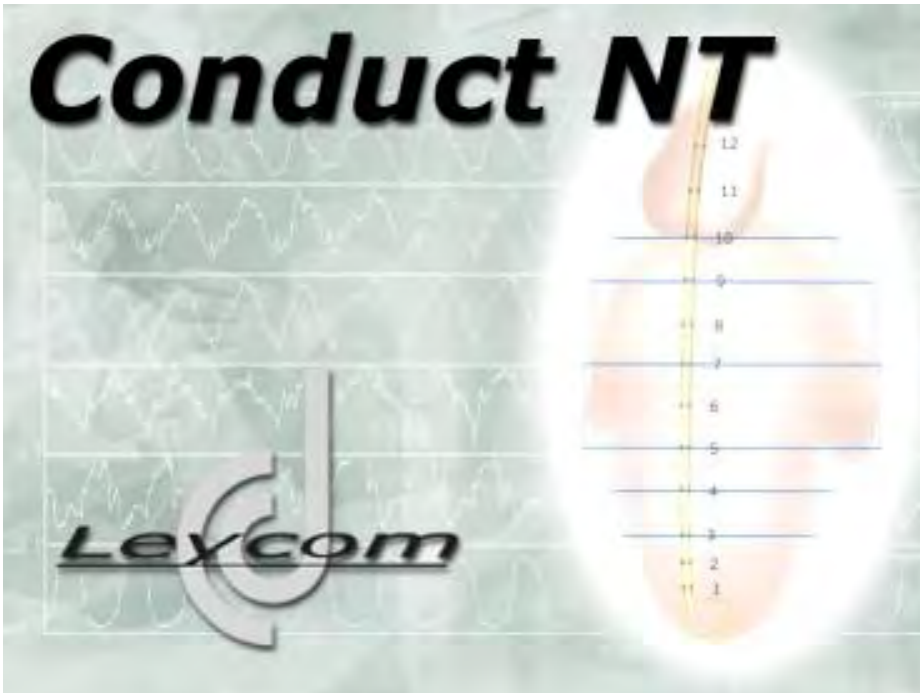

LEYCOM® Conduct NT V3.18

Software manual V1801.0

Important Notice

Preface

This manual informs about the main operations of the Conduct NT software to be used in conjunction with CD Leycom's Cardiac Function Laboratory Modular series (CFL-M) the "Inca". This manual provides guidelines and recommendations on how to set-up, perform and analyze a study.
Conduct NT is the successor of the Conduct 2000 software as was developed for CD Leycom's CFL-512.

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Disclaimer
This software is intended as a decision support system for persons who have received appropriate medical training, and should not be used as a sole basis for making clinical decisions pertaining to patient diagnosis, care, or management. All information derived from the software must be clinically reviewed regarding its plausibility before use in treating patients. Any deviation of the application of medical information from the program, other than the original design or intended use there of, is not advised and considered a misuse of the software product. For additional guidance, see published studies.

CE 0344

This equipment meets the requirements of the Medical Device Directive (93/42/EEC).
Conduct NT has been developed by CD Leycom and has been CE approved by KEMA NV, Arnhem, The Netherlands, Notified Body Identification Nr 0344.

Edition

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Table of Contents

1. Introduction

Conduct NT is a software package for the display, acquisition and analysis of physiological signals which was developed to be used with the Leycom® equipment for continuous measurement of ventricular volume by the conductance catheter technique.

The full Conduct NT package consists of the items below:

- This manual
- One installation USB flash drive with the Conduct NT software

1.1 Requirements

The requirements to run Conduct NT are:

1 Standards

When the PC is placed in a medically-used room the PC and all additional components must be according IEC 60601-1-1.

When the PC is placed outside the patient environment in a separate room (registry room) it must at least comply with IEC 60950.

The PC and all components connected to the PC must always be conform the local restrictions where the system is used.

2 Windows operating systems running at 32 Bit

☑ **Note**

A 64-bit operating system will not allow for installation of the Conduct NT software.

3 Network UTP

The network card should be 100 Mbps.
The connection between pc and Inca should be direct by an interface cable.
There should be **no use** from hubs or switches between the Inca and PC when those are also used for different network components such as printers.

4 Performance

When using Conduct NT with the Inca in real time measurement there should be no background programs running, NO print jobs, NO Windows update's, NO program update's ext.
The fire wall and or Virus scanner should allow full access to Conduct NT

1.2 Passwords

To use the Inca you need the software Conduct NT. The software Conduct NT will be installed in the program files directory of Windows.
If your user account is not a valid name to use Conduct NT, Windows prevents you from accessing the software program Conduct NT, ensuring that only valid users have access to the Inca and patient data.
Contact your administrator to create users, add or remove users, and change user passwords. Log-in files are provided by the Windows environment.

☑ **Note**

The user environment variables are different for each user. The variables include the path to the study folder of Conduct NT (created under folder 'my documents' of the user that has been logged in).

1.3 The software

Start the software Conduct NT.

The menu options can be selected by using the mouse. On a form, point and click using the mouse or pressing the <ALT>-key and the highlighted character.

☑ **Note**

If the software does not recognize the Inca in 'Live data' check your port settings or check if you used the correct Ethernet connection.

1.4 Keyboard and mouse

Being a graphic interface, the software is designed to work most easily with the mouse. The middle button on a 3-button mouse will be ignored.

In the data entry fields, the software provides a text cursor changed to a vertical bar that is positioned immediately to the right of last character and extends the full height of a character cell.
The text cursor can be moved within a single field using the left and right cursor keys. If multiple fields are present, the TAB and SHIFT-TAB keys move between successive fields. HOME and END position the cursor at the beginning and end of the current field respectively.

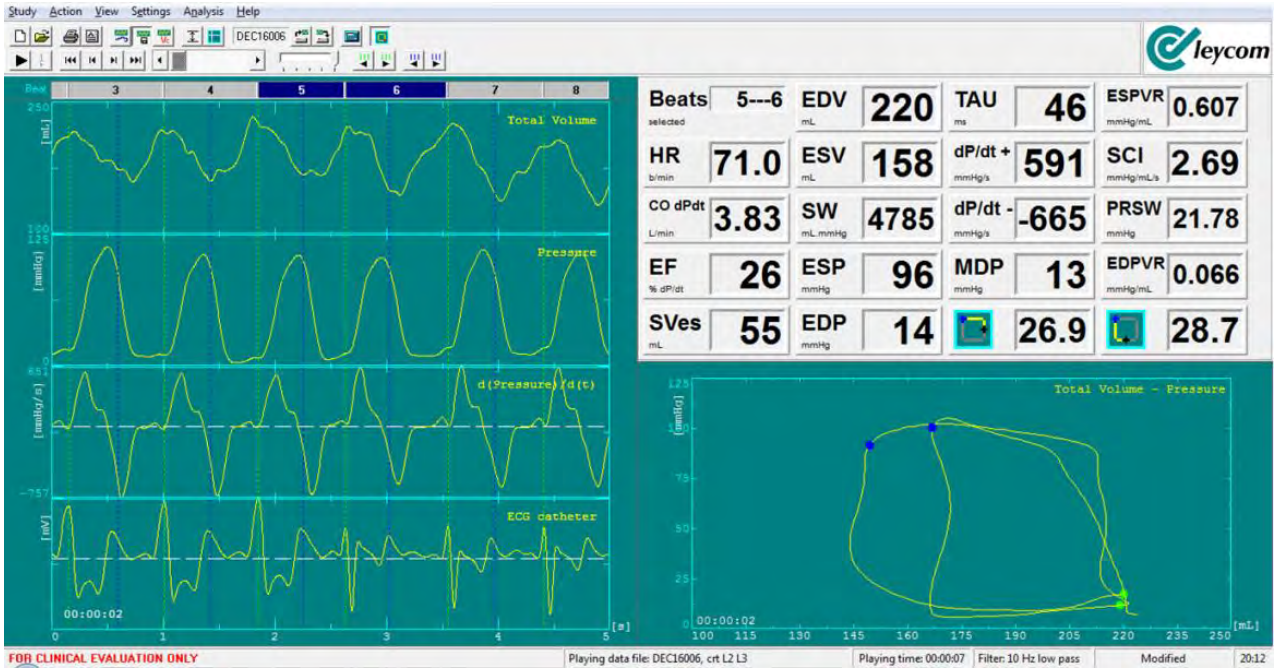
To select consecutive files, click the first item, press and hold down SHIFT, and then click the last item.
To select files that are not consecutive, press and hold down CTRL, and then click each item.

Conduct NT works also from the touch-screen tablet.

☑ **Note**

To use and save the settings in the form, leave a form with 'OK'.
'Apply' saves all the changes you have made without closing the dialog box.
To cancel all changes made and restore the settings, leave a form with 'Cancel'.

1.5 The main window



The main window consists of four parts; the main menu, the toolbar, the view area and the status line. The main menu bar is located at the top of the screen and contains drop-down menus to access the various commands and dialogues. In the main menu the user can choose the following:

Study: within this menu users will find choices to create, open, edit, backup, restore, export and delete a study. Furthermore, menu choices are available for printing graphs that are visible in the view area, updating the Conduct NT software, setting the system's date and time and exit Conduct NT.
CD Leycom will inform users when an update is available. It depends on the new features if a user would be interested to update Conduct NT.

Action: within this menu users find menus to manipulate the graphs to work with data files. Users may select to acquire the current data in a data file or choose to play a previously recorded data file.

View: within this menu users can make a choice between the various types of data views. You can also set the time base for the graphs and toggle the grid on and off.

Settings: within this menu users can select functions for adjusting the settings of both the program and the patient module.

Help: within this menu users can select the help function and open the 'About'-window, which presents information about the software and the system.

The toolbar with the shortcut buttons is located directly below the menu bar.

In the view area, the graphs that have been selected by the menu choices from the View menu are being displayed. The Print function only prints the graphs that are displayed in this area.

The status line, located on the bottom of the screen, shows the following items:

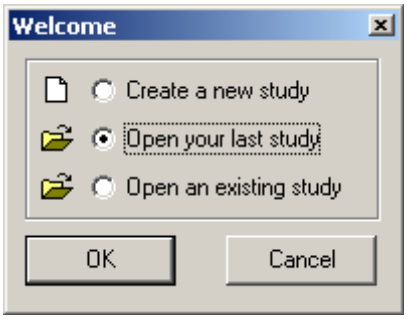
- Screen tips: When pointing with the mouse over the various buttons and menu items, this section shows the function.
- Display status: This section shows what is displayed. This can be: 'Real-time display', 'Please wait, freezing', 'Display freezed' and 'Playing data file <data file name>.
- Acquire: The length of the acquired data is displayed in the section. This is only shown when acquiring is active, else this section is left blank.
- Filter: Tells which filter is in use currently

2. Start-up

After start-up the program will guide the user through the first steps.

2.1 Welcome

In the form "Welcome" the user can decide which study to use.



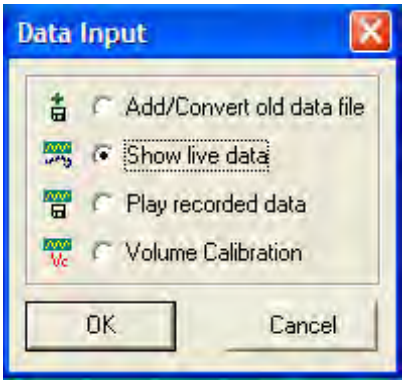
1. Create a new study
   The user can add a new study to the list. For this, the user has to fill in a form with information about the study and the patient.

2. Open your last study
   The user decides to open the last study that was opened by the program.

3. Open an existing study
   The user can choose from the list of studies, which study to open.

2.2 Active modes

Conduct NT can run in three active modes:



1. Live data; communicate with the Inca to display real time signals measured with a Pressure-Volume catheter.

2. Recorded data; analysis of data recorded with the Inca.

3. Volume calibration; calibrate measured volume to real volume.

The program needs data input to show signals on the screen.

1. Add/Convert old data file
If you already acquired data with an earlier DOS-version of Conduct 2000 or Conduct PC, it will be possible to convert this data to Conduct NT.

2. Show live data
To run in real-time mode select 'Show live data'. Conduct NT is written to work with the Inca. It allows the user to display all signals in real-time in various types of tracings and display modes like Pressure-Volume Loops, dP/dt, ECG, Total volume, pressures, etc. Up to 50 variables and indices can be displayed in real time. It is possible to display and store data simultaneously.

3. Play recorded data
Select this option to open an earlier acquired data file to analyze. Plots can be made of ventricular volume, ventricular pressure and ECG versus time, and of pressure-volume loops. More than 50 indices can be calculated. The End-Systolic Pressure-Volume Relation (ESPVR) can be calculated and plotted (the 'Ees-line'). Extensive report options are also included.

4. Volume Calibration
Select this mode for volume calibration of existing files.

The segmental volumes measured with the Inca system are always relative volumes. Moreover, due to parallel conductance of tissues around the measured chamber also the estimated Ejection Fraction (EF) will also be a relative value. **Absolute EF** can be calculated automatically from the data obtained with injection of hypertonic saline (5-10 ml of 5-7.5% saline depending on cardiac output) into the pulmonary artery for left ventricular measurements and the right atrium for right ventricular measurements.

Absolute total volume values can be achieved by matching cardiac output or stroke volume derived from the volume catheter to an independent reference method, for instance to thermodilution or MRI or Echo derived estimates. The accuracy of the absolute volume variables derived from the volume catheter then are therefore dependent on the accuracy of the applied reference method.

☑ **Note**

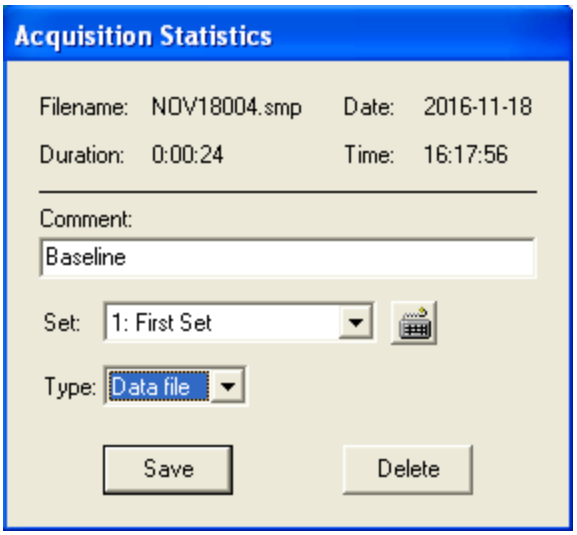
It is also possible to calibrate Ejection Fraction and total volume by Echo or MRI values. For more information about volume calibration, read chapter 7.

2.3 Live data

Select "Live data" and be sure the Inca is turned on. Wait until the connection with the Inca is made before you start to acquire data. The acquired data will be stored in the current study folder. This folder is default located under 'my documents/studies'. It is possible to change the folder by 'Set Study Folder' in the 'Study'-menu (read chapter 4).

2.3.1 Acquire data

Push the red dot button  to start acquiring data. The data will be stored in an SMP-file that is saved in the study folder. During data acquisition you will read the text 'Acquire data' above the plot windows and you can hear a beep every second when sound is on. To stop data acquisition, push the red dot button again.



When the user stops acquiring a window comes up with acquisition statistics. The user can add a comment to title the acquired file and assign the recording data to a Set and further to a specific file type like EFcal files, SVcal files or Data files.

The filename is generated automatically. Conduct NT uses the system date to generate a unique name for each subsequent data-acquisition file. The first three characters of the filename are the month (jan, feb, …) followed by two numbers representing the day (jan02, feb25, …). The last three positions of the filename are given a three-digit number (001,002, …, 999) which automatically increases with each run.

In principle, the length of a data file is only limited by hard-disk space. However, it is recommended to limit the length of individual runs. It is easier to analyze multiple short data files than extract the information from one single long file because data is stored as raw data.

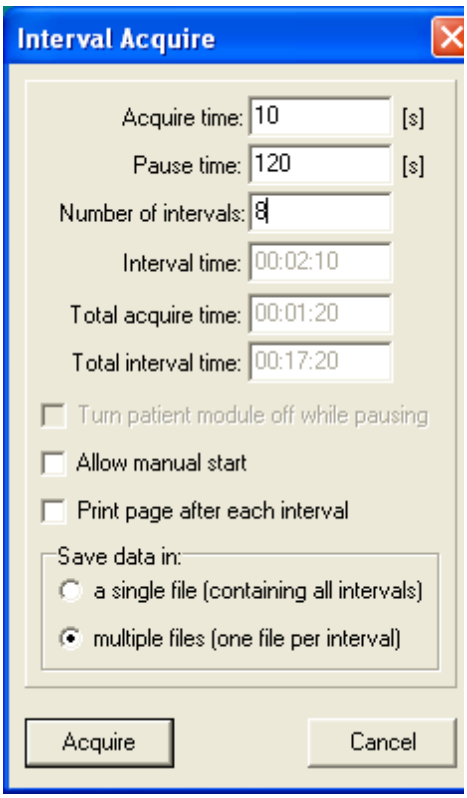
☑ **Note 1**

Check system data at start of study. Conduct NT uses the system date in the name of the data files.

☑ **Note 2**

Select **'Edit File Comment'** in the Action Menu if you want to change the comment of the data file.

2.3.2 Interval measurements



Press the clock-button to open the form for interval measurements. In the form the user can fill in the following items:

Acquire time: the time that data will be acquired.
Pause time: the time that the system runs without acquiring data.
Number of intervals: the number of files that will be acquired.

The program calculates the following items:

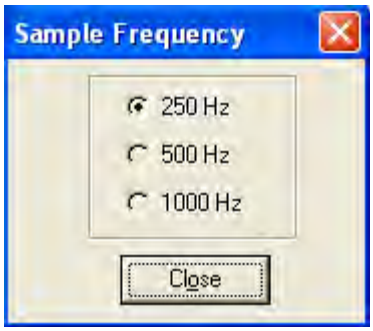
Interval time: the total time of one cycle.
Total acquire time: the total acquire time of all files together.
Total interval time: the program calculates the total time of the whole interval measurement.

