IVIUM TECHNOLOGIES

A/ Connecting the electrodes

After you have installed IviumSoft, connected your instrument and made sure the instrument firmware is correct (see Quick Guide / Item F) you are now ready to start your first measurement.

Before starting the measurement you will need to connect the electrode leads of the cell cable to the electrodes or connections of your cell. This needs to be done correctly, otherwise the potentiostat will not measure correctly.

A standard Ivium potentiostat includes a cell cable. This cell cable will have a connector on one side to connect to the potentiostat, and banana terminals on the other sides to connect to your electrodes/cell. Depending on your cable there can be 5 or 6 bananas:

- RED - Working electrode (marked W)
- BLACK - Counter electrode (marked C)
- BLUE - Reference electrode (marked R/RE)
- WHITE - Sense (marked S)
- GREEN - Ground (marked T/GND)*
- optionally: RED - Working electrode 2 (marked W2)**

*The Ground is used for example to connect to a Faraday cage. When not used, the Ground can be left unconnected
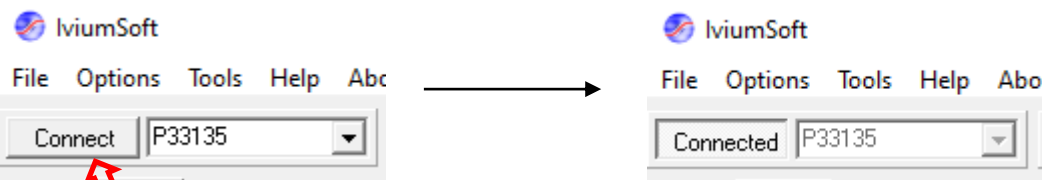
**The WE2 lead is used when you have an optional bipotentiostat or when you wish to access an analog input. For these advanced options refer to the IviumSoft Help. When not used the WE2 can be left unconnected.

2 electrodes:

BATTERY

3 electrodes:

