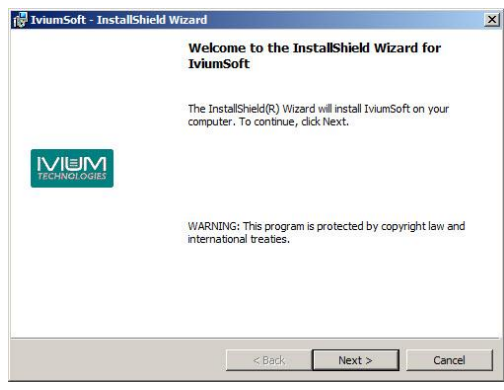


A/ Software installation

Install IviumSoft from the installation CD; use the "setup" application on the CD and follow instructions. IviumSoft will be installed on your C-drive (by default) in the "IviumStat" directory. This directory will include the drivers, some example data files, a Labview example, and all manuals. Also a shortcut to IviumSoft will be placed on your desktop.

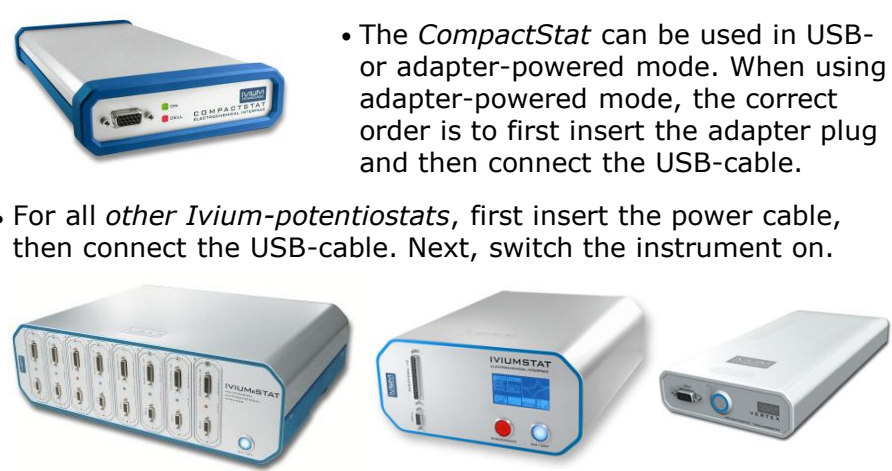


B/ First contact

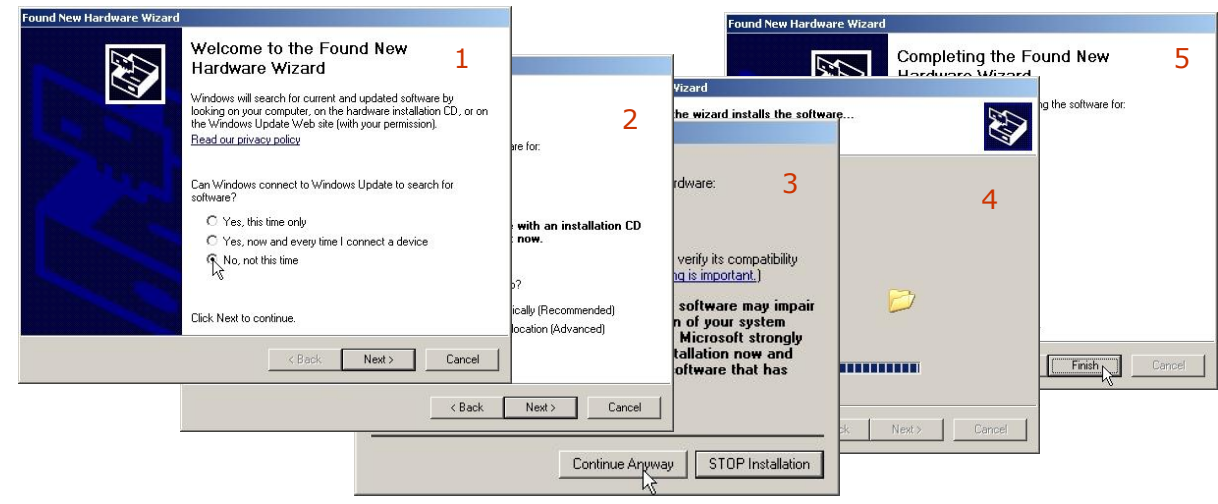
The *CompactStat* can be used in USB- or adapter-powered mode. When using adapter-powered mode, the correct order is to first insert the adapter plug and then connect the USB-cable.