Select the option 'Allow manual start' to start the intervals by pressing a button before the Pause time is passed.

To print a page directly after acquiring each interval, select the option 'Print page after each interval'.

The user can choose to save the data in one single file or in multiple files.

2.4 Sample Frequency



The default sample rate for the Inca that is used is 250 Hz per second. For smaller hearts or higher heart rates you would prefer to use a higher sample frequency.
A sample rate up to 1000 Hz per second is possible.

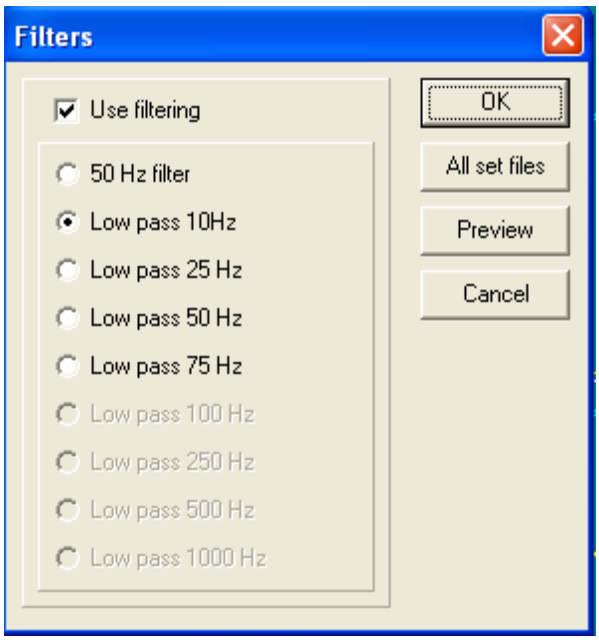
For the 500 Hz and 1000 Hz less filtering options are available compared to the 250 Hz option.

☑ **Note**

Using a sample rate of 1000 Hz instead of 250 Hz will result in a data file that is 4 times larger. Increasing the sample frequency may limit the type of filter that can be used

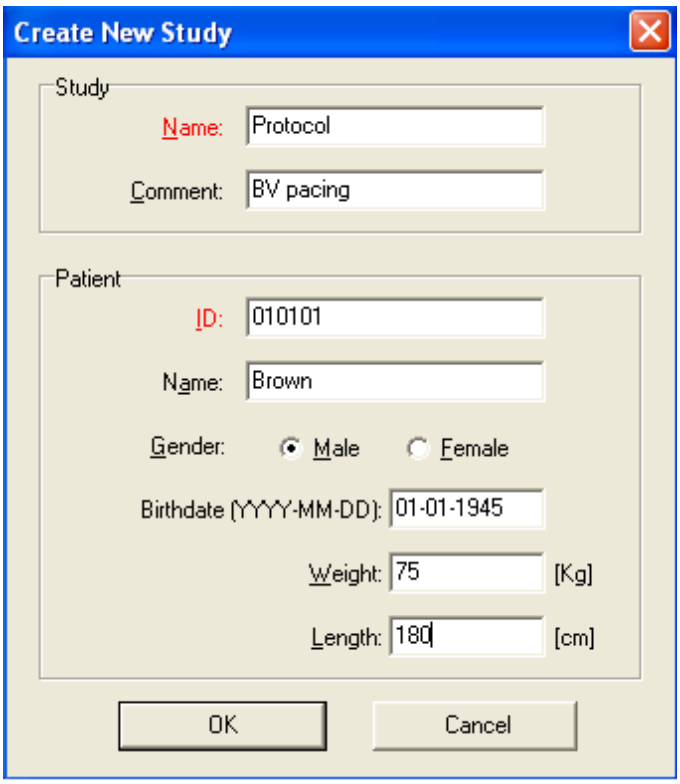
2.5 Filters

Several filters can be used to smooth signals. The available filters depends on the sample frequency that is chosen.
Press 'All set files' to use the selected filter for all the datafiles in the same set of the files.Press 'Preview' to get a first indication of the filter that is currently selected.



3. Study management

Conduct NT uses the windows environment to control the study management. Before Conduct NT becomes operational, a study (*.sty) must be created or opened. During initial set up the user can select **Create a new study** or **Open an old or an existing study**, or after selecting the main menu item 'Study' in the menu bar, the **Study Menu** becomes visible in which **New Study ...** and **Open Study ...** can be selected.



3.1 Create a new study

The user can select **New Study ...** where the parameters for this new study can be entered.

When you select the file name in the Open Study box, these parameters appear to help you identify the study.

Enter the following parameters in the window:

- Study Name: The user can enter any name of up to 40 characters, to identify the study. For privacy reason, avoid patient names.
- Study Comment: This is a free text line where the user can enter a comment, which will help the user better identify the content of the study during analysis.
- Patient ID: This identifies the patient', avoid names. It can be a unique number and/or letter combination of up to 40 characters.
- Patient Name: Preferably a code name only known by the user.
- Patient Gender.
- Patient Birth date: Input depends on the Inca's regional setting. For Western Europe this is dd-mm-yyyy, for United States mm-dd-yyyy. Birth year can be relevant for future options.
- Patient Weight: The weight of the patient. Together with Patient Length the unit is used to calculate Cardiac Index. The unit is fixed to Kilograms.
- Patient Length: The unit is fixed to cm. Note that the decimal separator character is a '.' (Point).

☑ Note

To create a new study, at least a study name and patient ID must be filled in. After this has been done, the 'OK' button becomes available. Other characteristics can be edited later.

☑ Warning

Do not change the names of the study or your study folders where your data is stored manually. The software program will not recognize the studies anymore.

If everything is correctly filled in, press the 'OK' button to accept the parameters. All items (except the study name and ID number) can be changed afterwards. See Edit Study on how to do that.

The name of the newly created study will appear in the top line of the Conduct NT program.

3.1.1 Edit study

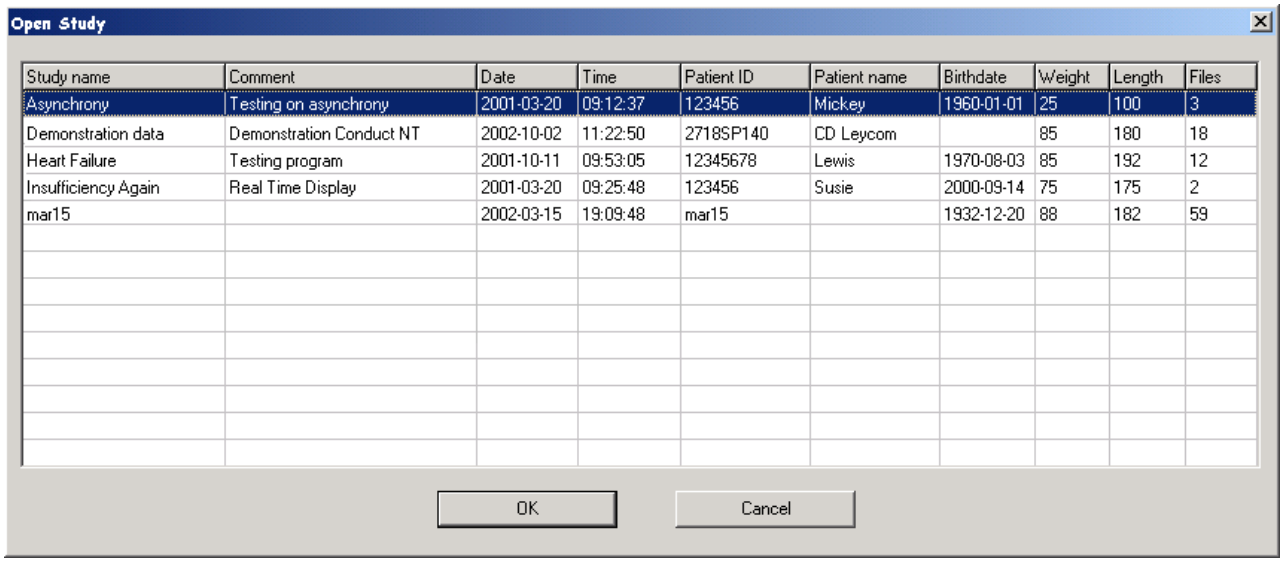
Select **Edit Study** under the Study menu to change the study parameters. Press **OK** to save the changes or press **Cancel** to leave the form without changes.

☑ **Note**

The study name and patient ID number cannot be changed after the study is created.

3.2 Open study

Select **Open Study** to open a window in which all available studies are listed.



Study name	Comment	Date	Time	Patient ID	Patient name	Birthdate	Weight	Length	Files
Asynchrony	Testing on asynchrony	2001-03-20	09:12:37	123456	Mickey	1960-01-01	25	100	3
Demonstration data	Demonstration Conduct NT	2002-10-02	11:22:50	2718SP140	CD Leycom		85	180	18
Heart Failure	Testing program	2001-10-11	09:53:05	12345678	Lewis	1970-08-03	85	192	12
Insufficiency Again	Real Time Display	2001-03-20	09:25:48	123456	Susie	2000-09-14	75	175	2
mar15		2002-03-15	19:09:48	mar15		1932-12-20	88	182	59

To select a study, move the mouse pointer over a row in the table and click on the left mouse button. The pointed study is highlighted in blue. Press **OK** to open the selected study. It is also possible to use the arrow keys to walk through the list and press <ENTER> to open a study.

To sort the studies in the list, press on one of the column headers above the studies (e.g. Comment, Last name). Consecutively, the studies will be sorted in ascending order. After pressing the same column header a second time, the studies will be sorted in descending order.

If the list of studies becomes longer than the window can show, a scroll bar becomes visible at the right side of the window. Use this scroll bar to scroll through the list of studies. It is also possible to use the up and down arrow keys to walk through the whole list.

3.3 Backup

The Backup utility helps the user create a copy of the data onto additional storage devices. In the event that the original data on the hard disk is accidentally erased or overwritten, or becomes inaccessible because of a hard disk malfunction, the copy can be used to restore the lost or damaged data.

Select **Backup** in the **Study Menu** to back up the currently active study together with selected data files to a removable storage device. To select a storage device, press on the list box below the text "Backup to:" A list of all available storage devices will be shown. Point with the mouse pointer (or use the up/down arrow keys) to select the device on which the data files have to be stored. At the right side of the "Backup to:" box the free disk space of the selected storage device will be shown.
Select all data files from the study that should be backed up.

- To select consecutive files, click the first item, press and hold down SHIFT, and then click the last item.
- To select files that are not consecutive, press and hold down CTRL, and then click each item.
- To select all the files in the study, click **Select All**. Use **Deselect All** to deselect all data files.

The data files can be sorted by clicking on the column headers of the list.

Press **OK** to start the backup function. On the selected storage device a directory <study name> is created. The study information file (<study name>.sty) is copied into this directory. This file contains all study specific data (e.g. patient data, catheter type etc.). The selected data files are also copied into this directory.

Use **Cancel** to close the window without backing up the files.

☑ **Note**

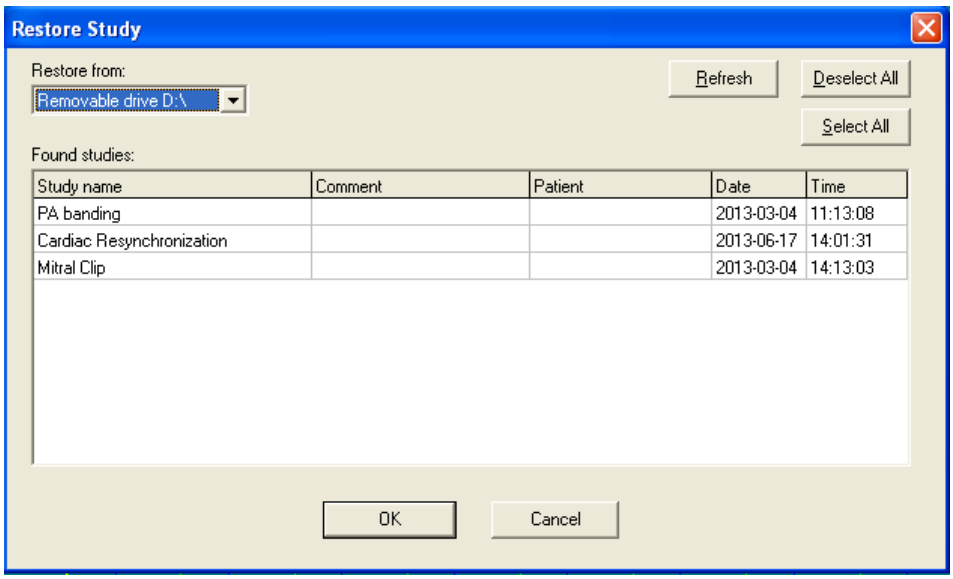
Conduct NT will overwrite files that have the same name as the files that are being backed up.

If you try to back up data files whose combined size exceeds the available disk space, a warning will be shown before the copying begins. You may then select to continue or to abort the backup action.

3.4 Restore

If you want to retrieve data you backed up, select **Restore** in the **Study Menu**.

When clicking in the box under "Restore from:" a storage device list becomes available. Select a storage device from this list from which holds the study to be restored. In the list box 'Found studies' all available studies found on the storage device will be listed. Click on the studies to select them. The order of the displayed studies can be changed, by clicking on a column header (e.g. Comment, Patient). The study files are sorted depending on which column header is clicked.



To select all studies, the **Select All** button can be used. To deselect all studies use the **Deselect All** button.
Use **Refresh** to refresh the list of studies. This can be useful when changing the storage medium, e.g. when changing a USB flash drive.

The text "Free disk space:" shows how much space is left on the systems hard disk. Be aware to always leave some space on the hard disk.
Finally, press **OK** to restore the studies. The restored studies can be opened with **Open Study**.

Use **Cancel** to close the window without restoring anything.

☑ **Warning**

If you restore a study with the same name as already available on the hard disk, you will receive a warning that the study file will be overwritten.

Take care that your study name is unique to prevent this.

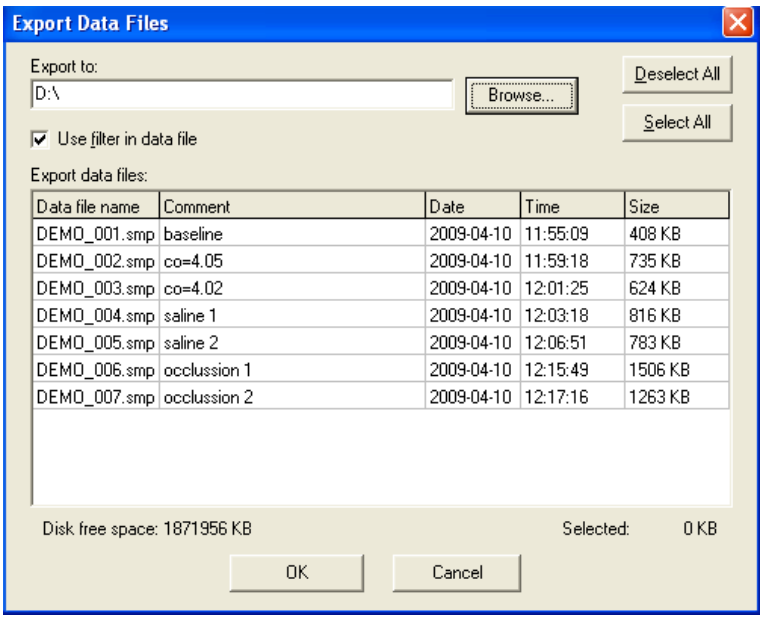
3.5 Export data

If you want to analyze your data using your own formulas, you can export the raw data to a comma-separated file. You can recognize this file with the extension CSV.

The folder where these exported files will be saved, can be filled in under 'Export to:'

Select the data files to be exported using the mouse. Press the left button to select a data file; this line will be colored blue.

To select more than one data file you can use the <SHIFT>-key to select files in a row and use the <CTRL>-key to select files separately.



See Appendix B for example of exporting data.

☑ **Note**

If Excel has problems readingin the data correctly, check your user local settings.
A good normal setting is United Kingdom. These settings affect the way some programs display and sort dates, times, currency, and numbers.

3.6 Delete study

Simply select to highlight the desired study and select delete to remove the study from your hard disk. Be sure that you have made a backup before the study is deleted (read chapter 3.3).

3.7 Print view

Print view will send the displayed screen to the printer. If you press this option during 'Live data', the plotted signal will be finished until the screen is filled before printing is started.

On the bottom of the print-out you will also some useful information of the displayed data file.

3.8 Change the default working folder for your studies

New studies will be created in 'my documents' normally. But if you want to save your studies on a different location select **Set Study Folder** on the **Study** menu.

Select a Study Folder and click **OK**. Use **Cancel** to close the window without changing your default study folder.

☑ **Note**

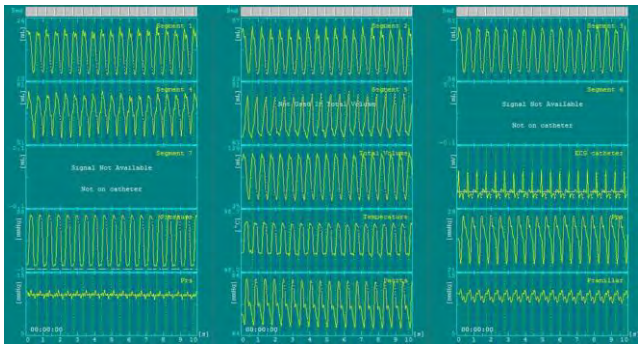
The setting 'Study Folder' is a user account. Changing the 'Study folder' will not change this folder for all users.

4. View

Different predefined views are available to give you a complete overview of the signals and their calculated results.

It is recommended to start the case displaying the segmental loops for an indication of catheter positioning. After catheter positioning in the ventricle is optimized, choose to display a screen with indices. Be sure that markers (see chapter 6) are placed well to see the calculated results.

