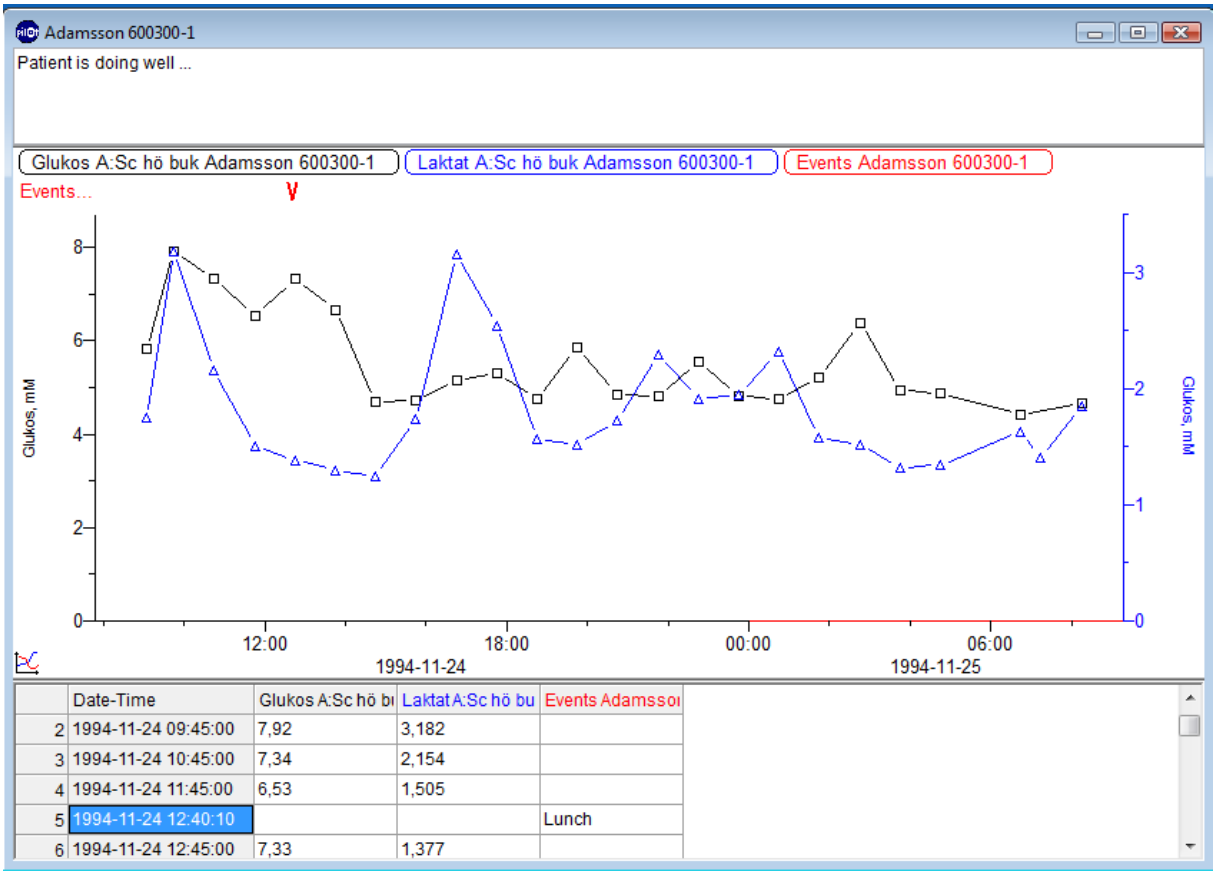
To rename a file or folder then click **Explorer | Rename item**, or faster, right click on it and select **Rename item** on the shortcut menu that appears.

If you want to delete a file or folder click **Explorer | Delete**, or faster, right click on that object and select **Delete**. The file or folder will then be deleted (but can still be recovered from the Windows recycle bin).

You can quickly switch to Windows Explorer if you want the full functionality of the Windows Explorer. Click on the folder you would like to open then click **Explorer | Windows explorer**. Alternatively, faster: Right click on a folder or file and select **Windows explorer**. This will start Windows Explorer with the current folder open.

You can create files that have been registered to windows (e.g. a text document) just by right clicking on a folder and select **New | [the registered document type]**. This will create a document of the desired type in the selected folder.

6. Charts



	Date-Time	Glukos A:Sc hö bı	Laktat A:Sc hö bu	Events Adamssoı
2	1994-11-24 09:45:00	7,92	3,182	
3	1994-11-24 10:45:00	7,34	2,154	
4	1994-11-24 11:45:00	6,53	1,505	
5	1994-11-24 12:40:10			Lunch
6	1994-11-24 12:45:00	7,33	1,377	

The chart window has three sections of which you initially can see one. The visible section is the section where the series are plotted.

At the top of the chart, there is a simple text editor where you can comment on the plot. This text will be saved along with the chart.

At the bottom there is a spreadsheet so that you can view and edit your data numerically.

To display the text editor, right click on the chart and select **Comment**. To display the spreadsheet, select **Spreadsheet** instead.

The plot section has labels at the top. These labels show the name and color of the displayed series. They also indicate active series.

6.1. Organizing charts

Since ICUpilot has a multiple document interface, the charts can be moved around and resized, this means that you can scale the entire window to make a curve occupy a larger or smaller amount of your screen. You can also arrange the windows at any time using the standard window commands, like tiles, for example **Window | Cascade, Tile Horizontal, Tile Vertical.**

In ICUpilot you can also move the series between different chart windows. Just as you dragged a curve from the tree view, you can move curves between charts. You can grab the curves in two ways; either selects the curve by clicking on the actual curve or select the curve by clicking on its label. Then drag the curve to another chart or to the Work Area to create a new chart.

If the series is dragged to the Work Area or to another chart, the series will be removed from the current chart and inserted in the new chart.

You can also right click on a series label and then click Copy and then paste the curve onto the Work Area and then drag it into another chart. In this case the curve is not removed from the original chart.

6.2. Line color coding

The curves are colored according to the order they appear in the chart. The first added series in a chart will get a certain color (black), the second another color (blue) and so forth. When a series is removed, all series that have been added after that series will advance one position and subsequently get a new color.

It is possible to override this behavior and select a custom color for an individual series by right clicking the series label and then clicking **Properties**. The series will then keep this custom color until another color is chosen for this series or the series is given the default color again.

6.3. Displaying multiple series on the same axis

To display multiple series on the same axis, drag a series and drop it on a y-axis. The series will attach to the y-axis. The axis will get color marks at the top, showing what

series are plotted against the axis. Remove the series by dragging the mark into an empty spot of the plot area.

6.4. Editing the objects in the chart window

All series and axes have properties that can be accessed through the properties menu item in the file menu. First select the object by left clicking on the object then click **File | Properties**. This will display a dialog where properties specific for the selected objects can be changed.
There are different dialogs for different objects in the chart.

6.5. Changing the series properties

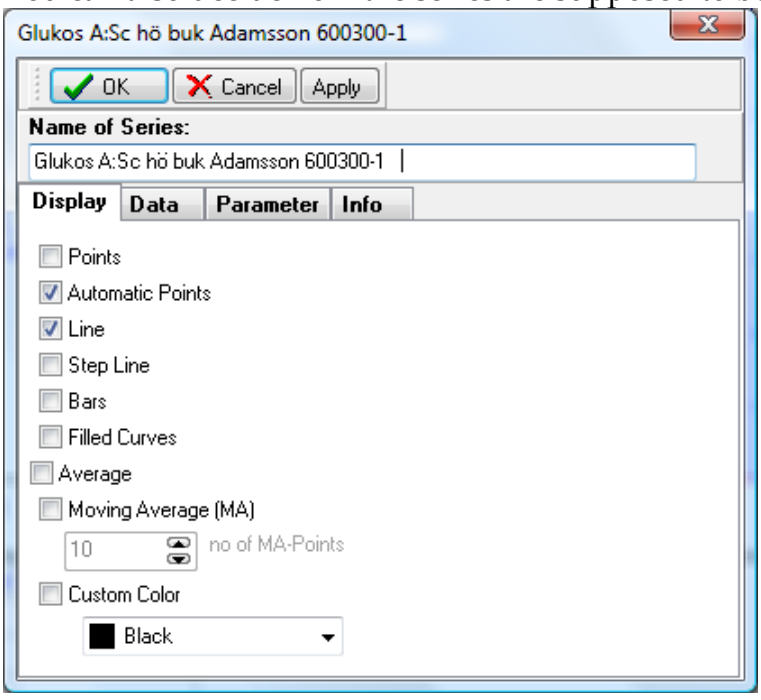
The properties of a series can be changed, in the series properties dialog. To open this dialog, select the series by clicking on it. (As an indication of that the series has been selected, the series label changes its background color to silver.) Then click **File | Properties**. This will display a dialog that lets you set the properties of this axis.

- **Name of series**

You edit the names of the series by changing the name in the edit box. The name of the series is displayed in the labels on top of the chart.

- **Display page**

You can also decide how the series are supposed to be displayed:



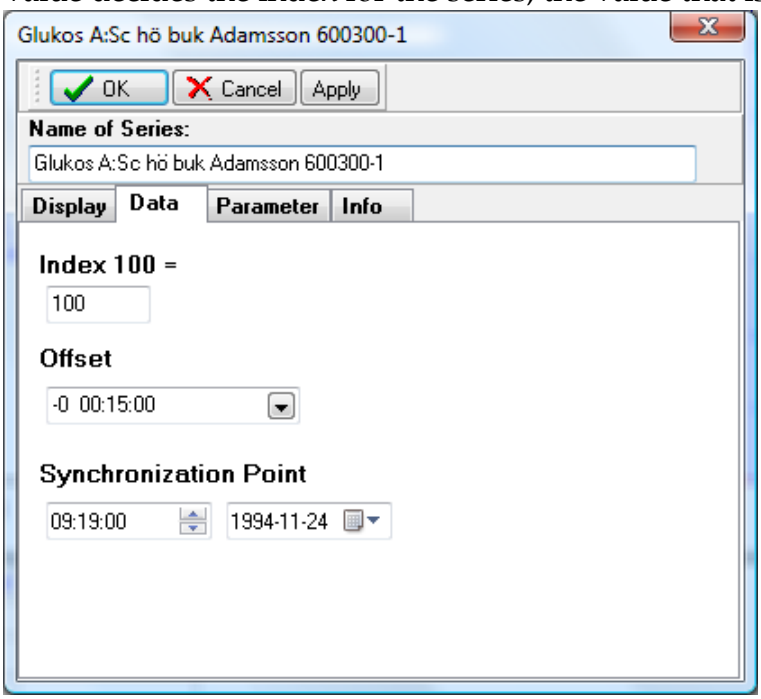
"Points" indicate if the individual points always should be marked out.
"Automatic Points" will only show the points if the density of the points is low.
"Line" indicates if there should be a line connecting the values of the series.
"Step Line" displays a step line.
"Bars" displays bars.
"Filled curves" fills the area under the curves.

"Average" indicates if the average of the series should be displayed. The average is drawn as a line along the series.
"Moving Average (MA)" indicates whether a moving average is to be calculated and drawn next to the curve. The number of points to include in the moving average calculation can also be set.

"Custom color" can assign a certain color to the series that will override the default automatic coloring of the series. If you click on the colored panel, you can change the color of the series.

- **Data page**

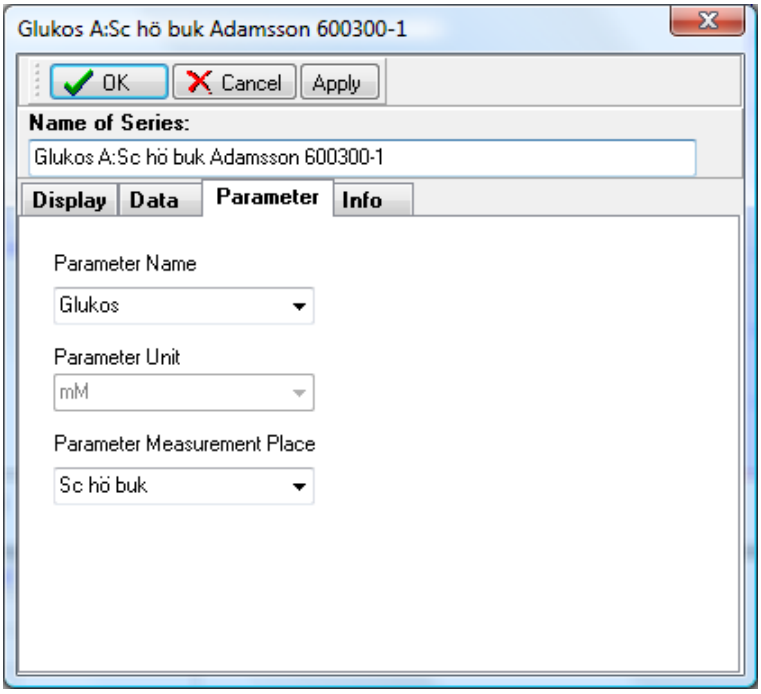
The *Index 100* field is used when using normalization feature of the ICUpilot. The value decides the index for the series, the value that is mapped to 100.



The *Offset* edit field controls the Offset.

The *Synchronization point* is the point that will be set to zero when using synchronization.

