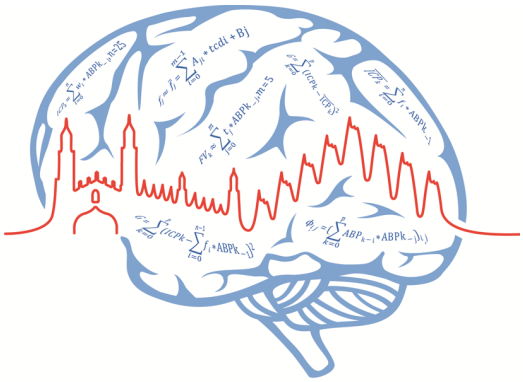
ICM+ Standard Operating Procedure



ICM+®

Getting started

May 2022

http://icmplus.neurosurg.cam.ac.uk

Table of Contents

Prerequisites

1. **A laptop (or a PC) with the latest version of ICM+** and the required monitor modules (e.g. GE Carescape) installed

2. **Appropriate cables** – connection to the monitor will differ depending on the monitor make and model. Most of the time it will be a serial null-modem cable connecting the serial port on the monitors with the serial (RS232) port on the laptop with ICM+. However, there may be variations; for example, a straight modem cable might be needed instead. Also, for some monitors, like GE Carescape or Integra Cerelink, a specific USB-Serial adapter supported by the manufacturer will be required. These will need to be established on individual basis – please contact ICM+ support for details.

3. **Serial port available in the laptop** - If no serial port is available on the laptop an appropriate USB-Serial adapter must be used (e.g. ATEN UC232A, http://www.aten.com/global/en/products/usb-&-thunderbolt/usb-converters/uc232a/). However, if a null modem connection is also needed, then a cable that combines both is a better choice: https://www.startech.com/uk/Cards-Adapters/Serial-Cards-Adapters/USB-to-Null-Modem-RS232-DB9-Serial-Adapter-Cable-DCE-FTDI~ICUSB232FTN

4. Optional file server, for archiving the data.

Locking and unlocking ICM+

ICM+ includes a simple system of user-based permissions, which allows it to be used safely in a clinical environment, including by people with minimal training. This ensures that the vital data collection process is not inadvertently interrupted or disrupted.

If your ICM+ is correctly configured, the program will automatically initialize with the default user 'Nurse'. There are three other users already configured in ICM+: the Administrator, the Manager and the Operator. The users have been configured with progressively decreasing operational rights.

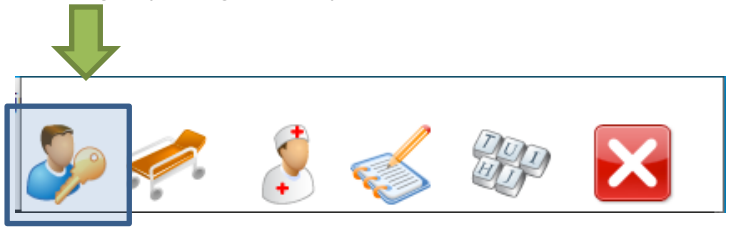
The **Nurse** is the user with the fewest rights in the software, effectively only being able to insert clinical events, browse the charts and start new sessions, without any possibility to disrupt the data collection procedure. Please refer to the 'How to use the events form' for more details. After 3 minutes of inactivity, ICM+ automatically logs in as a Nurse.

The **Administrator** is the user that will have full access to the full features of the application.

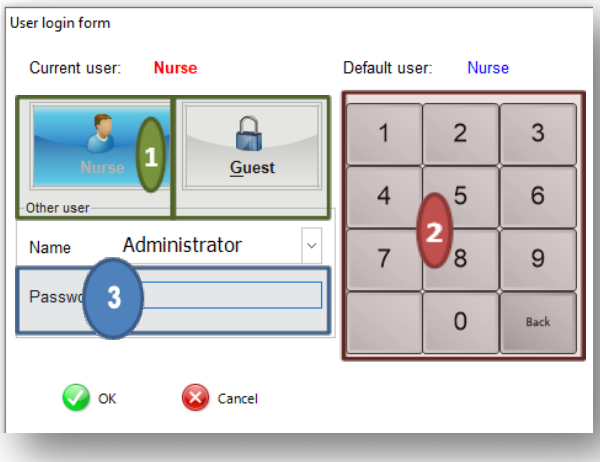
The **Manager** will have the same privileges but will not be able to manage user accounts.

The **Operator** will only be capable of starting new recording sessions with available profiles; browsing data, inserting clinical information, display configuration as well as, importantly, pausing the session, moving beds or discharging the patient (closing the session).

The login (change users) form is accessible via a button on the tool bar/main menu bar.



When you press the Login button, the User login form will appear.

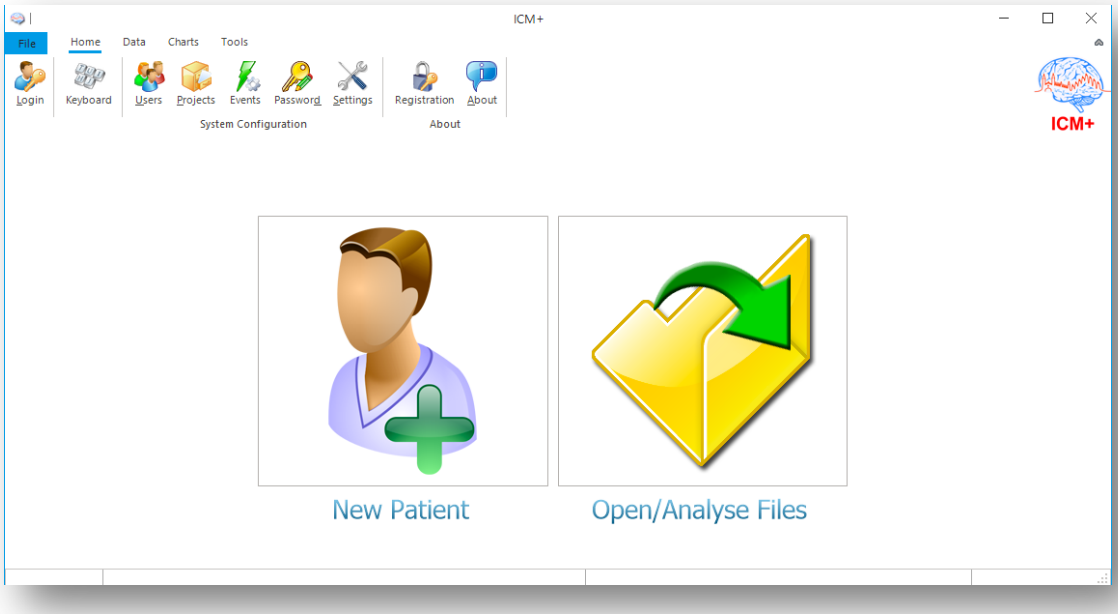


In this form you will find:

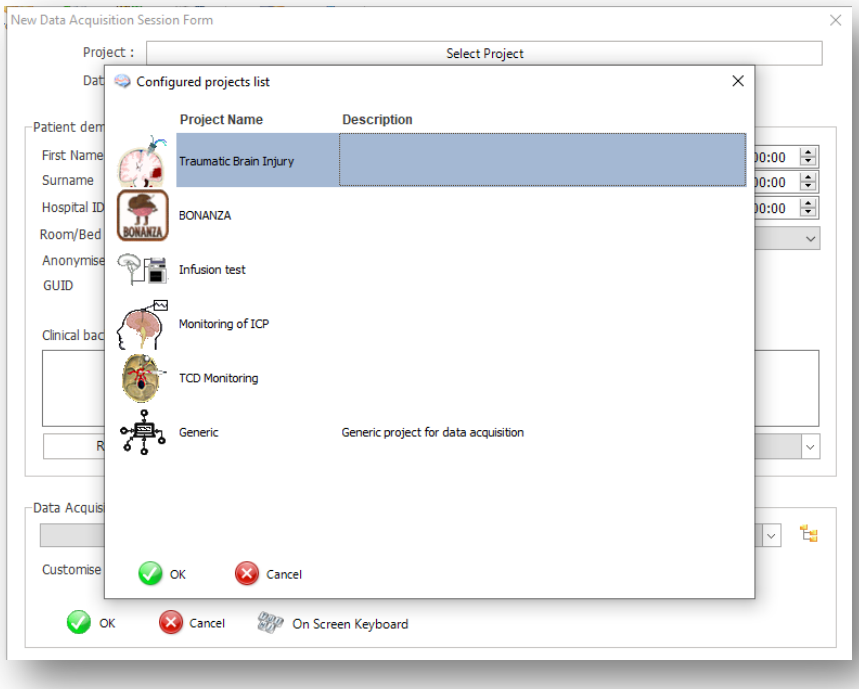
1. A button showing the Default user and a button to lock the application so that nothing but the login button is accessible.
2. A keypad to enter the Password for a given use.
3. A drop-down menu to select the user to Login as