For all other *Ivium-potentiostats*, first insert the power cable, then connect the USB-cable. Next, switch the instrument on.

All Ivium potentiostats have a unique serial number that is connected with the device driver. The first time the potentiostat is connected to a specific computer, the driver will install. MS Windows-XP will show the pop-up window for the "New Hardware Wizard" (see example for MS Windows XP English); Windows Vista/7 may do this automatically. When running a 64bit operating system, the driver needs to be installed manually. For manual driver installation, refer to technical note "T2 Ivium driver installation" in the manuals folder on your installation CD).

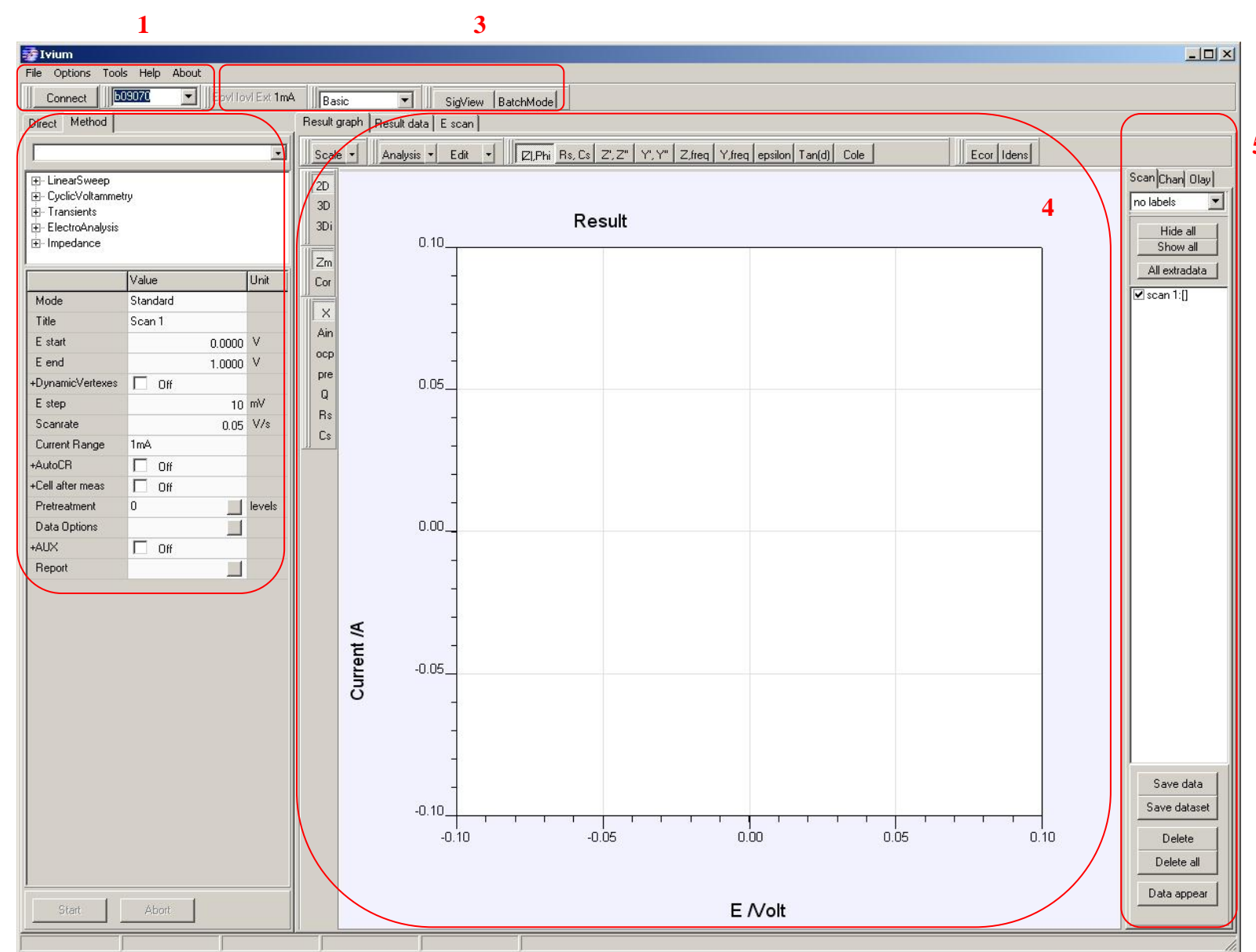


- Windows-XP driver installation, Windows New hardware wizard:
1. When prompted to connect to internet choose "no, not this time" and click "next".
 2. Then choose "Install software automatically".
 3. At the warning pop-up choose "Continue anyway".
 4. Windows will now install the driver
 5. Upon completion click "Finish". The driver is now installed and the instrument is ready for use.



C/ Software – user interface

1. Device & software control
2. Operating parameters
3. Advanced parameters
4. Measurement results