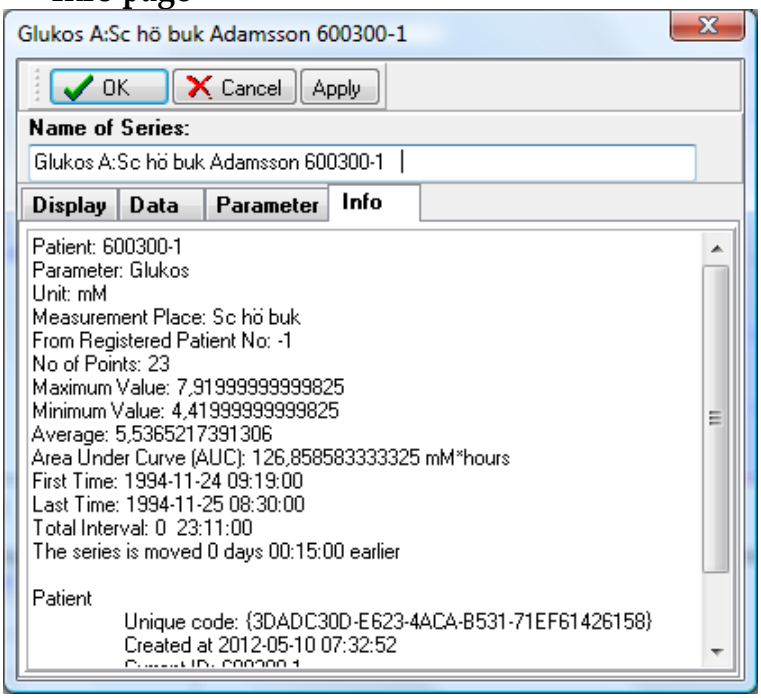
- **Parameter page**



In the Parameter page it is possible to see the parameter name, unit and measurement place if they have been assigned a value. The values can be changed when entering data for the first time.

The parameter name is displayed on the axis label along with the parameter unit.

- **Info page**



On the info tab there is information about the series.

6.6. Changing the order of the series within a chart

It is possible to change the order of the series within a chart by dragging the series caption and dropping it on another series caption. The dragged series will be inserted before the series that it is dropped on.

6.7. Changing the axis scale

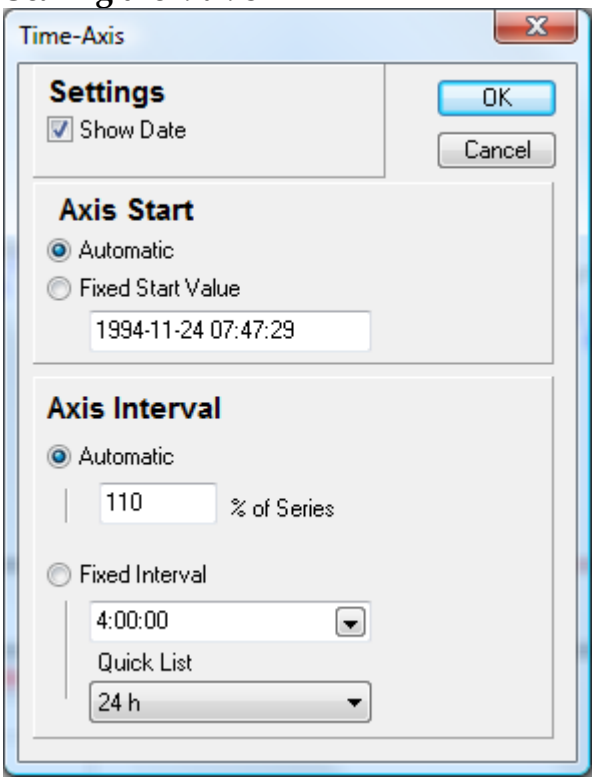
The way you set the scale can greatly influence the way you look at your data. Different scales can reveal or conceal different patterns in your data.

ICUpilot offers you a great number of possibilities when it comes to viewing series. You can view your series in almost an unlimited number of ways.
There is one important button to remember: the auto scale button.

Auto Zoom

This button puts everything back to the original chart. All axes are automatically scaled and all series will be visible. However, the offset of the series is not changed.

Scaling the x-axis

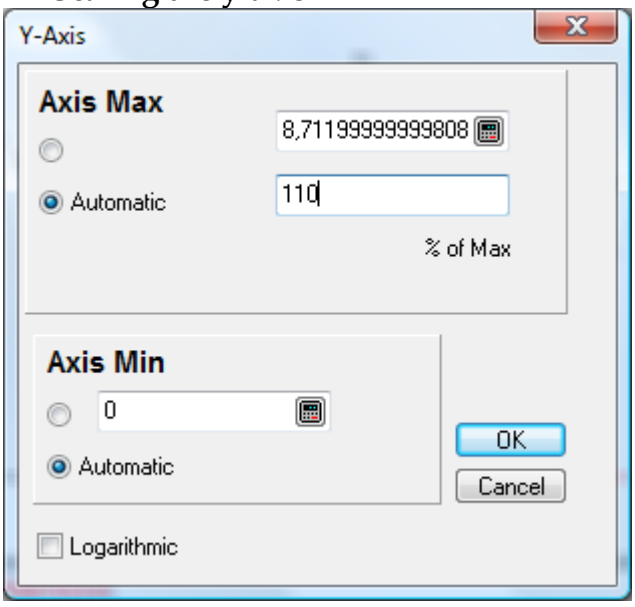


To scale the x-axis, select the axis by clicking on it. As an indication that the axis has been selected, a thin wire box surrounds it. From the file menu, select properties or right click and select properties . This will display a dialog that lets you set the properties of this axis. (See section 6.5)

With this dialog, you are able to change the start value of the axis and the interval that the axis spans. Both can be set automatically, and will then adapt to changes of the curves in the chart.

When the automatic interval option is selected, this value sets the interval of the axis. If set to 100% the length of the axis will be that of the series. The Show date option decides whether if the date should be shown on the axis or not.

- **Scaling the y-axis**



Scaling a y-axis is very similar to scaling the time axis:

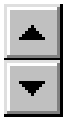
To scale a y-axis, select the axis by clicking on it. As an indication of that the axis has been selected, the axis is surrounded by a thin box.

From the file menu, select properties or right click and select properties. This will display a dialog that lets you set the properties of this axis.

Two factors, the minimum and the maximum value, determine the y-axis interval. These values can be set to a fixed value or can be set automatically. When setting the lower bounds for the y-axis automatically, the axis will make sure that the curve's lowest value is visible. The axis will not start on a value higher than zero, though. The higher bound for the axis can be set in a more sophisticated way than the lower bound. The maximum value of the axis is set to a percentage of the highest value of the attached curve. (I.e. if the percentage is set to 200 and the highest value of the curve is 3.6; the maximum value of the axis will be 7.2).
To make the scale logarithmic, check the logarithmic check box.

Just as with the x-axis, there are ways to speed up some common tasks. There is a tool to scale the axis quicker and that is the scale curve tool (see section 7.4).

Fast scale



There is also another option to change the scale. Right click on the axis. In the appearing menu click **Fast scale**. This will display two spin buttons next to the axis. One controls the offset, and one controls the maximum value. The buttons will be visible until you click on the plot outside the buttons.

- **Formatting the x-axis**

The series in ICUpilot can be displayed with a number of different x-scales. The series can be displayed with date-time, elapsed time, ordinals or values.

The plot can be swapped between the different formats by selecting the different formats on the toolbar or by clicking **Plot | X-Scale | Date-Time/ Elapsed time / Ordinal / Value**.

Date-time

By selecting Date-Time, the series will be displayed with a date-time axis. Offset will be used to adjust series based on elapsed time.

Elapsed time

By selecting Elapsed time, the series will be displayed with an elapsed time axis. The synchronization point will be used to adjust series based on date-time.

Ordinals

By selecting Ordinals, the series will be displayed with an ordinal axis.

Value

By selecting Value, the series will be displayed with an ordinary value axis.

7. The Tools

To accomplish different tasks, you use tools, just like in your ordinary drawing program. ICUpilot has nine tools. If you click once more on the tool that you are using, the pointer tool is automatically selected. The tools are used to manipulate the charts.

7.1. The Pointer tool

The tool you use the most frequently. Unless you want to do something specific, use this tool. (Click **Tools | pointer**).

7.2. The Display value tool

This tool is used for looking at the exact values of the series. In order to do that, click **Tools | Display Value** and move the cursor over the chart. The cursor will swap into a vertical line and a hint window is displayed at the bottom of the chart, telling the data and the time. The series labels will be expanded to include a value that is the readout for that specific series.

If a series is active, the line snaps to the points of that series. This makes it easy to look at the actual points.

Additionally, this tool can be used to select an interval. Click on the time that starts your interval with the left mouse button. Move the cursor to the end of the interval, keeping the button down. The selected interval can then be copied and pasted. The readout in the labels will now show the area under the curve.

This tool is also used in conjunction with the index tool. (See section 8, Analyzing data).

If the data spreadsheet at the bottom is visible, the active row in the spreadsheet will follow the vertical line.

Note: The displayed time is not always valid for all series in the chart. If a series has been moved in time, there is a lag between the displayed time and the actual time. A series that has been moved has a strikethrough font in the series label.

7.3. The move curve tool

This tool is used to change the offset of a series by clicking **Tools | Move Curve**. This is important when comparing series from different times.

It can also be important when comparing trends at an earlier stage with later trends.

Just grab the curve with this tool and drag it to the desired position. If the series has an offset, the name of the series is written with a strikethrough font. To change it back to the original chart, right click on a series and select “No Offset”

7.4. The scale curve tool

If you want to stretch the curves in order to see if they match each other or to see its dynamic behavior use the scale tool by clicking **Tools | Scale Curve**.

Click on a series and drag the series up or down. The series will be scaled accordingly. If you hold down the Ctrl button on your keyboard while dragging the curve, the axis offset will change instead.

7.5. The Add/Edit Point tool

Click **Tools | Add/Edit Point** to add new points to a series or to edit existing points of a series. The cursor will change to a cross when moving over a plot. If you press down the left mouse button (do not hit any points), a new point will be created in the active series. If no series are active, the point will be added to the first curve. When you move the cursor with the mouse button still down, a preview with the new point will show. If you move the cursor (mouse button still down) off the

edge of the plot, the plot will start to scroll. When you finally release the mouse button, you will get a dialog to confirm the value of the new point.

If you click on an existing point instead of on a free space, you will edit the point instead of adding a new point. The routine will be similar to the one described above.

7.6. The select tool

Click **Tools | Select** to select an area in order to remove points from your curves. Right click on the chart after selecting the area that you want to clear and click "Delete points" from the menu that appears. It is also possible to hide points using this tool. The hide and unhide commands will appear next to the Delete Points Area command. Hidden points are not completely removed from the series, but are not used in calculations.

7.7. The Add event tool

The event tool is used to add events of various sorts.

To add a new event, click **Tools | Add Event** and click on the plot area where you want your event. If an event series is present, the new event will be added to this series. If no event series is present, a new event series will be created, and the event will be added to that series. If more than one event series is present, the events will always be added to the first event series.

It is not important to click on the very right time since the event dialog that appears lets you edit the time of the event.

Note: If you want to add more than single lines of text it may be better to create a comment file.

7.8. The zoom in and zoom out tools


To use the zoom in tool to zoom in on interesting areas of the plot, click **Tools | Zoom In**. When you click on the plot, you will zoom in, centered on that particular area. If you hold down the Ctrl button on your keyboard, the tool will work in reverse. (Like the zoom out tool in this case, **Tools | Zoom Out**.)

8. Analyzing Data

8.1. Normalizing

Using index is an elegant and powerful way to compare variables with different absolute values. This is especially true if the values differ vastly.

A typical situation in which to use normalization is when an experiment is conducted with an initial steady state period followed by the period of interest.

You select a value or a series of values to be 100% and compare the curves with that value.

In the most common situation, a few points in the beginning of the series define the normalization period (index 100).

In this case, do this:

First, select the interval with the points that make up the index 100 with the **Display Value tool**.

Then click **Plot |Normalization** in the Plot menu.
For each curve, ICUpilot will calculate the average of the selected points and set that average to index 100.

Note: It is not the area under the curve that controls the value, but the mean of the y-values of the selected points.

After having done this, all curves are mapped onto the single y-axis remaining after the operation.

If you would like to go back to displaying the normal values, click on **Plot | No Normalization**.

It is easy to toggle between these two different states. However, the index 100 will be redefined only if an interval is selected, so when you toggle between the states, be sure that no interval is selected.

8.2. Using Synchronization

If you would like to compare data series based on a certain event, you can use the "Synchronize series" function to synchronize the series against that event. Some examples of events are the administration of a drug, the onset of electrical stimulation or changes in management.

The chart has two states: synchronized and normal. In the synchronized state, the actual date and time for the series are ignored. Instead, an elapsed time scale is used. The synchronization point for the individual series matches the starting point for this scale.

If you want to synchronize series collected at different time points, click on **Plot | Synchronize** shown here below. This will synchronize the series. Setting the first point to zero initially synchronizes the series. An arrow indicating the synchronizing point will be attached to every series.


Clicking on another point in a series will move the arrow to the new point. The series will not synchronize again until the **Synchronize** in the Plot menu is pressed a second time. All arrows will then disappear and the points indicated by the arrows will be synchronized to elapsed time zero. It will no longer be possible to change the synchronization by clicking on the curve.

The Synchronize Series button toggles between the two states. The next time synchronize is selected the arrows will appear again.


To go back to the normal state, click the **Plot | No Synchronization.** If you want to synchronize more than one series at the same time, select all the series that you want to synchronize (hold down the shift button to enable multiple selections). When the synchronization is changed for one series, it is changed for all selected series.

9. Calculations

You can do several calculations with your data series.

1. Place one or several series in a chart window by dragging and dropping.

2. Select a mathematical function by clicking **Plot | Calculate**  .

3. ICUpilot will create the new, calculated series in a new window. This series is connected "live" to the series it is based on. That is, it adapts automatically to changes in the underlying series. Because of this the points in the calculated series cannot be edited.

If you want to edit a calculated series you need to disconnect it from the underlying series. This can be done in two ways:

1. Click Copy and then Paste or

2. Save the calculated series.

9.1. How calculations are performed

All points in the series are used in the calculation. If one series lacks a point at a particular time, a point is still calculated by interpolating (linear) a value from the surrounding points of that series. (Note: Applies only if “Use interpolated values” in the ICUpilot tab of the options dialog is selected)

If the function has no meaning outside the shortest common interval for the series (for instance division), the resulting series is cut to only include the common interval.

The result of a calculation is plotted in a new chart window but can be moved into any other chart.

- **Add, subtract, multiply, divide**

Perform the four basic calculations.

- **Add constant**

A constant value is added to every point in the series. The constant value can be either positive or negative.

- **Multiply with constant**

A constant value is multiplied to every point.