Starting a new data collection session

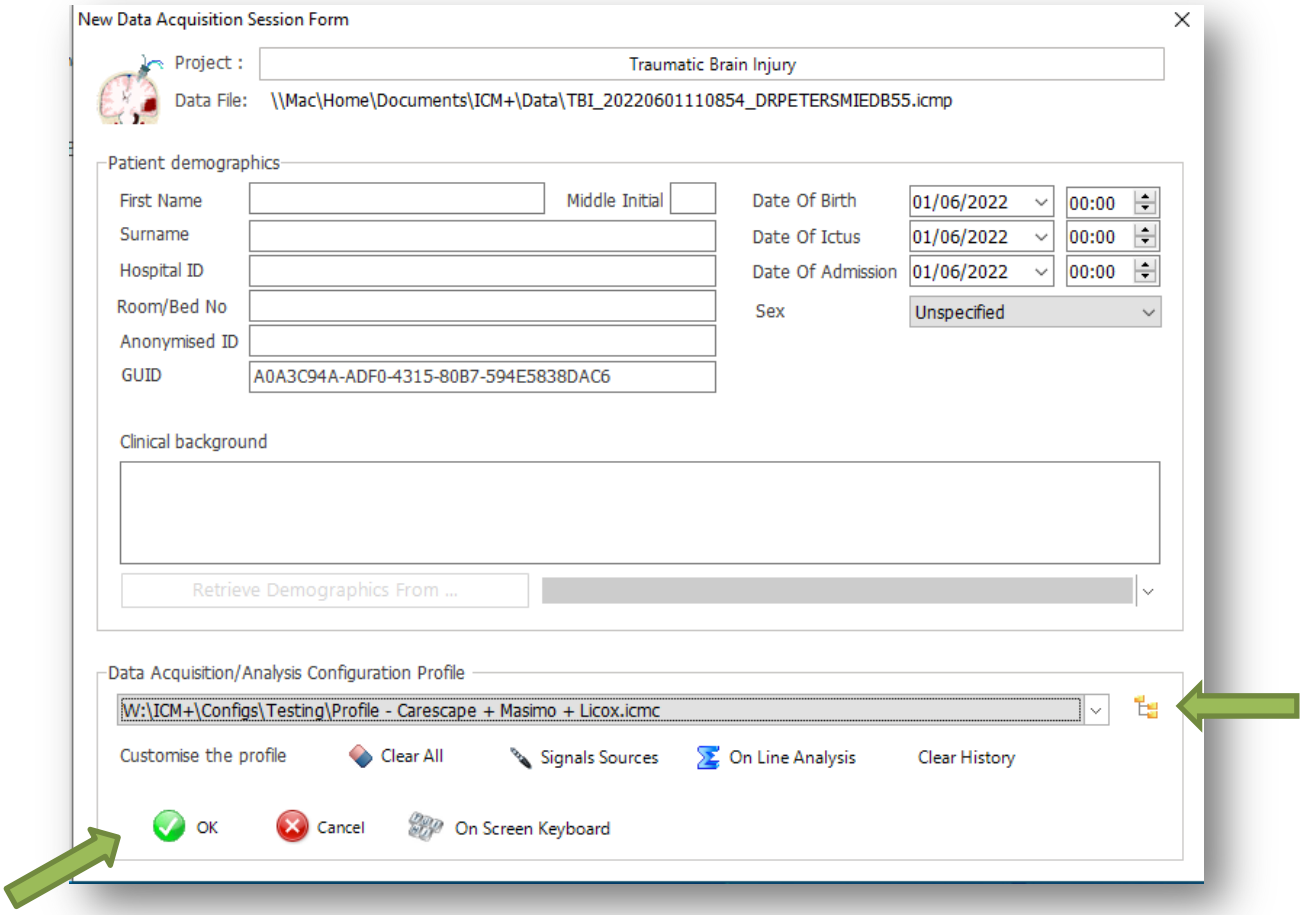
To create a new data acquisition session, click on the New Patient button.



Clicking on New Patient will open a Project Selection form, where preconfigured projects will be listed:

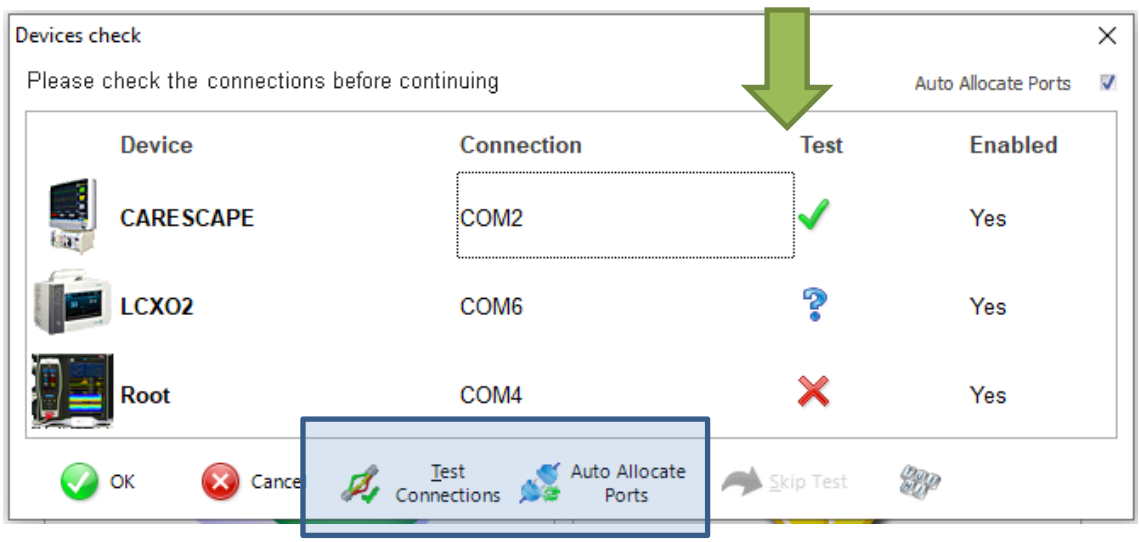


Choose a relevant project. This will bring up a new form:



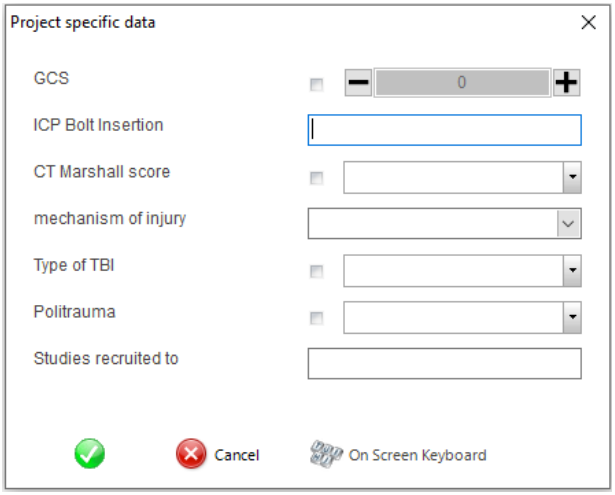
More importantly, you should select a data acquisition/analysis profile (configuration) file, either from the history list box or loaded from the file system. You can then modify it, if necessary, using Signal Sources editor (described below), and/or On Line Analysis editor.

After clicking the OK button, the Devices check dialog is displayed.



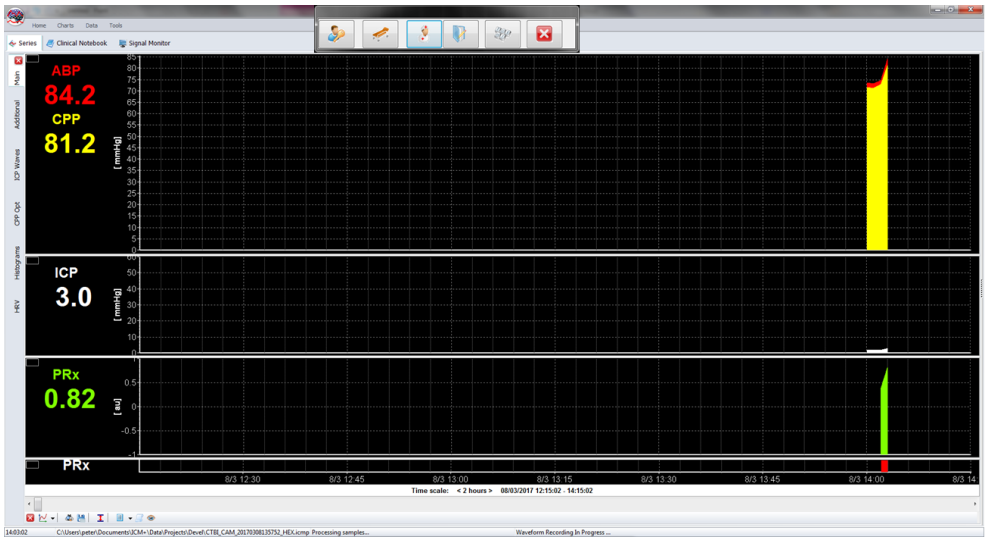
This dialog is used to test the communication between ICM+ and the monitor (the 'Test connections' button) and it is also accessible from the Data menu tab later.

This form can also be used to modify the connection port (if it is a serial connection) or an IP address (in case of a network interface). For serial connections, the button 'Auto allocate ports' can be used to initiate the process of scanning and testing all the available ports for automatic port allocation.

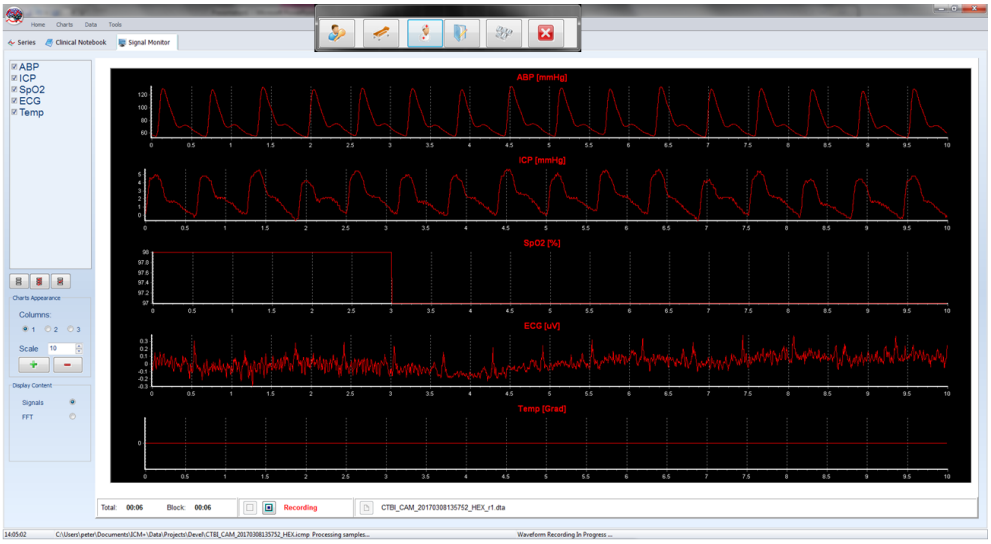


Just before the session starts, the user is prompted to insert some additional information about the patient, if configured, via the Project specific data dialog. This form is also accessible from the Clinical Notebook tab but it is highly recommended that you complete it, wherever possible and feasible, at the start of the session.

After this dialog, the ICM+ main chart display is presented and the session begins recording automatically, if this behaviour is configured in the project you are using. Otherwise, use the Start button to start data acquisition (see below). The charts with configured calculated parameters will get updated with the rate specified in the configuration profile. In order to see the raw data as it comes in from the monitor(s), click on the Signal Monitor tab, or on the Monitor button if the tab is not available yet (see below).



Data analysis, main, display (as configured in the loaded profile). The charts can be modified using the Charts top menu tools.

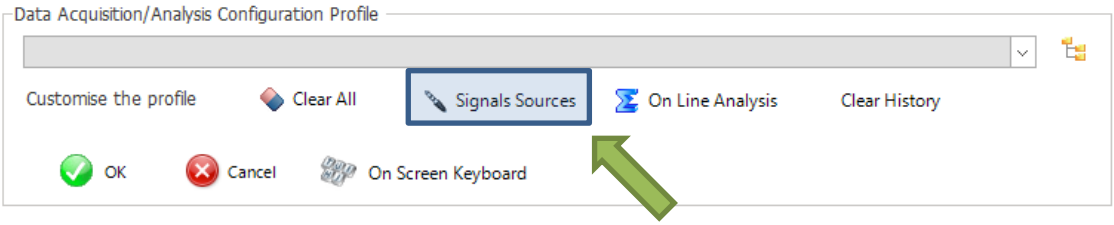


The raw signal monitor, showing all the data as it comes in. Please note that the raw data is stored in a separate file (or files if the one grows too large) with the name shown at the bottom of the monitor signals panel (file extension *.dta).

