Astrol Electronic AG Bat-Small Precision Computer Controlled Potentiostat User Manual

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Astrol Electronic AG

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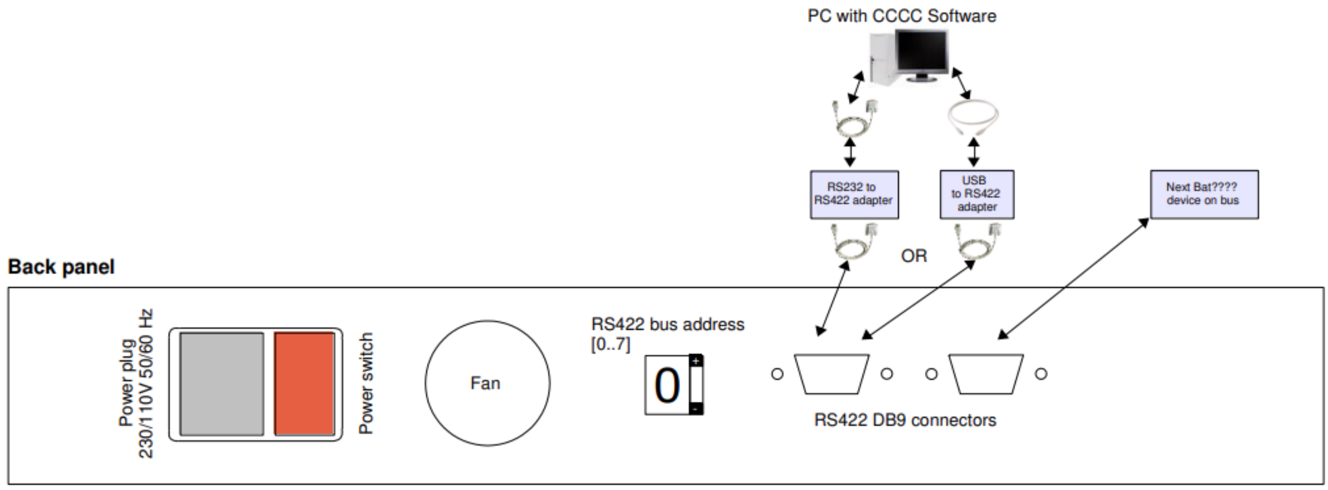
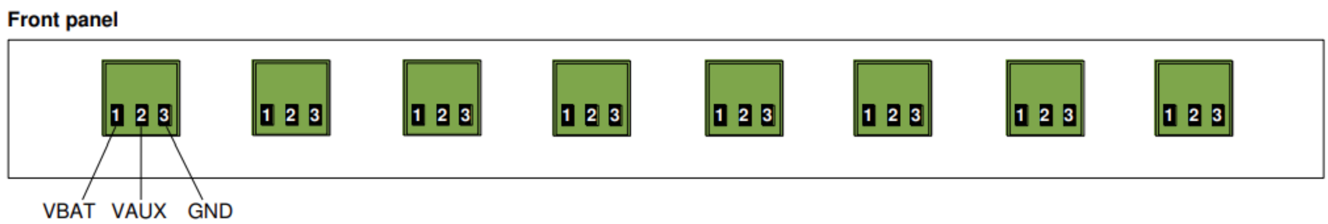
Overview and Connection Drawing





- **VBAT:** Battery anode/counter
- **VAUX:** Battery auxiliary/reference
- **GND:** Battery cathode/working

Hardware Installation

BatSMALL

- Connect a power cord to the device → 230V/50Hz or 110V/60Hz AC.
- Connect the RS422-Cable to one of the two DB9 connectors. The other end of the RS422-Cable belongs to the

delivered USB to RS422 adapter.

- Set the device bus address on the decimal number changer. Numbers from 0..7 are allowed (max. 8 devices on the same bus).
- Press the power switch and the device starts up and calibrates.
- The device is now ready to communicate with the PC.