BATTERY TEST CELL

4 electrodes:
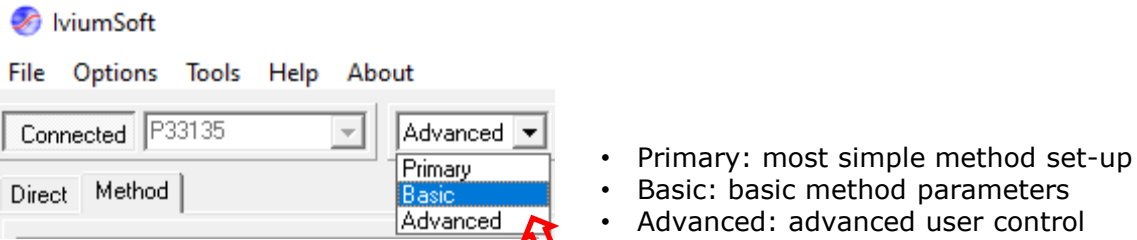

H-TYPE CELL
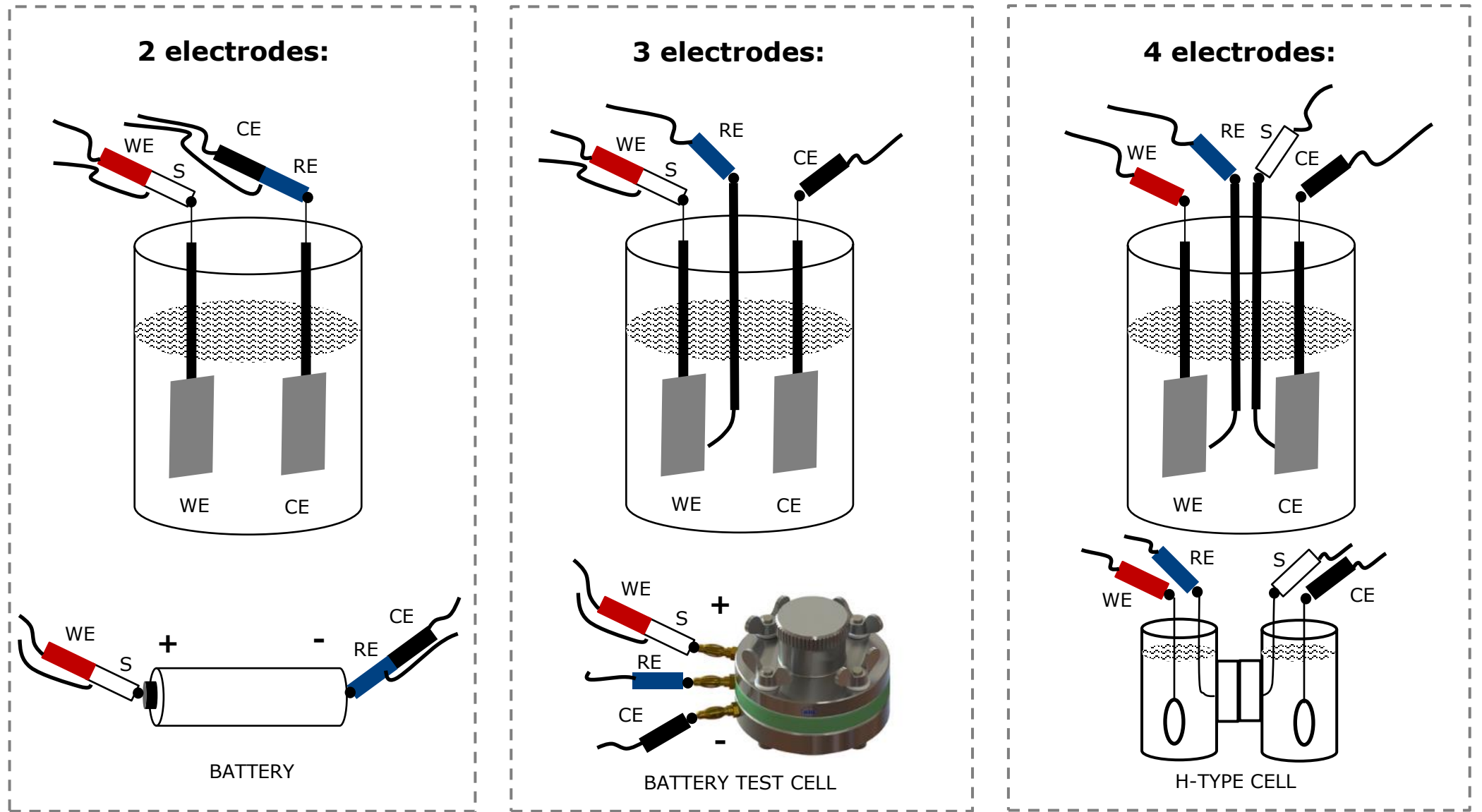
B1/ Starting a measurement: CV

After you have switched on your potentiostat and connected the electrodes correctly (see section A), you can start a measurement by selecting the desired method and parameters in IviumSoft, for example cyclic voltammetry:
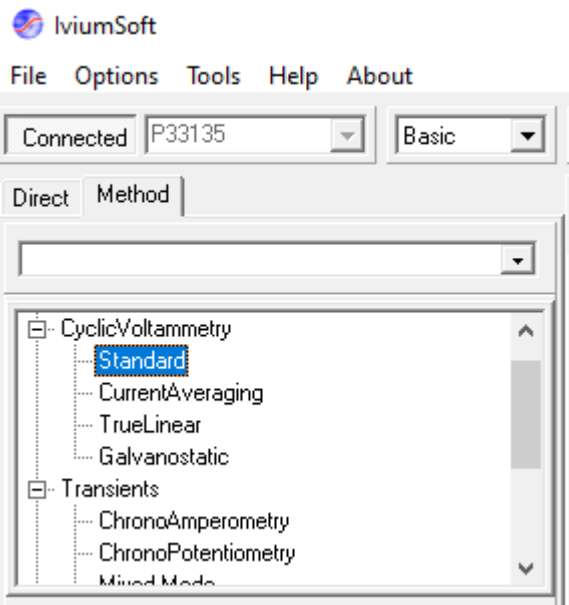
❑ Connect your potentiostat/channel in IviumSoft:

❑ Select your operating mode:

- Primary: most simple method set-up
- Basic: basic method parameters
- Advanced: advanced user control

❑ In the method panel from the tree select: "CyclicVoltammetry" > "Standard" for potential controlled CV.