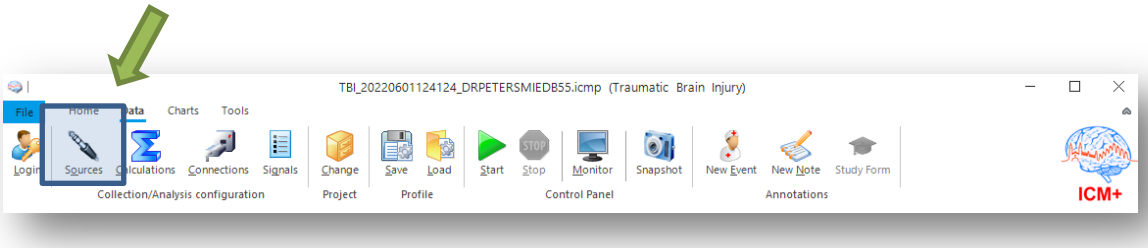
If ICM+ **shuts down during a recording session**, the next time it is run, the previous session is automatically restored, but you must first verify that all the signals are being received correctly by selecting the Monitor button. After this, you must press the Start button and the session will resume recording.

Manually configuring data collection

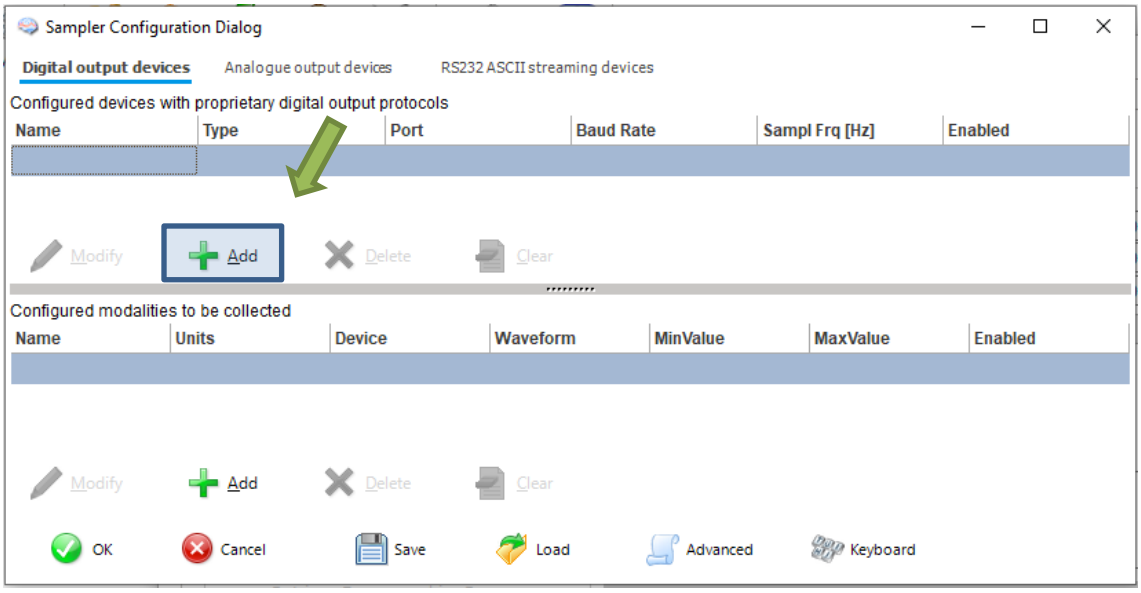
If there is no prepared profile available that includes the desired data collection from the monitor or if you need to modify or add parameters downloaded from the monitor, you will need to use the Signal Sources option. You can do this in the New Data Acquisition Form:



Or by using the Signals button in the main Menu (Data Section), with the data acquisition in pause mode.

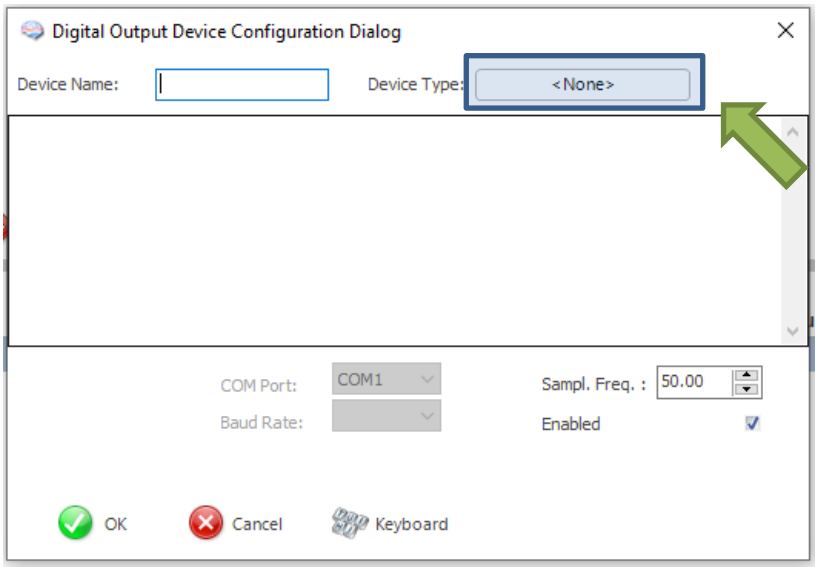


This brings up the Sampler Configuration form:

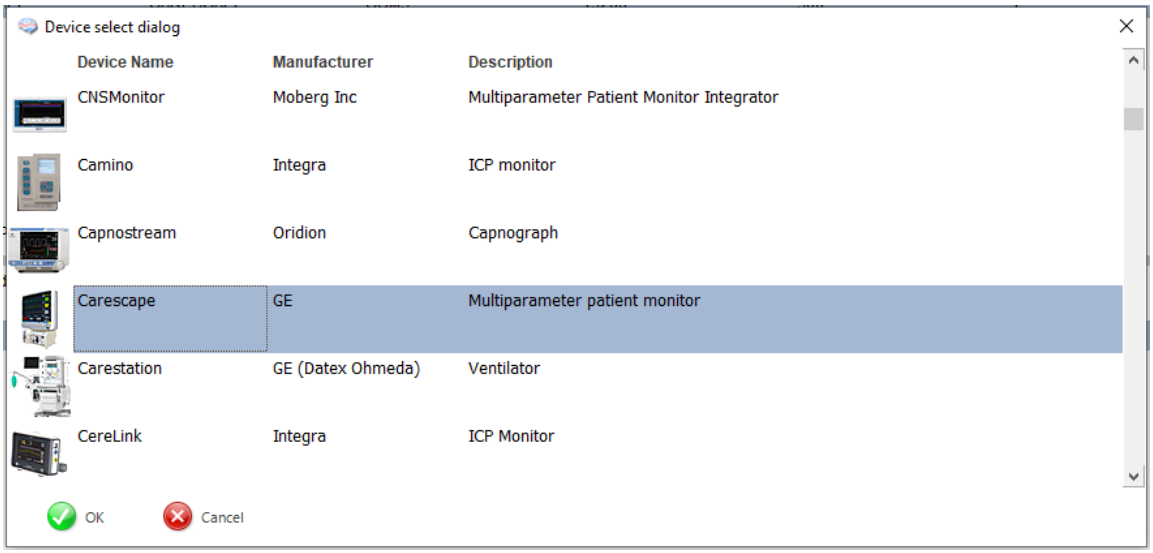


Clicking on the Add button in the upper area (Digital Output devices tab) opens a Device Configuration dialog.

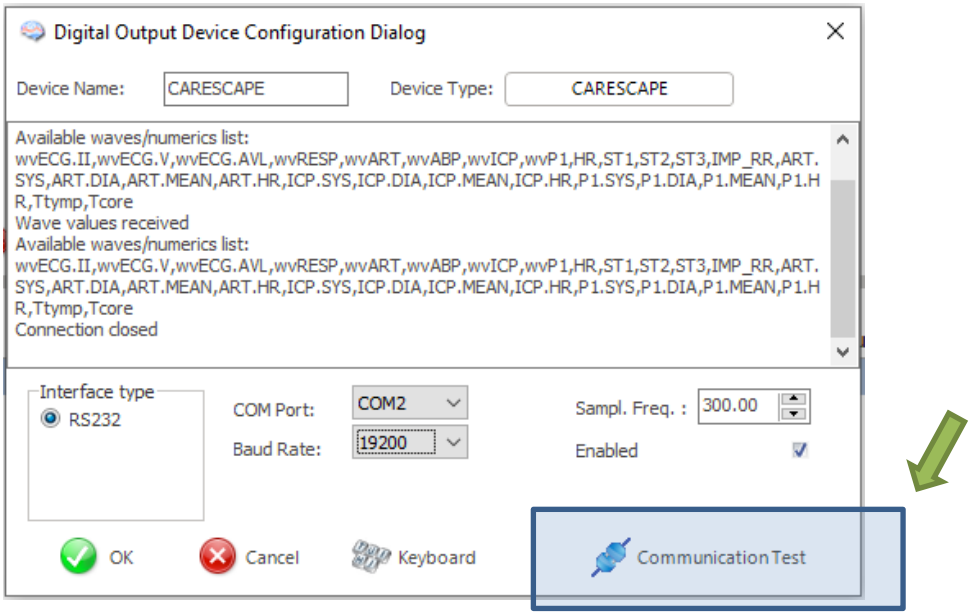
Here, you can select the monitor module from the list of available (installed) interfaces, as well as specify the serial port (real or virtual, when using a USB-RS232 adapter) and its baud rate to match the one configured/offered by the device.