- **Median**

A median value is calculated for all points in all curves in the active chart window.

- **Mean**

A mean value is calculated for all points in all curves in the active chart window.

- **SEM**

Calculates the mean and displays standard error of the mean (SEM) bars at each point.

- **Standard deviation**

Calculates the mean and displays Standard deviation bars at each point.

- **Regression**

The points for one series are plotted against the corresponding (in time) points of the other series.

- **Histogram**

Calculates a histogram. The histogram gives you information of the amount of time your curve has been in certain intervals.

- **Cluster**

In real life, the points in the series rarely coincide in time. One way to be able to compare different series is to group the points in intervals, i.e. every 30 minutes. The cluster function automates this clustering of points in intervals. To use this function, the series must first be synchronized (see Using synchronization above).

When you use the cluster function, a dialog will appear that lets you choose the cluster size in minutes. All points that fall into this interval will be merged into one single point (for each series) and placed at the middle of the interval.

- **Merge**

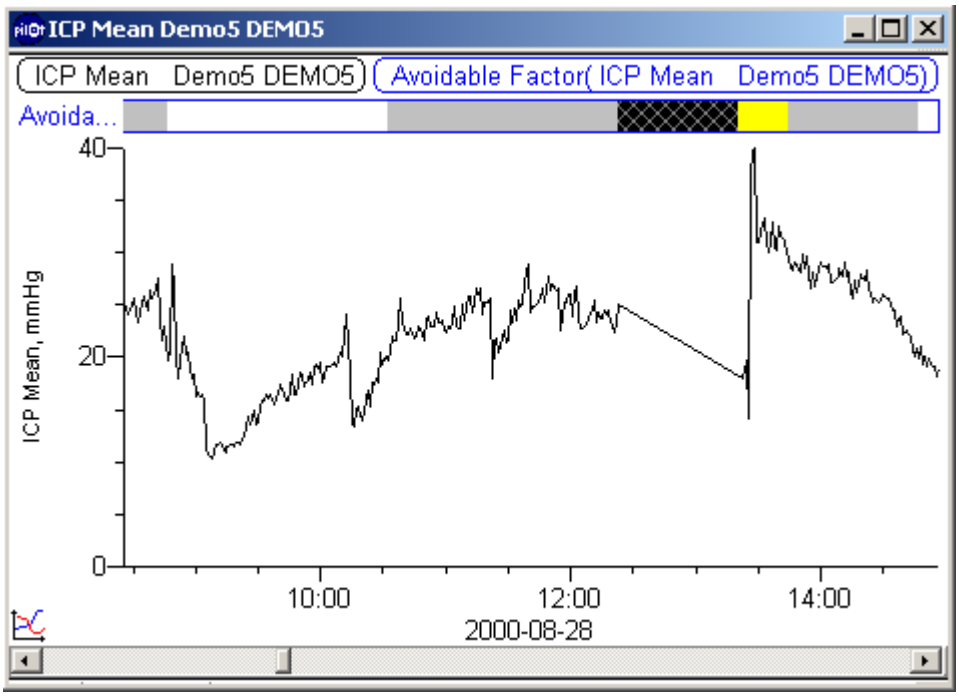
Merges two curves together. The result will be a new curve containing all the points from all old curves.

$$S = S_1 \cup S_2 \cup S_3 \cup \cdots \cup S_n$$

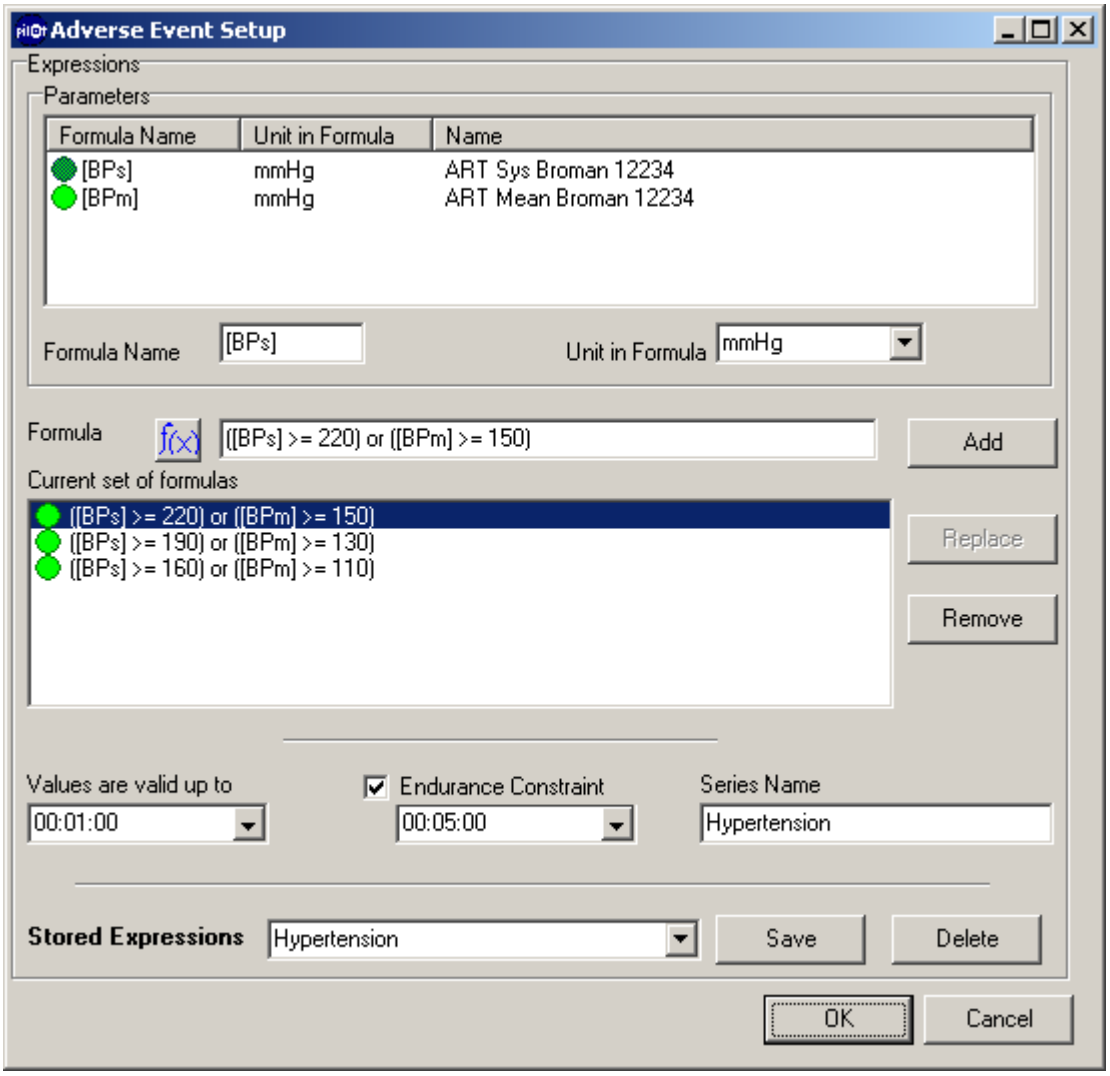
9.2. Adverse Event

Adverse Event is a special type of calculation where unwanted states can be detected. This is done by setting up different criterias . The calculation results in a series with colored bands where different colors indicate different grades of severity.

The adverse events are calculated just like any other calculation in ICUpilot. (Just select *Adverse Events* from the calculations menu.) The calculation will be performed on the series that are in the active window.



The actual calculation is defined in the *Adverse Event Setup* dialog.



The parameters are displayed at the top. These parameters are fetched from the active window and have a *Formula Name* to be used in the formula and a *Name* that is the name of the series. The *Formula Name* is also reflected in the formula name edit box.
A green dot in front of the parameter indicates that the parameter is used in one of the formulas. By dragging a formula name and dropping it on another, the order of the formula names can be altered so that they match the order of the series in the graph.

The formulas are shown in the middle. Enter a formula in the *Formula* edit box and press *Add* to add a formula. The formulas must be of expressions that evaluate to true or false. A green dot indicates a proper expression.

The unit for a formula can be changed in the *Unit in Formula* edit box.

The expressions are calculated at all times where there are data points. The score for a time point equals the number of expressions that evaluate to true.

If one expression evaluates to true, there will be a yellow band in the adverse event series, if two expressions evaluate to true, there will be an orange band and if three or more expressions evaluate to true, there will be a red band.

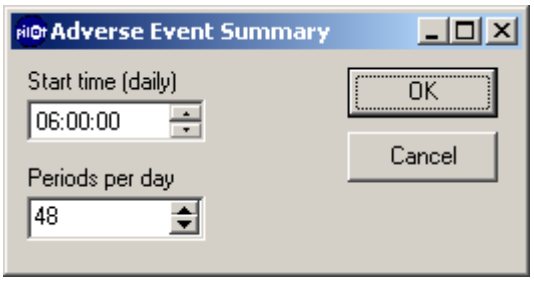
If no values are recorded for a period of time, there will be a black colored field with a cross diagonal pattern in the series. The time after which lack of values should be considered missing values is governed by the time field under "Values are valid up to". It is also possible to add a constraint that a grade has to be fulfilled for a certain amount of time before it is signaled. This is done by setting an "Endurance Constraint".

The text in the Series Name field form a basis for the name of the resulting series.

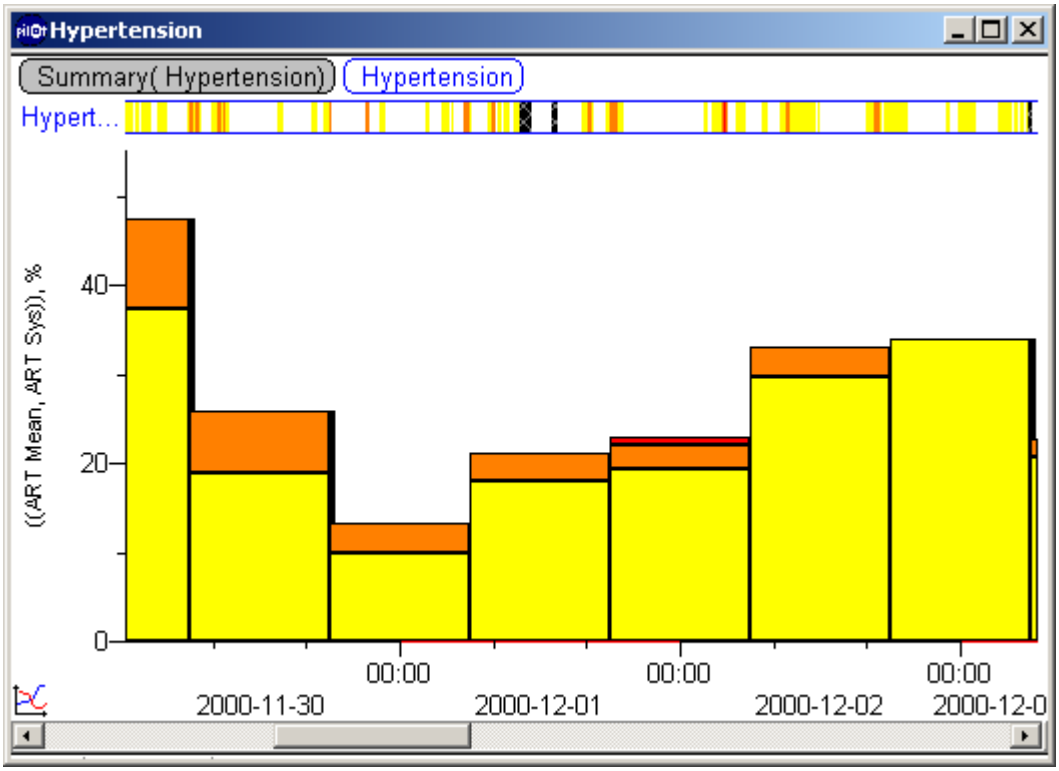
It is possible to store sets of expressions by clicking *Save*. To load a stored expression, select in the Stored Expressions combo box.

9.3. Adverse Event Summary

A summary can be calculated for an adverse event series. The summary is performed so that it calculates the ratio of points with different grades (ignoring missing values). This is repeated daily. This calculation can only be performed on adverse event series.



The calculation has two parameters that can be set: Start time and Periods per day. The start time is the time of the day where the summation starts. Periods per day sets how many intervals there should be per day.
The calculation results in a bar series with fields that correspond to the grades of the adverse event series. 100 percent means all recorded points in the interval.



- **Other types of calculations**

You can use the Display Value tool to select a portion of the curve (Hold down the left mouse button and move it over the curve). The area under the curve is then calculated and displayed under the series label. The actual intervals between adjacent points are multiplied with the average y-value of the points using a trapezoid method.

$$\sum \frac{y_i + y_{i+1}}{2 * (x_{i+1} - x_i)}$$

where

Y_i is the y-value of point no i
X_i is the x-value of point no i

This is repeated for all pairs of points.

It is also possible to calculate a regression line for the series in the selected interval. This will display a least square fit line. Use the value display tool to select an interval, right-click and select add regression.

10. Saving Data

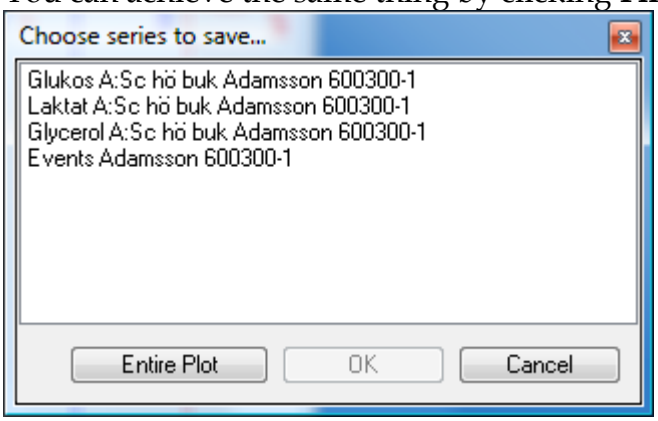
10.1. Saving your work

The easiest way to save a series is to grab the series by clicking its name label and drag it to the tree view and drop it over the file where you want to store it. A new file will then be created in the tree view where you dropped the file using the following dot symbol: 

 If you have arranged your entire chart and then want to save it that way, you can grab the **entire chart symbol**, a small figure at the bottom left of your chart, and drag that figure to the tree. In this case, all series and all axes will be saved in the same file.