5. Legend panel



1. Device & software control

The menu bar:

- File - Loading and saving data and method files.
- Options - Setting the device and module options, incl. FRA options
- Tools - Device maintenance and special operations
- Help - Help file and topic search (Windows Vista/7: see instruction note)
- About - Shows software version



- To start:
- a. In the drop down menu select the device.
 - b. To operate this instrument, click "Connect".



2. Operating parameters

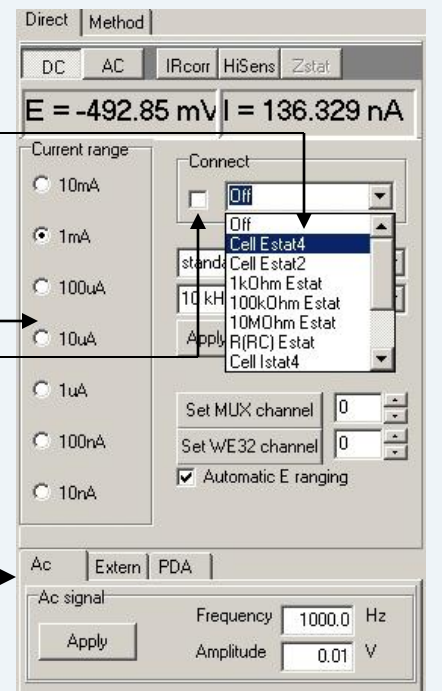
"Direct" mode: for direct control of the instrument

- Intended for diagnostic purposes
- Actual potential and current are displayed
- When not controlled, the open cell potential is displayed (within specified accuracy)

- Example:
- a. Select configuration, i.e. "Cell Estat4".
 - b. Select current range
 - c. Check connect-box: cell on/off
 - d. Insert value
 - e. Press "Apply"

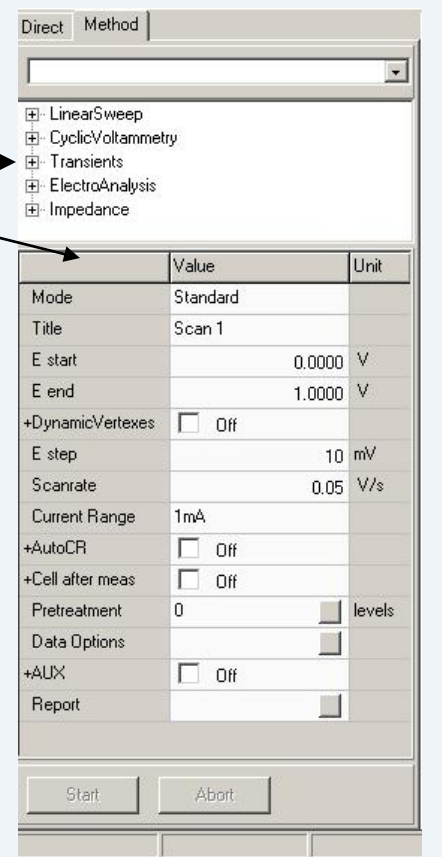


- f. Above:
 - DC/AC - to toggle between AC/DC signal measurement
 - Ircorr - will open IR-drop correction window
 - HiSens - will make hi-sensitivity current ranges available
- g. Below: direct control of the peripheral port and FRA are possible.



"Method" mode: for executing electrochemical methods.