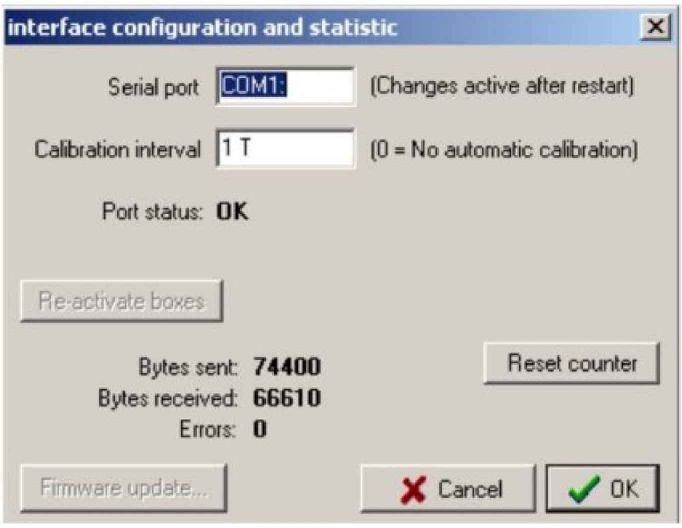
RS422 adapter
There are three common RS422 adapter devices on the market: PCI-Cards, USB and RS232 adapters. An USB to RS422 adapter with the appropriate cable is shipped together with the battery cycler. If a PCI-Card or an RS232 adapter is preferred, care should be taken to the DSUB connector pin out. It may be different than the pin out of the shipped MOXA Uport1130 because RS422 cables aren't standardized. Eventually a custom made cable is necessary.
Installation steps for the shipped USB adapter (MOXA Uport1130; Windows 2000/XP):

- Install the driver software as described in the manual on the driver CD.
- Connect the USB adapter and install the proposed driver.
- Configure the adapter as „4-Wire RS485" device as described in the manual on page 2-14.
- Set the device COM-Port as desired.

CCCC Setup

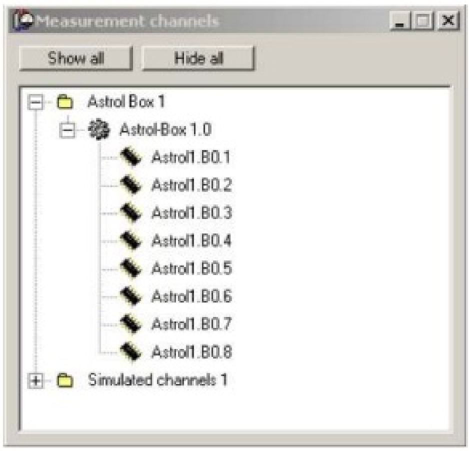
Preparation
First of all the CCCC-Folder needs to be moved from CD to the local hard drive. From there the application can be started by executing „cccc.exe". No additional installation is required.

Communication Setup

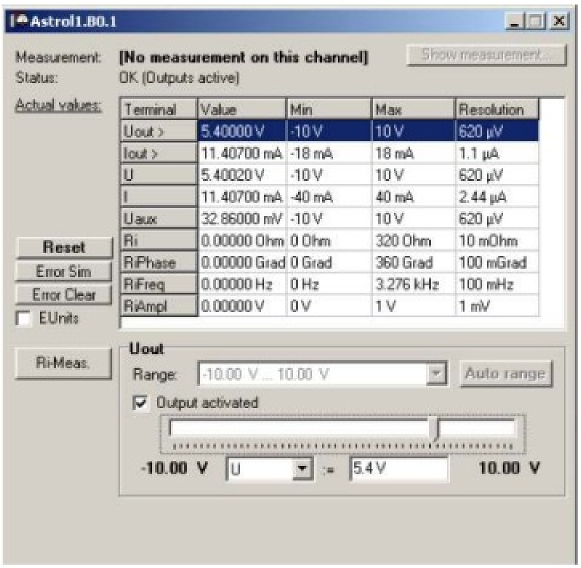


On startup the application searches for devices on the bus. CCCC assumes COM-Port 1 as default for communication. If the RS422 adapter is on a different COM-Port, the application reports an error on opening the COMPort. The first action after the main window shows up is to get into the communication setup by right-click on „Astrol Box ". A popup window appears. After a click on „open…" the communication window opens up. There you can specify the COM-Port to which the RS422 adapter is connected. (Remember the double point in the end) By pressing „Ctrl" and „left Shift" additional buttons appear. With „Reactivate" one can search for new devices on the bus and with „Firmware update" a new firmware can be uploaded to the devices. After setting the COM-Port correctly the application needs to be restarted. The COM-Port assignment for the RS422 adapter is defined in the windows device manager in the device properties of the RS422 adapter. Note: It`s possible to use more than one device with a single RS422 adapter. In that case a regular, not crossed D-SUB 9Pol cable has to be used to loop the RS422 bus trough the devices instead of the adapter cable provided by Astrol.