Click on the Device type button to see a list of available, installed monitor modules to choose from:

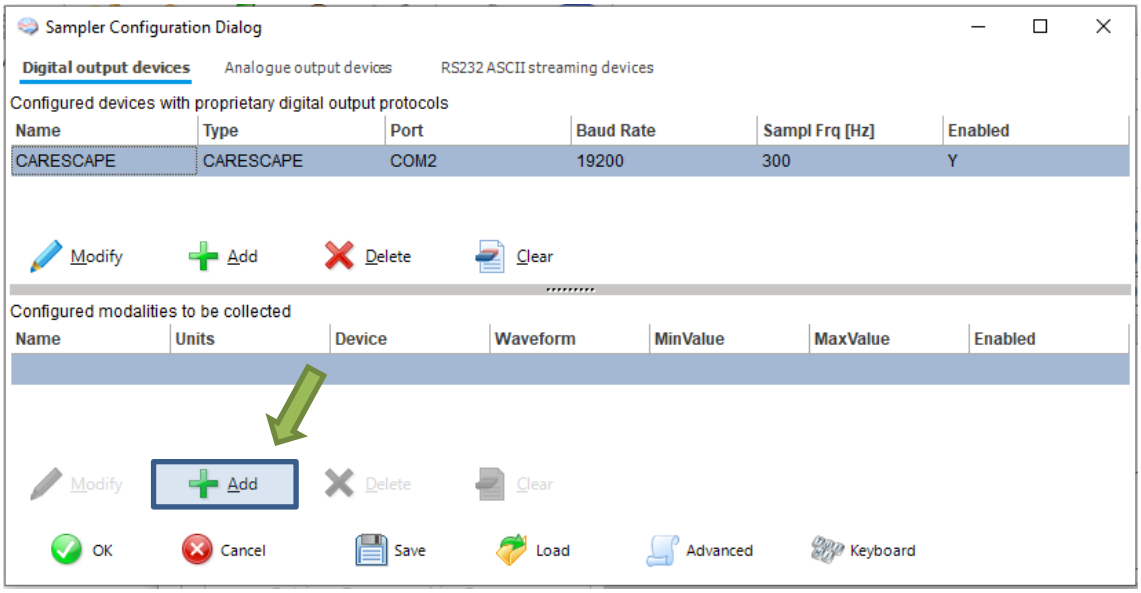


When you have chosen the correct interface module, the COM port and the baud rate, clicking on 'Communication Test' will try to establish communication with the monitor. The log of that communication is printed in the memo box, also listing all the parameters that are available to download from the monitor.

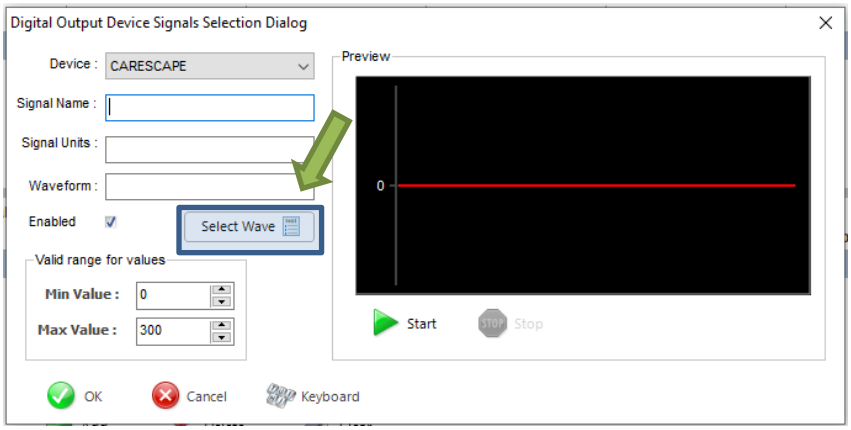


When the connectivity is confirmed, the dialog can now be closed by clicking OK, which causes the device to be added to the data collection configuration.

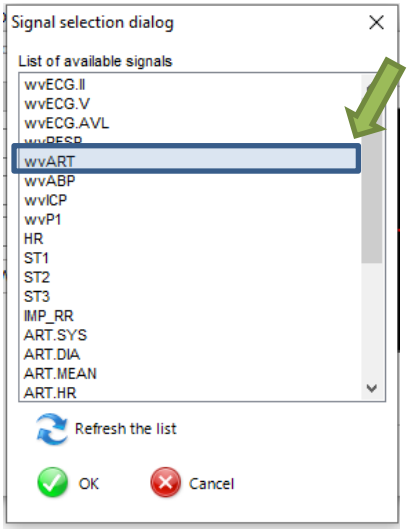
In order to complete the configuration, you must add to the configuration all the desired parameters to be downloaded. Do this using the Add button in the lower part of the Sampler Configuration dialog.



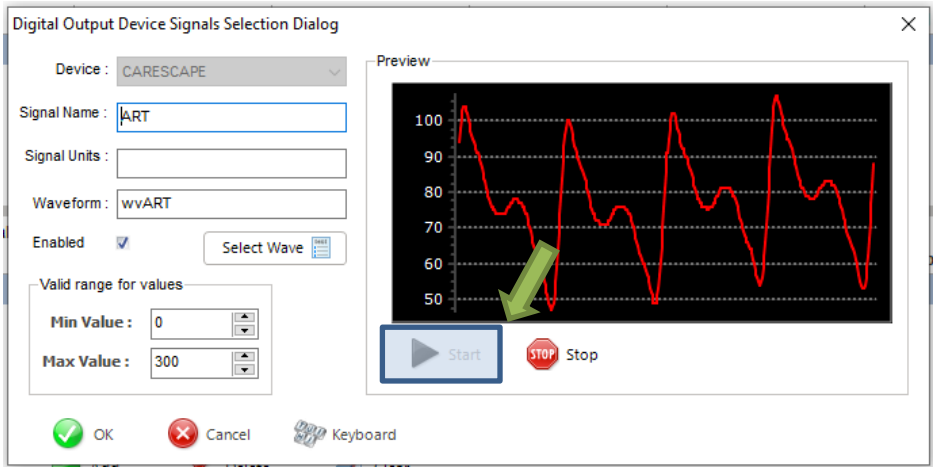
This opens a signal selection dialog:



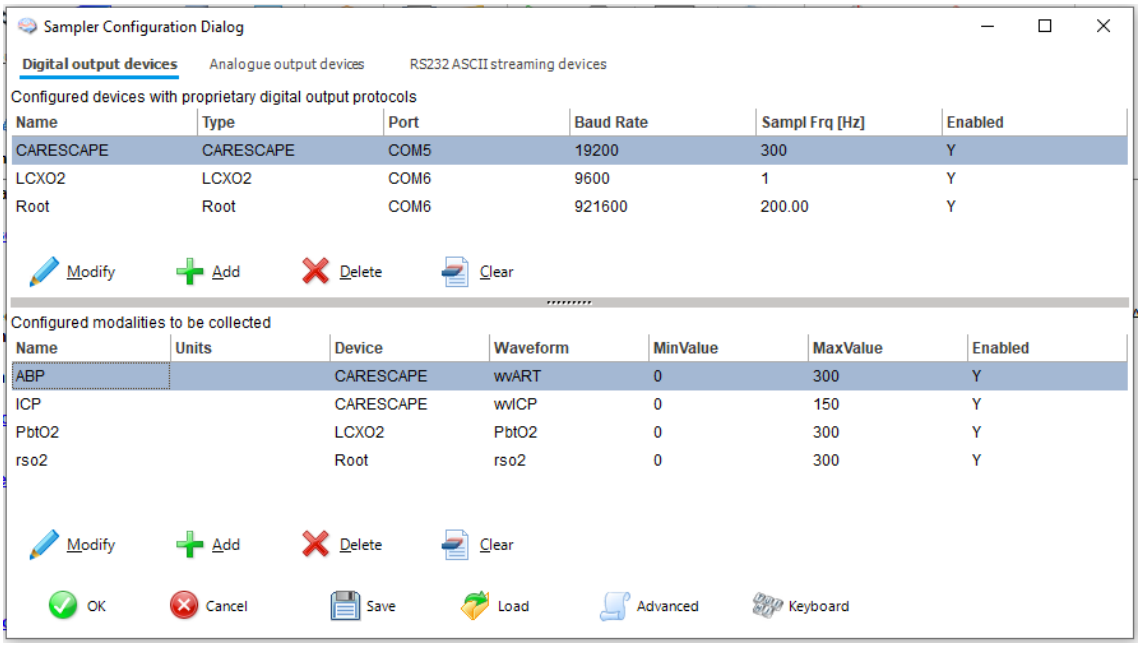
Using the 'Select Wave' button you can select available signals, one at a time.



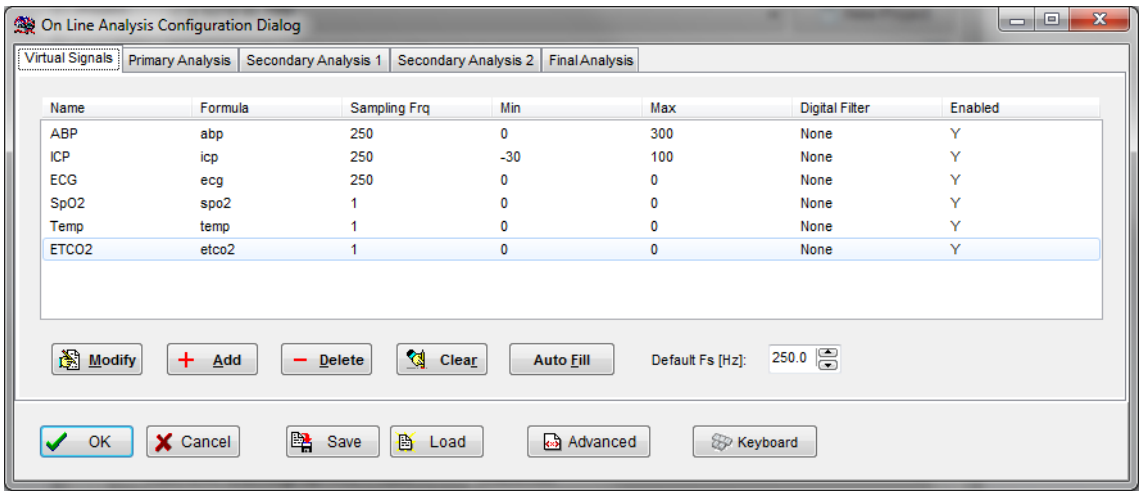
When a parameter is selected you can test whether the data is coming in as expected by using the Start button



You can repeat this process as many times as needed putting together the complete list of parameters to be collected. This completes the data acquisition configuration procedure.



Please note that adding parameters/signals to the data collection will make ICM+ show and record the data through the Signal Monitor window but the trends charts will not automatically get configured to show them. This is because the trend charts only show results of calculations, not the raw data. So, to display even just a mean trend of a newly added variable collected from the monitor in ICM+, this needs to be configured first in the analysis section, as in the screenshot below, and then the new trend needs to be added to the charts.



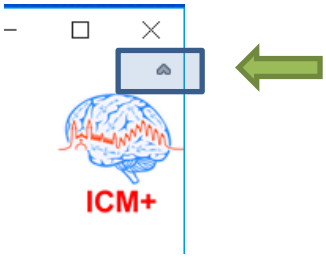
Annotating clinical events

As soon as data acquisition starts, the main menu toolbar will get minimised and, in its place, a small ‘data acquisition essentials’ toolbar will open, as shown below.