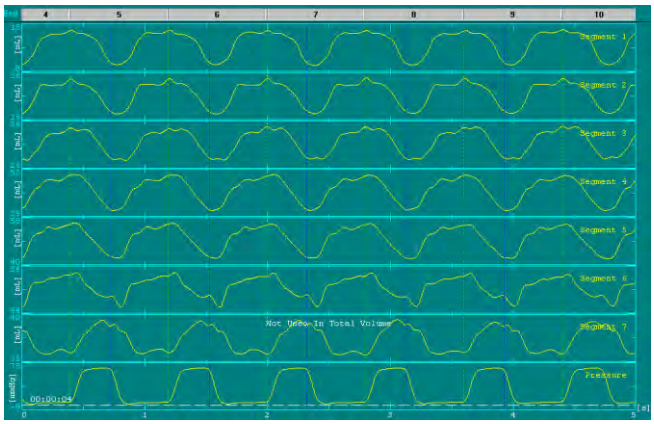
4.1 All channels vs Time



This display mode shows all 15 available signals except the pressure-volume loop.

The time-scale of the horizontal axis is predefined. Select one of the 6 possibilities.

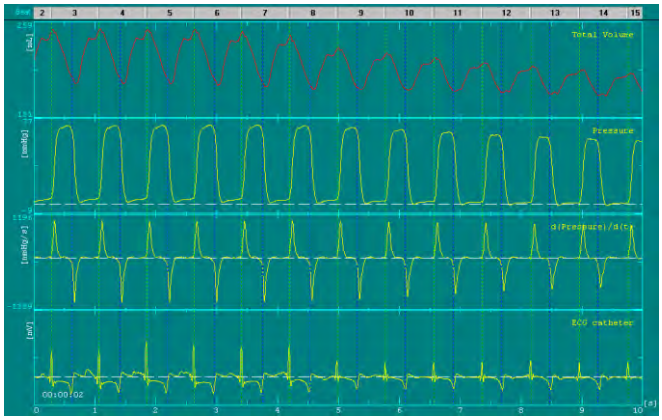
4.2 Segmental Volumes



The 'Segmental Volumes' view shows all segmental volume signals from segment 1 (apex) to segment 7 (base) and the pressure signal. Except when the catheter is introduced through the apex of the heart. Then the order of the segmental volumes is inverted.

Segmental volume signals not included in the calculation of total volume are shown but indicated as "Not Used In Total Volume'.

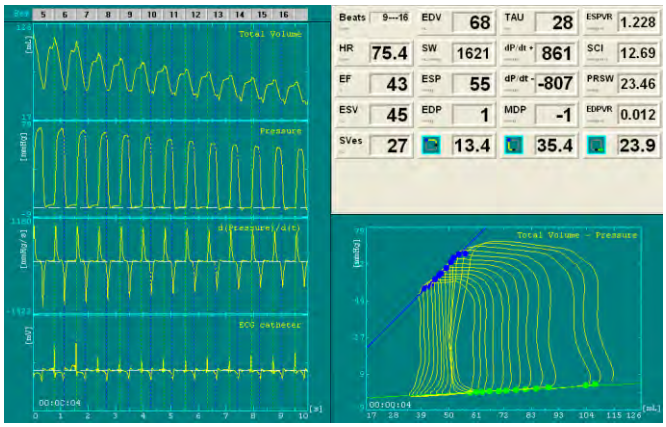
4.3 Volume, Pressure, dP/dt, ECG



This view displays the most useful signals for pressure-volume studies. The total volume is calculated as the sum of the included segments. The dP/dt signal is calculated real-time from the pressure signal.
If the total volume is displayed in a red color this means that the volume is not calibrated.

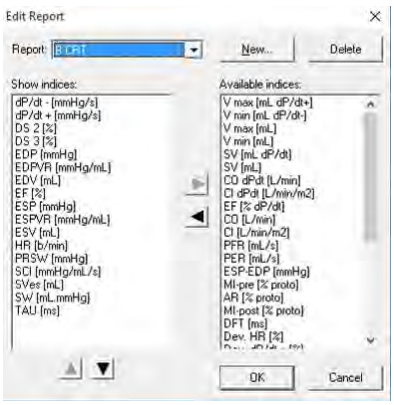
4.4 Pressure-Volume loops

The total volume on the horizontal axis is plotted against pressure on the vertical axis. If enabled (see EDPVR and ESPVR lines in the View Menu), the end-systolic and end-diastolic PV points are indicated and fitted with the specified relation.



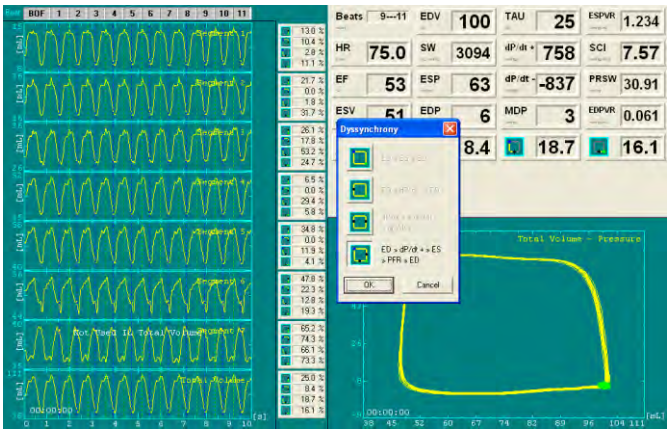
4.5 Indices

There are five different views where the indices can be displayed. Go to "View" then to Indices.
Build up your own indices scheme to see the indices of your interest.



4.6 Dyssynchrony

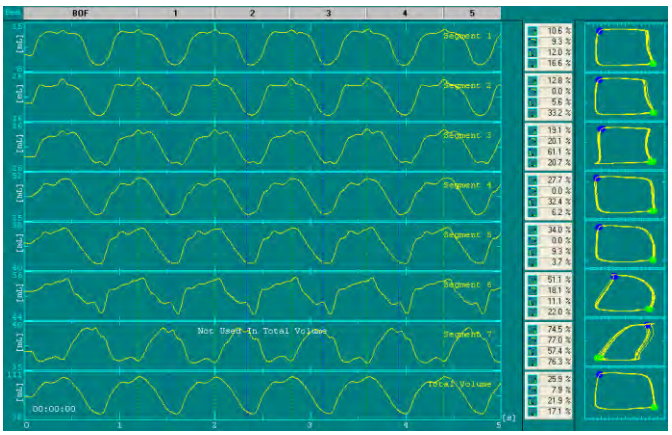
Ventricular dyssynchrony is a difference in timing of contraction and relaxation in different ventricular segments. Conduct NT calculates a time percentage of each segment when out of phase with total volume.
Go to "View" then to Dyssynchrony.
The heart beat is divided in different time frames generating two or four time frames within 1 beat, see midle column.



4.7 Segmental loops

An easy way to determine the position of the catheter is to display the segmental loops. For each segmental volume the Pressure Volume loop is generated.

> ☑ **Note**
>
> This is the recommended view during catheter placement



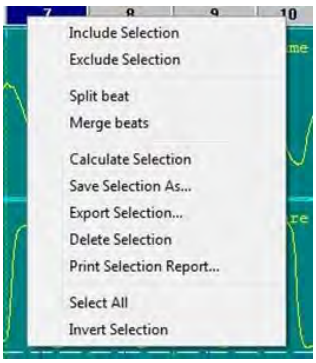
Intra-ventricular pressure-volume loops should run counter clockwise.

4.8 Screen Display options

Go to menu **View**, depending on the options already activated, the user may also see:

1 .. 60 seconds:	Time that the signals will be displayed at a full screen.
Gridlines:	Horizontal and Vertical lines can be displayed on the screen to give a better idea of the signal changes.
Beat numbers:	If markers are placed, beat numbers will be displayed at the top of the plot-windows. (See also chapter 4.2.1 right mouse button)
EDVPR and ESPVR lines:	If you acquire load changes recordings these lines can be plotted to calculate Pressure-Volume relationships.
Show selected beats:	This option will only display the beats selected by the cursor.

4.8.1 Pop-up Menu



When the beat numbers are displayed above the plot windows (see above) a pop-up menu can be opened by clicking the right mouse cursor at one or more beat numbers.

Move the mouse cursor above the box with the beat number and click on the left mouse button. The box will be colored blue. Move the mouse cursor above the box with the last beat number and hold down the <SHIFT>-key when you click the left mouse button. The complete row within these beat numbers will be colored blue.

The pop up menu shows some special functions.

Include / Exclude selection

The selected beat(s) will be included / excluded from the calculated results.
If you exclude the beat a red cross will be displayed through the beat number.

Split beat / Merge beats

Select one beat and choose "Split beat". The selected beat will be divided into two equal beats, possibly the EDP marker should be adapted in case of irregular HR, by clicking with left mouse at green dotted lines at the level of the beat numbers and moving that EDP marker line to the actual EDP positioning, pressures and dP/dt tracings can be helpful to place the marker appropriately. Select more than one beat and choose "Merge beats", the selected beats will be combined to one beat.

Calculate selection

To calculate a specified range of beats, select this range first and choose the option "Calculate selection". To see the result of this range be sure that on the indices scheme the selected beat numbers are presented.

Save selection as

To copy a specified range of beats to a new file, select this range first and choose the option "Save selection as …". Enter a filename and the file will be saved in your study folder. Such a selection could be used as a calibration recording.

Export selection

The raw data of the specified range will be exported to a new excel file. A filename must be entered and be saved in the study folder. See 3.5 Export Data and also Appendix B.

Delete selection

To delete one or more beats from one data file, select the beats and select "Delete selection". Note 3.3 that this will delete the beats definitely from the data file. It also possible to choose 'exclude selection' to see the results without these beats.

Print Selection report

See 6.2.2. Report. The calculated results of the specified range will be exported into a new comma separated file (csv). A filename must be entered.

Select all

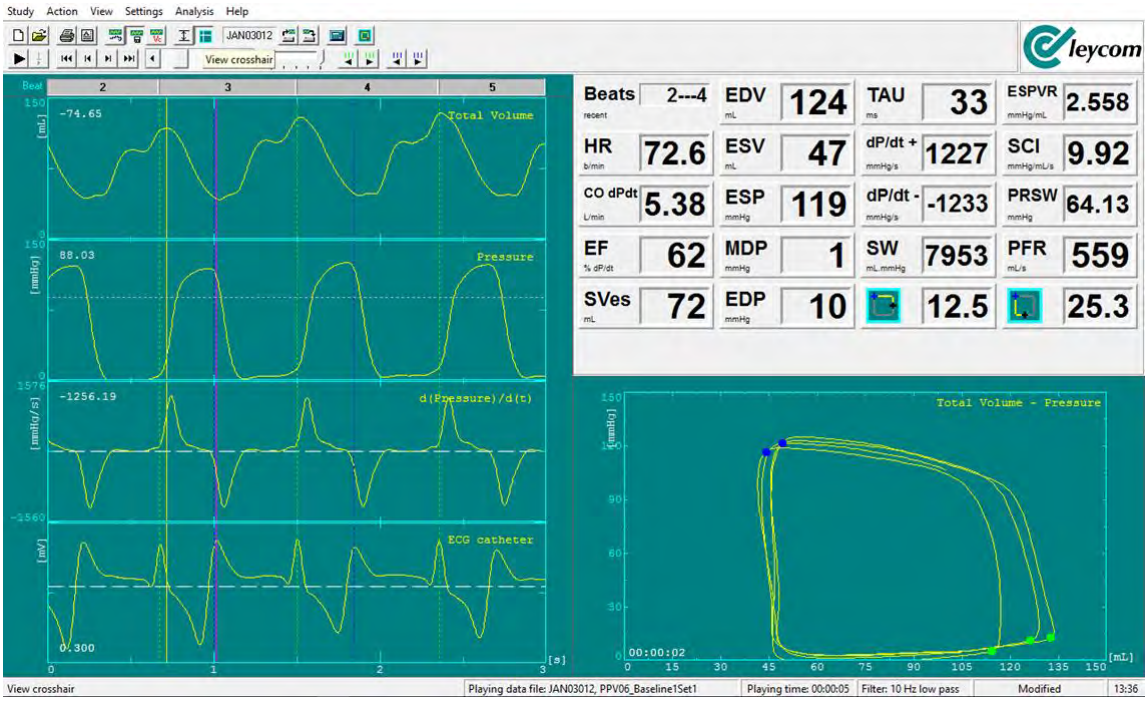
A fast way to select all beats.

Invert selection

Allows you to reverse the selection; the selected beats will be de-selected and the de-selected beats will be selected.

4.8.2 Cross hair

With the cross hair pressures, volumes and time in ms from the EDP marker can be determined at each moment within the cardiac cycle by using the left mouse button, using subsequently the right button gives the changes from the initial point and time delay.



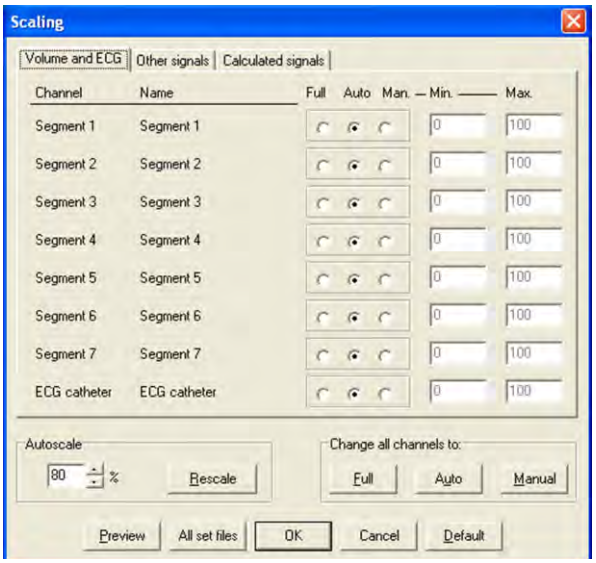
5. Software Settings

5.1 Scaling

'Scaling' on the 'Settings' menu gives the possibility to scale all channels individually. In total 15 channels divided in three forms are available.

At 'Autoscale' a percentage can be chosen for which the screen will be filled with this percentage. To change all channels to 'Manual', 'Auto' or 'Full' click the buttons or click the round holes to change the channels individually.

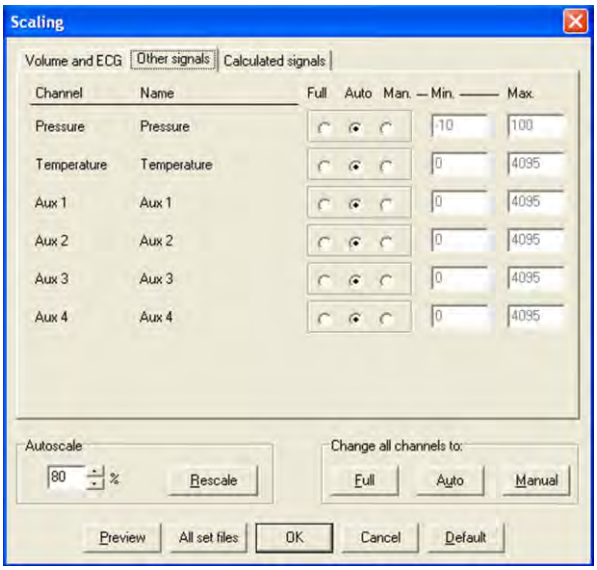
"Volume and ECG" : 7 segmental volumes and the ECG receiving from the volume arm of the catheter.
"Other signals" : pressure, temperature and the auxiliary signals.
"Calculated signals" : the calculated signals Total volume, dP/dt and Stroke Work.

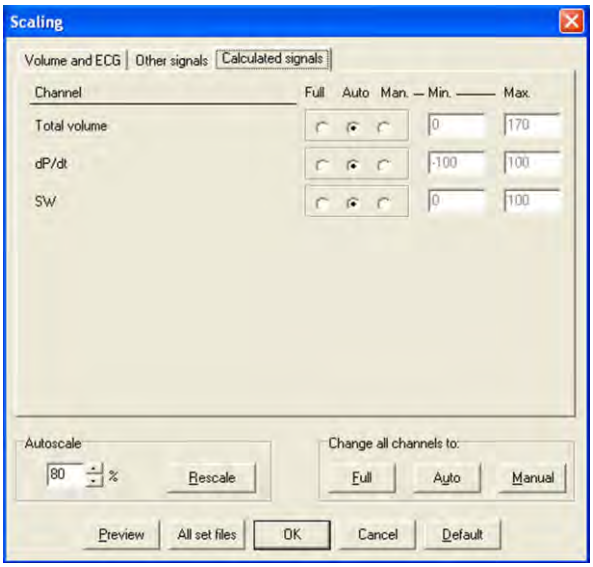


☑ **Hint**

We recommend to set the scaling for all signals to 'Auto' initially at the start of the measurements.

If the catheter is placed correctly and segments in use are selected, total volume and pressure can be set at manual scaling.



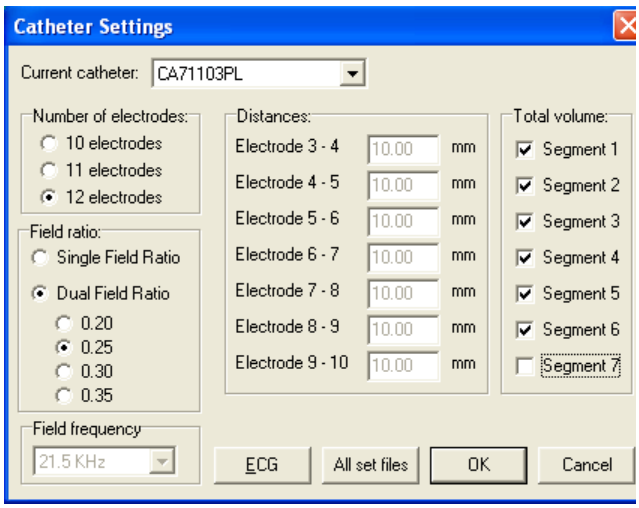


5.2 Catheter settings

The main module of the Inca supplies a 21,5 kHz, 30 µA current to two pair of electrodes (one pair distal the other pair proximal) to setup an intra-ventricular electrical field and senses the resulting voltage gradients between the other pairs of electrodes.