- Example:
- a. Select desired method from the tree
 - b. The relevant method parameters show and are accessible in the window below
 - c. Once the relevant parameters are inserted the measurement can be started by clicking the "Start" button at the bottom of the window
 - d. Clicking the "Abort" button will abort the measurement immediately at the next data point.
 - e. When for a specific method all parameters are set to appropriate values by the user, this method can be saved (.imf) for future use by selecting "File" in the upper menu bar and choosing "Save method". From "Menu bar>File" also previously saved methods can be loaded.

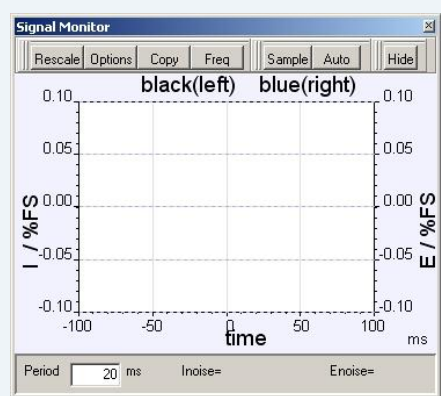


3. Advanced parameters

In "method" mode, by default the basic parameters are shown. Selecting "Advanced" from the drop down menu will add a number of advanced method parameters.

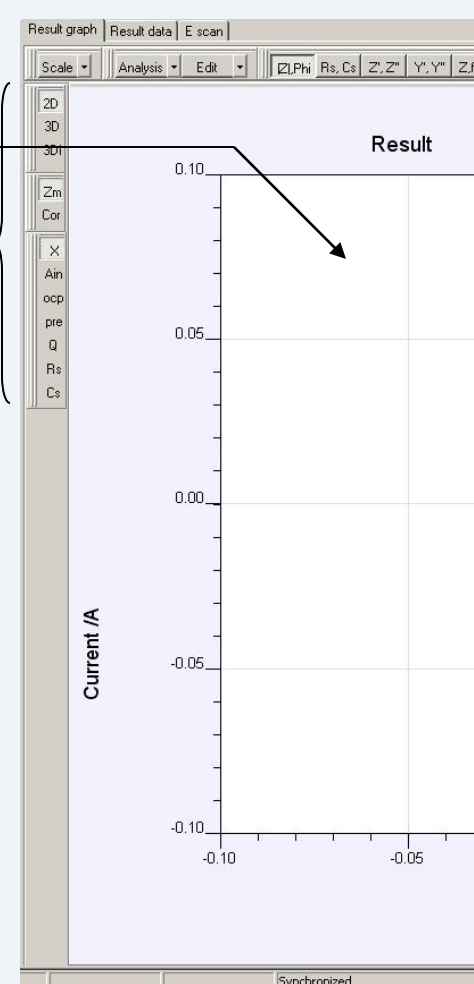


- Indicators: the grey indicators will light up red when the corresponding parameter reaches an overload. The black indicator shows the actual current range in use.
- "SigView" opens a window that shows voltage and current signal trace during an AC measurement. Can be used to verify the quality of the signal and to check for i.e. overload/oscillation situations.
- "BatchMode" opens the batch programming window. This can be used for automating measurements. For instructions, refer to the tech. note "T1.1 Batch mode...".



4. Measurement results

- When a measurement is started the data are shown real time in the result graph. A right mouse click on the graph will give the user a number of options, including changing the graph colour and background, as well as copying the graph to clipboard.
- The buttons to the left allow additional data to be displayed. Data is by default displayed "2D"; "3D" and "3Di" display may also be chosen. Clicking the "Cor" button after the measurement has finished, will start the correction mode, allowing the user to change individual data-points. "X" shows the primary data, "Ain, ocp, pre, Q, Rs, Cs" will all open a second graph that shows the corresponding data when available: optional analog inputs, ocp-measurement before scan, pre-treatment data, etc.
- The "Scale" button allows the scale of the graph to be adjusted via the drop down menu; clicking on the button itself will auto-scale the graph. "Analysis" will make a number of analysis methods available to the data in memory. "Edit" will allow smoothing of the scan data.
- The buttons on the top right of the graph activate different representations of impedance measurement data.
- The tabs "Result graph" and "Result data" on top enable switching between graphical and numerical representation of the scan data. "E scan" will show the data for analysis when an impedance-scan method has been carried out.