The toolbar gives access to the following functions, from left to right:

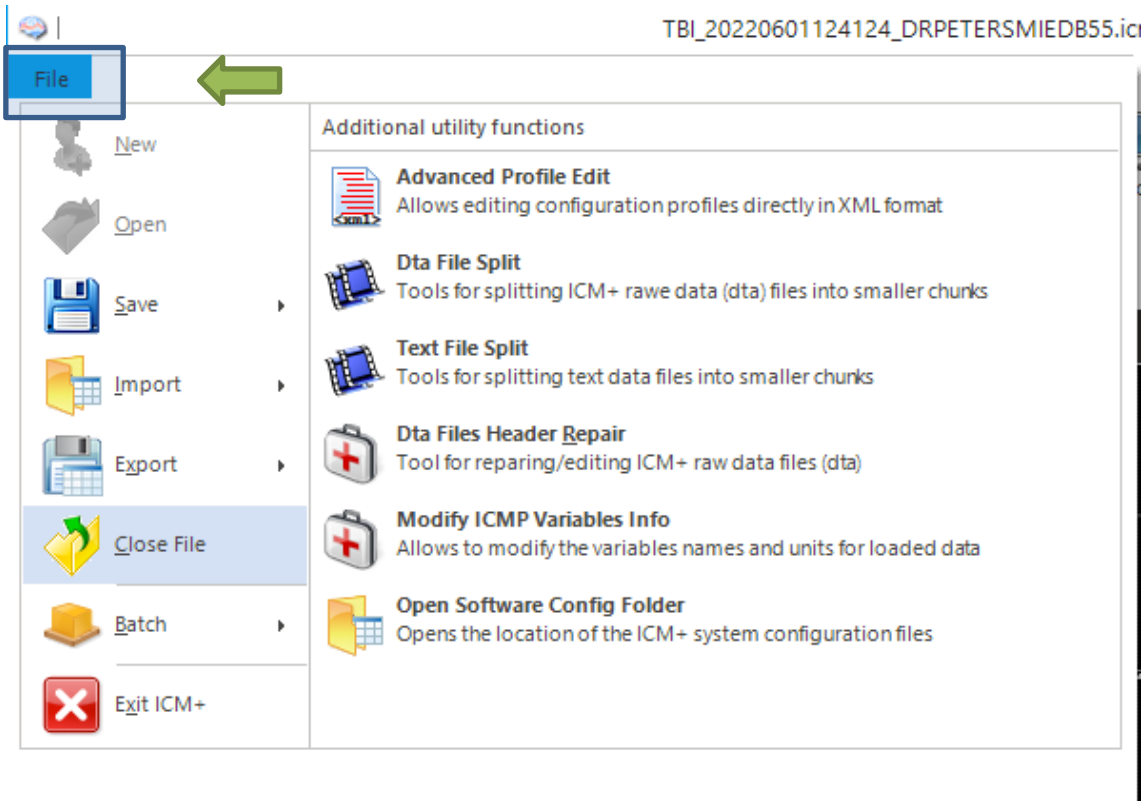
1. Log-in/Log-off form – to change the user (i.e., privileges)
2. Patient Discharge/Bed change button
3. Event annotation form
4. Free textual annotations form
5. An on-screen keyboard
6. The last button closes this toolbar and opens out the main menu toolbars

The toolbar can also be opened or hidden using the little arrow button in the top right corner:



Terminating the data collection session and uploading the data

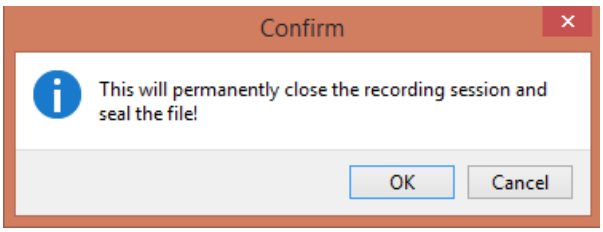
When the data acquisition process is finished (patient discharged) the recording session can be closed using the Close button present in the ICM+ button. This will initialize a cascade of forms that will eventually lead to the file being sealed and subsequent archiving of the data to the file server, if required.



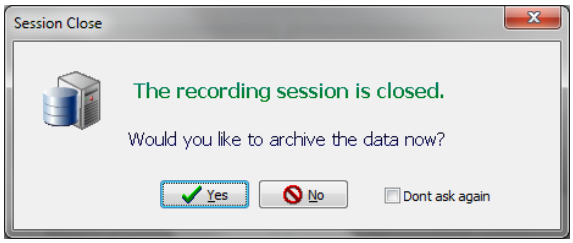
If the data acquisition tool bar is open, click on the Discharge/Bed transfer button instead.

Closing a session is different from closing the program. To close the ICM+ application you need to press the red cross on the upper right corner of the screen. If ICM+ is closed (Exited) using this button or if the computer shuts down, the next time it is run, the recording session will be resumed with the same configurations it had at the moment of shutdown.

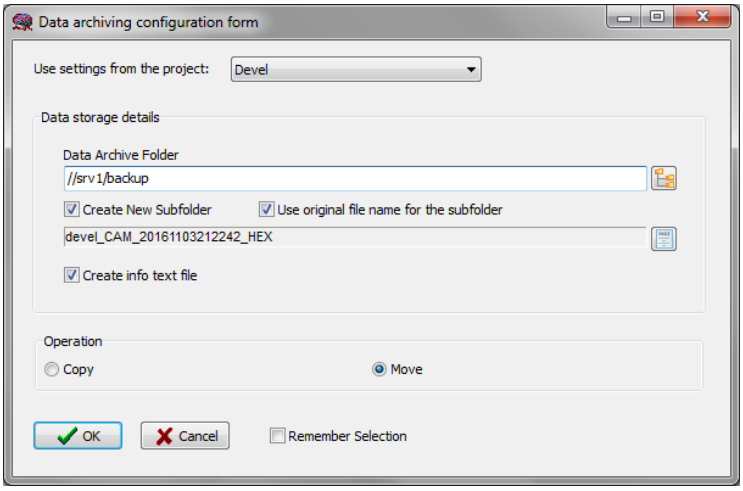
When you click this Close/Discharge button, a dialog will appear prompting you to confirm the closure of the recording session:



After confirming the end of the recording session another dialog will appear prompting you to archive the data:



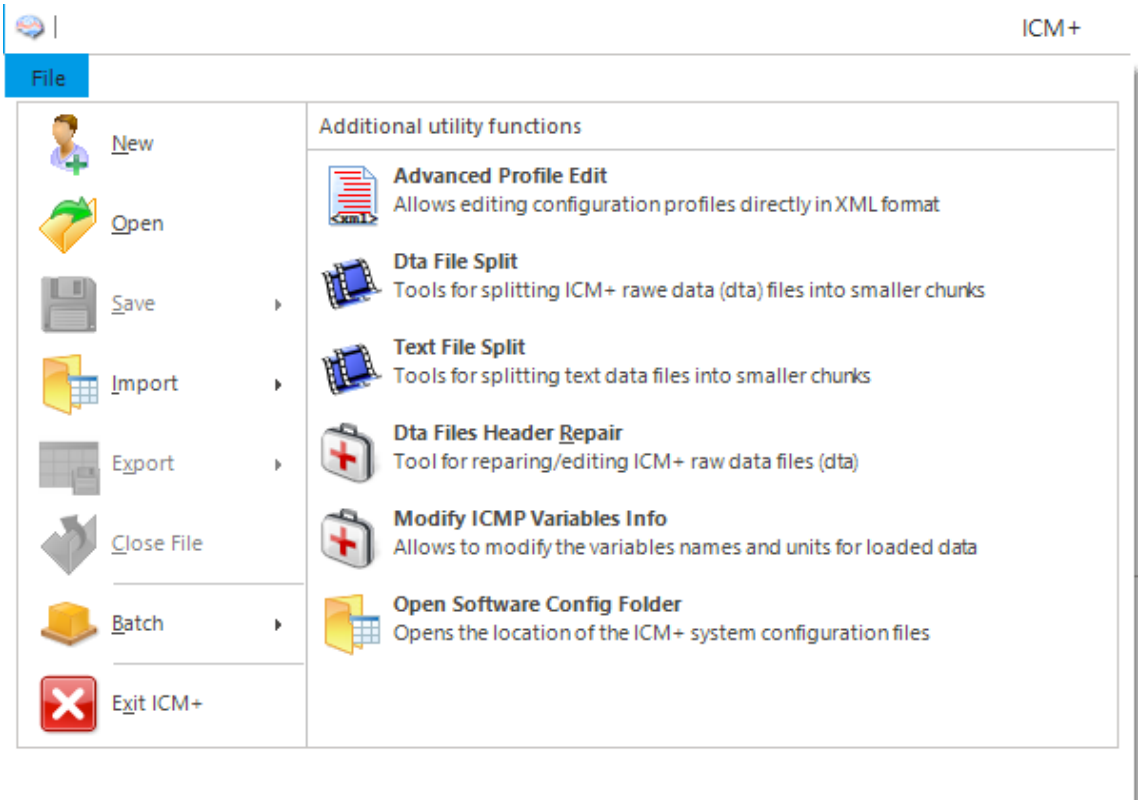
After confirming this dialog, the Data Archiving Form is displayed, where you can specify/confirm the location of the server and its share (the folder location on the server) to use:



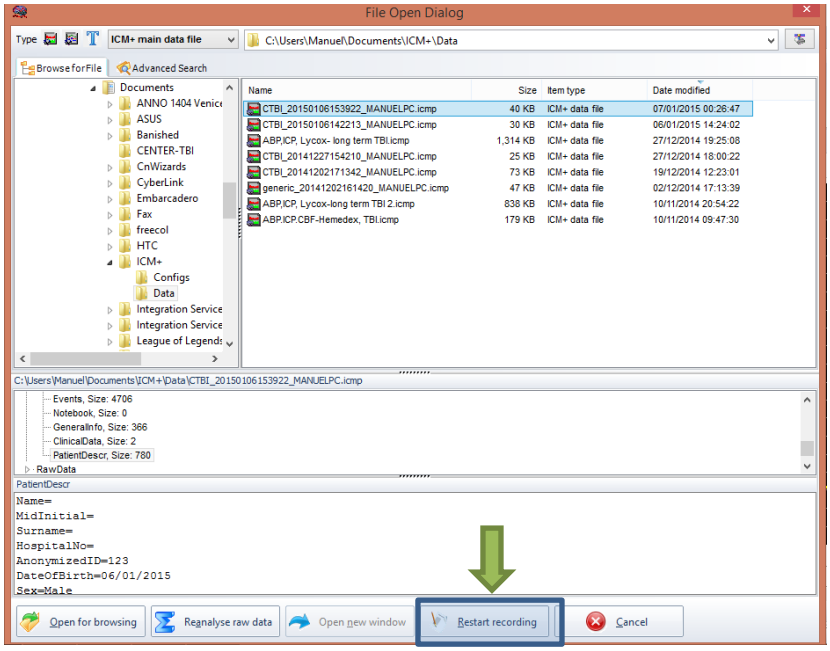
Restoring a closed data collection session

If a session was closed and you need to restore a recording again, you can click the Open button.

Using the dialog that opens, you can reopen the file in order to upload the data to our servers or restore the recording session.