5.2.1 Select catheter used

Select 'Catheter' in the settings menu. Check if the catheter is listed in the preferred list of catheters. The distances between each pair of electrode for the selected catheter will be filled in automatically.



> ☑ **Note**
>
> If the catheter type is not mentioned in the list of catheters, select 'User defined' and fill in the electrode spacing.

5.2.2 Number of electrodes

Start with the maximum available number of electrodes. With a 12-electrode catheter it is possible to measure 7 segments. If the heart is smaller than the measuring area, the user can decide to decrease the number of electrodes to 11 (6 segments) or 10 (5 segments), which is recommended in case only 4 segments are measured in the ventricle, to achieve a more homogenous electrical field within the ventricle. These choices can be best made from the segmental loops display.

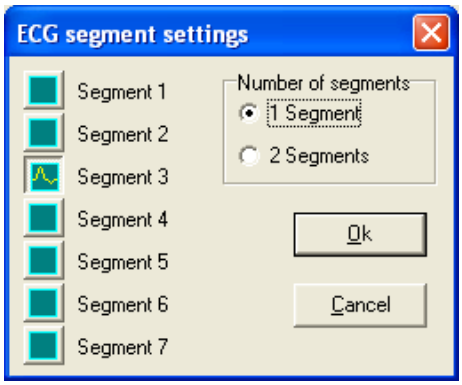
5.2.3 Single Field / Dual Field

Default Dual field (DF) excitation is used to optimize the uniformity of the intra-ventricular electrical field. Generally, a dual field ratio of 0.25 is optimal. Dual field ratios of 0.30 or 0.35 may improve signals in very large hearts. To select the optimal ratio, first set Display Mode to 'Pressure-Volume Loops': Increasing the DF ratio generally increases stroke volume (PV loop width) by changing the volume signal, so when installed after calibration this should then be repeated. Usually the iso-volumic phases are a good indicator for the appropriate Dual Field Ratio: the iso-volumic contraction and relaxation phases of the PV loop should be closest to vertical. In smaller ventricles the Single Field setting can be used.

> ☑ **Note**
>
> The Inca is measuring with a field frequency of 21.5 KHz
>
> The sheath or guiding catheter used for placement of the 4 F catheter should not cover the electrodes during the measurements

5.2.4 ECG

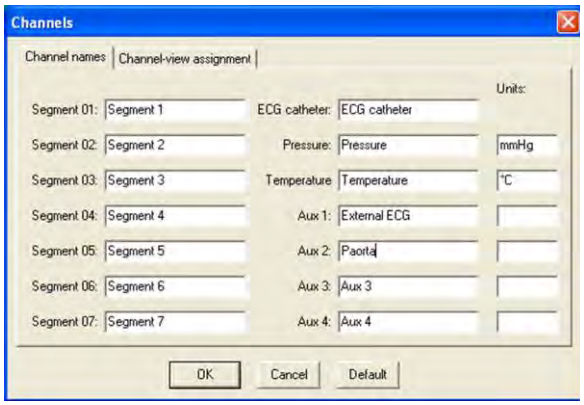
The internal ECG is measured from two electrodes of the catheter.
You can select which electrodes to use by choosing the segments. It is possible to choose one or two segments.

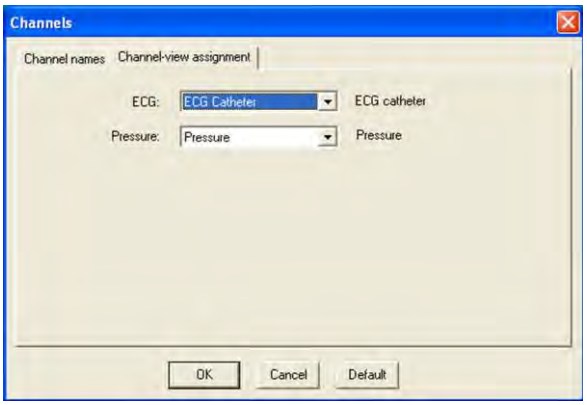


> ☑ **Note**
>
> The segment(s) used is displayed as an orange led on the volume module of your Inca.

5.3 Check channels

Select 'Channels' in the settings menu. The current channel names are given. The user can update the names for all channels and update the units for the external signals.





5.3.1 Channel view assignment

Check the channels selected for ECG and pressure. The selected ECG-signal will be used to find the end-diastolic-pressure (EDP) markers and the selected pressure will be used to create the PV-loop. Default settings used are the ECG measured by the catheter (volume module) and pressure measured by the pressure module of the Inca.

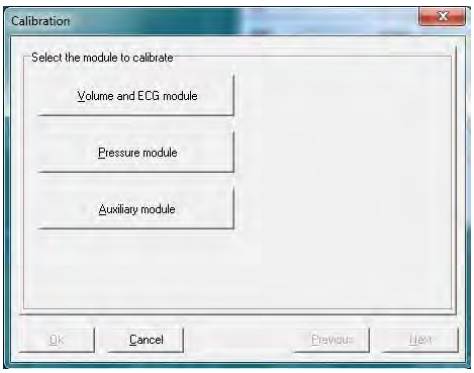
5.4 Pressure Calibration

The calibration of the pressure signals is done automatically.
Remove the catheter from the package and withdraw the protective sleeve. Put the catheter on the table. Using a lumen catheter, flush the catheter first. Immerse catheter pressure sensor for approximately 10 seconds in a sterile saline solution. Leave the catheter on the table and connect the pressure arm of the catheter to the pressure module. An indication bar comes up automatically to tell you that the pressure can be calibrated. Press 'Yes' when you are ready to calibrate the pressure. It is very important to leave the catheter pressure sensor then untouched during calibration.

The pressure calibration takes about 20 seconds. The pressure signal will automatically turn from red into yellow when the calibration is successful.
After calibration the pressure signal should be around '0'. Recalibrate pressure sensor when necessary only when pressure sensor is at ambient pressure and recently wetted by saline solution.

5.5 Recalibration

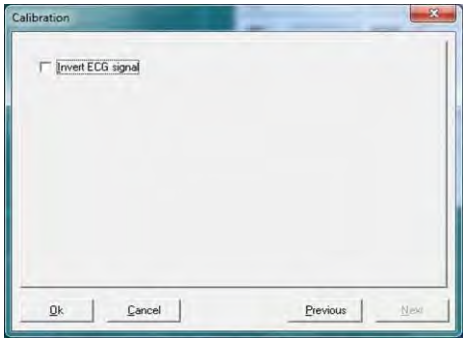
To recalibrate signals, select 'Calibration…' in the settings menu. A window appears that shows the three modules of the Inca.



Volume and ECG module
Calibration of volume is not possible here, go to menu 'Action' and then Volume Calibration.
In the ECG module there is the option to invert the ECG in case the R-peak is negative.

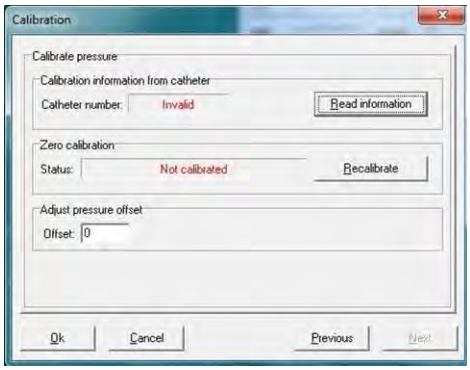
Pressure module
Pressure calibration is done automatically. If this is not done appropriately you can recalibrate the pressure here.

Auxiliary module
Extra signals connected to this module can be calibrated here.



Invert ECG Signal

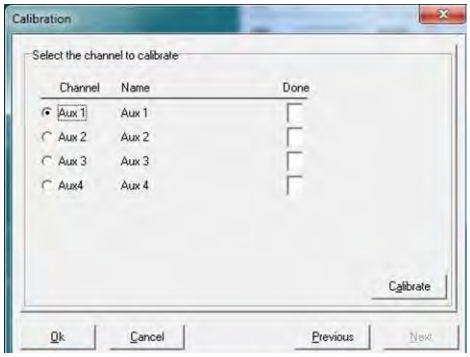
When the ECG signal is displayed with a negative R top it can be inverted at this spot by placing a checkmark to improve EDP marker detection.



5.5.1 Pressure module

Press <Read information>, the serial number of the catheter will be shown.

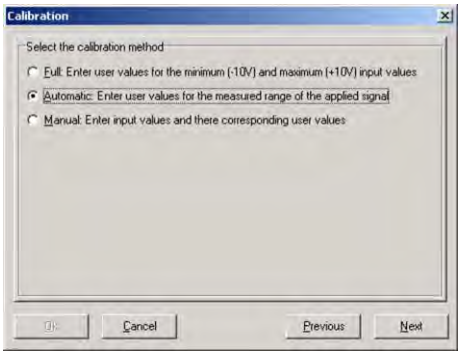
Recalibration at room temperature and catheter outside the body can be performed after 10 seconds in a 0.9% saline bath, leave the offset '0' and press <recalibrate>. Fill in the surrounding temperature and press <recalibrate> again. A measured offset as derived from a reference pressure can be inserted.



5.5.2 Auxiliary module

Select one of the auxiliary signals you want to calibrate and press <Calibrate>.
After calibration is done a checkmark will appear in the column 'Done'.

The software Conduct NT provides three methods to calibrate the auxiliary signals. Select one of the methods and press 'Next'.
If you want to leave form without any changes, press Cancel.

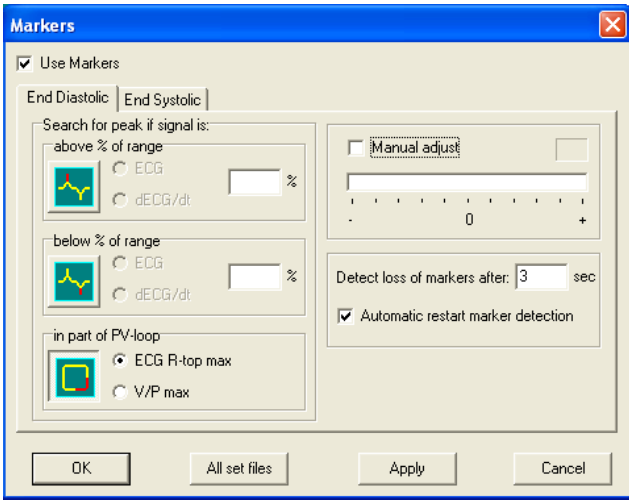


Full
The Inca has a voltage range from –10 Volt to 10 Volt. Fill in the user values that correspond with these two voltages.

Automatic (recommended)
The Inca measures the given values and calibrates the signal using the measured values.

Manual
Supply two known signals and the software will measure these signals and uses these signals to calibrate the signal.

6. Data Analysis



6.1 Markers

Markers are required to separate individual beats and allow the software to calculate a range of variables for each individual beat. The markers to be set are end-diastolic and end-systolic points.
Go to "Analysis" then to Markers

6.1.1 End-Diastolic Markers

Conduct NT incorporates different methods to find end-diastolic (ED) markers automatically on basis of either ECG and or pressure and volume, using detection level as a percentage of the maximum value found during 1 second. The ECG and or pressure channel that will be used are set in 'Channels' (see chapter 4.3).
It is possible to select the ECG or the first derivative of the ECG.
The optimal method is to search the positive R wave of the ECG in the right under corner of the loop (red), using the PV data at lowest pressure and highest volume. When the R wave is negative it should first be inverted in "Calibration", when the segmental volumes are not well addressed, or the catheter positioning is not optimal this end-diastolic marker option may fail.

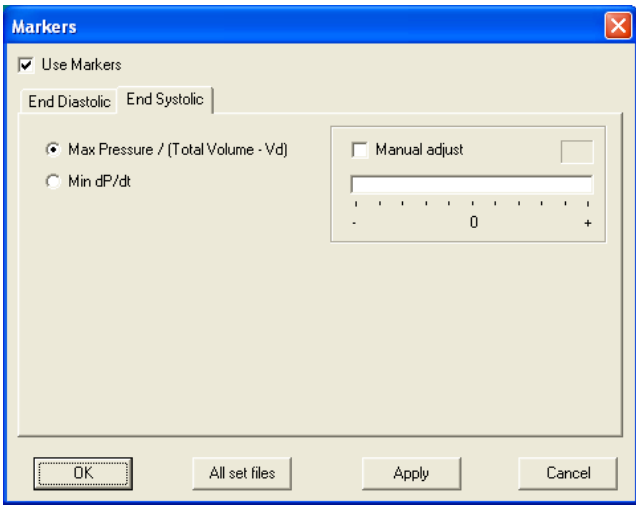
Manual shifts of the ED marker can be necessary in severe heart failure with a long pre-systolic activation, use a light (25 Hz) low pass filter to judge the end-diastolic pressure point accurately.

6.1.2 End-Systolic points

Conduct NT has two methods to calculate the position of the end-systolic (ES) points. The standard method for the left ventricle is to calculate the highest value of maximum LV pressure divided by total volume.

The other method is to place this end-systolic point at minimum -dP/dt, which is recommended for the right ventricle when RV (or LV) pressure decreases during the ejection.

Select the method by placing a checkmark. Manual shifts maybe necessary.

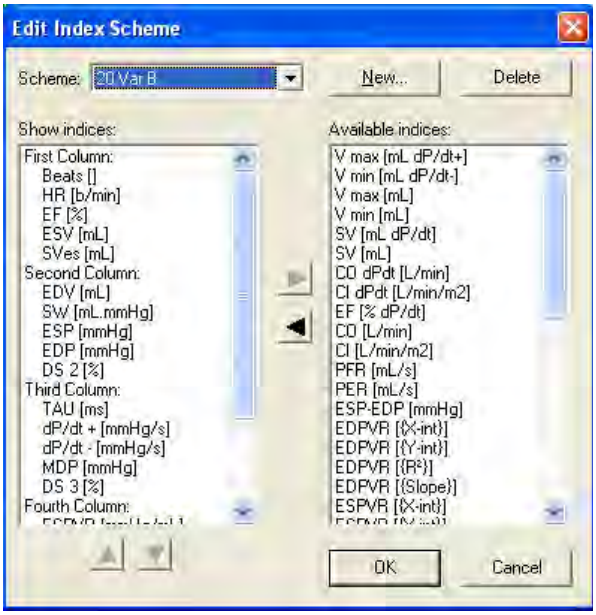


6.1.3 Manual shift of markers

Fine tuning the position of the markers (end-systole or end-diastole) can be performed by shifting the markers manually. Select the option 'Manual adjust' and move the markers to the left or right. This method can be used for end-systole and end-diastole.

The end-diastolic points can be replaced individually for each heartbeat. The heartbeat numbers should then be displayed on the screen (select 'Beat Numbers' in the View menu). Move your mouse

to the displayed beat numbers. When the cursor crosses an end-diastolic point, the cursor is changing in two vertical lines. Press the left mouse button and move your mouse. Select a smaller time frame to move a marker more accurately.



6.2 Indices

Conduct NT can calculate about 60 indices, up to 30 indices can be displayed on the screen. Some standard views and reports are given, but dedicated indices screens and reports can be made (Press <New…>).

Use the arrow key <Left> to place the selected indices into the view and use the arrow key <Right> to remove an index from the view.

Use the arrow keys <Up> and <Down> to place the indices on a certain place of one of the columns. Try to equalize the number of indices in the columns used.

Read Appendix A to get an overview of the calculated indices.

6.2.1 Moving average

The indices shown in some displays are calculated as an average of a number of heartbeats. This number of heartbeats can be entered in 'Indices' in the settings menu.

☑ Note

After every screen refresh the calculated indices will be first displayed after the entered Number of beats are detected.

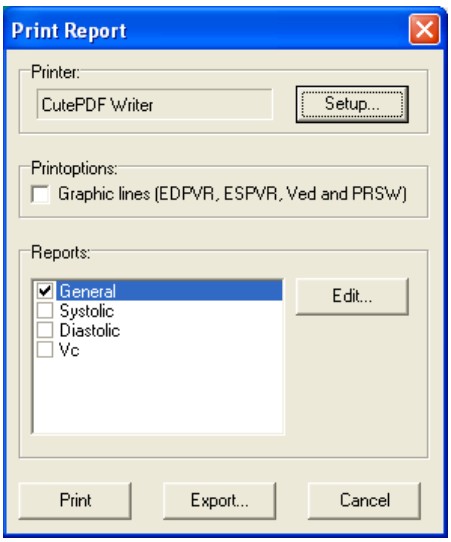
6.2.2 Reports

All the calculated results can be printed. Report names are given in a table. Place a checkmark for the desired print option.

To change one of the reports, select a report; the name of the report will be colored blue and then press 'Edit'. A windows comes up with all the indices. To make changes, use the arrow-keys to add or remove indices from the list.

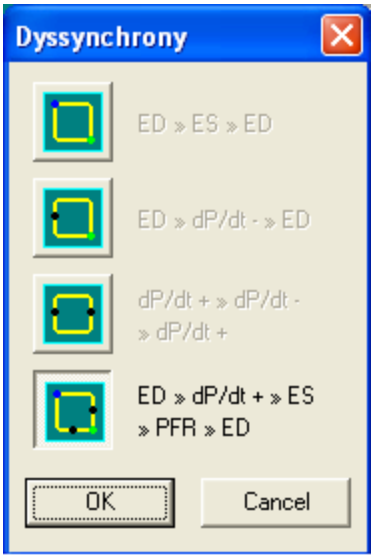
To create a new report, select 'New…'. Enter a name for a report and choose indices from the listing. The user can create dedicated reports. Select 'Print Report' in the 'Study' menu (this option is only available in Recorded Data).