CCCC Overview

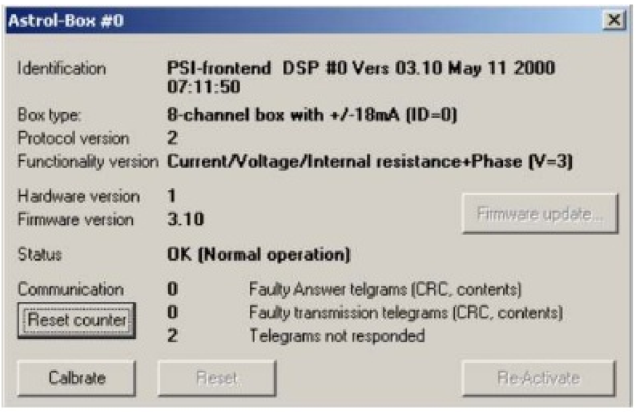


After restarting the application with the communication set up correctly, the devices on the bus should be identified and displayed in the device list similar to the screenshot on the right side. By right click on a channel in the list, the channel window can be opened. In that window all measurement values for the selected channel are displayed. Additionally a constant current or a constant voltage can be set to the output of the channel for testing purposes.



- **Constant voltage:** By clicking on „Uout >“ a slider shows up. By enabling the checkbox the value set by the slider gets sent to the device which tries to reach the defined voltage.
- **Constant current:** Same procedure as with constant voltage. One can click on „Iout >“ and then set the desired output current. Care should be taken to the measured current in this window because the current measurement range doesn’t switch automatically to constant current mode. The range can be chosen by clicking on „I“ and selecting the appropriate range in the dropdown menu.

By right-clicking on the „Astrol-Box“ in the channel-list a window appears with some additional information about the selected device. There are also some buttons to calibrate, reset, search for new devices and update the firmware.



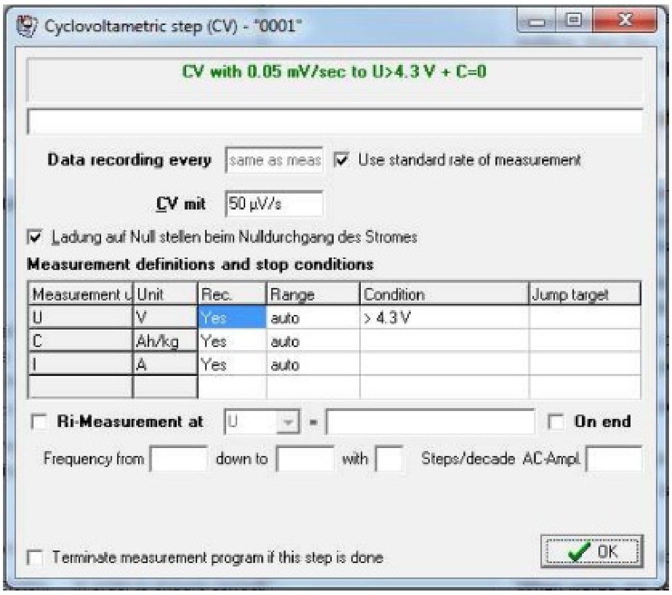
Set up the Measurement Program

Introduction

Each measurement consists of 3 different files. All files are readable with a text editor.

1. The Measurement Program File (*.mpr): This file contains the general structure of the measurement. It can be created with the Editor Tool (CCCC Tool). If one wants to implement a custom software or script to create measurement flows, one should refer to the step syntax documentation.
2. The Data File(*.dat): The Data File is created by the CCCC Software during a measurement. It contains the measurement data reported by the device.
3. The Log File (*.log): This File consists all the events that took place during the measurement. For example if the measurement was canceled or if a counter was set to a specific value during the data recording.

The files should not be separated from each other during a measurement. Otherwise the CCCC Software will not recognize pre existing data and is going to create a new Data File in the folder of the Measurement Program File. However if one likes to share the data after a recording, it is sufficient to pass just the Data File because it contains all the essential information to visualize the results.