❑ Enter the desired parameters:

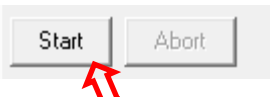|	Value	Unit
Mode	Standard	
Title	Scan 1	
E start	0.5000	V
Vertex 1	1.0000	V
Vertex 2	0.5000	V
E step	10	mV
N scans	4	cls
Scanrate	100	mV/s
Current Range	1mA	
+AutoCR	☐ Off	
Data Options		
Report		

Select "Standard" mode (HiSpeed is for fast measurements; see also IviumSoft Help file)

Enter measurement title; this will be stored in the data file

A CV starts at start potential E start, runs to Vertex1, reverses to Vertex2, then returns to E start. (If Vertex1 or Vertex2 is chosen the same as E start, the CV will run between the 2 chosen potentials).

- E step = voltage increment
- N scans = number of full cycle repetitions
- Scanrate = rate of scan voltage

[NOTE: E step/Scanrate = number of points per second]

❑ After the method parameters have been selected, press "Start" to start the measurement:
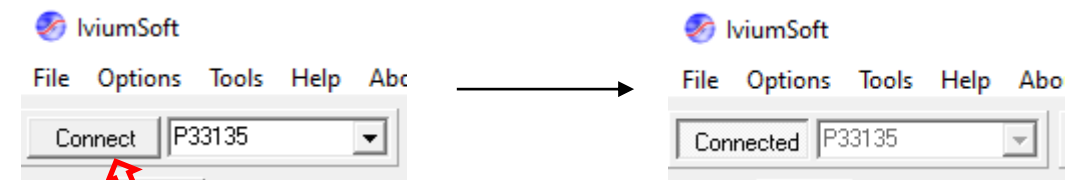

❑ The measurement will now start and the results will be plotted real time in the Result graph window.

💡 The IviumSoft menu "Help" opens the extensive Help file that describes all available techniques, method parameters, control possibilities, etc:

- Current Range = current range for measurement; can measure up to ±4 times the range, i.e. CR = 1mA can measure ±4mA max.
- AutoCR = activate for automatic current ranging; choose Max range and Min range to include the selected Current range
- Data Options = opens a pop-up that allows the user to set material and electrode specific parameters (see also IviumSoft Help file)
- Report = allows user to type comments that will be stored in the datafile


B2/ Starting a measurement: EIS

After you have switched on your potentiostat and connected the electrodes correctly (see section A), you can start a measurement by selecting the desired method and parameters in IviumSoft, for example Impedance (EIS):
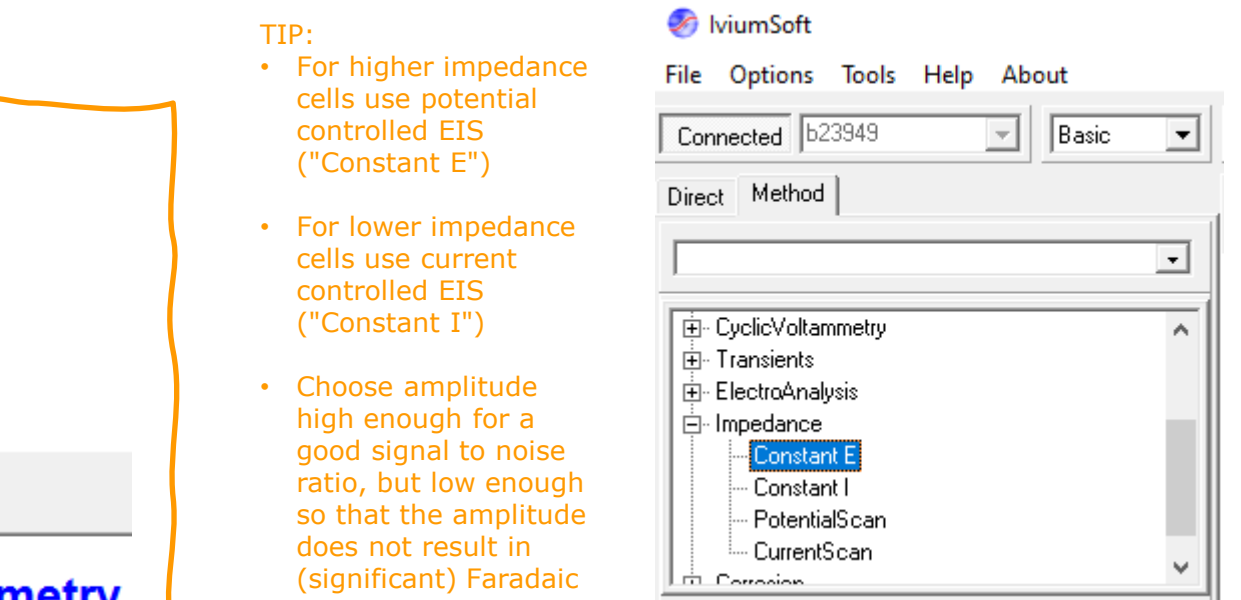
❑ Connect your potentiostat/channel in IviumSoft:

❑ Select your operating mode:

- Primary: most simple method set-up
- Basic: basic method parameters
- Advanced: advanced user control
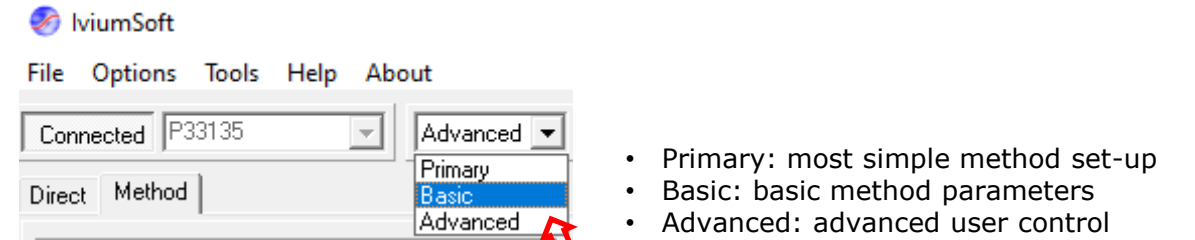
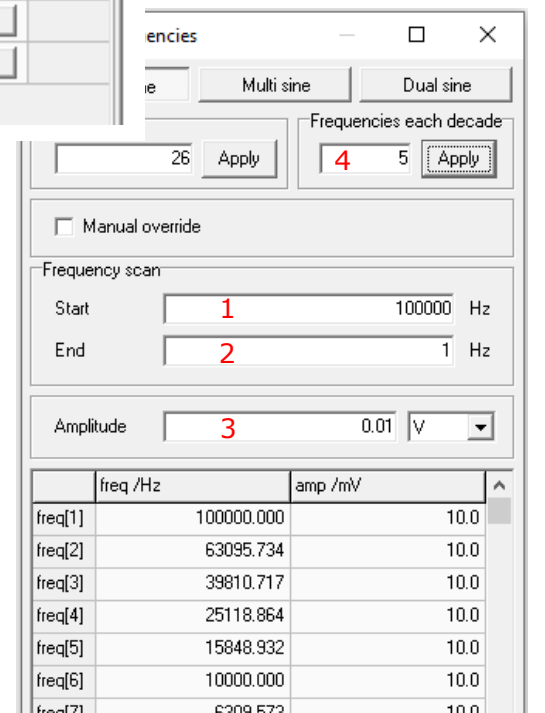❑ In the method panel from the tree select: "Impedance" > "Constant E" for potential controlled EIS.

TIP:
- For higher impedance cells use potential controlled EIS ("Constant E")
- For lower impedance cells use current controlled EIS ("Constant I")
- Choose amplitude high enough for a good signal to noise ratio, but low enough so that the amplitude does not result in (significant) Faradaic current; i.e. 25-50mV amplitude is normally a good start.

❑ Enter the desired parameters:

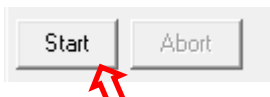|	Value	Unit
Title	Scan 1	
E start	0.5000	V
Frequencies	5	
Current Range	10nA	
+AutoCR	☐ Off	
Data Options		
Report		

E start is the (absolute) voltage bias

Frequencies opens the frequency selection window

1. Choose Start frequency
2. Choose End frequency
3. Choose Amplitude
4. Choose no# frequencies per decade and "Apply"

Frequency scan		
Start	1	100000 Hz
End	2	1 Hz
Amplitude	3	0.01 V

	freq /Hz	amp /mV
freq[1]	100000.000	10.0
freq[2]	63095.734	10.0
freq[3]	39810.717	10.0
freq[4]	25118.864	10.0
freq[5]	15848.932	10.0
freq[6]	10000.000	10.0
freq[7]	6309.573	10.0