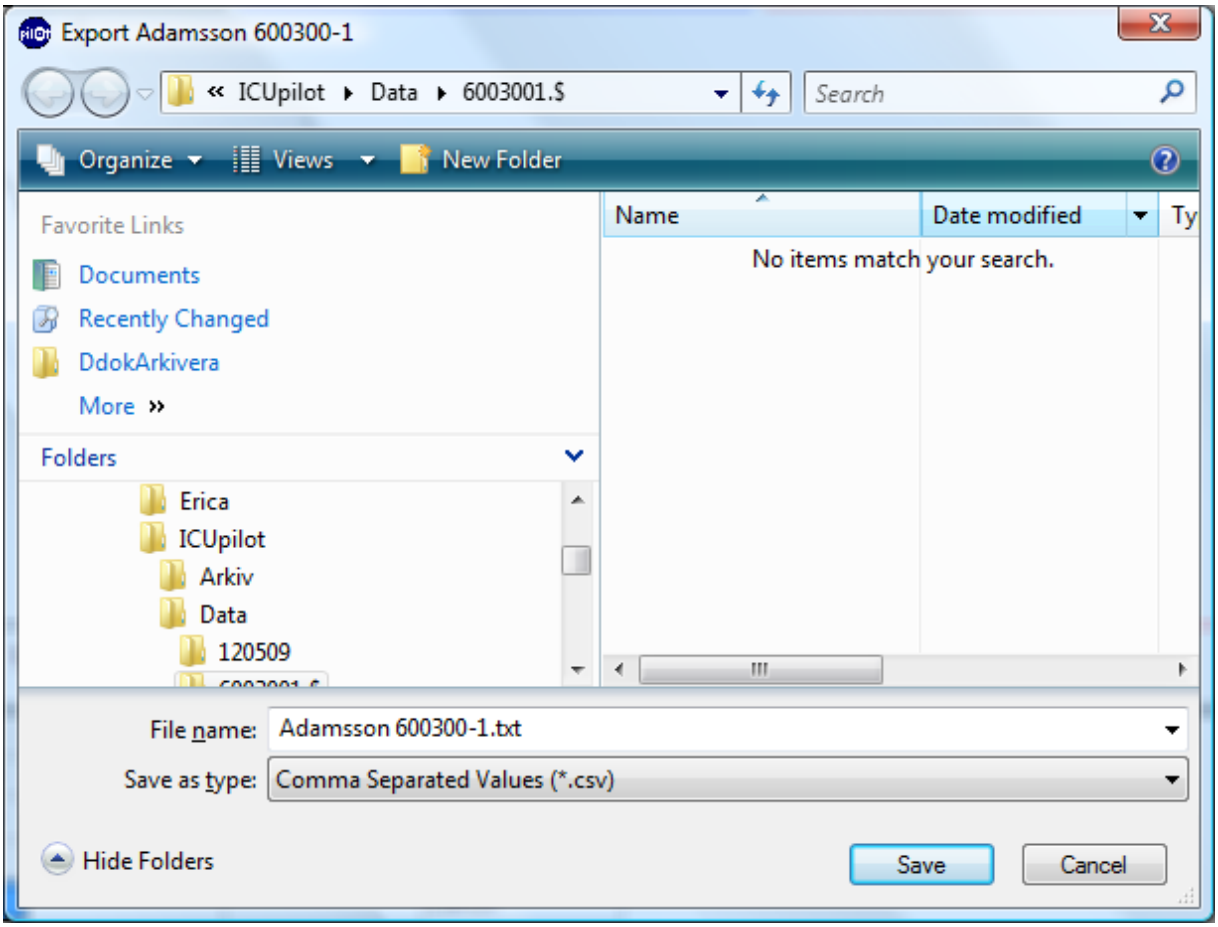
This means that when you open the file the next time you will have the same axis scaling as when you saved the chart.

You can achieve the same thing by clicking **File | Save**.



This will display a dialog that lets you choose which series to save. Choosing the entire chart in this dialog is the same as dragging the entire chart symbol to the tree view.

10.2. Exporting data



You can export the data in a plot as comma separated values in a*.csv file. Make sure that the data is in the active window, and then click **File | Export | Export Active Plot.**

You can also use copy and paste to export data. First copy the series in ICUpilot and then open the destination program and select paste. If the destination program can handle pasted text, the (numerical) data will be pasted into that program.

You can also, if you like, paste it back to ICUpilot.

11. Copy and Paste

- **To copy the entire chart to the clipboard**

Select the entire chart by clicking on the entire chart symbol at the bottom left of the chart. Then select **Edit | Copy**.

- **To copy only one series to the clipboard**

Select the series by clicking on the series label. Then click **Edit | Copy**.

- **To copy an interval of the series to the clipboard**

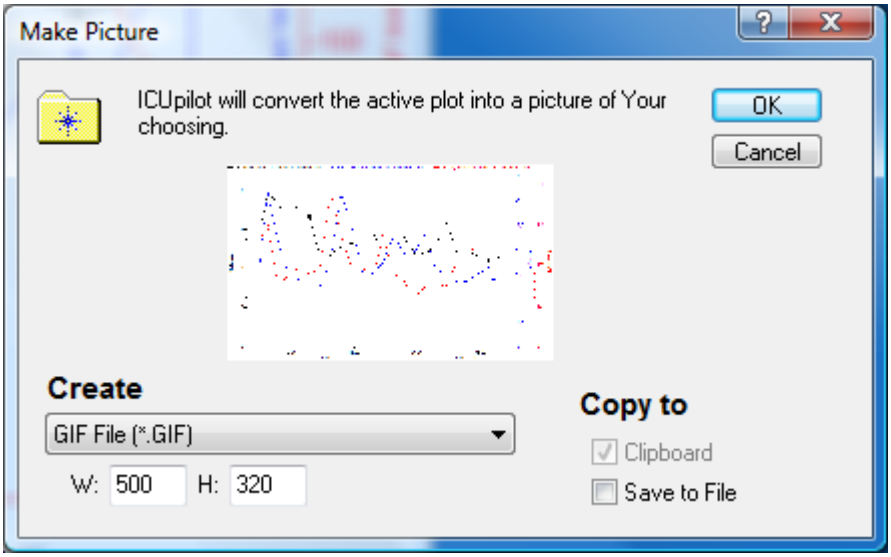
Select the part of the series that you want to export (using the Display Value tool). Then select **Edit | Copy**. By now the data points that are enclosed in the selection of the active chart have been copied to the clipboard.

- **The format of the data in the clipboard**

First there is a column of the x-values. After that, there are columns with the points from the data series. At the top of every column, there is a description of what that column contains. This text is given by the name of the series. The columns are separated by tabs and the rows by CR + LF.

11.1. Making pictures

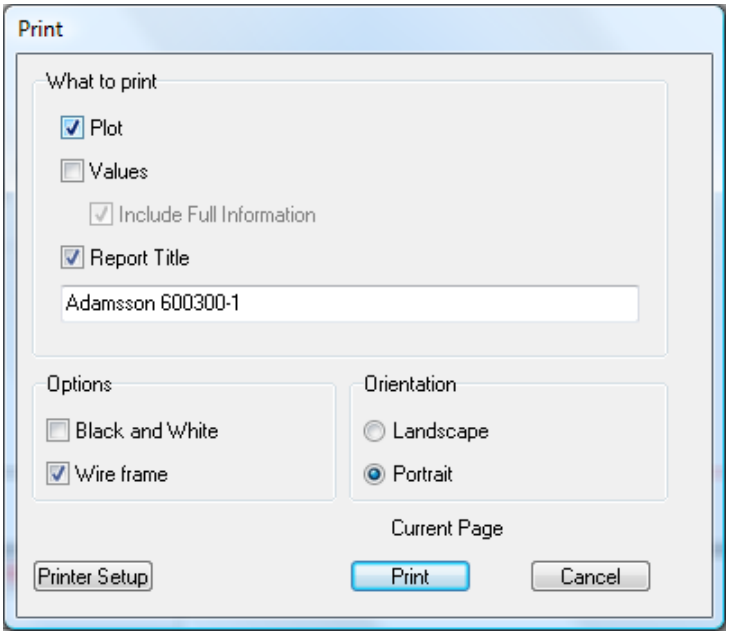
Click **File | Make Picture**. This will display the Make Picture dialog.



The active chart will be converted to a picture. In this dialog, you can decide what kind of picture you want to create. The picture can be put on the clipboard and saved as a file.

11.2. Printing

If you want to print the active chart click **File | Print**. A Print dialog will appear.



In the dialog, you can choose whether to print the chart, the values or both.

The chart is best if printed in color, but it is possible to use a black and white printer.

There are a number of options in the print dialog:

- **Plot** decides whether the plot will be printed.
- **Values** decide whether the values will be printed.
- **Include Full Information** decides whether additional information about the series will be displayed.
- **Report title** displays a title on the printout.

12. Internet branch

The Internet branch has a link to the M Dialysis AB home page, where you can find the latest information about ICUpilot. It also has a folder where you can collect your favorite web pages.

Note 1: This branch is only visible when Internet in the Options dialog is checked.

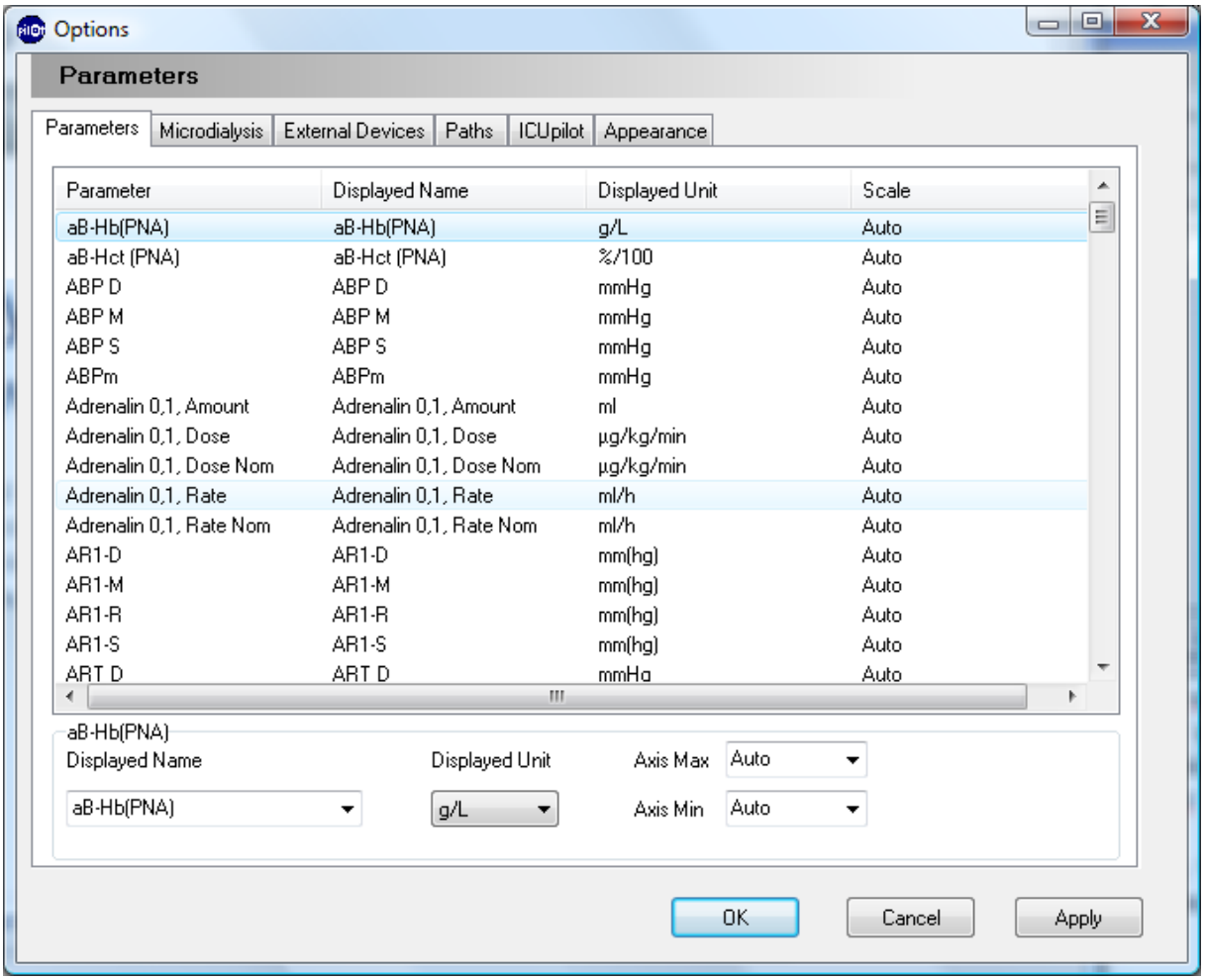
Note 2. To be able to use the built-in web browser you need to have Microsoft Internet Explorer version 4.02 or later installed.

13. Customizing ICUpilot

ICUpilot can be customized using the Options dialog. To open the Options dialog, select Options from the View menu.