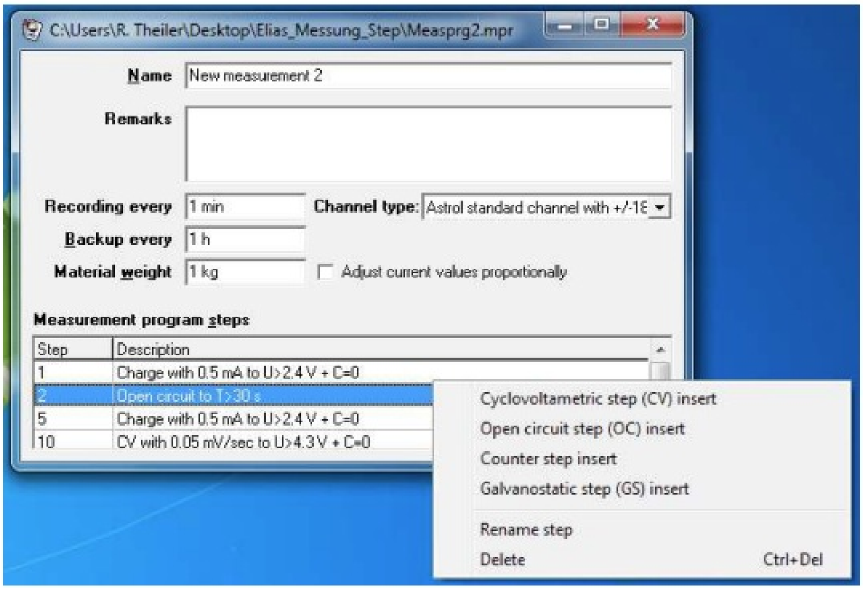


Available Steps

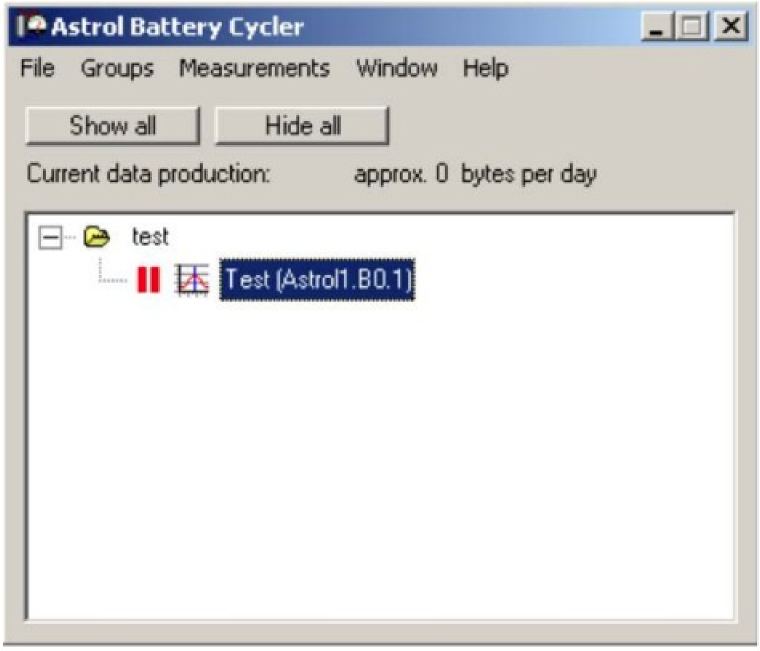
Each measurement is defined as a sequence of different steps. The execution pointer will then move from position to position during the execution. Each step has its unique ID and can be configured with individual parameters. It‘s also possible to jump between the steps by setting conditions to these parameters (for example if U > 1.5V jump to ID 20) to offer maximum flexibility to the user.

- **Counter Step:** The Software offers 3 counters that can be incremented, decremented or set to a specific value with this step. It's also one of the most obvious points to initiate a jump to another step. Counters are normally used if one wants to iterate a program n times.
- **Galvanostatic Step:** This step implements a galvanostat (or current source). Its main purpose is to keep the current trough the cell constant, disregarding changes in the load itself. This step offers a conditional reduction of the current depending on another parameter (voltage, auxiliary current, …)
- **Cyclovoltametric Step:** This steps purpose is to implement a cyclic voltametry. It's capable to run a predefined voltage ramp on the output.
- **Open Circuit Step:** This step opens the output for a specific amount of time.