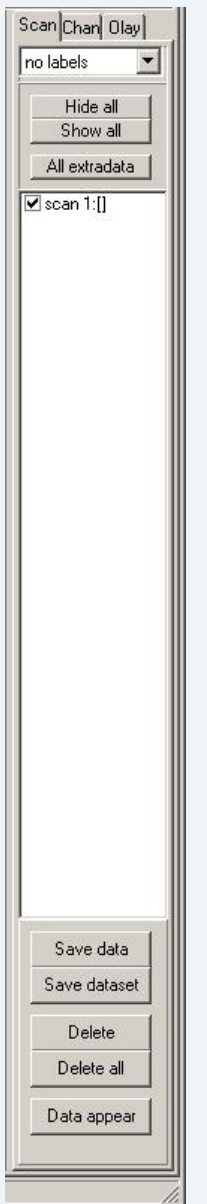
5. Legend panel

Three tabs:

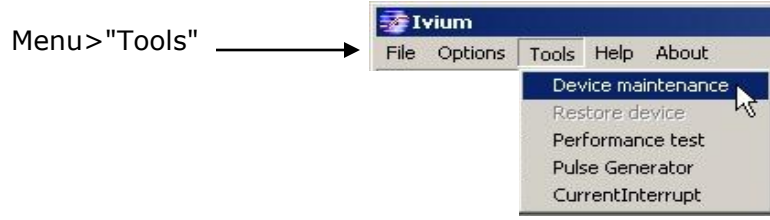
- 1) "Scan" shows the scans that have just been measured or loaded as data from memory.
 - "Hide all"/"Show all" will respectively hide and show all scans. In the list of scans below that, checking/unchecking the box next to the scan will show/hide individual scans. Note that the scan that is highlighted blue is the scan in active memory. This is the one that is evaluated in "Analysis", or has the numerical data shown in "Result data", etc. Clicking on a different scan will select that one (highlight it), making it available for analysis, saving, etc.
 - "Save data" will save data only of the selected scan, as data file (.idf)
 - "Save dataset" will save all scans, as data set (.ids)
 - "Delete" will delete the selected scan
 - "Delete all" will delete all scans
 - "Data appear" will allow user to change the appearance of the data: lines, colours, symbols.
- 2) "Olay" will allow the user to load data from file, to overlay it so that it can be compared to the scan data that was just recorded. Several scans can be loaded at the same time. All the same options apply as in the scan-tab.
- 3) The "Chan" tab shows when analog inputs are sampled (advanced method parameter), it allows the user to show/hide analog channels in the second graph.

Note that:

- Scans and data are by default NOT automatically saved (unless the option is activated in the advanced parameters of the method). User action is necessary to save data.
- When different electrochemical methods are used, the data cannot always be represented in the same graph; i.e. running a FRA-scan after a CV-scan without clearing the graph window will lead to unreadable graphs.
- Running a CV-scan will automatically clear the graph when the next experiment is started. Save data before running the next experiment.

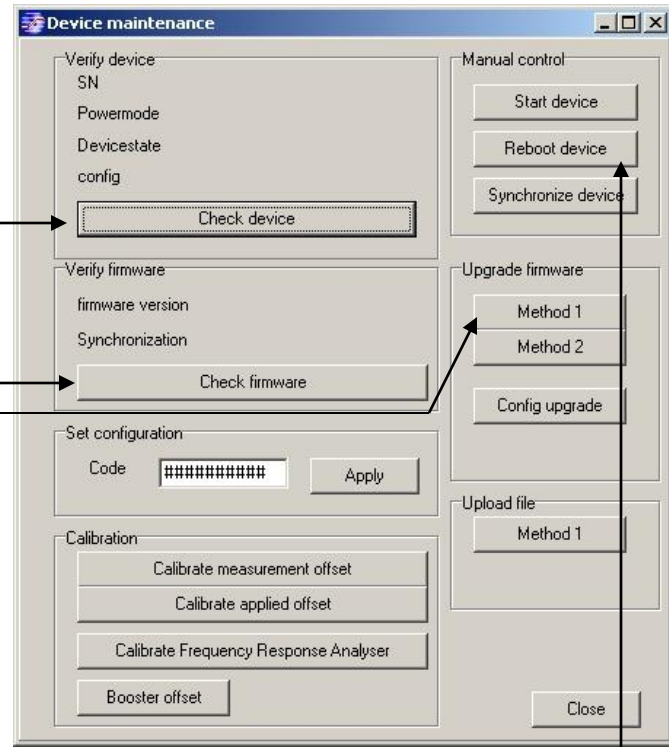


D/ Device maintenance & special operations

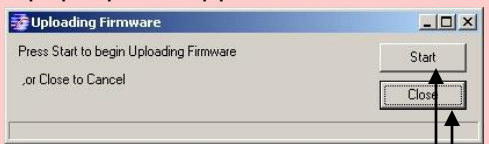


"Device maintenance" will open a pop-up window:

- "Check device" will show the status and configuration of the instrument.
- "Check firmware" will display the firmware version that is running. A new instrument will always have installed the firmware belonging to the software that is delivered. When a software upgrade is carried out, the firmware also needs to be upgraded.



Procedure: Firmware upgrade

- Click "Method 1"
- A pop-up will appear:
 
- Click "Start", the firmware is transferred to the instrument.
- When no error messages occur, Click "Close".
- Click "Reboot Device"
- Now close and re-start the pc software. The new firmware will be activated after re-connecting.

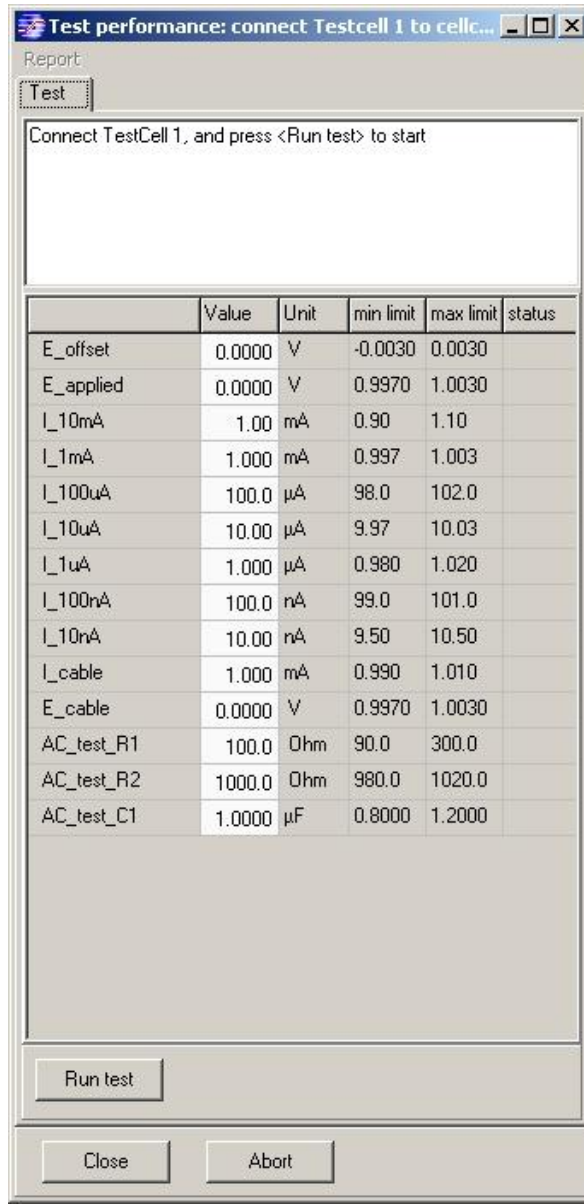
Note:

- If during the Firmware upgrade process, an error message is shown, try to upload again. If Method 1 remains ineffective, try to apply Method 2. Here use the right-top-button indicated "Start".

- Other options in the "Device maintenance" are for special operations and are not to be used without special instructions.

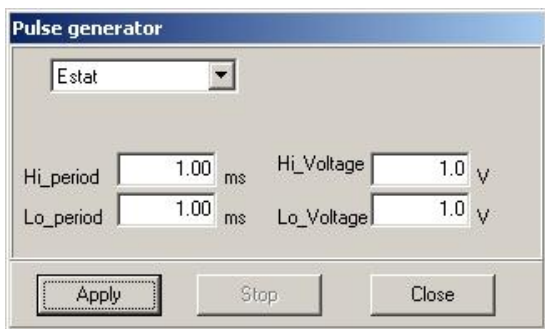
"Performance test"

"Performance test" will open a pop-up window that allows a self-diagnostic test of the instrument. The performance test can only be executed when the instrument is in the "standard" configuration. This means that all options and modules need to be unchecked. A CompactStat needs to be powered from USB only. Connect the cell cable to Testcell1, uncheck all options in the menu "Options>Options", and run the test. All status reports should read "pass". If one reads "fail", the instrument may need calibration. This cannot be done by the user, contact your supplier.