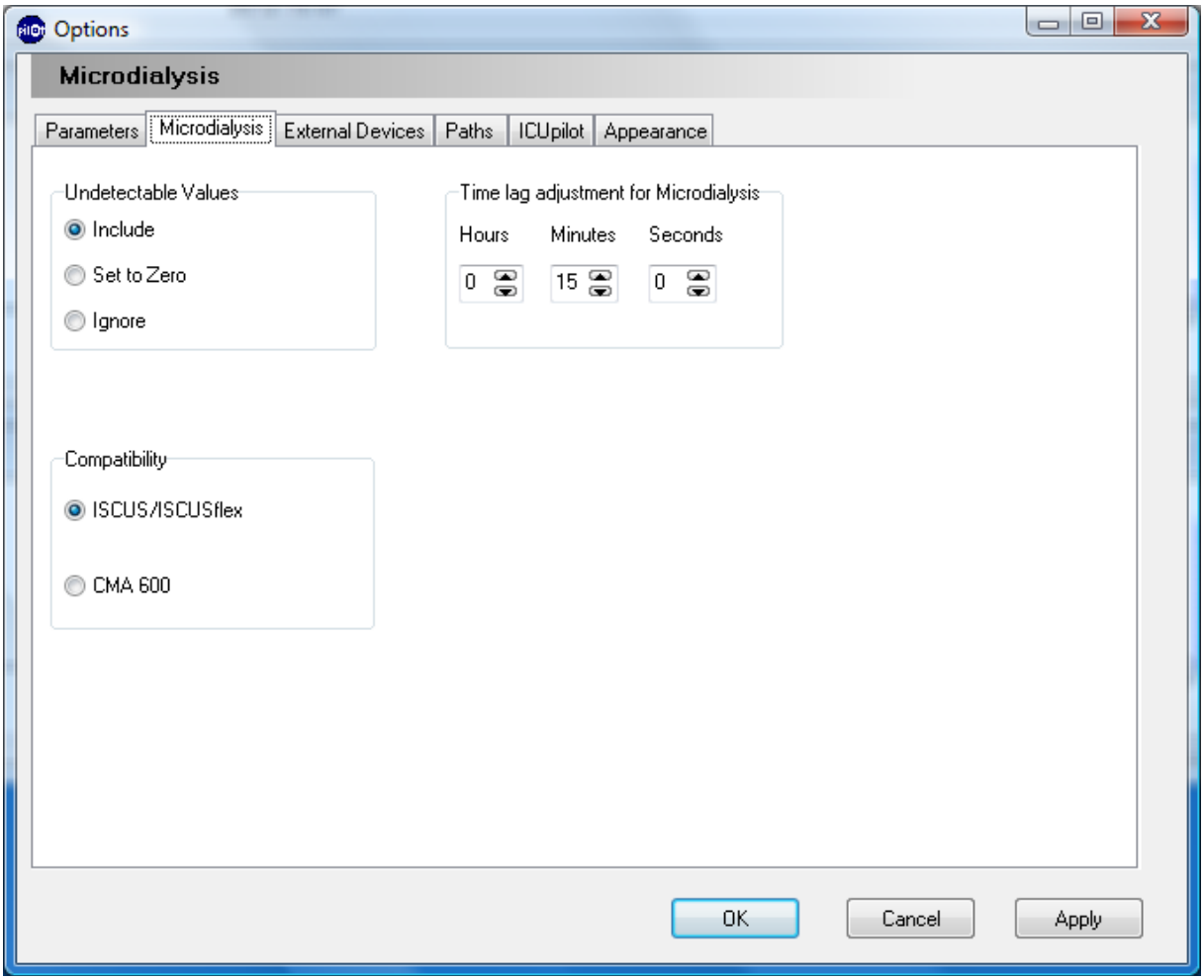
The Options dialog is divided into following tabs:

13.1. The Parameter page



In the Parameter page, you can set the default behavior of different parameters. You can decide the default scaling (max and min value) and the unit to use (if it is known). ICUpilot can convert between a number of different units. Some of these conversions are parameter dependent. One parameter dependent conversion is between mg/l and mmol/l, which is dependent on the molecular weight. It is also possible to change the displayed name (on the axis) for a parameter.

13.2. The Microdialysis page



This dialog contains settings for microdialysis data.
When the microdialysis samples are analyzed the measured substance is sometimes below the detection limit. This might mean that we actually have a low value or it can also be that the microdialysis vial is empty.

If you choose the option “Include”, these results will be shown.
If you choose the option “Set to Zero”, these results will be shown with a zero value.
If you choose the option “Ignore”, these results will simply be ignored and subsequently not shown in your series.

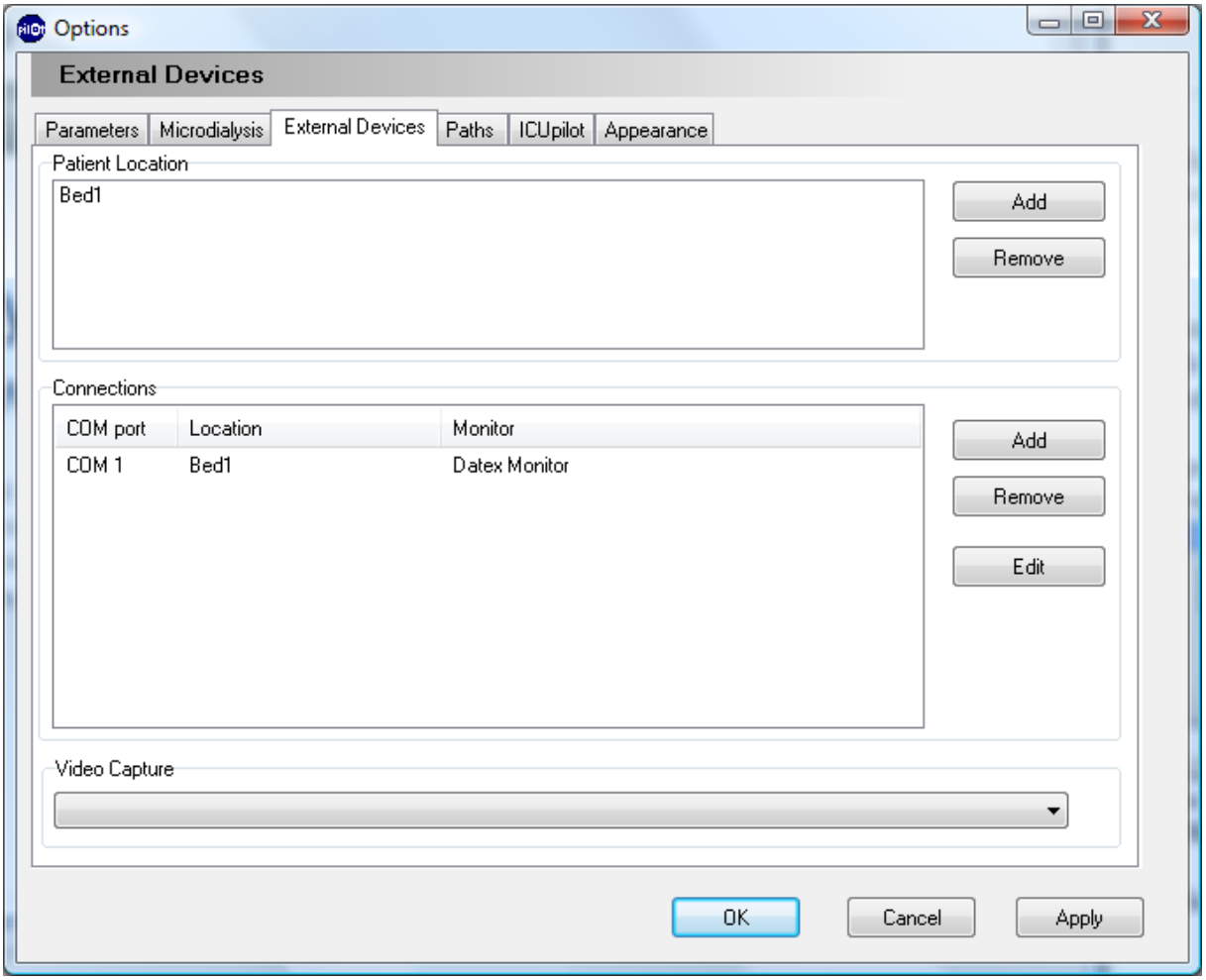
- **The time lag problem**

There is a time delay built into the Microdialysis technique. One can therefore argue that the microdialysis data should be moved in time to match other vital signs data that comes into ICUpilot with no time delay.
Since, with microdialysis, we are dealing with fluids leaving the body through the catheter and further to the vials before it will be analyzed, we get a delay. It is therefore very important to make a correction when comparing the microdialysis data with other vital signs data. The magnitude of this delay is hard to tell, but should be approximately 10 to 15 minutes in the normal case.
You can have ICUpilot to correct this systematic delay automatically in the Microdialysis page, and the only thing you have to do is to estimate this delay.

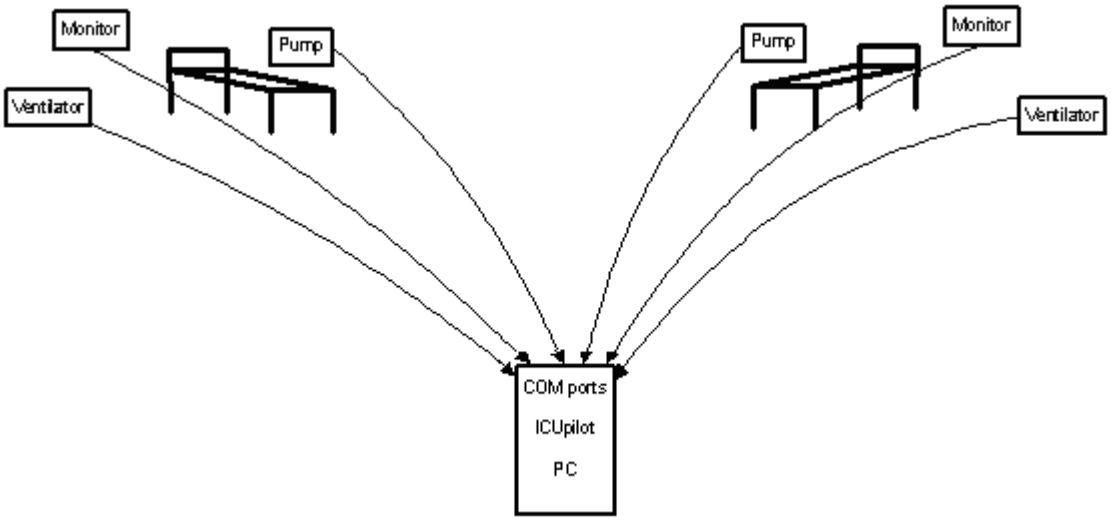
- **Compatibility**

There are two choices – ISCUS/ISCUSflex and CMA 600.
ISCUS/ISCUSflex to ensure that the patient folders do not contain the CMA 600 specific character $
CMA 600 to ensure compatibility with previous patient folders and CMA 600.

13.3. The External Devices page



In the External Devices page you set up your external devices.
In addition to the data from the 600 Microdialysis Analyzer, that is automatically presented, it is also possible to get other types of data.
ICUpilot connects to the patient monitors, ventilators and pumps via serial cables. One end of the cable goes into the connected device and the other end goes into one of the COM ports of the computer where ICUpilot is running as illustrated below. (The COM port is usually a ninepin connector on the back of the computer).
The COM ports cannot be shared so every monitor needs an individual COM port.

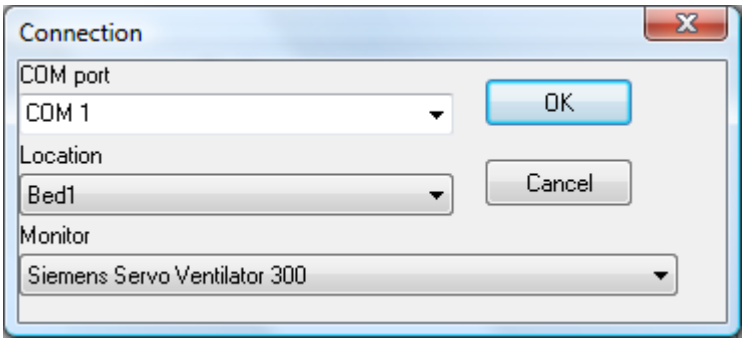


- **Data collection**

To be able to collect data from several patients simultaneously, the concept of patient locations (beds) has been added to ICUpilot. They are typically set up at installation of the system and do not change very much over time.

To be able to "talk" to the connected device, ICUpilot needs to know which device is connected to which COM port. It is also important that ICUpilot knows at which bed the connected device is located.

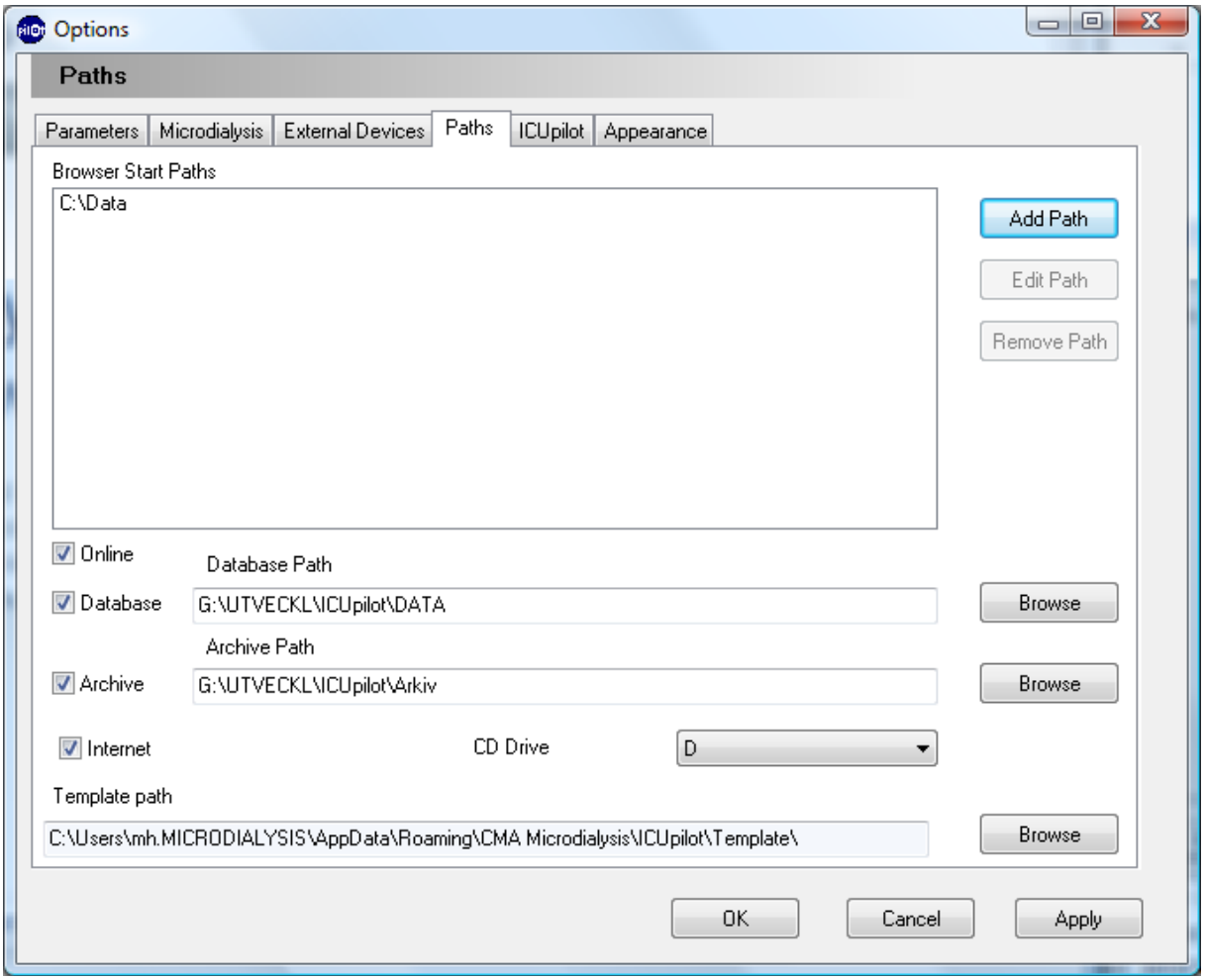
To associate bed-monitor-COM-port, in a new connection, press the "**Add**" button in the Connection section.