The 'Graphic lines' are the calculated results of the linear regression. The results are the slope, the intercept for X and Y and the regression coefficient for the end-systolic pressure-volume relation (ESPVR), for the relation between +dP/dt



max and end-diastolic volume (SCI) and for preload recruitable stroke work (PRSW, relation between stroke work and end-diastolic volume).

See Appendix B for data export in data management programs as excel or other.



6.2.3 Mechanical Dyssynchrony

See "View" then Indices. At each time point, a segmental volume signal defines dyssynchronous if its change (dVseg/d*t*) is opposite to the simultaneous change in the total LV volume (dVLV/d*t*).

Segmental dyssynchrony is quantified by calculating the percentage of time within the cardiac cycle that a segment is dyssynchronous to total volume.

Total LV dyssynchrony is calculated as the mean of all segmental dyssynchrony together.

Dyssynchrony can be calculated within each specified time interval; it depends on the period chosen if two or four indices are displayed.

Divides one beat into two periods. The dyssynchrony indices DS1 and DS2 can be used.
DS1 : time period from EDV to ESV (Ejection phase)
DS2 : time period from ESV to EDV (Filling phase)

Divides one beat into two periods. The dyssynchrony indices DS1 and DS2 can be used.
DS1 : time period from EDV to minimum dP/dt
DS2 : time period from minimum dP/dt to EDV

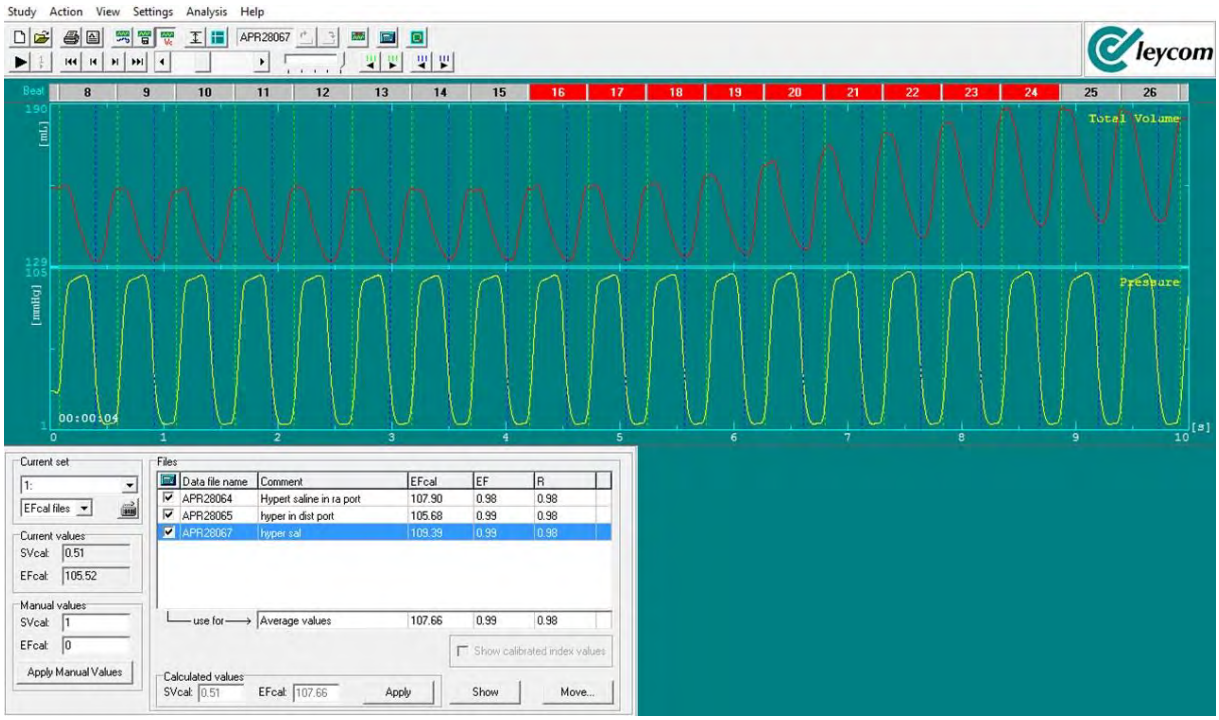
Divides one beat into two periods. The dyssynchrony indices DS1and DS@ can be used.
DS1: time period from maximum dP/dt to minimum dP/dt
DS2: time periode from minimum dP/dt to maximum dP/dt

Divides one beat into four periods. The dyssynchrony indices DS1, DS2, DS3 and DS4 can be used.

DS1: time period from EDV to maximum dP/dt
DS2: time period from maximum dP/dt to ESV
DS3: time period from ESV to maximum dV/dt
DS4: time period from maximum dV/dt to EDV

7. Volume Calibration

Select 'Vc data' in the Action menu or press the button , to start the mode 'Volume Calibration'. Within this mode it is possible to split up the files into different set of data files and to calculate the values for Stroke Volume calibration (SVcal) and Ejection Fraction calibration (EFcal) for each data set.



The 'Current values' shows the actual EFcal's and SVcal's for the total volume used in the data files. When measuring in different situations (e.g. before and after an intervention) it is possible to calculate more than one EFcal and SVcal in different measurement sets. This should be done when the catheter positioning has been changed.

It is also possible to enter manual values for EFcal and SVcal, in case absolute values are not necessary and the user wants to present the data in a normal value range. To copy the manual values to the current values, press 'Apply Manual Values'. Echo or MRI values can be implemented to calculate the calibration factors used in the Data Files.

Using the checkmarks in front of the list, the user can decide to use the results of a specific calibration file in the calculation of an average value.

Click on the line of a file, this line will be colored blue. Double click or press <Show> will display the total volume and pressure from the selected file on the screen.

Use <Move…> to change the type or set from the selected file.

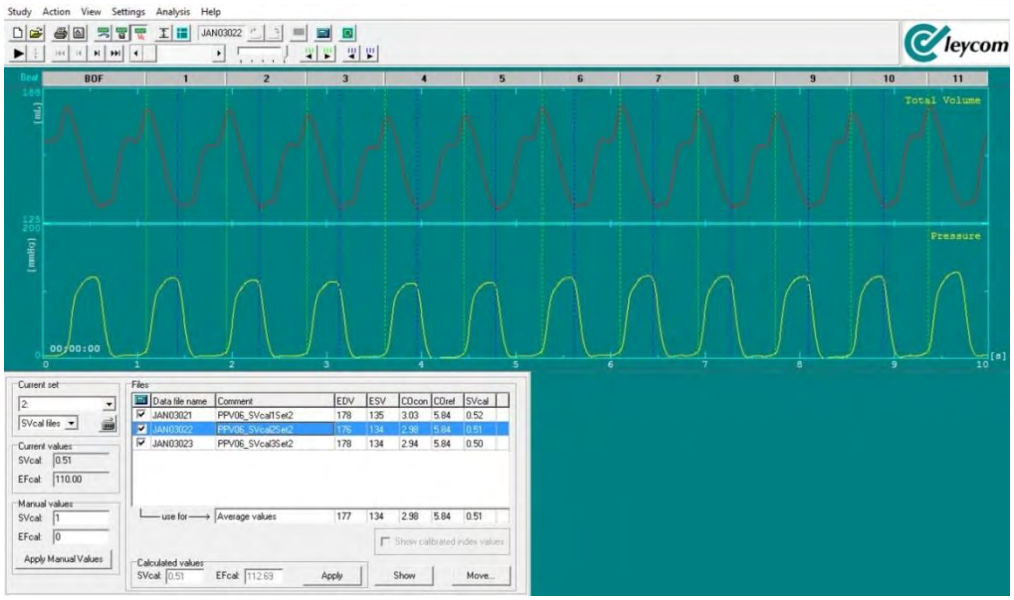
☑ Note 1

If the PV-loops and total volume are displayed in red, the volumes are uncalibrated. If the PV-loops and total volume are displayed in yellow, the volumes are calibrated using Alpha and Vc in 'Current values'.

7.1 Volume correction factors

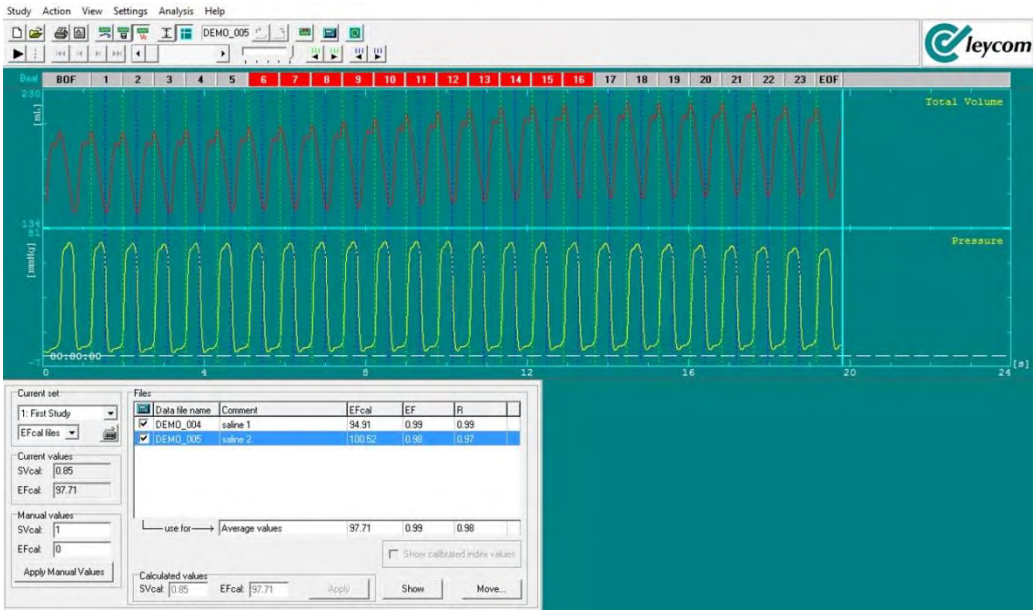
7.1.1 SVcal (correction factor related to Stroke Volume)

SVcal is a calibration factor that is a product of Cardiac Output measured by the volume catheter divided by a reference CO by example from thermodilution, or another method of CO measurement. The value for the reference method must be entered into the column 'COref'. The calculated results for SVcal can be read in the column 'SVcal'. Perform at least 4-5 thermodilution measurements simultaneously with recording PV relations to ensure the most accurate calibration.



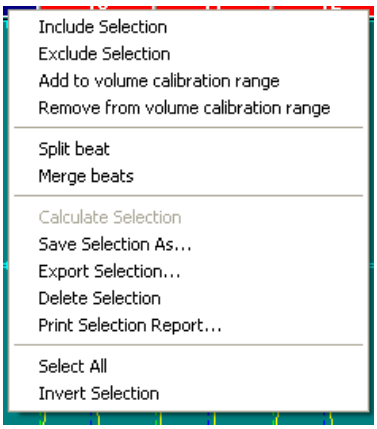
7.1.2 EFcal (correction volume related to parallel conductance)

The software enables determination of the parallel conductance correction from signals acquired during a hypertonic saline injection (5-10ml, 5-7.5% saline). EFcal is a calibration factor that is calculated by the beats affected by the hypertonic saline injection, resulting in an increase in estimated EDV and ESV, followed by a wash-out episode. Only beats during the increase in conductance by the hypertonic saline should be used for this calculation, it should start with the last beat prior the increase until the first beat showing a decrease. The Conduct software automatically detects these beats and indicates them in red.



7.2 Add to / Remove from Vc range

If the user is not satisfied with the Volume Calibration (Vc) range that is found automatically (check the red colored beat numbers), it is possible to make manual changes by removing or inserting beats. Optimal results can be reached by starting with the last beat prior the increases of EDV and ESV due to the hypertonic saline until the last beat prior decreases in EDV and ESV due to wash out.



Move the cursor to a beat number and press the right button. The selected beat will be colored blue. Use the left mouse button in combination with CTRL or SHIFT-key to select more than one beat.

Select 'Add to Vc range' to add the selected beat(s) to the Vc range and select 'Remove from Vc range' to remove the selected beat(s) from the Vc range. The result of the new calculation will be displayed in the table directly. A guide for optimal results are given by the correlation numbers shown as EF and R on top of the table, optimal is near 1.00, EF is the correlation number of the EDV change and R the correlation of the ESV change due to the hypertonic saline.

When the user is satisfied with the calculated SVcal and EFcal, copy the average value to the current values by pressing 'Apply'. All the data files in the same set will use the EFcal and SVcal displayed at current value.

☑ Note 1

The calculated EFcal and SVcal will not be used in the EFcal- and SVcal-files themselves. Only after transporting them to data files those files can be calibrated.

☑ Note 2

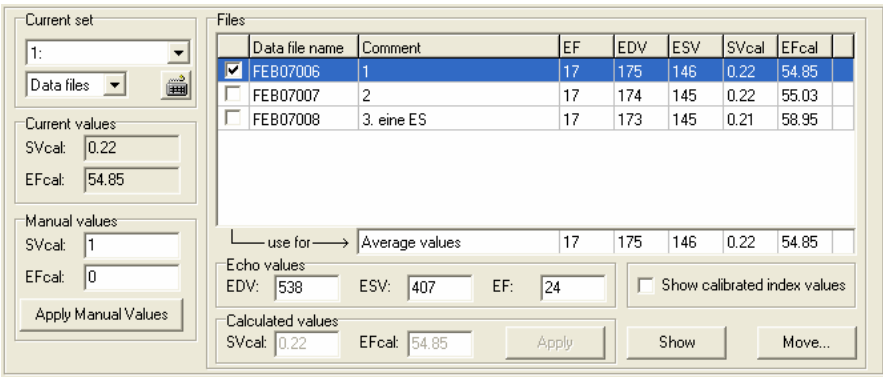
After pressing 'recalculate' the manual changes are lost.

7.3 Use Echo or MRI values

To shorten the measurement you may also use MRI or Echo values to calibrate the volume. Therefor you need to know two indices of EDV, ESV or EF.
Enter two indices in the boxes of Echo values, the third value will be calculated automatically.
Place a checkmark in front of one (or more) datafiles. If you place more than one checkmark an average will be calculated using the values mentioned in the columns SVcal and EFcal.

You see the calculated results in grey at "Calculated values".

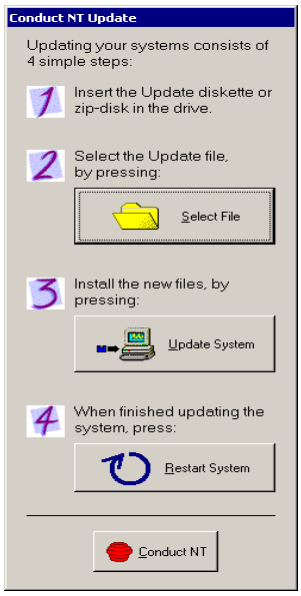
Press 'Apply' and the calculated values will be copied to 'Current values'. All the files set to datafile and in the same number of dataset will be calibrated using the values for EFcal and SVcal.



8. Conduct NT installation

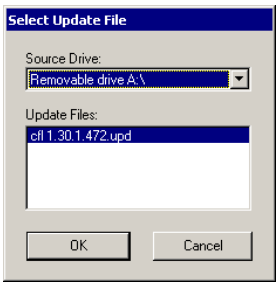
8.1 Updating software

If a new version of Conduct NT has been released, CD Leycom will have an update file available that can be sent by e-mail. Copy the file on an external disk that can be connected using an USB cable. Be sure that the file is in the root of the drive. Run the software Conduct NT and select 'Update Conduct NT' from the study menu.



Update the software Conduct NT in four simple steps.

1. Be sure that the software can read the file on the external disk.
2. Select the update-file by pressing 'Select File'. Choose the Source drive where the update file is located. The program will recognize the update-file automatically and it will appear in the box.



3. To start the update press 'Update Conduct NT'. The program will update the software. An indicator will appear to show the remaining time for the update to complete.
4. To complete the update, restart the computer by selecting 'Restart computer'.

To cancel the update, press 'Conduct NT' to return to Conduct NT.

9. Help

9.1 Contents of Help

To find more information about the Conduct NT software, select 'Contents' in the Help menu or press F1.

There are 3 options to search for a topic.

1. Contents
   Press a book to know the contents of the books. If there is information about a topic, press the question mark .

2. Index
   Type the name of the topic. The program will search your topic in an alphabetical list.

3. Find
   Type the word to find. Select some matching words to narrow the search. Click a topic and select Display to read the information about the selected topic.

9.2 Contact CD Leycom

Before contacting CD Leycom for questions about the software, please select 'About Conduct NT' in the Help menu first and write down the version number of the software.
Send an e-mail message to CD Leycom Support; attaching files is ideal for questions. Submit a question at any time and receive a response within a few business days.
Please send your questions to support@cdleycom.com.

Appendix A. Hemodynamic Indices

HR[b/min] = Heart Rate
The heart rate is calculated in beats per minute.

Vmax[ml] = maximum volume
This is the absolute maximum volume.

Vmax[ml dP/dt+] = maximum volume
This is the 'maximum' volume that is found at maximum dP/dt.

Vmin[ml] = minimum volume
This is the absolute minimum volume.

Vmin[ml dP/dt-] = minimum volume
This is the 'minimum' volume that is found at minimum dP/dt.

SV[ml] = Stroke Volume
This is the difference between the minimum and maximum volume.

SV[ml dP/dt] = Stroke Volume
This is the difference between the minimum and maximum volume found on dP/dt.

SV [mL ED-ES)
Stroke volume determined between volume at EDP and end-systolic point.

SVes [mL]
Stroke volume determined between volume at dP/dt+ and end-systolic point.

CO [L/min] = Cardiac Output
The Cardiac Output is calculated by CO = SV[ml]*HR[b/min]

CO dP/dt [L/min] = Cardiac Output
The Cardiac Output at dP/dt+ is calculated by CO = SV[ml dP/dt]*HR[b/min]

CI[L/min/m2] = Cardiac Index
The Cardiac Index is calculated by CO / (Height(cm) * Weight(kg) / 3600)$^{1/2}$.