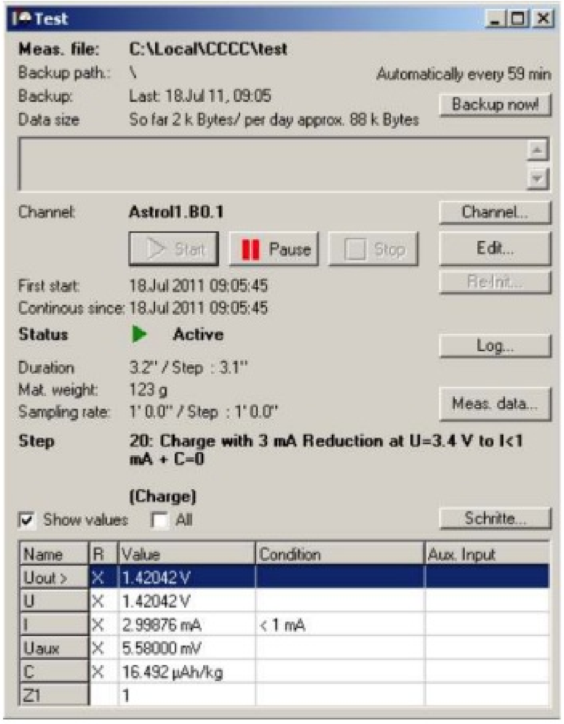
The device allows measuring of the internal resistance of the cell at an individual time. This can be defined inside the step itself. Optionally, the charge can be reduced to zero at a specific point (after a step) to reset the cell.



Assignment
To assign a Data File to a channel one has to switch from CCCC Tool to the CCCC main software. Each channel can contain a single measurement file at the same time. A new measurement should be started trough the assignment dialog in the CCCC main window (or with the shortcut Ctrl + N). One can select the predefined Measurement Program File here. The dialog asks here for an optional backup path to avoid loss of data during longer measurements. In a last step an available channel has to be selected. After that the measurement window can be opened. The measurement window contains control elements to start stop and pause the data recording as well as a table with the current measurement values for each active recording.



The recorded data can be exported to a file or displayed in a graph by clicking on the „meas. data“ button. For further details please refer to the Data Analysis chapter. The measurement file can also be changed this way (even during a running measurement) by pressing the „Edit…“ button. It’s possible to track the previously mentioned execution pointer during a measurement by opening the „Schritte (Steps)“ window.