In the dialog, enter a combination of COM port, Location and Monitor, and then click "**OK**". If the combination was OK, it should now be present in the list.

Close the "**Options**" dialog by clicking "**OK**".

13.4. The Paths page



Settings regarding the data tree are set up in the Paths page. You set up new top folders in the options dialog. You can enter new file paths by pressing the "Add Path" button. A dialogue appears that lets you choose a folder in the computer where ICUpilot should look for data. This enables you to make up your own data structure.

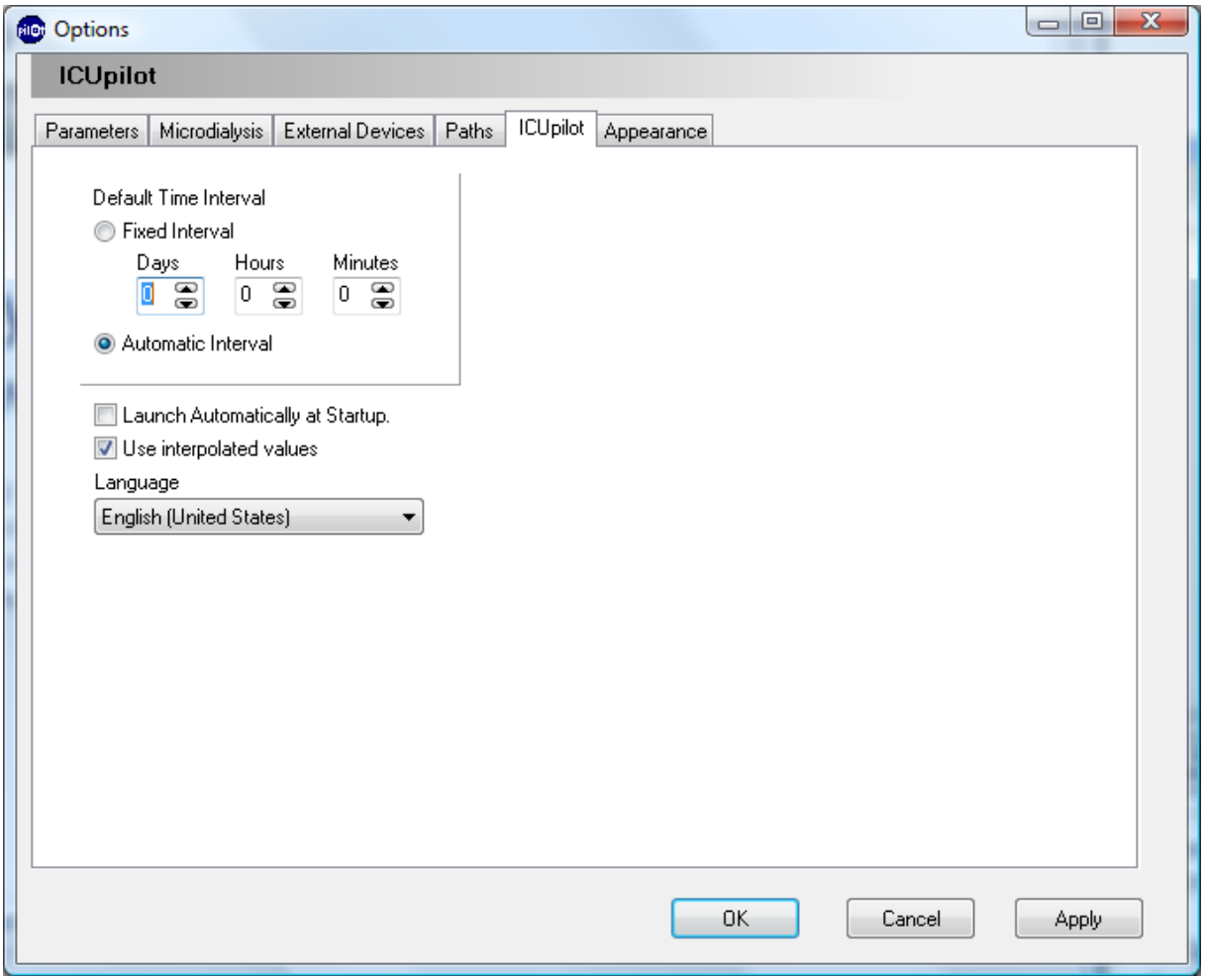
In addition to the previous branches, two more branches are possible, the Database and Online branches.

If "Database" is checked, the Database branch is visible in the data tree. Select the folder where your data is stored.

When "Online" is checked, the online branch of the data tree is visible. If the Database Path has been set correctly (see above), the patients that are registered in the 600 will be visible. Patients registered in ICUpilot will also be visible here.

Note: It is only possible to register patients when "Online" is checked.

13.5. The ICUpilot page



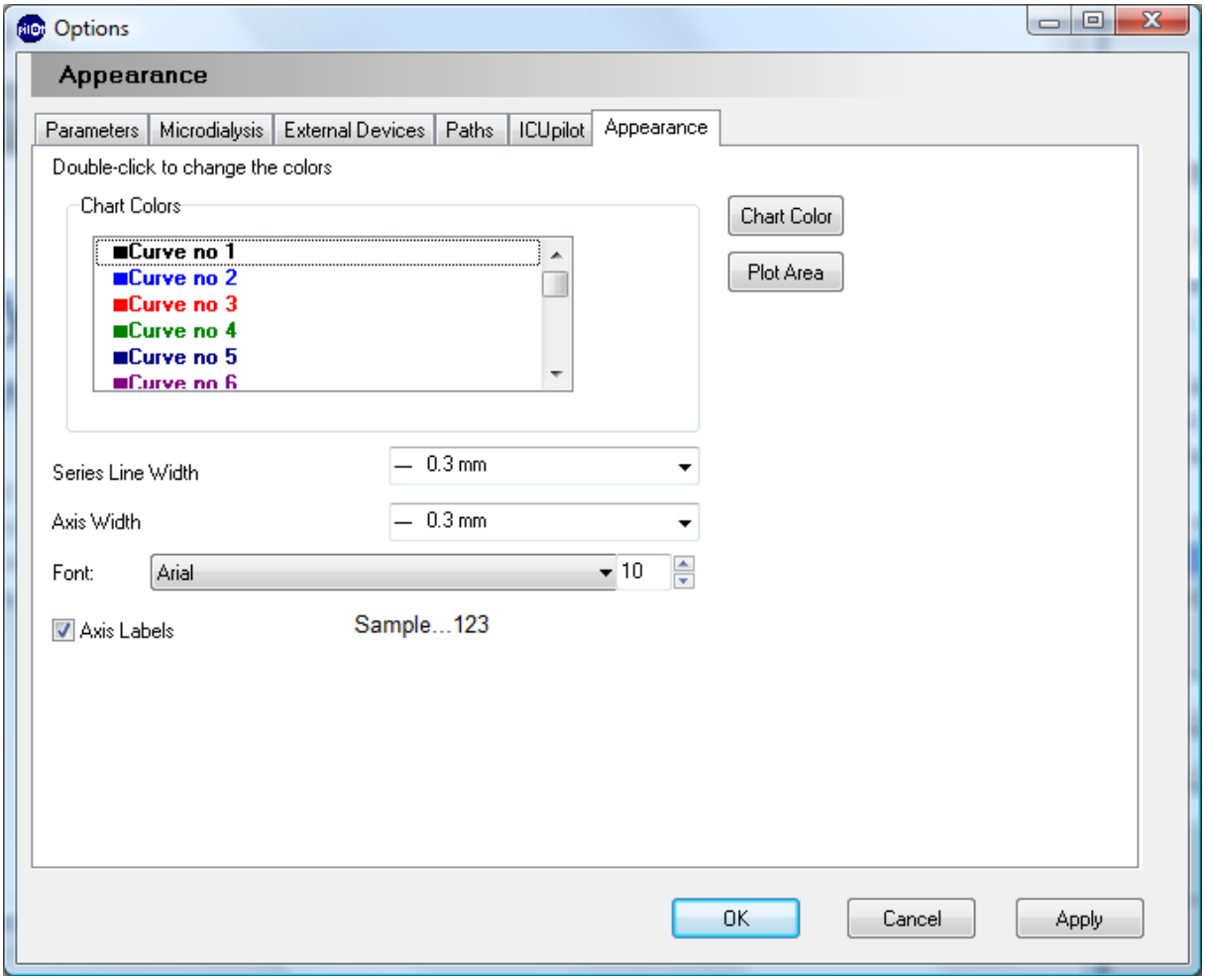
It is possible to set a default time interval for all curves. This means that the length of the time axis will be set to the decided interval instead of being scaled automatically. This time interval applies only to date-time axes.

You can have ICUpilot start whenever the computer starts by checking the Launch Automatically at Startup.

ICUpilot will interpolate values in calculations if "Use interpolated values" is selected.

It is also possible to change the language used in ICUpilot (if installed). The language setting will be applied the next time ICUpilot is started.

13.6. The Appearance page



You can set the colors that you want to have as default when you add and remove series from your charts. The first color (Color no 1) will be used for the first series in the chart. The second color (Color no 2) will be used for the second curve, etc.

You can choose the line width that you want and the axis width and font. ICUpilot will try to match the given line width as good as possible. The result can differ between different monitors and printers.

You can choose whether to display a label next to the axis or not. If Axis Labels is checked, all axes will have a label showing the parameter name and parameter unit if they have been assigned.

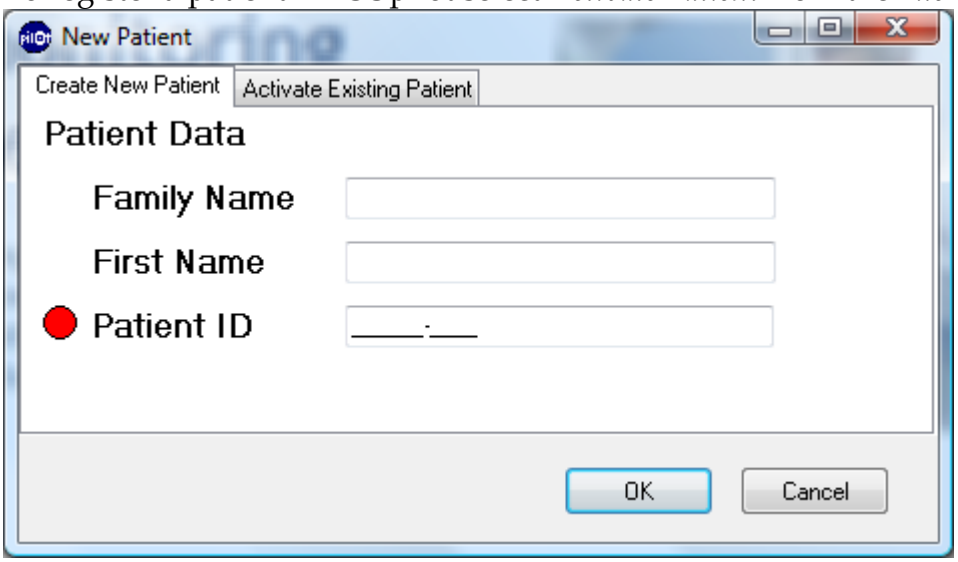
14. Patient management

14.1. Register a new patient

To be able to collect data, there must be a registered patient OnLine. This can be done through the 600 control program, or it can be done in ICUpilot.

It is not possible to register a patient in ICUpilot and get it automatically registered in the 600-control program however. Therefore, if you are using the 600 Microdialysis analyser, it is better to register the patient in the 600-control program.

To register a patient in ICUpilot select *Activate Patient* from the *File* menu.