EF[%] = Ejection Fraction
The Ejection Fraction is calculated by EF = (SV / Vmax * 100%)

SW[ml.mmHg] = Stroke Work, calculated as the area of the pressure-volume loop.

TAU[ms] = Time constant of isovolumic LV pressure relaxation
Tau (Mirsky) is calculated as the time from dP/dt min until pressure reaches half the value at dP/dt min.

dP/dt + [mmHg/s] = maximum value of first derivative of the pressure
Calculated as the maximum value of 1/(P[n+1] – P[n]).

dP/dt - [mmHg/s] = minimum value of first derivative of the pressure
Calculated as the minimum value of 1/(P[n+1] – P[n]).

PFR[ml/s] = peak filling rate
Peak Filling Rate is calculated as the maximum value of dV/dt max. dV/dt = 1/(V[n+1] – V[n]).

tPFR[ms] = Time in milliseconds between start of heart cycle and PFR.
Calculated as the time between End Diastolic point and PFR.

PER[ml/s] = peak ejection rate
Peak Ejection Rate is calculated as the minimum value of dV/dt min. dV/dt = 1/(V[n+1] – V[n]).

tPER[ms] = Time in milliseconds between start of heart cycle and PER.
Calculated as the time between End Diastolic point and PER.

EDP[mmHg] = End Diastolic Pressure
Pressure measured on end diastolic point. The end diastolic point is equal to the position of the marker.

EDV[ml] = End Diastolic Volume
Volume measured on end diastolic point. The end diastolic point is equal to the position of the marker.

ESP[mmHg] = End Systolic Pressure
Pressure measured on end systolic point. The end systolic point is found on the sample where Pn / (Vd – Vn) reach the maximum value.
Vd is calculated as Vmin – (0.5 * SV).

ESV[ml] = End Systolic Volume
Volume measured on end systolic point. The end systolic point is found on the sample where Pn / (Vd – Vn) reach the maximum value.
Vd is calculated as Vmin – (0.5 * SV).

DFT[ms] = Diastolic Filling Time
Time between dP/dt min and end diastolic.

ESP-EDP =
Difference between end systolic pressure and end diastolic pressure.

EDPVR (mmHg/mL)= End Diastolic Pressure Volume Relationship.
Beat-to beat EDPVR as can be measured continuously (without loading change), calculated as end-diastolic pressure divided by volume at the end diastolic point.

EDPVR [slope]
Slope of the linear regression of the EDPVR as can be determined from a loading change.

EDPVR [X-int]
Intercept for X on the linear regression of the EDPVR as can be determined from a loading change.

EDPVR [Y-int]
Intercept for Y on the linear regression of the EDPVR as can be determined from a loading change.

EDPVR [R^2]
Correlation of the linear regression of the EDPVR as can be determined from a loading change.

ESPVR (mmHg/mL)= End Systolic Pressure Volume Relationship or end-systolic elastance (Ees).
Beat-to-beat end-systolic pressure-volume relation (ESPVR) can be displayed continuously (without loading change), calculated as end-systolic pressure divided by volume at the end-systolic p-v point.

ESPVR [slope]
Slope of the Linear regression of the end systolic pressure volume relation determined from a loading change.

ESPVR [X-int]
Intercept for X of the Linear regression of the end systolic pressure volume relation determined from a loading change.

ESPVR [Y-int]
Intercept for Y of the Linear regression of the end systolic pressure volume relation determined from a loading change.

ESPVR [R^2]
Correlation of the Linear regression of the end systolic pressure volume relation determined from a loading change.

MDP [mmHg]
Mid diastolic pressure calculated at the moment of PFR.

PRSW (mmHg)= Preload Recruitable Stroke Work
Beat-to-beat PRSW as can be displayed continuously (without loading change), determined from SW divided by EDV.

PRSW [slope]
Slope of the linear regression of the PRSW as can be determined from a loading change.

PRSW [X-int]
Intercept for X of the linear regression of the PRSW as can be determined from a loading change.

PRSW [Y-int]
Intercept for Y of the linear regression of the PRSW as can be determined from a loading change.

PRSW [R^2]
Correlation of the linear regression of the PRSW as can be determined from a loading change.

SCI (mmHg/mL/s)
Beat-to-beat Starling contractile state index (SCI) as can be displayed continuously (without loading change), determined from peak dP/dt + divided by end-diastolic volume.

SCI [slope]
Slope of the linear regression of the SCI as can be determined from a loading change.

SCI [X-int]
Intercept for X of the linear regression of the SCI as can be determined during a loading change.

SCI [Y-int]
Intercept for Y of the linear regression of the SCI as can be determined during a loading change.

SCI [R^2]
Correlation of the linear regression of the SCI as can be determined from a loading change.

Divides one beat into two periods. The dyssynchrony indices DS1 and DS2 can be used.
DS1 : time period from EDV to ESV (Ejection phase)
DS2 : time period from ESV to EDV (Filling phase)

Divides one beat into two periods. The dyssynchrony indices DS1 and DS2 can be used.
DS1 : time period from EDV to minimum dP/dt
DS2 : time period from minimum dP/dt to EDV

Divides one beat into two periods. The dyssynchrony indices DS1and DS@ can be used.
DS1: time period from maximum dP/dt to minimum dP/dt
DS2: time periode from minimum dP/dt to maximum dP/dt

Divides one beat into four periods. The dyssynchrony indices DS1, DS2, DS3 and DS4 can be used.

DS1: time period from EDV to maximum dP/dt
DS2: time period from maximum dP/dt to ESV
DS3: time period from ESV to maximum dV/dt
DS4: time period from maximum dV/dt to EDV

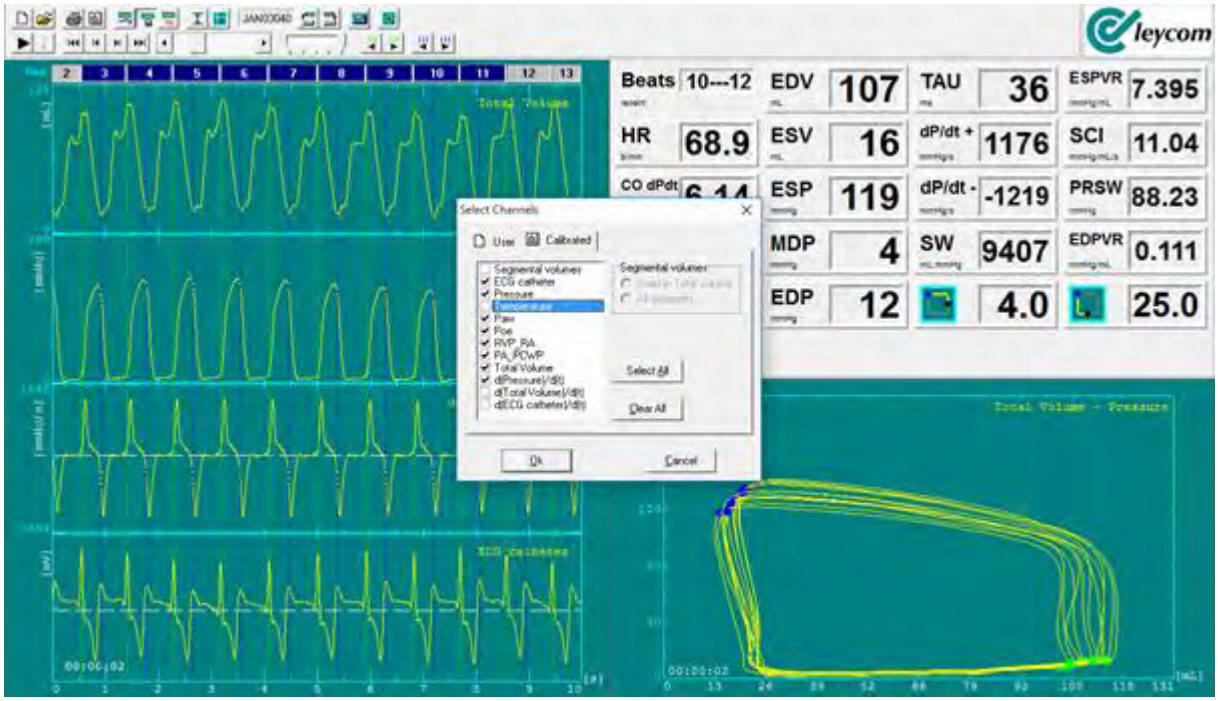
Appendix B. Export Data

This appendix provides an explanation how to export the raw data and calculated indices to a tabular format (.CSV) and how to view the file within Microsoft Excel.

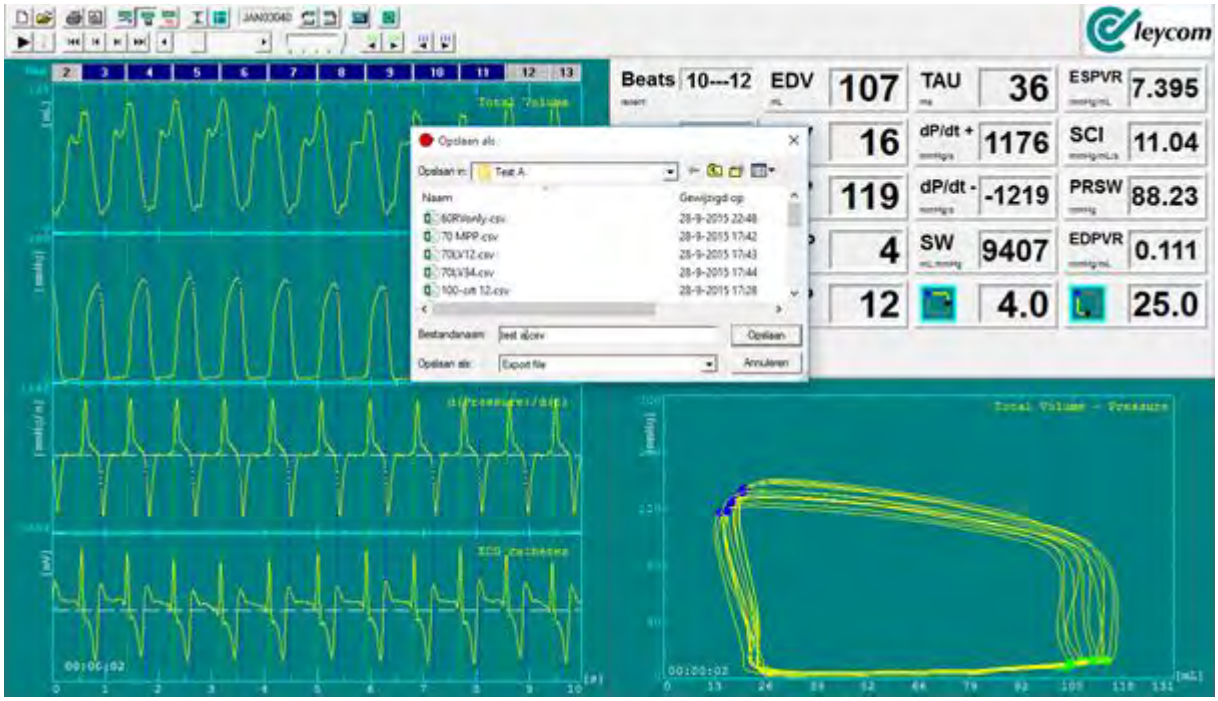
Export Raw Data

Select beats you want to be exported. Click with your right mouse button on the selected beats and go to "export selection".

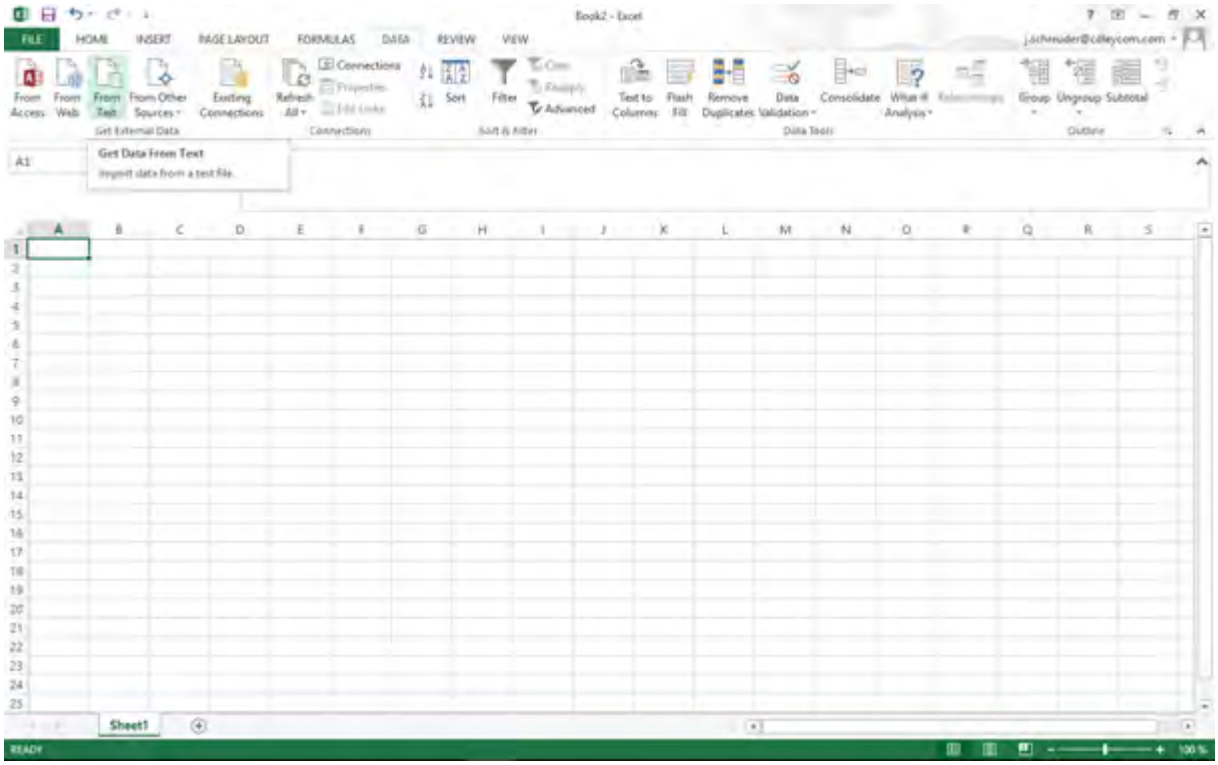
Subsequently select one or more signal channals to be exported from the options shown.



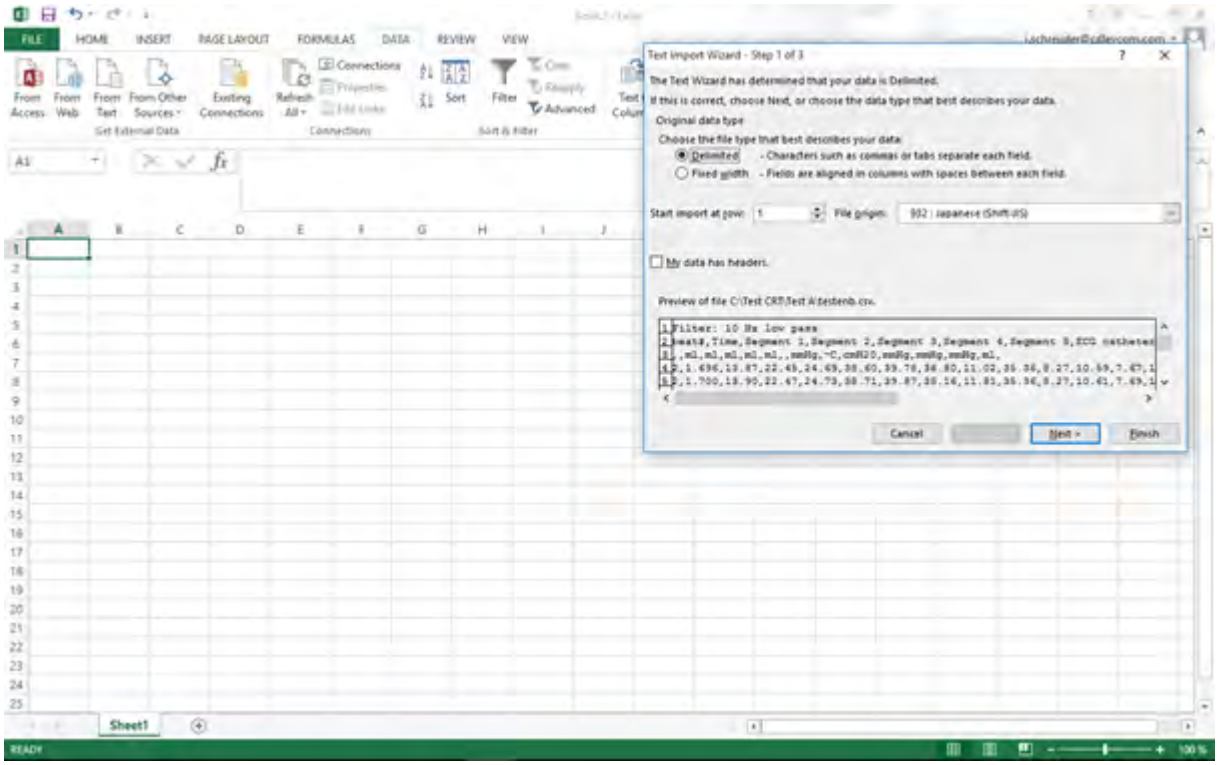
Below save the selection raw data into a directory