❑ After the method parameters have been selected, press "Start" to start the measurement:

❑ The measurement will now start and the results will be plotted real time in the Result graph window.
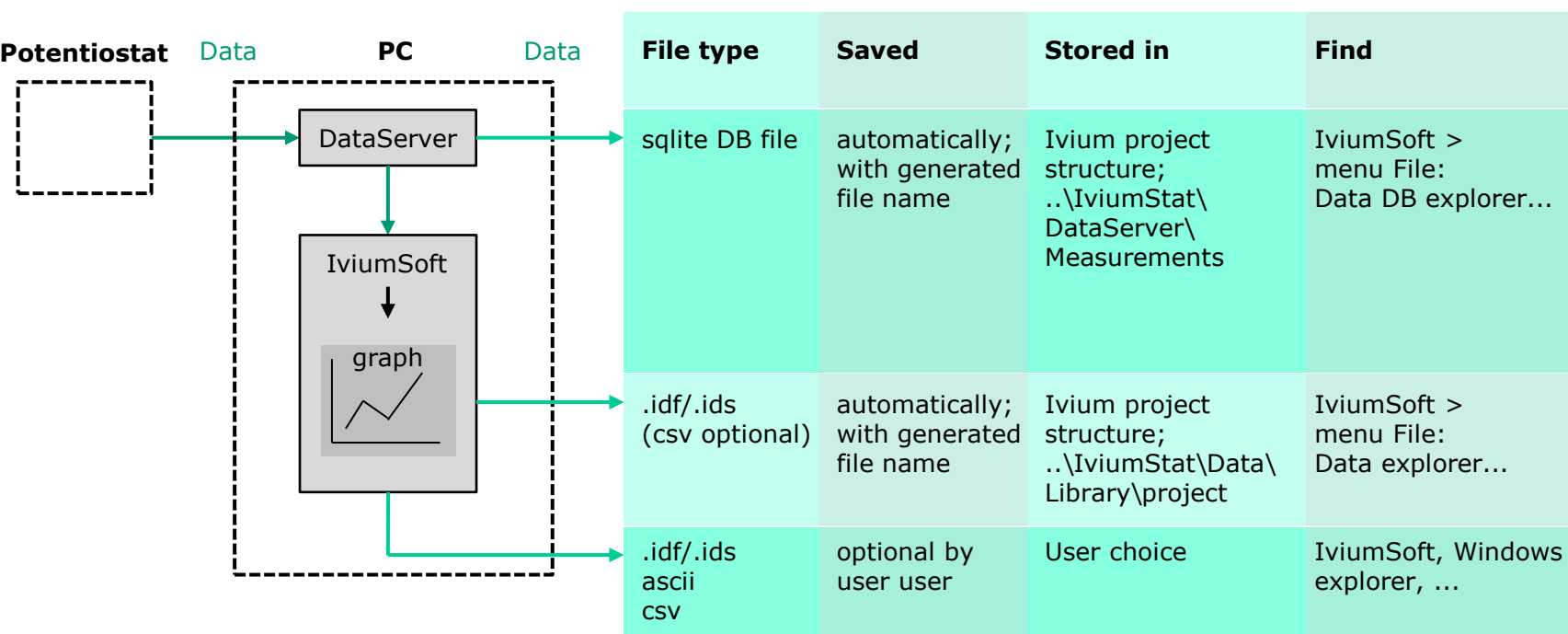
C/ Measurement results