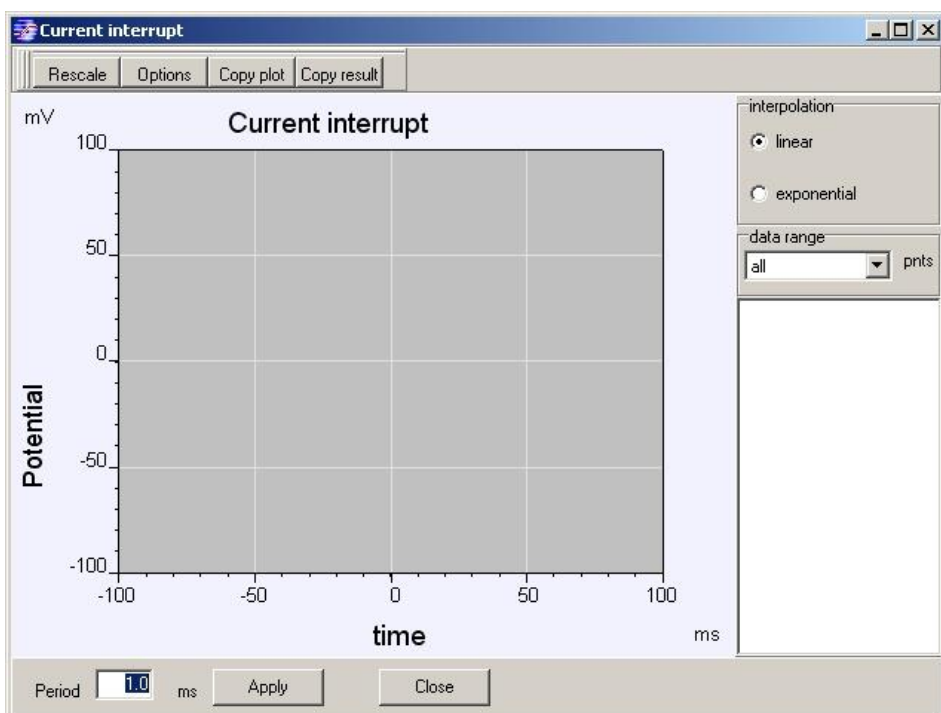
"Pulse generator"

"Pulse generator" is a direct function that will apply a pulse according to the selected parameters:



"Current Interrupt"

"Current Interrupt" will open a window that allows use of the Ivium Current Interrupt module (CIM). The CIM can be purchased separately to determine the ohmic drop of an electrochemical system via the current interrupt method.



E/ Troubleshooting: Recovering from an unresponsive instrument

If the connection process takes exceptionally long and/or reports an error, or the instrument fails to respond at all, possibly its internal firmware is corrupt. In this case a recovery procedure can be executed. Please note that the recovery procedure is slightly different for different instruments.

For CompactStat:

- Remove power cable and USB cable.
- Start the pc software and re-connect the USB cable (do not press connect !).
- Go to Tools>Restore device.
- Click on the desired option
- Close IviumSoft, remove USB cable
- Start up the CompactStat normally.
- Upgrade firmware if necessary

For IviumStat:

- Switch instrument off.
- Press the "DISCONNECT" button.
- Switch the instrument on.
- Start the pc software (do not press connect !).
- Go to Tools>Restore device.
- Click on the desired option
- Switch off instrument, un-press "DISCONNECT" button, close IviumSoft.
- Start up the IviumStat normally.
- Upgrade firmware if necessary

"Tools" and "Restore Device":



In the pop-up window three options are shown:

- Restore factory settings: reverts back to the original settings and calibration values.
- Restore factory firmware: sets the firmware back to the original release.
- Restore previous firmware: go back to the version before the last upgrade.