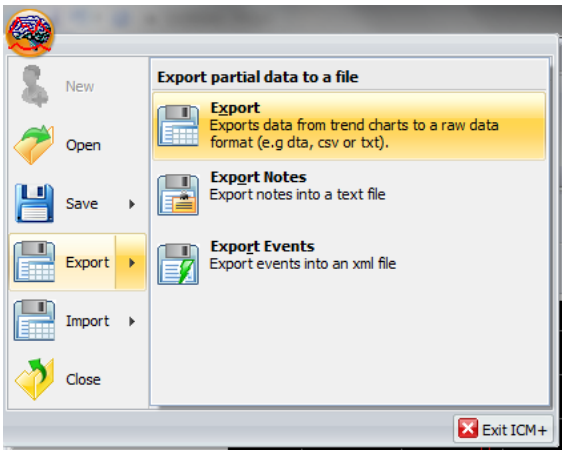
To reopen a file for inspection or to upload, all you need to do is double-click the desired file.



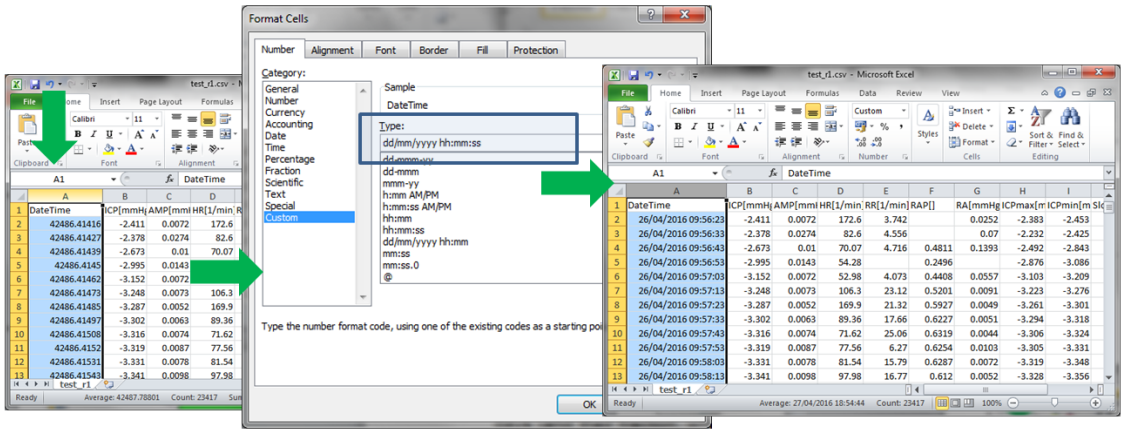
To restore the recording session, click the highlighted button. The recording resumes using the same profile as when it was closed.

Exporting data to a csv (Excel) format

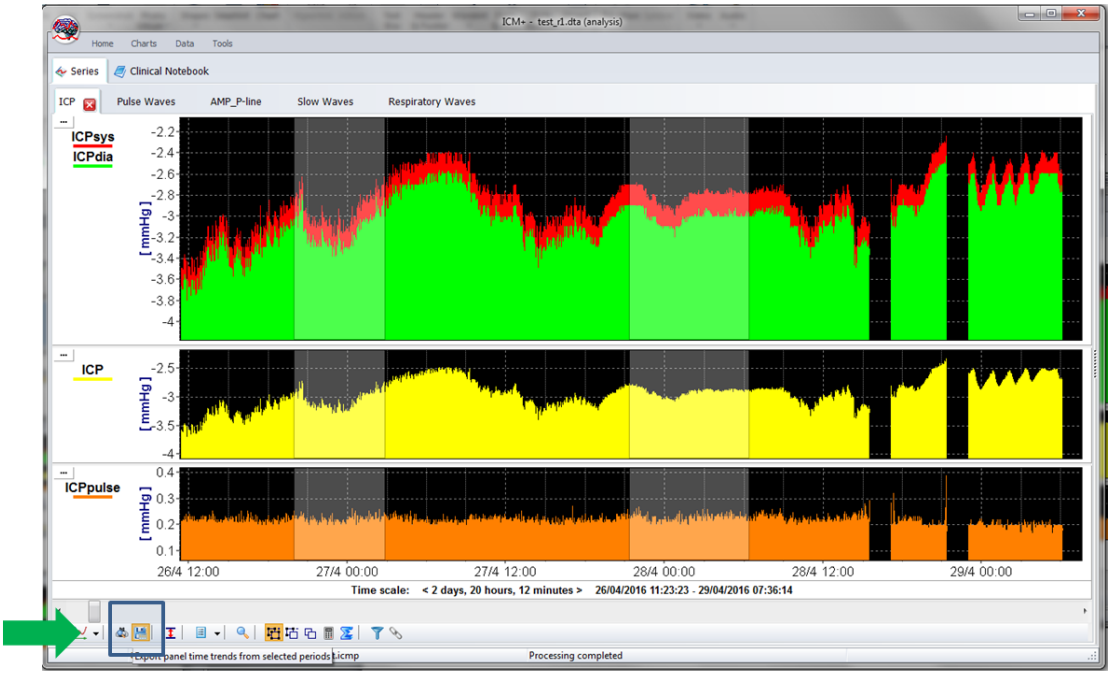
There are two ways to export the data from ICM+. One way is to select the Export option in the main menu (the Brain icon).



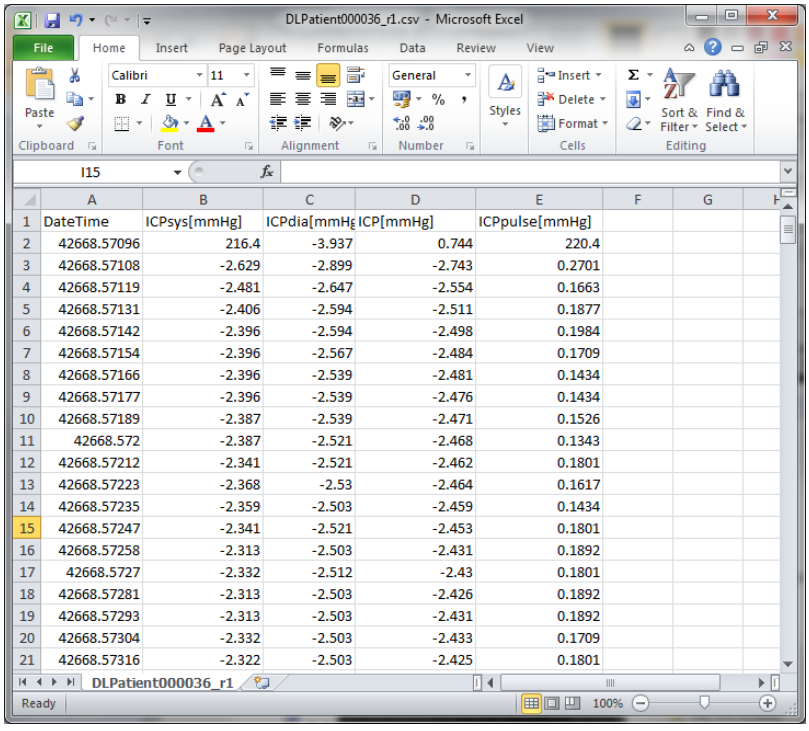
This will export all the trend data from the memory, all the variables, in comma separated columns of values, with the first column containing the time stamps, in the internal Windows DateTime format. The DateTime format is essentially a number of days (and their fraction, which translate into time) since 31/12/1899. When imported into Excel it will initially show up as those numbers, but if date or time (or combined) cell formatting is requested for that column, the date and/or time will be shown.



The second way of exporting data is to use the data export chart tool, located at the bottom of each charting vertical panel:



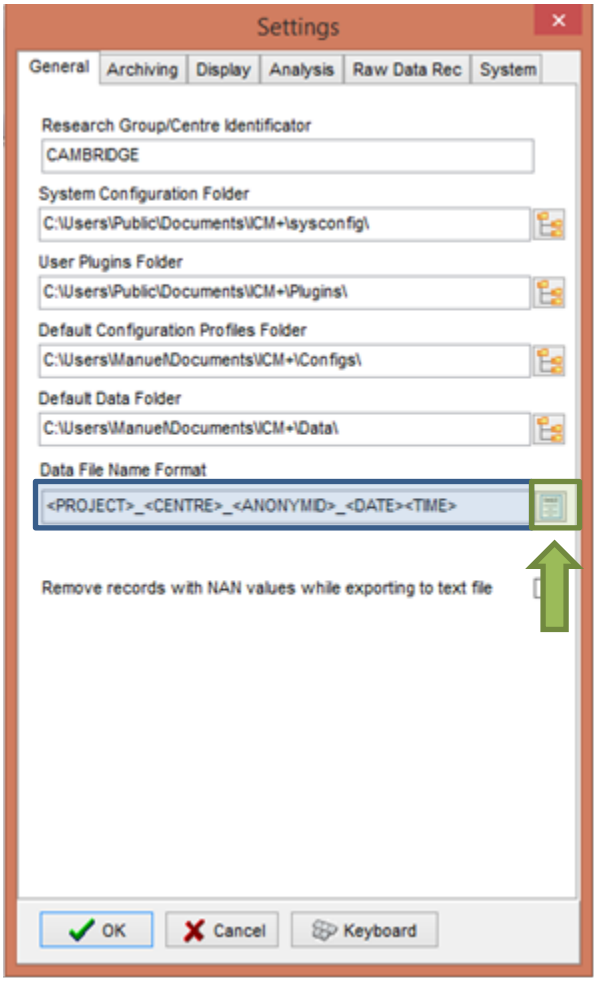
This will export data only from the variables plotted in the panel corresponding to the button toolbar. In this case, it will be ICPsys, ICPdia, ICP and ICPpulse only, and only from selected time periods, if the selection tool is used, or the whole recording time, if not.



Appendix 1: Configuring ICM+ system options

Most of the programmable behaviours of the software can adjusted via the Settings menu. This menu can be found by clicking the Home tab and the Settings button.

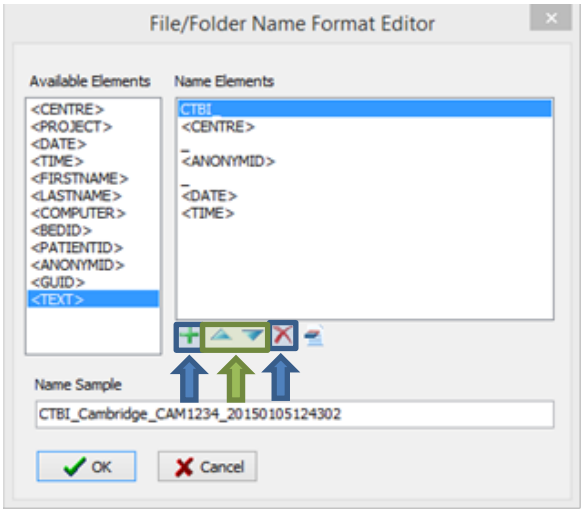
In the Settings menu you will find many system-wide configurations.