❑ After you have pressed "Start" to start a measurement, result data will be produced. The data will be shown real time in a graph that will be automatically formatted and scaled to show the data of your measurement (technique). This graph is shown in the "Result graph" area of IviumSoft:
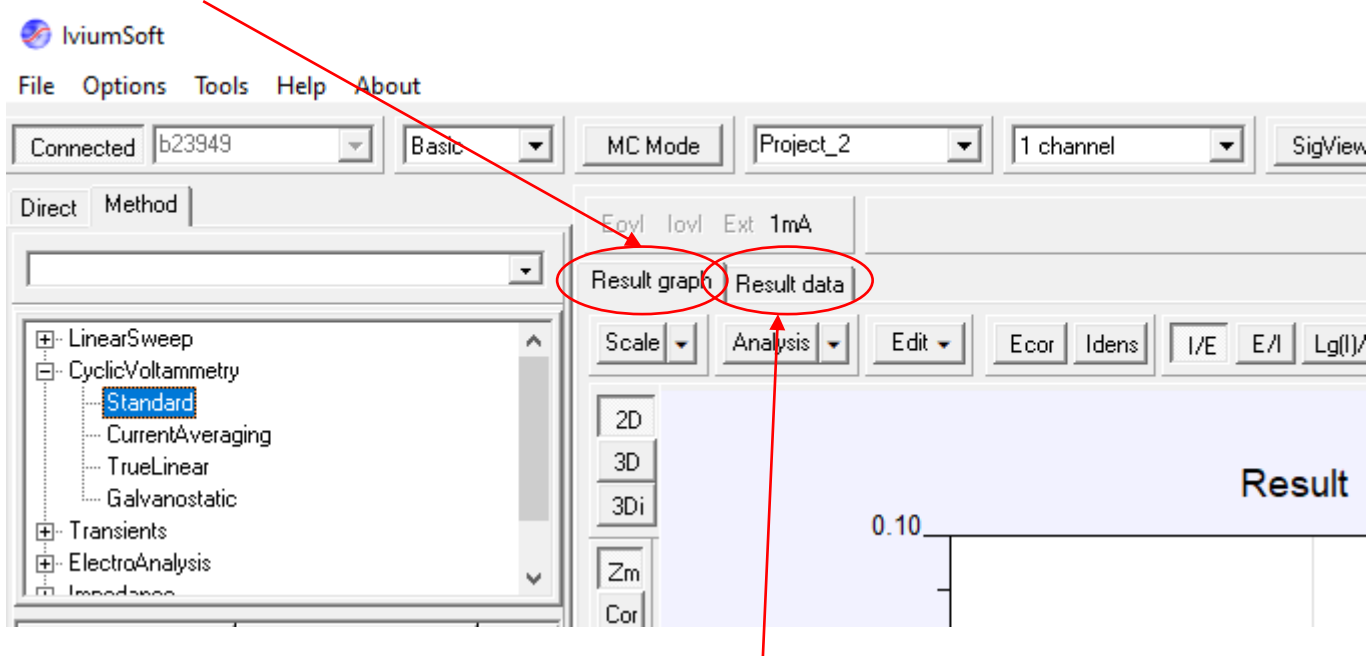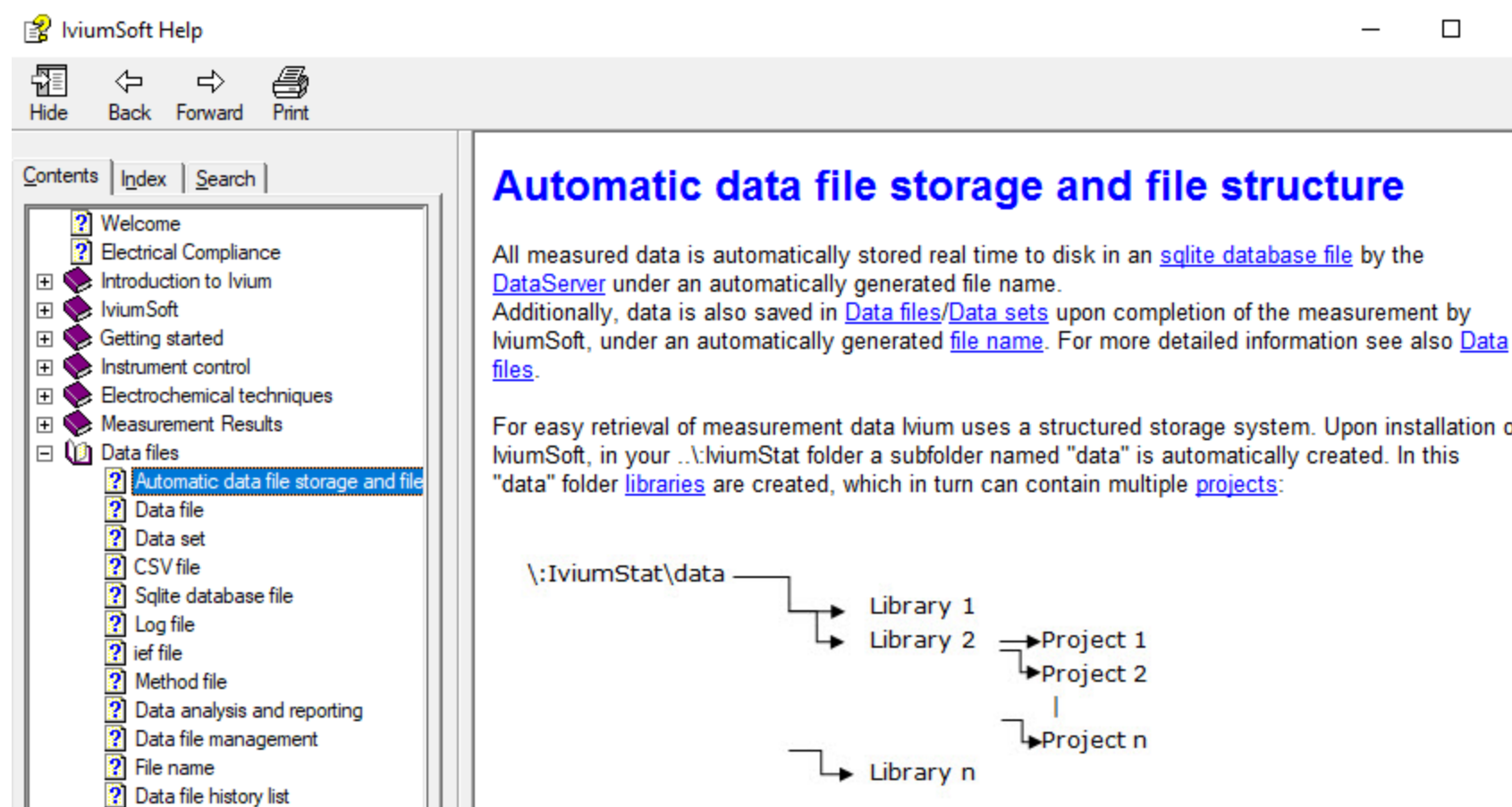