For Ivium-n-Stat:

- Switch instrument off.
- Connect EMO to GND (back of the instrument).
- Switch the instrument on.
- Start the pc software (do not press connect !) and select desired channel.
- Go to Tools>Restore device.
- Click on the desired option
- Switch off instrument, remove connection between EMO and GND, close IviumSoft.
- Start up the Ivium-n-Stat normally.
- Upgrade firmware if necessary



Option #3 is useful when recovering from a failed upgrade. If also the previous version was corrupt, the factory version can be used. When a firmware version is running again, the upgrade may be re-tried.

Note:

These recovery functions can only be used directly after power-on, before the Connect button is pressed. For the CompactStat, it means that the USB cable and power cable must have been removed (i.e. the CompactStat has to have been powered down completely).

Ivium Options & Modules

Bipotentiostat (BiStat)

Hardware option that enables a second working electrode (WE2) with programmable potential offset wrt RE or WE1:

- 2 configurations
 - "standard": fixed potential w.r.t. RE
 - "scanning": fixed offset potential w.r.t. the primary WE
- Applied offset potential range ± 2.0 V
- Maximum current ± 30 mA

True linear scan (LinScan)

Hardware option that applies a smooth analog ramp, instead of the standard staircase sweep:

- Scan range ± 2 V, 0.125 mV resolution
- Scanrate 1 μ V/s - 10.000 V/s
- Available in the techniques: LSV and CV



The **IviumBoost** is a hi-power booster that has been designed to increase the current of the IviumStat. The booster is connected in front of the IviumStat in-line with the cell cable.

IviumBoost compliance:
• ± 40 A @ ± 10 V

FastScan module

The **FastScan** module is a 20MHz data recorder in combination with an ultra fast scan generator. It connects to the peripheral port and has a built in memory.

Data sampling:

- 2 channels, 16 bits
- Max. acq. speed 20 Msamples/s
- Data memory 10,000,000 pts
- Input bandwidth >8MHz

Scan generator:

- CV/LSV: Staircase & TrueLinear
- Max. scan rate 10,000,000 V/s
- Vertex res. 0.125V at ± 4 V
- Transients: Chronopot./Chronoamp.



The **MultiWE32** is a multi-channel potentiostat unit that can control up to 32 working electrodes that share a single CE and RE. The potential is not multiplexed: it is applied simultaneously and continuously!

It is used in combination with either a CompactStat or an IviumStat and is developed especially to be used in micro and nano electrochemistry. The maximum applied voltage is determined by the controlling potentiostat, max. current ± 1 mA per WE.



The Ivium Technologies high performance electrochemical multiplexer (**HIMUX**) can work with 8 individual cells with 4 electrodes each and is fully compatible with all Ivium potentiostats. Because each channel has its own electrometer, its performance is superior to the switchbox approach. Furthermore, the multiplexer units can be stacked so that a maximum of 64 channels can be controlled by a single potentiostat: ± 20 V @ ± 5 A.



The **Peripheral Differential Amplifier (PDA)** module allows the simultaneous recording of differential bipolar high-ohmic external voltages, such as reference or pH meters. The PDA has 8 differential input channels, and it is stackable up to a total of 64 channels; each channel ± 2 V floating, with high input impedance ($> 10^{12}$ Ohm); next to that the PDA module is a connection box for the various analog and digital inputs&outputs that are available in each Ivium potentiostat.



The **Peripheral Level Transformer (PLT)** is an adapter module that increases the voltage of the analog inputs&outputs for easy communication with external devices. It is connected between the instrument and the periphery. The PLT transforms the range of the analog inputs 1&2 to ± 10 V, and the analog outputs to 0 to +10V (or ± 10 V)



The **Current Interrupt Module (CIM)** is an adapter module for measuring the IR-drop via the current-interrupt technique. This device connects in-line with the cell-cable of the potentiostat.



The **ModuLight-module** is a programmable light source, specifically designed to investigate photo-electrical devices, such as solar cells. The module will operate in combination with all Ivium potentiostats, through the peripheral I/O-port:

- Wavelength can be set programmatically: 465-635 nm in 7 steps.
- The light intensity can be modulated using the sinewave generator of the potentiostat: 10uHz to 2MHz.
- Extensive Solar cell applications in the Ivium software, including E/I curves as function of the light intensity, IMVS/IMPS, and solar cell modelling resulting in all characteristic values of the studied object.