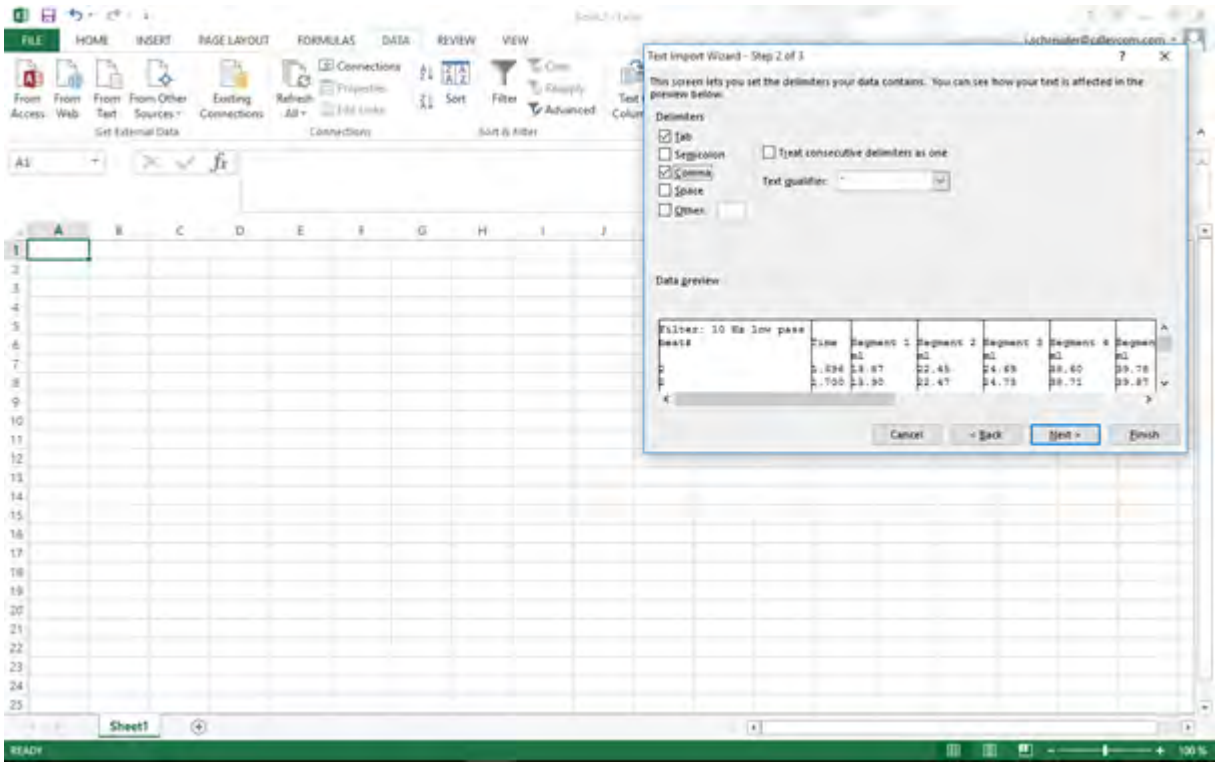
Below, open a new excel file and go to Data and get Data from text



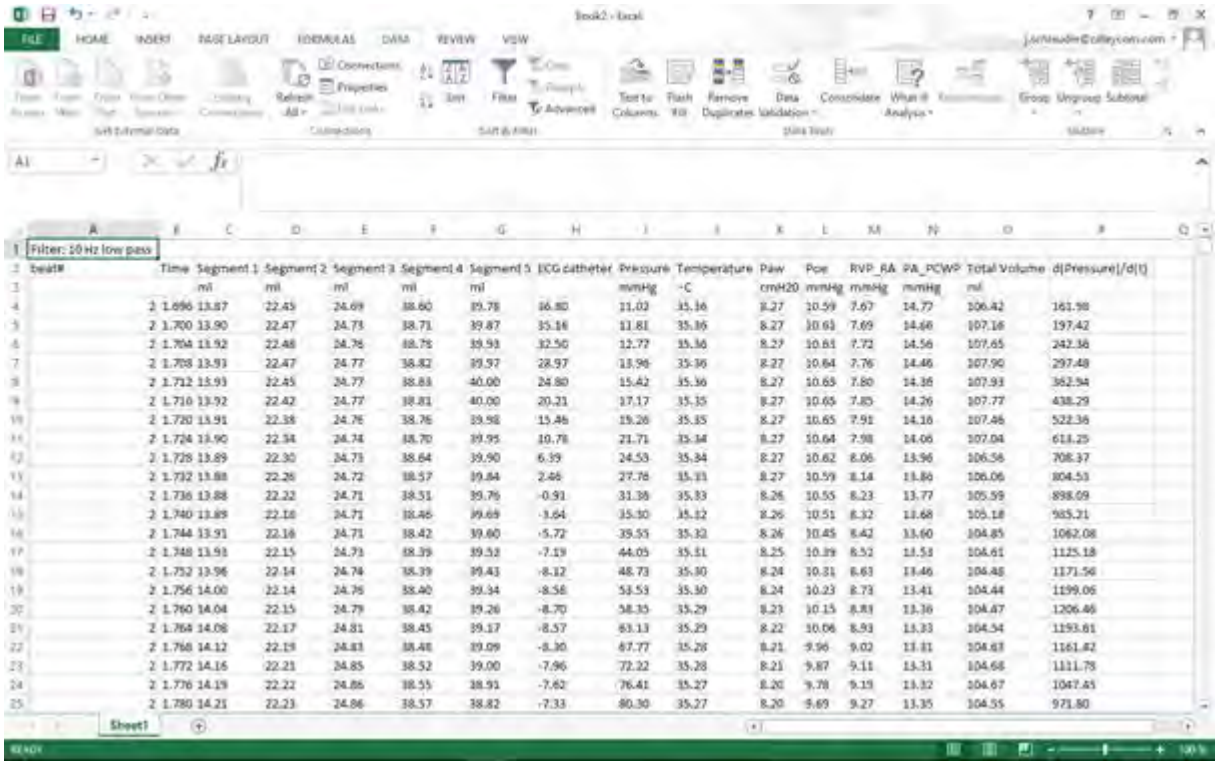
Below choose the delimited option and go to next



Below select Tab and Comma and go next and finish



Below the final import of the Raw Data in excel

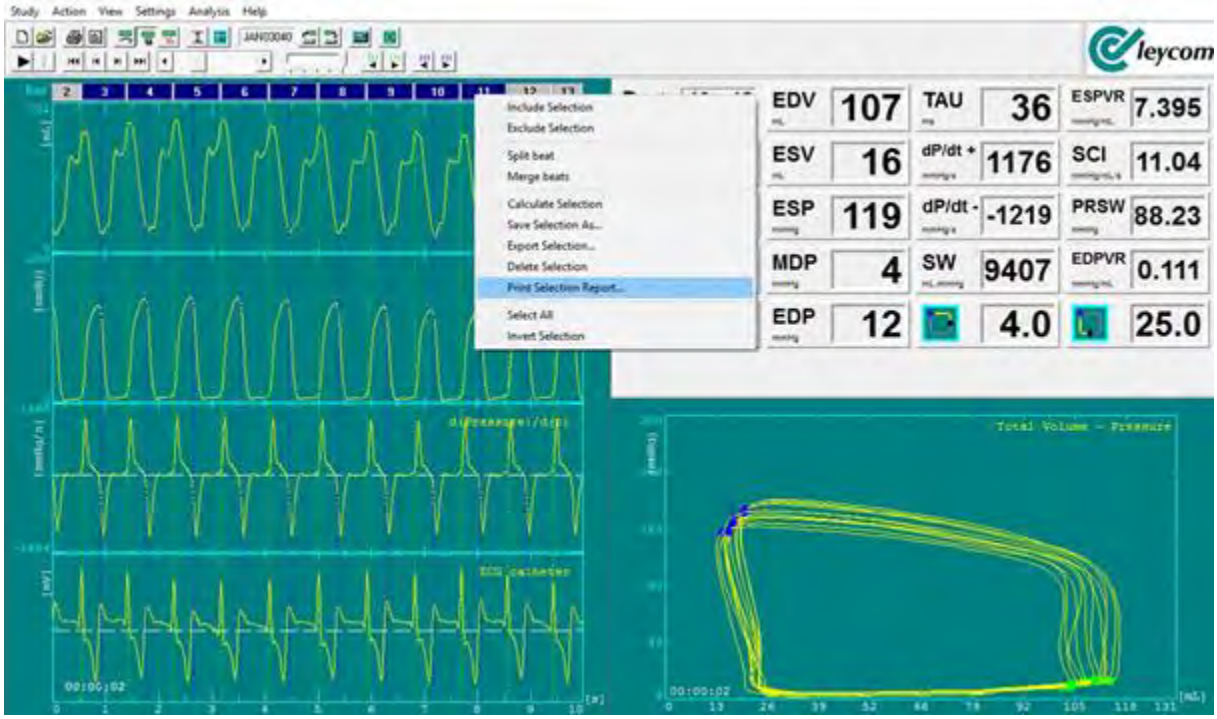


Filter: 10 Hz low pass

beat#	Time	Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	ECG catheter	Pressure	Temperature	Paw	Poe	RVP_RA	PA_PCWP	Total Volume	d(Pressure)/d(t)
		ml	ml	ml	ml	ml		mmHg	-C	cmH20	mmHg	mmHg	mmHg	ml	
2	1.696	13.87	22.45	24.69	38.60	39.78	16.80	11.02	35.16	8.27	10.59	7.67	14.77	106.42	161.98
2	1.700	13.90	22.47	24.73	38.71	39.87	35.18	11.81	35.16	8.27	10.61	7.69	14.68	107.18	197.42
2	1.704	13.92	22.48	24.76	38.78	39.93	32.50	12.77	35.16	8.27	10.61	7.72	14.56	107.65	242.36
2	1.708	13.93	22.47	24.77	38.82	39.97	28.97	13.96	35.16	8.27	10.64	7.76	14.46	107.90	297.48
2	1.712	13.93	22.45	24.77	38.83	40.00	24.80	15.42	35.16	8.27	10.65	7.80	14.36	107.93	362.94
2	1.716	13.92	22.42	24.77	38.81	40.00	20.21	17.17	35.15	8.27	10.65	7.85	14.26	107.77	438.29
2	1.720	13.91	22.38	24.76	38.76	39.98	15.46	19.26	35.15	8.27	10.65	7.91	14.16	107.46	522.36
2	1.724	13.90	22.34	24.74	38.70	39.95	10.78	21.71	35.14	8.27	10.64	7.98	14.06	107.04	613.25
2	1.728	13.89	22.30	24.73	38.64	39.90	6.39	24.53	35.14	8.27	10.62	8.06	13.96	106.56	708.37
2	1.732	13.88	22.26	24.72	38.57	39.84	2.46	27.76	35.13	8.27	10.59	8.14	13.86	106.06	804.53
2	1.736	13.88	22.22	24.71	38.51	39.76	-0.91	31.38	35.13	8.26	10.55	8.23	13.77	105.59	898.09
2	1.740	13.89	22.18	24.71	38.46	39.69	-3.64	35.30	35.12	8.26	10.51	8.32	13.68	105.18	985.21
2	1.744	13.91	22.16	24.71	38.42	39.60	-5.72	39.55	35.12	8.26	10.45	8.42	13.60	104.85	1062.08
2	1.748	13.93	22.15	24.73	38.39	39.53	-7.19	44.05	35.11	8.25	10.39	8.52	13.53	104.61	1125.18
2	1.752	13.96	22.14	24.74	38.39	39.43	-8.12	48.73	35.10	8.24	10.31	8.63	13.46	104.48	1171.56
2	1.756	14.00	22.14	24.76	38.40	39.34	-8.56	53.53	35.10	8.24	10.23	8.73	13.41	104.44	1199.06
2	1.760	14.04	22.15	24.79	38.42	39.26	-8.70	58.35	35.29	8.23	10.15	8.83	13.36	104.47	1206.46
2	1.764	14.08	22.17	24.81	38.45	39.17	-8.57	63.13	35.29	8.22	10.06	8.93	13.33	104.54	1193.61
2	1.768	14.12	22.19	24.83	38.48	39.09	-8.30	67.77	35.28	8.21	9.96	9.02	13.31	104.63	1161.42
2	1.772	14.16	22.21	24.85	38.52	39.00	-7.96	72.22	35.28	8.21	9.87	9.11	13.31	104.68	1111.78
2	1.776	14.19	22.22	24.86	38.55	38.91	-7.62	76.41	35.27	8.20	9.78	9.19	13.32	104.67	1047.45
2	1.780	14.21	22.23	24.86	38.57	38.82	-7.33	80.30	35.27	8.20	9.69	9.27	13.35	104.55	971.80

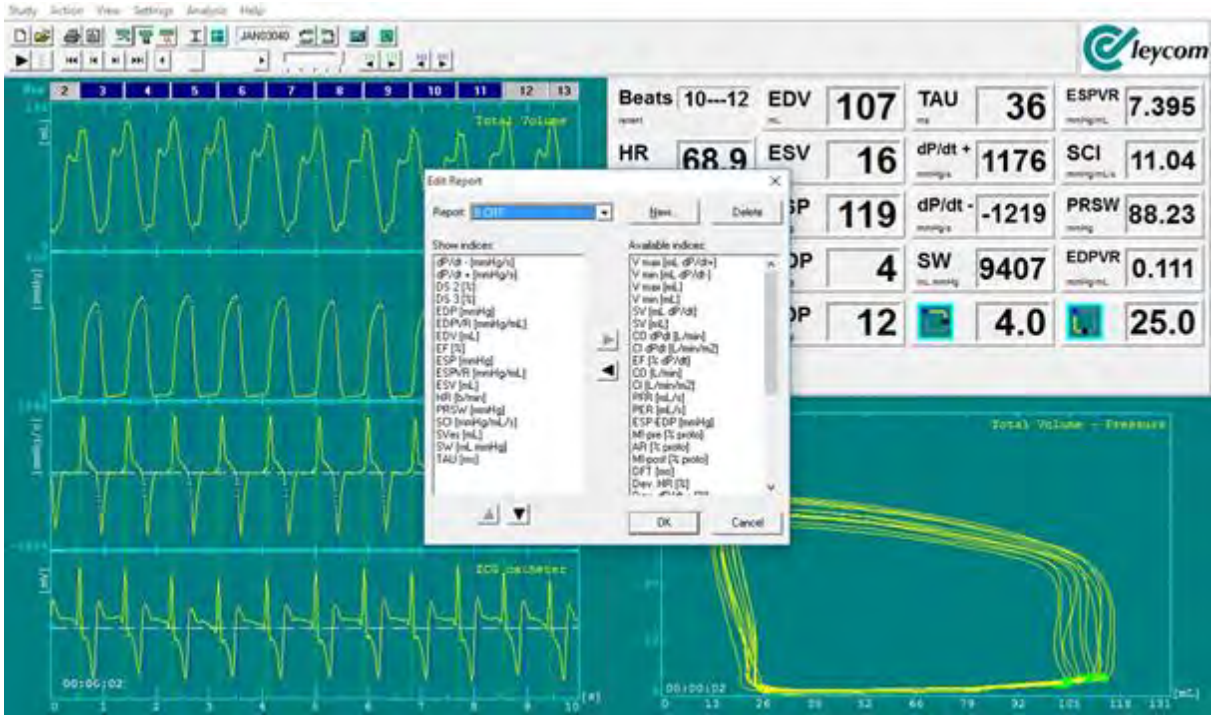
Export the Variables

Select the beats from which the variables have to be exported in excel and click on the beats with the second mouse and select "Print Selection Report"

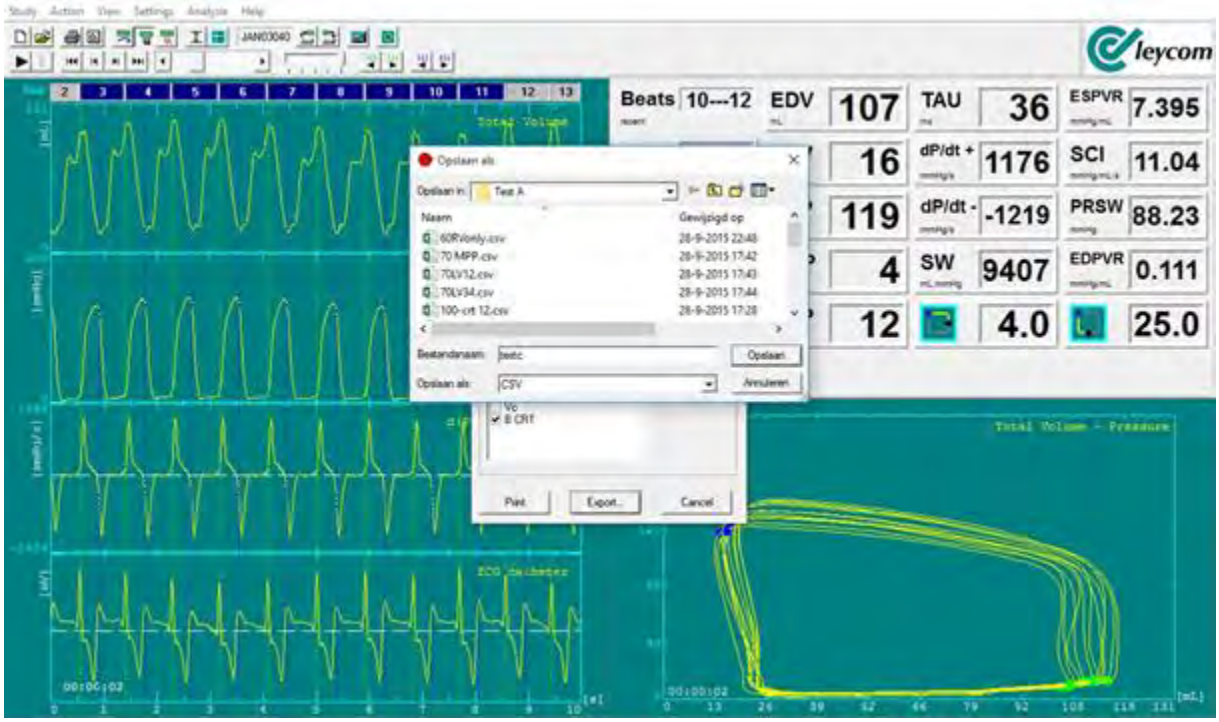


Below the menu of Print Selection Report, standard reports or editable reports can be choosen