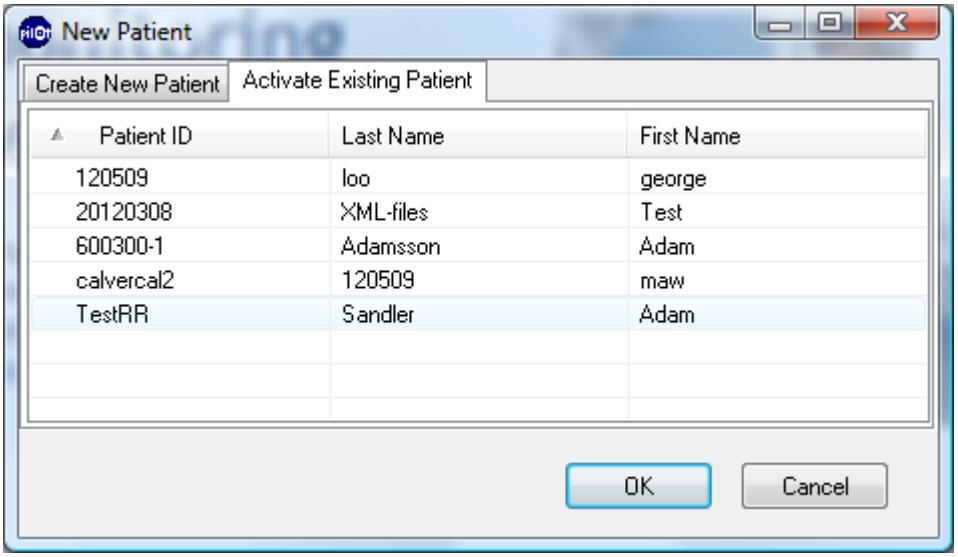


Note: The *Activate Patient* menu item is enabled only if at least one of the online or database branches is enabled.

In the dialog, enter the first name, family name and unique identifier of the patient. A new patient will be created. This patient will be accessible both in the 600 program and in ICUpilot.

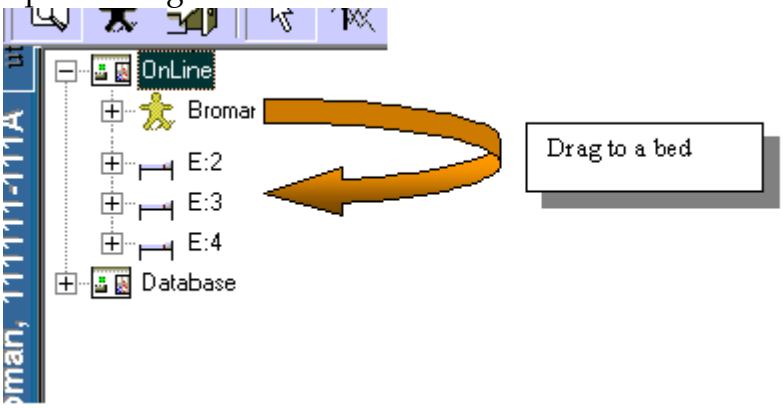
If a personal id of an already stored patient is entered, the small dot next to patient id will turn red. Once a valid patient id has been entered the dot will turn green.

By selecting one patient under the "Activate Existing Patients" tab, it is possible to activate already registered patients. Clicking on the columns can change the sort order.

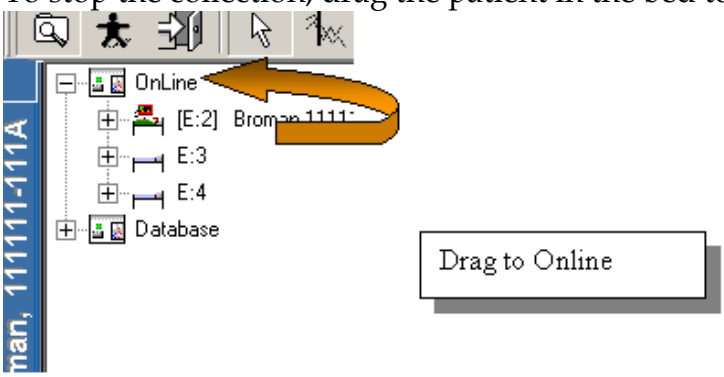


14.2. Starting and stopping data collection

To start the data collection, take one active patient under the "**Online**" folder and drag it to the bed. This will start the collection from all monitors that have been set up to belong to the bed.



To stop the collection, drag the patient in the bed to the online folder.

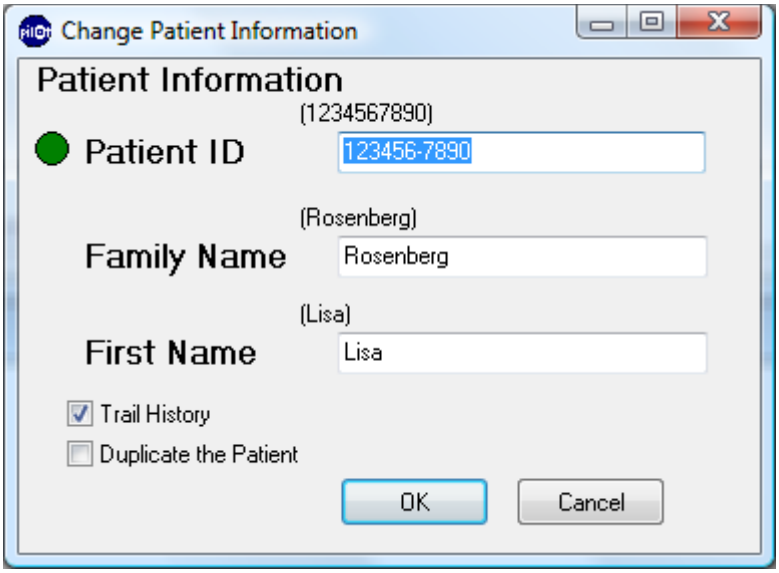


14.3. Data collection

During data collection, all active connections can be found under the "Active Connections" dropdown or under the monitors menu.
When all connections are working, the Active Connections icon is displaying two connected cables .
As soon as a connection is down, the icon will change to show two disconnected cables .
Clicking on a connection will activate the collect program for that connection.

14.4. Changing a patient's personal ID

To activate this dialog, select the person in the database and click with your right mouse button. Select Depersonalize with the person's name and ID number and click now with your left mouse button and the following dialog appears.



In this dialog you are able to change the stored information about a patient's identity. This is very useful in those cases when a person's identity cannot be established until later and therefore initially registered as unknown.

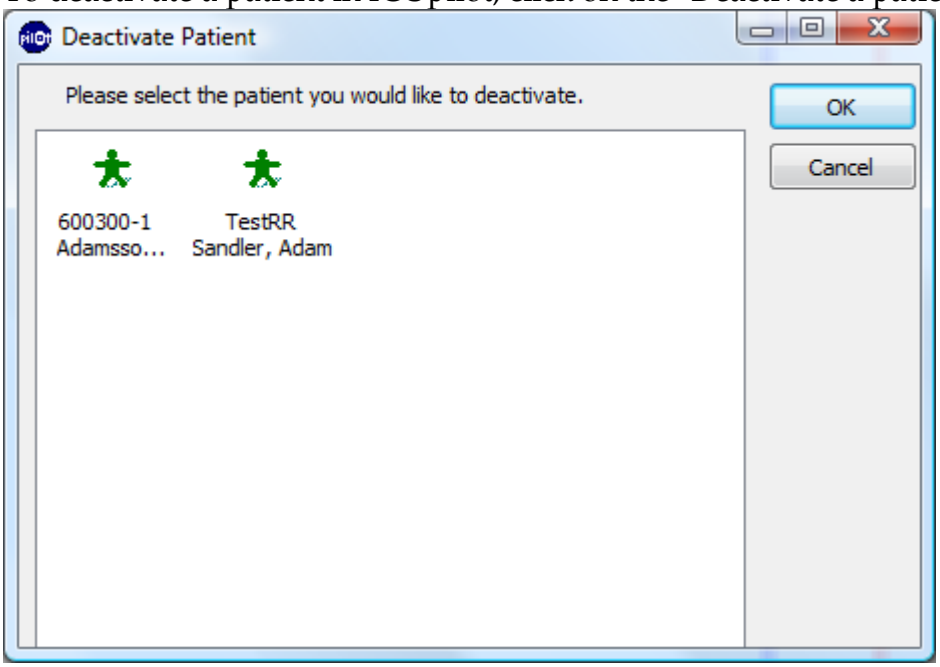
Changes in this dialog cannot be performed when a person is "**OnLine**". Make sure that the person is deactivated. It is not possible to enter a personal ID of an already stored patient. The OK button will be disabled and the small dot next to personal id will turn red. Once a valid personal id has been entered the dot will turn green and the OK button will be enabled.

If *Trail History* is checked, the previous information will be preserved. This information is stored in the "PatientKey.pil" file. This box should thus be unchecked when the intention is to remove all identifications for a patient.

A copy is created with the new personal identity if the *Duplicate the patient* box is checked.

14.5. Deactivate a patient

To deactivate a patient in ICUpilot, click on the "Deactivate a patient" button,  .



This will open the Deactivate patient dialog.
In this dialog, select the patient that you would like to deactivate and click on the OK button.

Note: Patients registered in the 600 Analyzer are also seen in this dialog but they cannot be deactivated through ICUpilot.

15. Templates

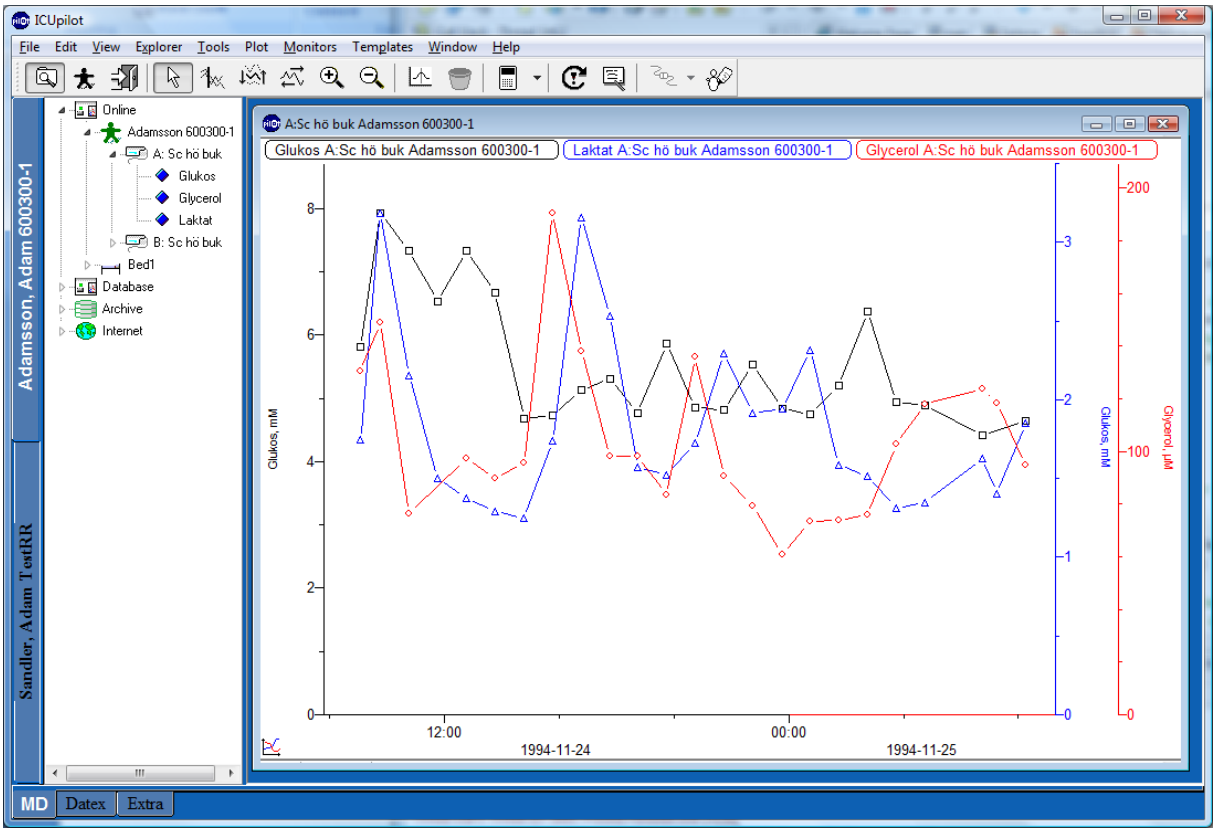
15.1. The performance of the templates

Templates are a way to set up one or many default views of data. It makes it easy to switch between these views and to switch between patients by clicking on the corresponding tab. The data in a template always refers to one patient to reduce the risk of patient mix-ups.

A number of tabs control the template.

- On the left side there are patient tabs, one for each active patient. One of the tabs is active, indicating which patient is active in the template.
- On the bottom there are view tabs, one for each view.

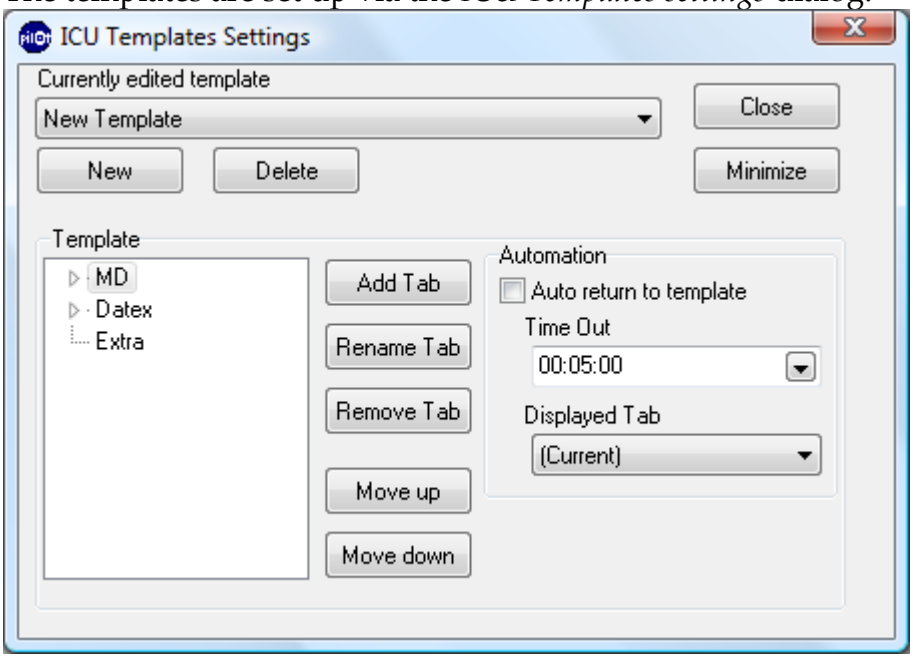
The views are not static. It is possible to rearrange the view just as previously explained. You can close plots and create new plots, just as you like.