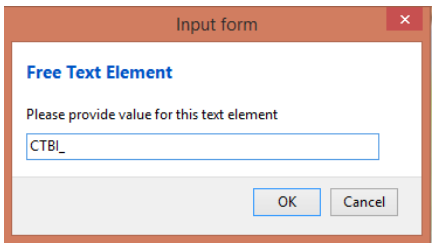
- Note that many of these settings will be overridden by Project settings, if a specific project is chosen for the Data Collection session. If a Generic project is chosen the system-wide settings will be used.

- The **Data File Name Format** is used to configure the format of the filename as the filenames are automatically generated at the start of a new Data Acquisition session.

To build the **Data File Name Format,** you will need to click the highlighted button and the following form will appear:

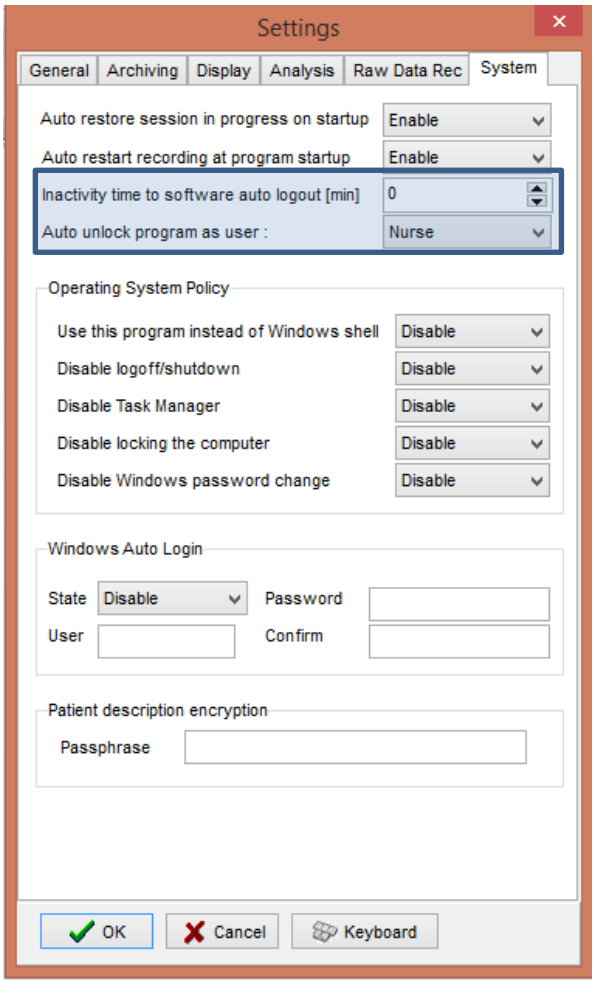


In this form it is possible to add/remove any name element present in the Available Elements menu.



The '_' and any additional static text can be inserted by using the element '<text>' and inserting the text to be added manually.

- On the System tab



For laptops used for Data Collection it is **recommended** to set the **'Auto unlock program as user'** to **Nurse**. Setting the inactivity time to a value greater than 0, e.g. 10 min, will cause the software to auto log-in as that default user following a selected period of inactivity on the software (this will only happen if the program was unlocked as another user).

Appendix 2: ICM+ configuration folders and files

ICM+ uses two locations (configurable via the Settings form) to store all its configuration files:

Location 1: **C:\Users\<username>\Documents\ICM+**.

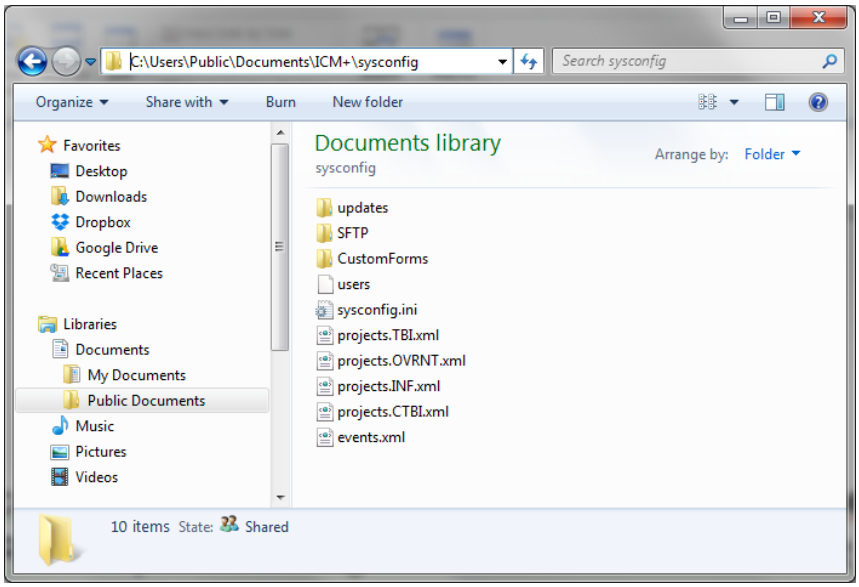
There are two subfolders here:

'**Data'** folder, where all the data recorded during the acquisition process is stored, and

'**Configs'** folder, used to store the data collection and analysis configuration 'profile' files, as in the figure below.

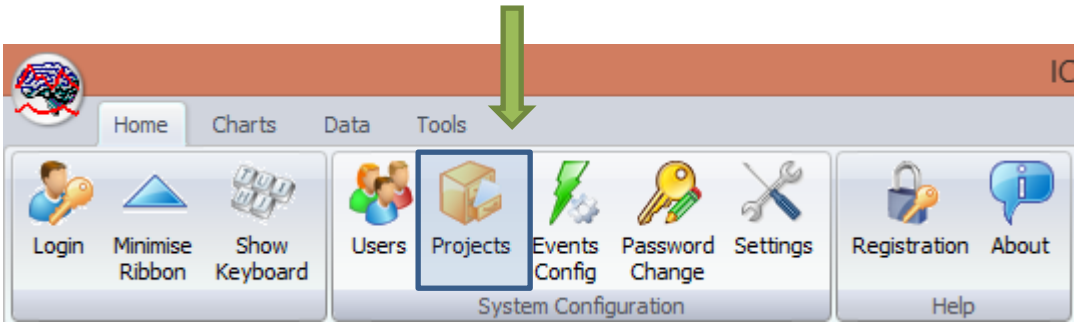
Location 2: **C:\Users\Public\Documents\ICM+**

Here, all the environment configurations/settings are stored. This location contains a folder called **Plugins**, where 3rd party function libraries reside; a folder called **TxtFilters**, containing parsing definitions for different text format data files; and a folder called **sysconfig** containing all the settings of the software, except the data collection and analysis profiles which are stored in Location 1 (as above). Although these files could be edited directly using a text editor, ICM+ has specific user interface forms to edit all aspects of the program functionality.

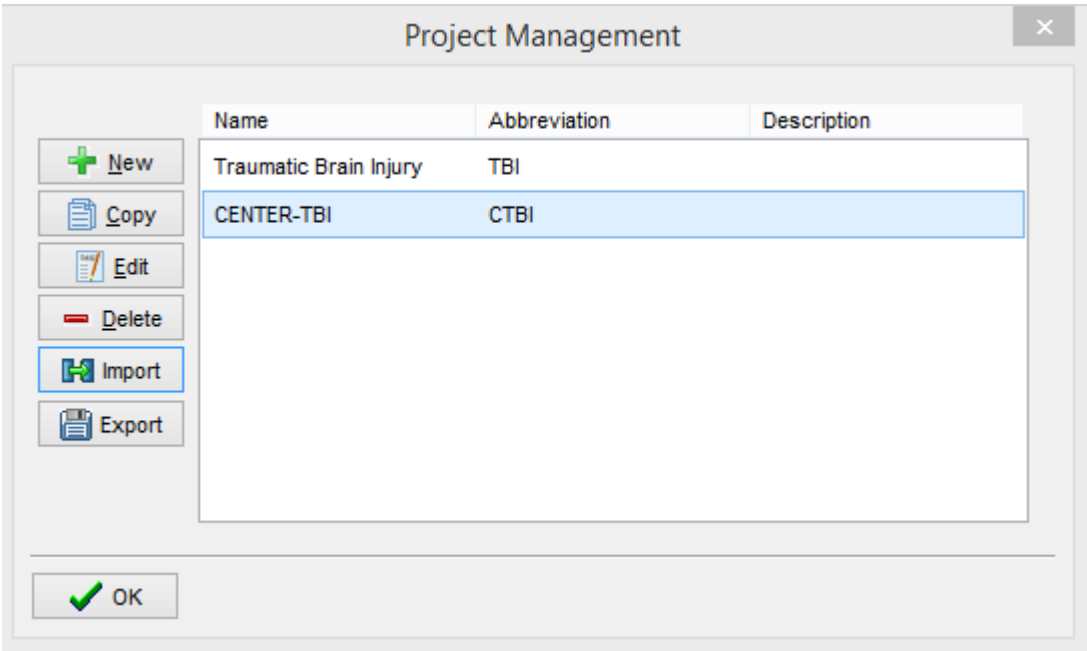


Appendix 3: Editing ICM+ Projects

Projects contain various configurations specific to a particular research project. These can be edited using the **Projects** button in the main menu toolbar.

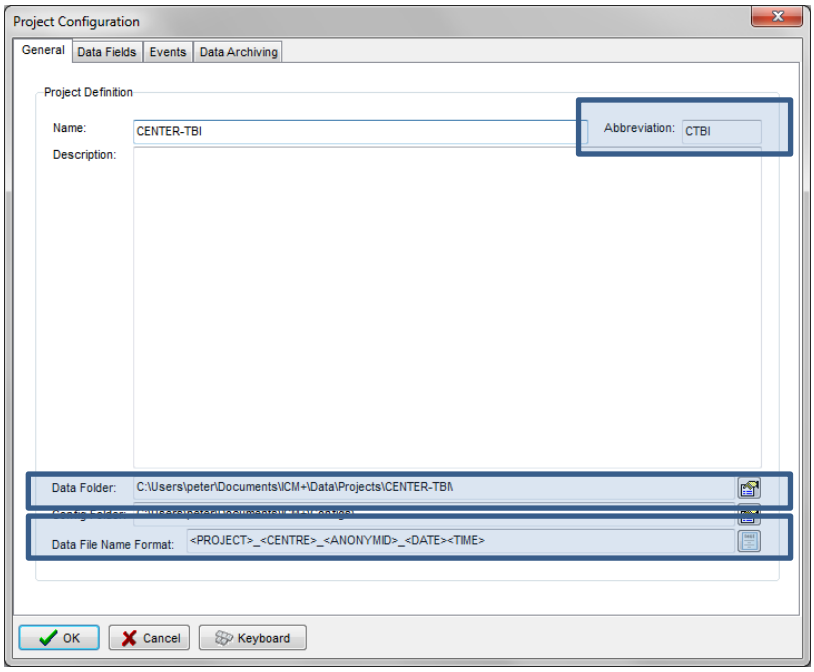


Clicking this button will open the Project Management dialog, where you create, copy, edit, delete, export/import selected projects to/from a file.