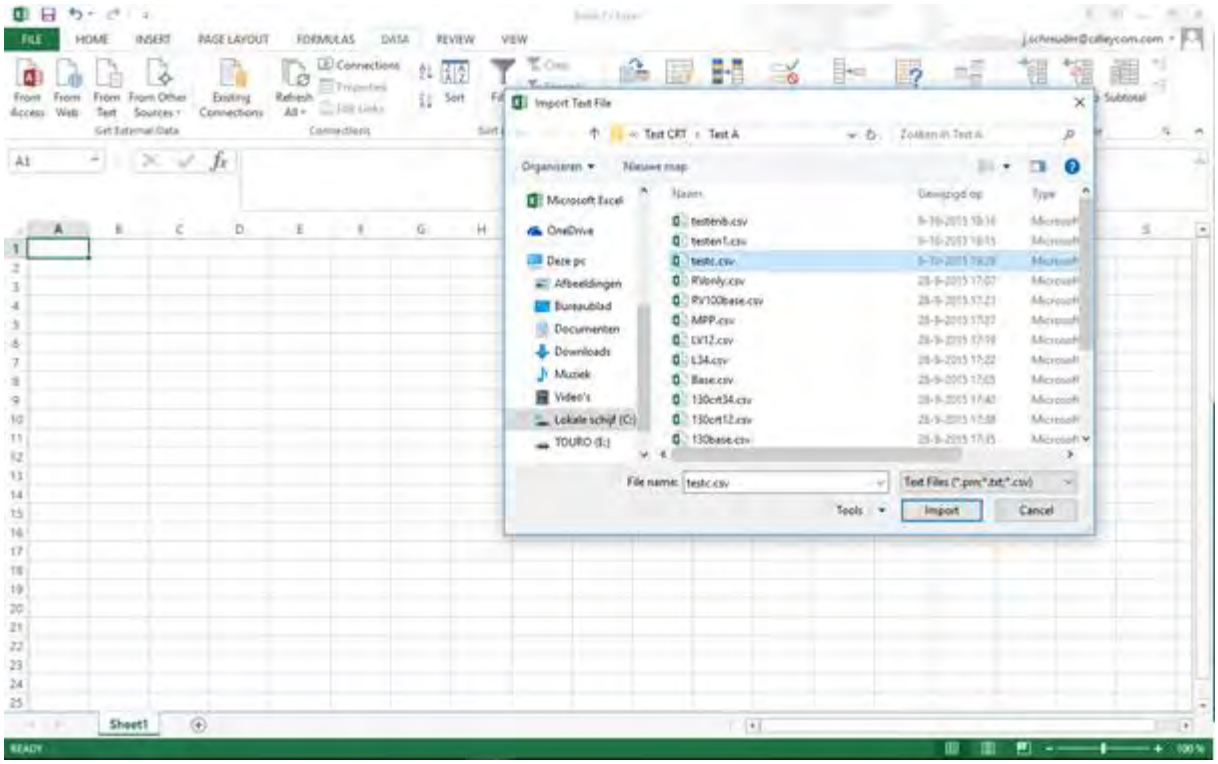
Below the editable selection can be dedicated to the study in this case a CRT example



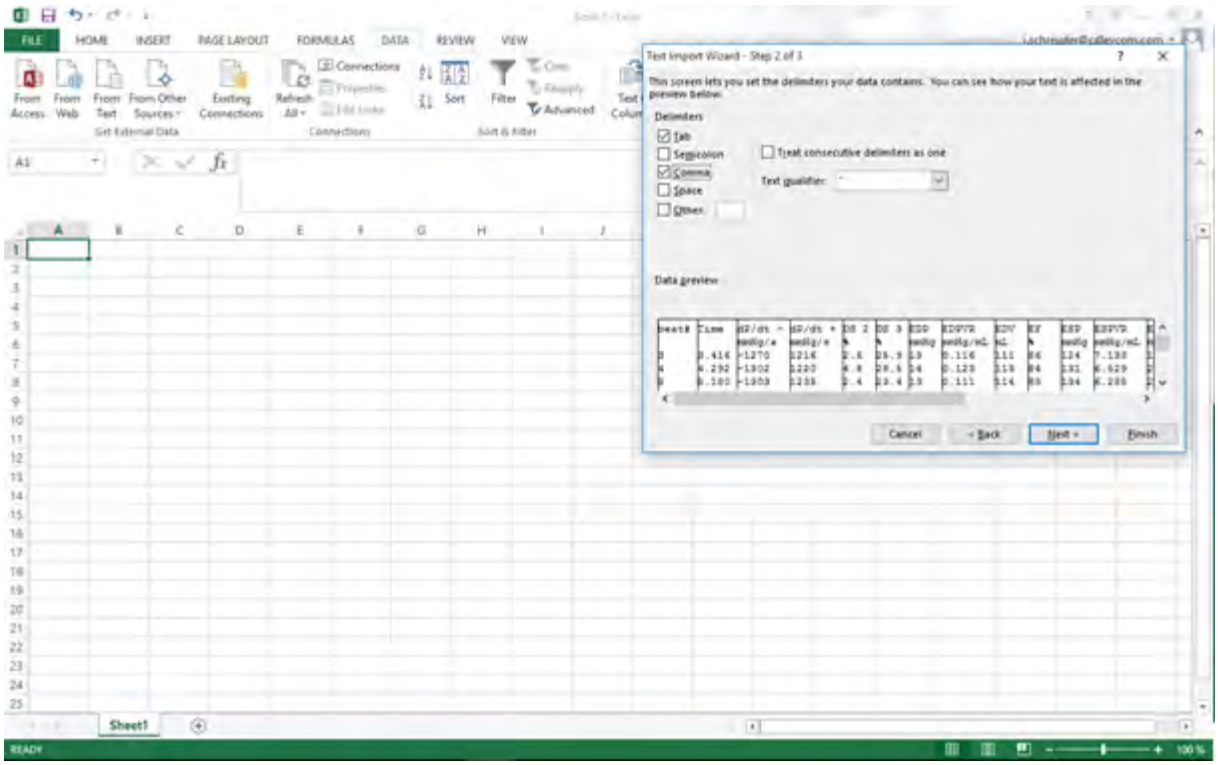
Below, save the dedicated CRT data in a directory and or print the data.



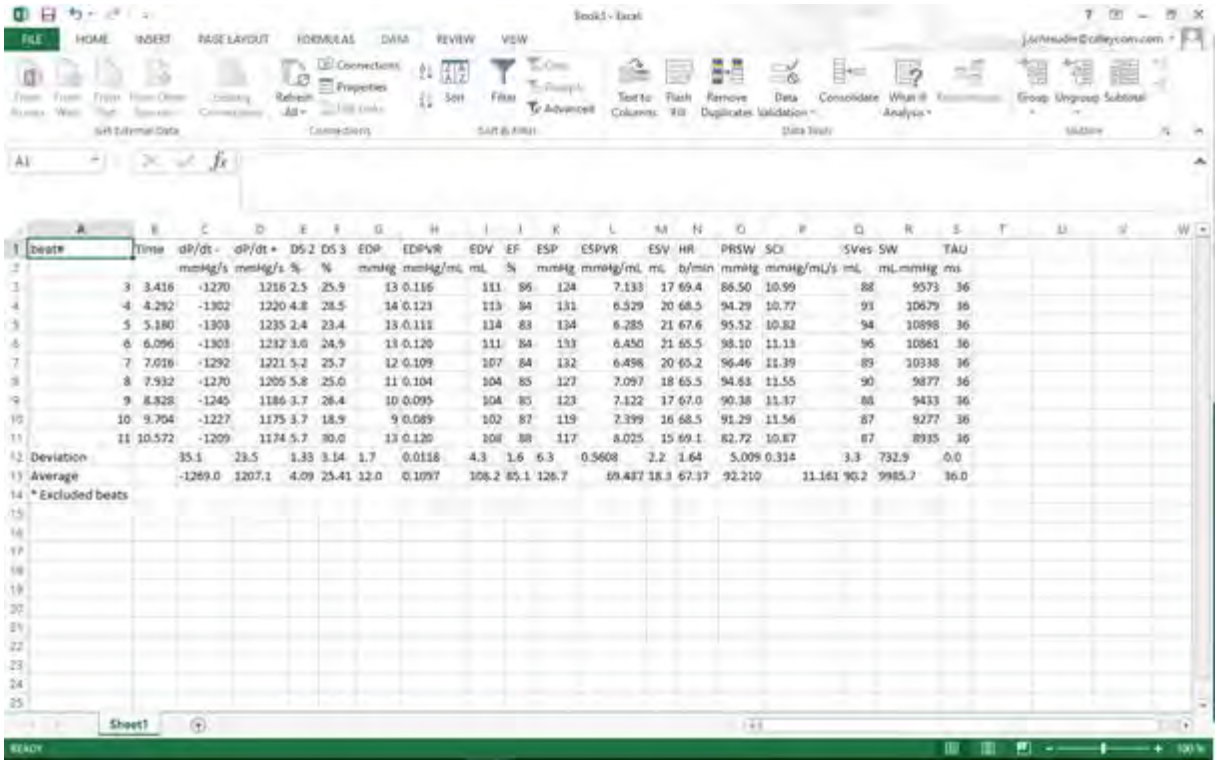
Below, open a new excel file, go to DATA and Get External Data from text and select file



Below select Tab and Comma and Finish



Below the selected variables of the selected beats

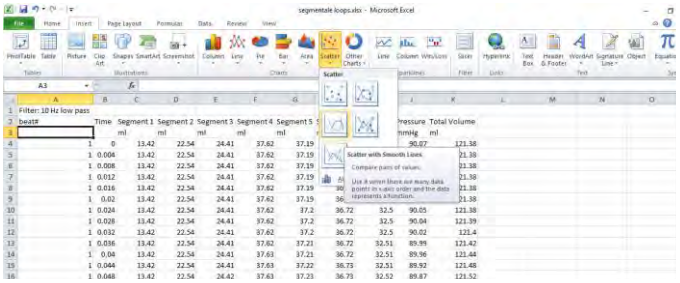


beat#	Time	dP/dt -	dP/dt +	DS 2	DS 3	EDP	EDPVR	EDV	EF	ESP	ESPVR	ESV	HR	PRSW	SCI	SVes	SW	TAU
		mmHg/s	mmHg/s	%	%	mmHg	mmHg/mL	mL	%	mmHg	mmHg/mL	mL	b/min	mmHg	mmHg/mL/s	mL	mL.mmHg	ms
3	3.416	-1270	1216	2.5	25.9	13	0.116	111	86	124	7.133	17	69.4	86.50	10.99	88	9573	36
4	4.292	-1302	1220	4.8	28.5	14	0.123	113	84	131	6.529	20	68.5	94.29	10.77	93	10679	36
5	5.180	-1303	1235	2.4	23.4	13	0.111	114	83	134	6.285	21	67.6	95.52	10.82	94	10898	36
6	6.096	-1303	1232	3.0	24.9	13	0.120	111	84	133	6.450	21	65.5	98.10	11.13	96	10861	36
7	7.016	-1292	1221	5.2	25.7	12	0.109	107	84	132	6.498	20	65.2	96.46	11.39	89	10338	36
8	7.932	-1270	1205	5.8	25.0	11	0.104	104	85	127	7.097	18	65.5	94.63	11.55	90	9877	36
9	8.828	-1245	1186	3.7	28.4	10	0.095	104	85	123	7.122	17	67.0	90.38	11.37	88	9433	36
10	9.704	-1227	1175	3.7	18.9	9	0.089	102	87	119	7.399	16	68.5	91.29	11.56	87	9277	36
11	10.572	-1209	1174	5.7	30.0	13	0.120	108	88	117	8.025	15	69.1	82.72	10.87	87	8935	36
Deviation		35.1	23.5	1.33	3.14	1.7	0.0118	4.3	1.6	6.3	0.5608	2.2	1.64	5.009	0.314	3.3	732.9	0.0
Average		-1269.0	1207.1	4.09	25.41	12.0	0.1097	108.2	85.1	126.7	69.487	18.3	67.17	92.210	11.161	90.2	9985.7	36.0

* Excluded beats

Appendix C. Working in Excel

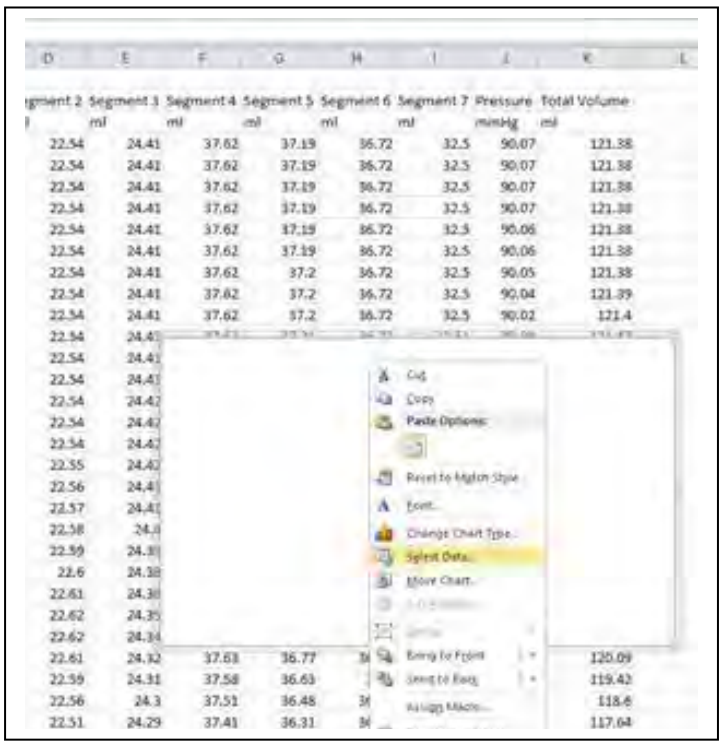
Below follows a step by step instruction how you can create your own PV-loop using your exported data.



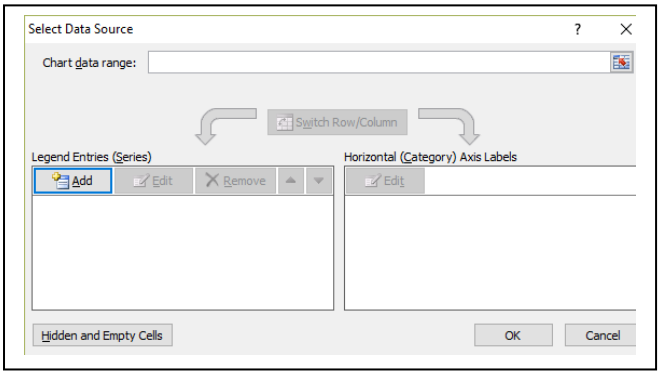
Select the menu option ‘ Insert’ .
Choose ‘ Scatter’ -> smooth lines.

An empty chart area appears on the screen.

Move your mouse to the chart area and press the right mouse button. A menu appears in the chart area.



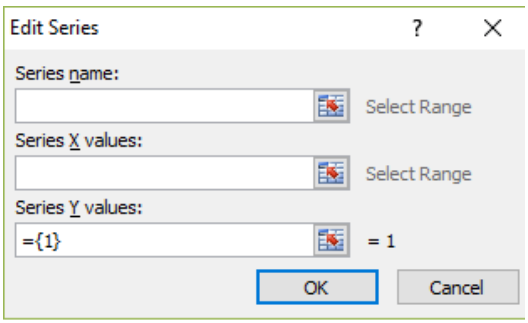
Choose ‘ Select Data …’ .
The form below appears on your screen.



Press Add.
A form appears to enter your graphic values.

Now we have to enter the values into this form.

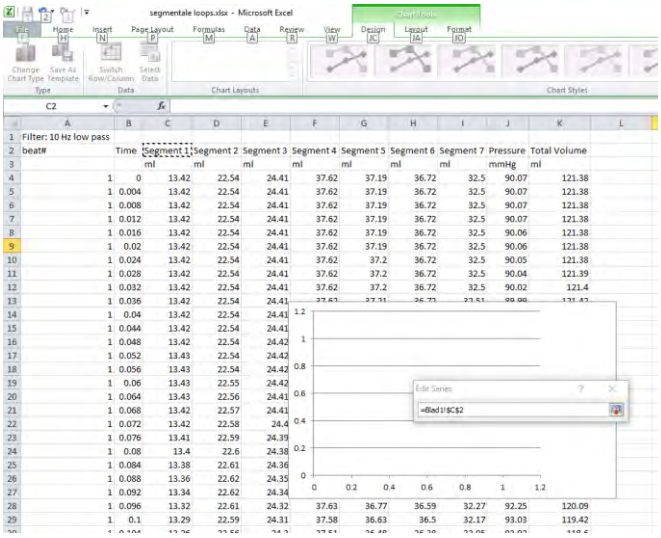
This can be done easily by select these values in your own excel sheet.



Press  behind the box ' Series name' to select your name for the PV-loop.

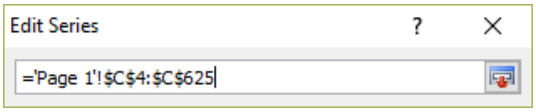
In this example box C2 is selected to generate a PV-loop of Segment 1.

Press  to go back to the first form.



Press  behind the box ' Series X values' to select your x-values.

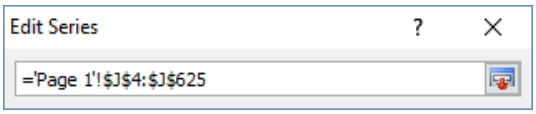
In this example box C4 to C625 is selected to enter the segmental volume values.



Press  to go back to the first form.

Repeat this for the Y –values.

In this example box J4 to J625 to enter the pressure values.



Press  to go back to the first form.

Press OK.

The segmental loop of segment 1 is created.

Now you can adjust your graphic by selecting each individual item and pressing the right mouse button.