To refresh the template,  means to go back to the default view again.

15.2. Setting up templates

The templates are set up via the *ICU Templates settings* dialog.



Open the dialog by selecting *ICU Templates Setup* on the *Templates* menu.

15.3. Create a new template

Click on *New* to add a new template. Enter a unique name for the template.
Add tabs by clicking *Add Tab* and give them meaningful names.

To define how the different tabs should look, drag parameters from any of the active patients. (Important: drag only data from active patients). It does not matter which patient you drag the data from as long as it is a patient under the "**Online**" branch. When you start to use the template, all data will be fetched from the active patient. Arrange the curves, as you would like them.

When you are satisfied, click *Close* to close the dialog. You will be asked if you would like to save the changes, answer yes. The template will be saved to a file.

The template can be set up to be refreshed automatically. In the automation section, check *Auto return to template* and choose a timeout period and the tab to be displayed after refresh.

Remove tab removes the currently active tab and deletes all plots in that tab

Pressing Minimize will hide the dialog and bring up a toolbar with three buttons:

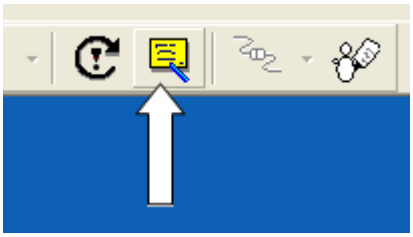
Add Tab, *Remove Tab* and *Restore Dialog*.

Add Tab works just like Add Tab.
Remove Tab works just like Remove Tab.
Restore Dialog will bring up the ICU Templates Settings dialog again.

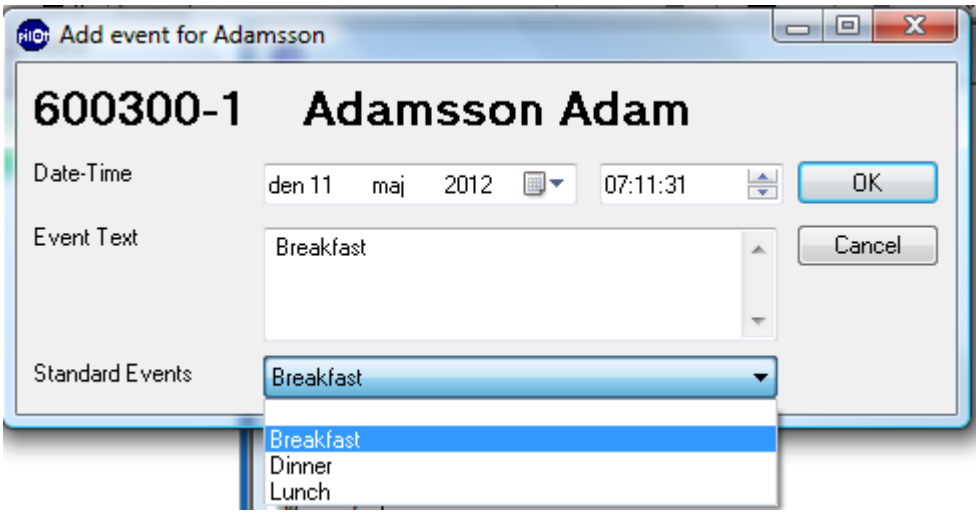
16. Care Events

Care events are collected at several occasions and describe the state of the patient at a given moment. The interval between collected events might be irregular.

The care events are shown in the tree structure, just like other parameters, and are pulled to the work area where they form event series.



To enter a care event, press the button "Add event". A dialog will show where the event can be entered. There is also a drop down list with pre-defined care events to select from.



16.1. Custom Care Events

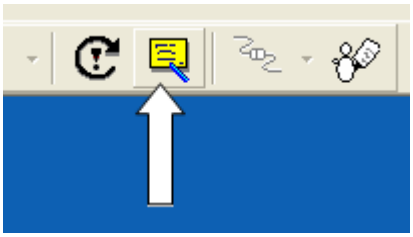
Note: To use Custom Care Events an installation configuration has to be made. Default only normal care events are activated.

It is possible to use define custom care events to be collected using ICUpilot. The definition files are stored in xml-files under ..\ICUpilot 2.0\Care\..

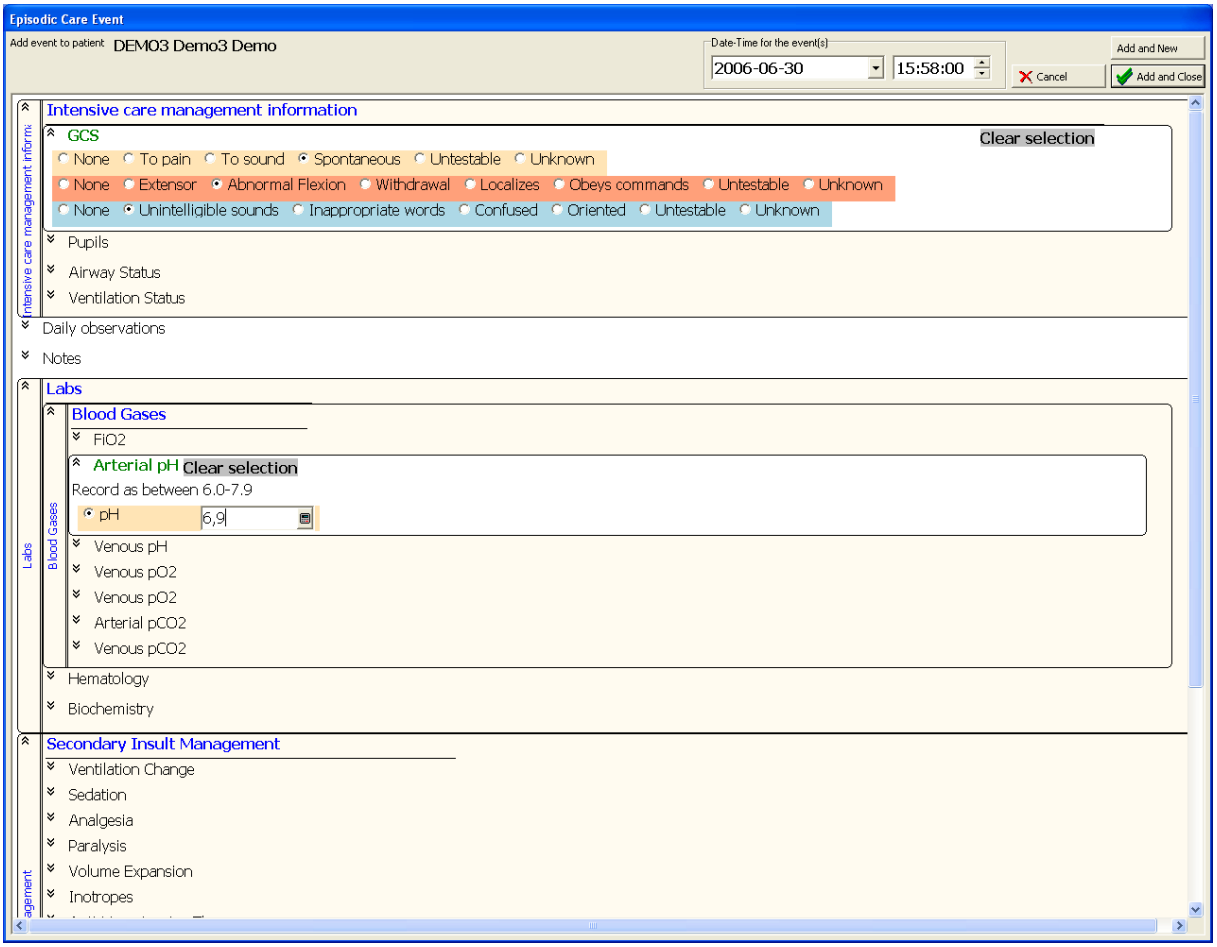
16.1.1. Episodic Care Events

Episodic care events are collected at several occasions and describe the state of the patient at a given moment. The interval between collected events might be irregular.

The episodic care events are shown in the tree structure, just like other parameters, and are pulled to the work area where they form event series.



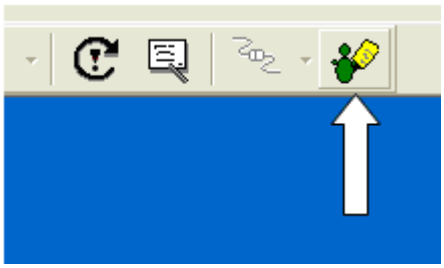
To enter an episodic care event, press the button "Add event". A dialog will show that describes the predefined care events.



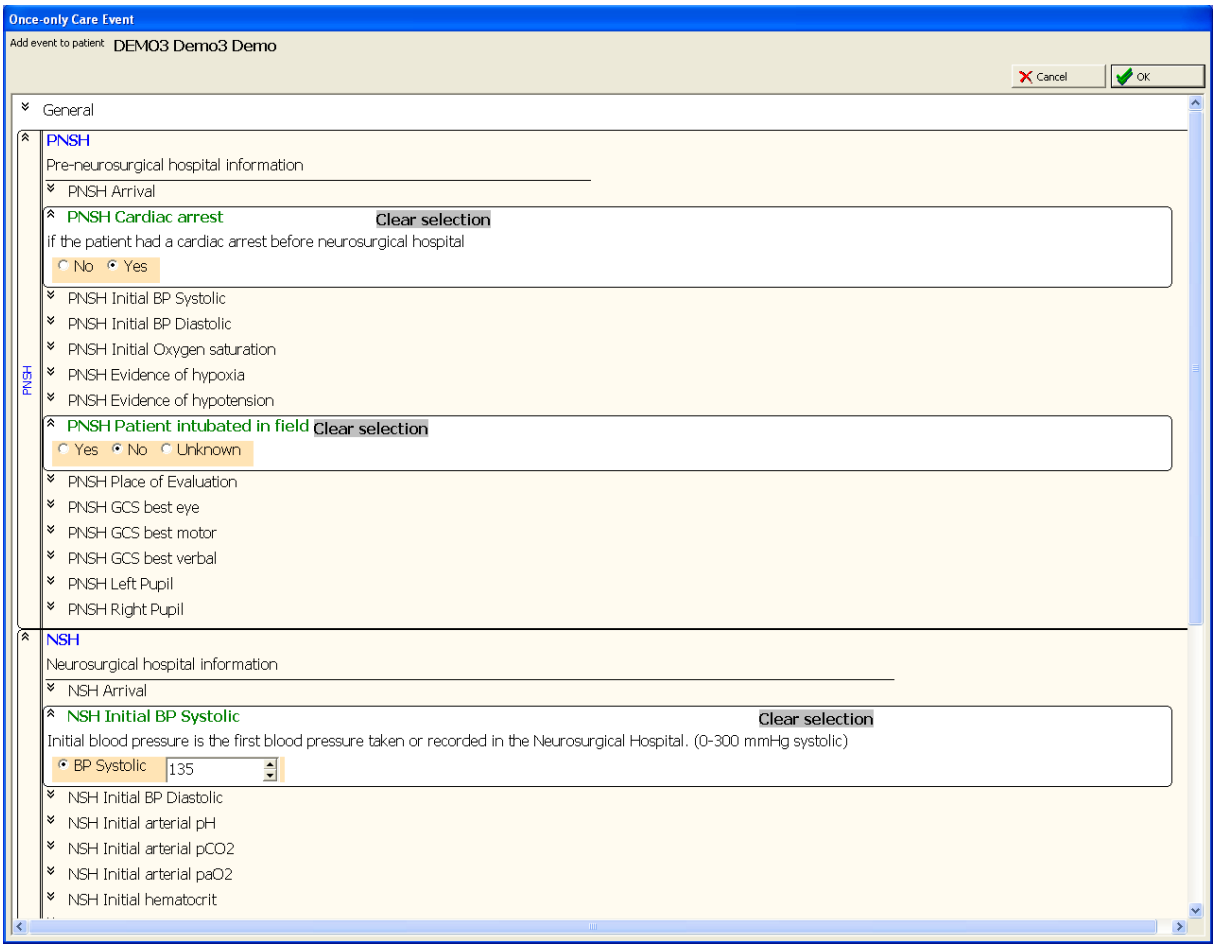
Please verify that the time is accurate for the care events that are to be entered. By clicking on the categories, they are expanded. The care events are selected – it is possible to select several events at the same time. To save the events, click the "Add and Close" button.

16.1.2. Once-Only Care Events

Once-only care events are events that do not have a time stamp (i.e. not time series). It can for instance be the age of the patient or level of consciousness at arrival to the first hospital.



To enter a once-only care event, press the button ”Data entered only once per patient”. A dialog will show that describes the once-only care events that are defined.



In the once-only care event dialog, no date-time is entered (compare with the episodic care events). The selections are static and selections previously performed are shown. By clicking on the categories, they are expanded. After entering the desired care events, press “OK” to close the dialog.

17. Other file formats

You can mix the ICUpilot files with files created in other programs. All registered file types, not just the files that ICUpilot recognizes, appear in the tree view.

A non-native ICUpilot file, is opened with the program associated with the file extension. This enables you to keep all of your files in the same place, and still be able to access them from the same program.

You can create new documents of file types that are registered to windows as file types that can be created. Select the folder where you would like the new document, then click **Explorer | New** and locate the document type in the sub menu that appears.

18. How the data is stored

The data is stored in files.
The microdialysis data is stored in a dedicated file structure defined by the Microdialysis analyzer control program. The patients are stored in folders under the data directory. See the User's manual of the analyzer for details.

In the patient folder, a number of files will be produced.

"Patient." containing all Microdialysis data in a binary format (for 600 Analyzer).
"ISCUS.pil" containing all Microdialysis data in binary format (for ISCUS and ISCUS*flex* analyzers).

PatientKey.pil stores information about historic patient id:s. Delete this file when sending anonymous data to colleagues.

Data collected from different external monitors is stored in different files. Different parameters, however, are stored in the same file if they come from the same monitor.

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