Double clicking on a selected project or clicking on Edit will open a Project Editor where you can modify all the custom project settings.

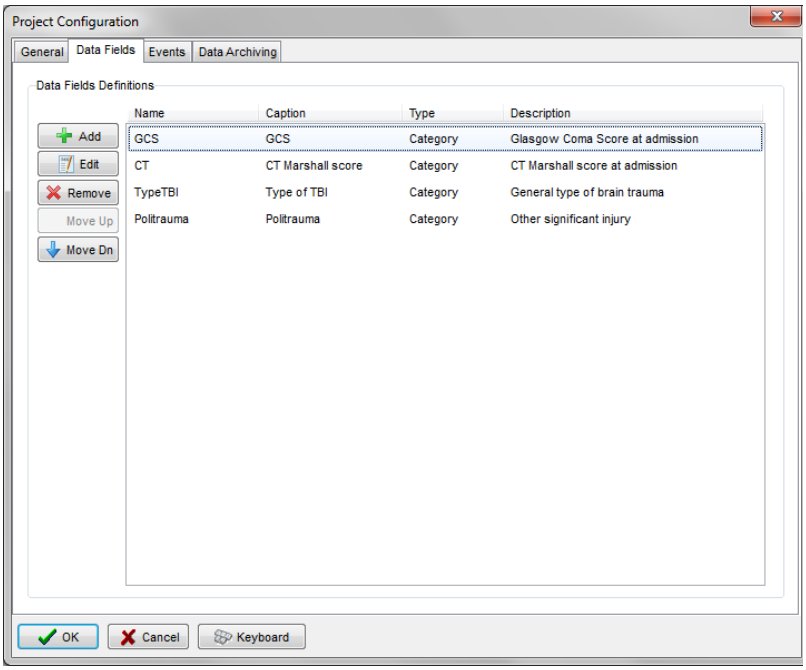
The following screenshots describe the settings specific to CENTER-TBI. These settings will have already been preconfigured for you if you have copied the provided project.ctb.xml file to the ICM+ sysconfig folder, or used the Project Manager to import the settings from that file. Please do not modify those for CENTER-TBI project.



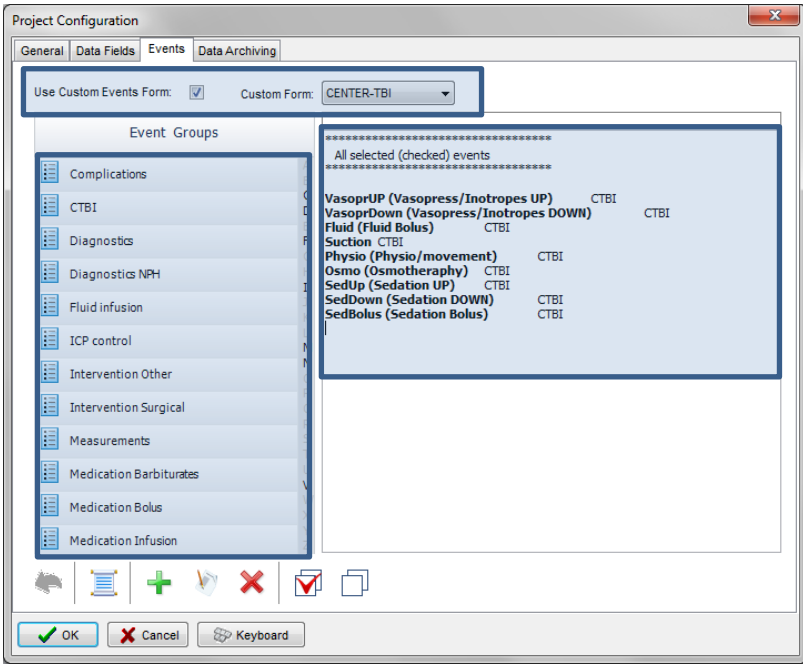
1. The project **abbreviation** will be part of the file name

2. '**Data Folder'** is a local folder where the data collected as part of this project will be stored

3. **Data File Name Format** lists elements that will be used to create automatic file names for each new data acquisition session. Please note that elements listed here will have to be filled in (e.g., Centre ID, or the anonymous Patient ID) at the New Data Acquisition form stage before continuing.



The data fields define placeholders for general clinical descriptors that characterise the patient at the time of admission to the critical care unit and that are useful to keep together with the monitoring data.



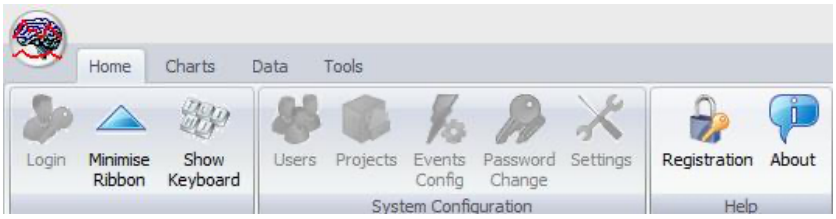
This is where events that are already defined elsewhere (in the Events form), listed in the left panel (1), can be assigned to the particular project (listed in the right panel 2.).

Please note that CENTER-TBI uses a customised event form, selected using the 'Custom Forms' list box (3). However, it is possible to add more events to the project but those will only be accessible from within the 'Event List' panel, toggled from the main menu tool bar panel, Charts section.

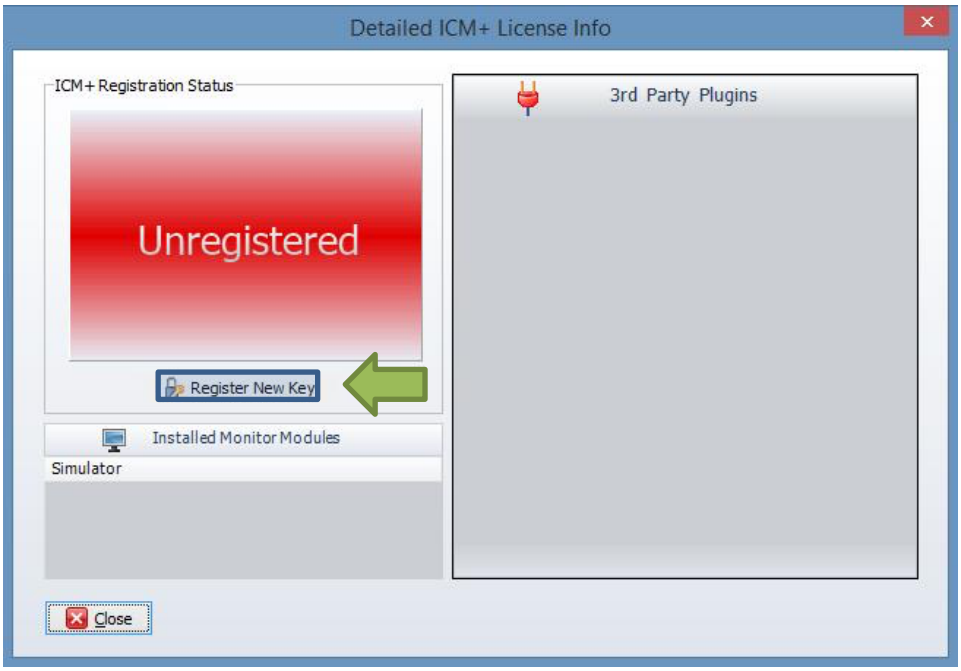
Appendix 4: Registering ICM+

When ICM+ is successfully installed for the first time on a computer it needs to be registered. This will probably already be done for you when you get the laptops, but if any major update needs to be done you will have to register it again.

To register ICM+ you need to press the Registration button on the Home tab.



This will bring up the Detailed ICM+ License Info window where you will need to press the Register New Key button.



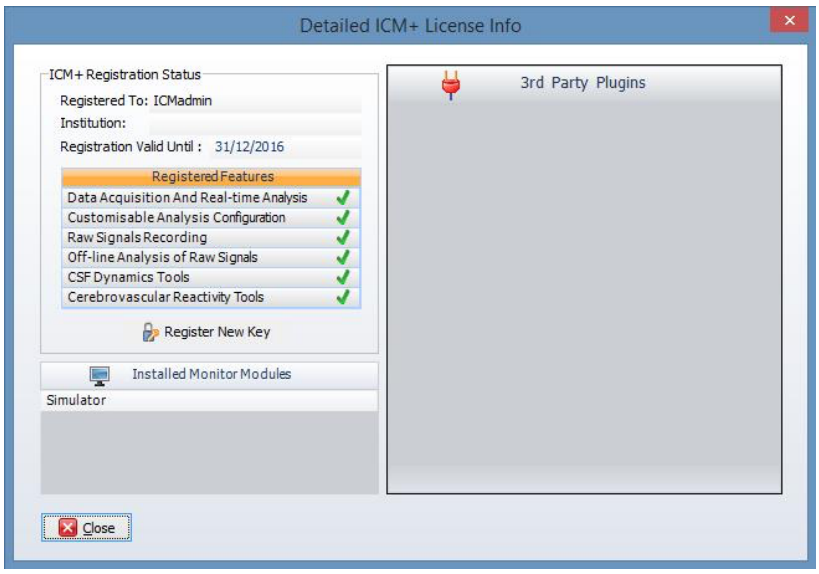
This will display the ICM+ Registration Form:

Please submit these details with your Key Request via the ICM+ website, in the user area:

https://icmplus.neurosurg.cam.ac.uk/user-area

Once the Key is released (you will be notified at the email address registered with the website), please retrieve it and enter into the Registration box as above and click Register Now.

Your Detailed ICM+ Licence Info window should look something like this:



Appendix 5: Preconfigured users and passwords

Administrator – 2718

Manager – 1618

Operator – 3142

Nurse – 1414

The users, their passwords, and their rights are fully configurable in the software, using the Users form. The default users have been chosen to fulfil the following roles:

User	Role
Administrator	Complete access to all the software configuration options, the users and passwords
Manager	Access to all the configuration options, except the users and password. This will normally be the user to do the entire configuration needed for data collection.
Operator	Control of the data collection process using preconfigured profiles, and changes to the charts layout and properties.
Nurse	Access to clinical annotations tools only. This should be normally set up as the default user kept logged in during the data collection process, in order to prevent any inadvertent disruption to data recording but at the same time allowing and encouraging quick access to the clinical annotations.
Guest	This 'user' has no rights, making it impossible to interact with the software in any way.