❑ This data can also be viewed numerically in the "Result data" sheet.

❑ The graphic toolbars at the top and to the left of the "Result graph" allow different representation of the data, scaling, analysis, editing, as well as showing additional data of OCP measurement, pretreatment, etc.

NOTE: More details on this can also be found in the IviumSoft Help file, accessible from the top menu "Help" in iviumSoft.
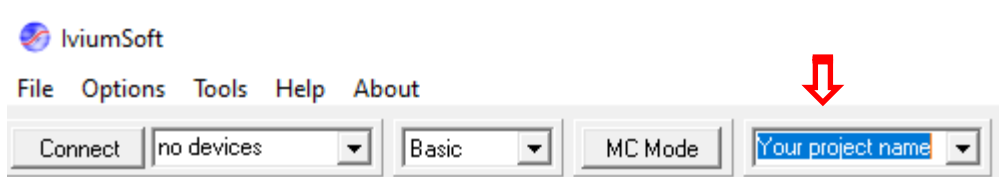
D/ Data files

❑ Parallel to the data being shown real time in IviumSoft, the data is also <u>automatically saved</u> real time. Data is saved to file using an automatically generated file name, there is no user action required for this. This data is saved as sqlite DB file. This is done by the DataServer program that is running in the background.

❑ Additionally, data is also <u>automatically saved</u> by IviumSoft upon completion of the measurement. This file is saved as .idf (for single scan measurements) or as .ids (for multiscan runs).

❑ It is of course possible to manually save yet another copy of the data from IviumSoft in a .idf/.ids file with a file name of your choice to any location, from the top menu "File" in IviumSoft.

File type	Saved	Stored in	Find
sqlite DB file	automatically; with generated file name	Ivium project structure; ..\IviumStat\ DataServer\ Measurements	IviumSoft > menu File: Data DB explorer...
.idf/.ids (csv optional)	automatically; with generated file name	Ivium project structure; ..\IviumStat\Data\ Library\project	IviumSoft > menu File: Data explorer...
.idf/.ids ascii csv	optional by user user	User choice	IviumSoft, Windows explorer, ...

❑ Read more about the Ivium Library and Project structure in the IviumSoft Help file:

❑ Simply create a new project data folder for each of your projects by typing a name of your choice in the project field in the top bar of IviumSoft:

The next time data is automatically saved during/after a measurement, a new folder with your project name will be automatically created and the new data file will be stored there.