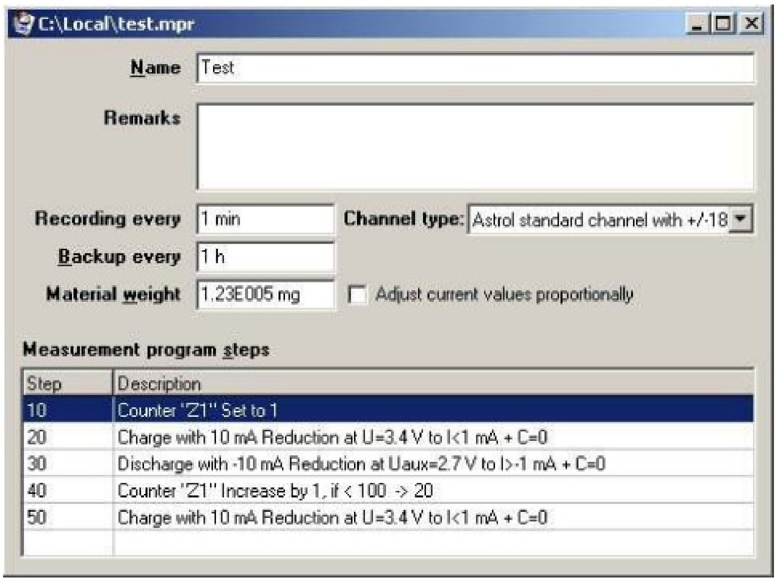
Measurement-Program Example

Example File

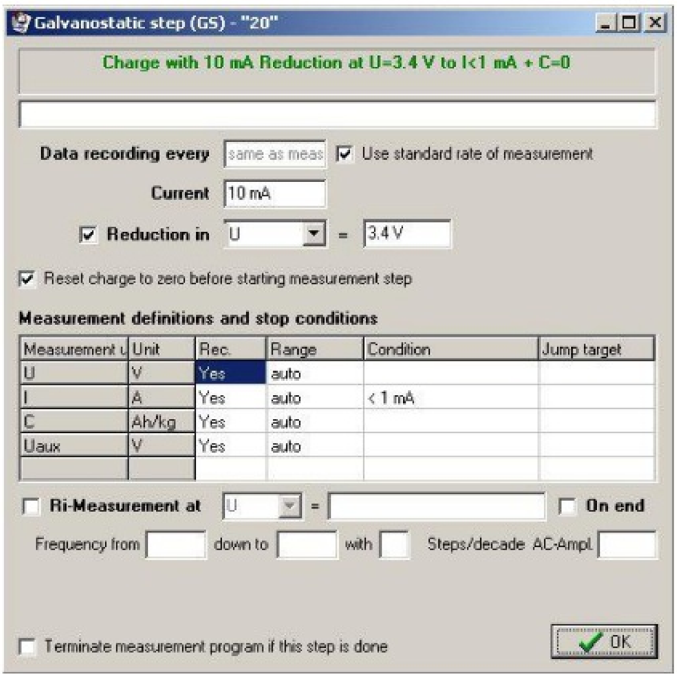
There is an example file on the CD with the name test.mpr. This file can be opened with the CCCC-Tool. This file contains only the program flow which describes the measurement behavior. The recorded data are saved in a separate file with the ending *.dat.

Program Description

The following chapter explains the example file test.mpr which contains a program for 100 GS-cycles from 2.7-3.4V with 10mA. If the file is opened with CCCC-Tool there is a window with all program steps listed. Every step has a unique number which acts as a reference for conditional jumps from other steps. The first step is a counter step which sets the cycle counter to one. The following two steps are galvanostatic-steps which charge/discharge with a constant current until the defined end voltage is reached. With the reduction condition the voltage is being held constant until the current drops below the defined current limit of 1mA. After these two cycles a counter step increases the counter and jumps to the next charge step if the cycle counter hasn't reached the limit of 100 cycles. At the end there is a charge cycle to charge the cell to a specific charge condition for storage. In the GS-Step window there are many options available. The important ones are the charge current and the reduction condition where one can choose the measurement source.

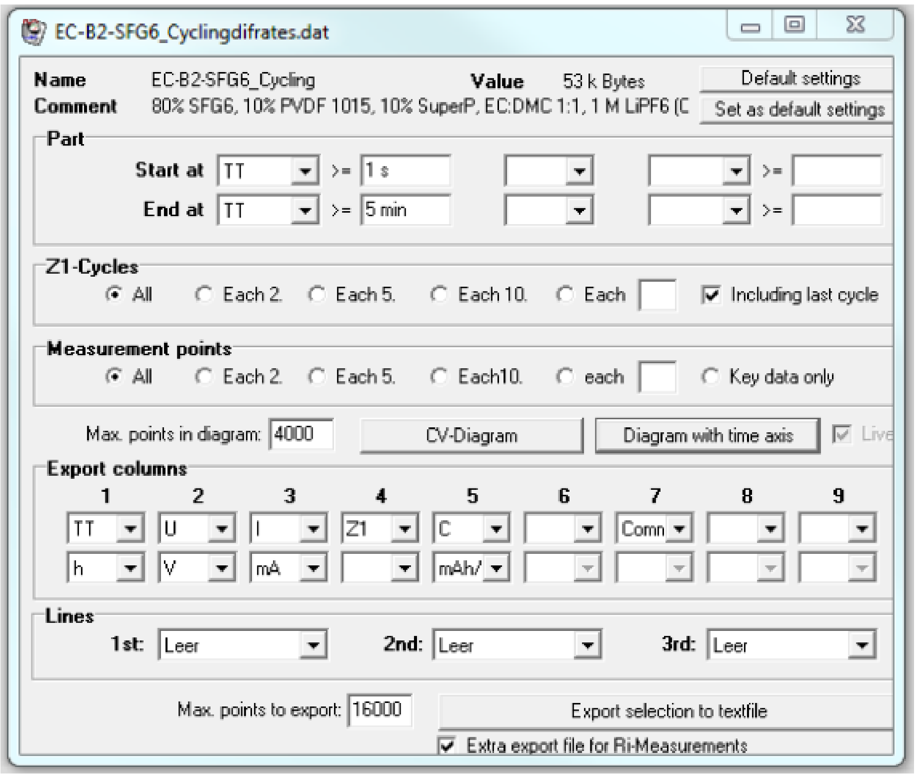


In the conditions table multiple conditions on which the step needs to stop or jump to a predefined step number can be defined. After saving the program one can proceed with the measurement and data analysis.



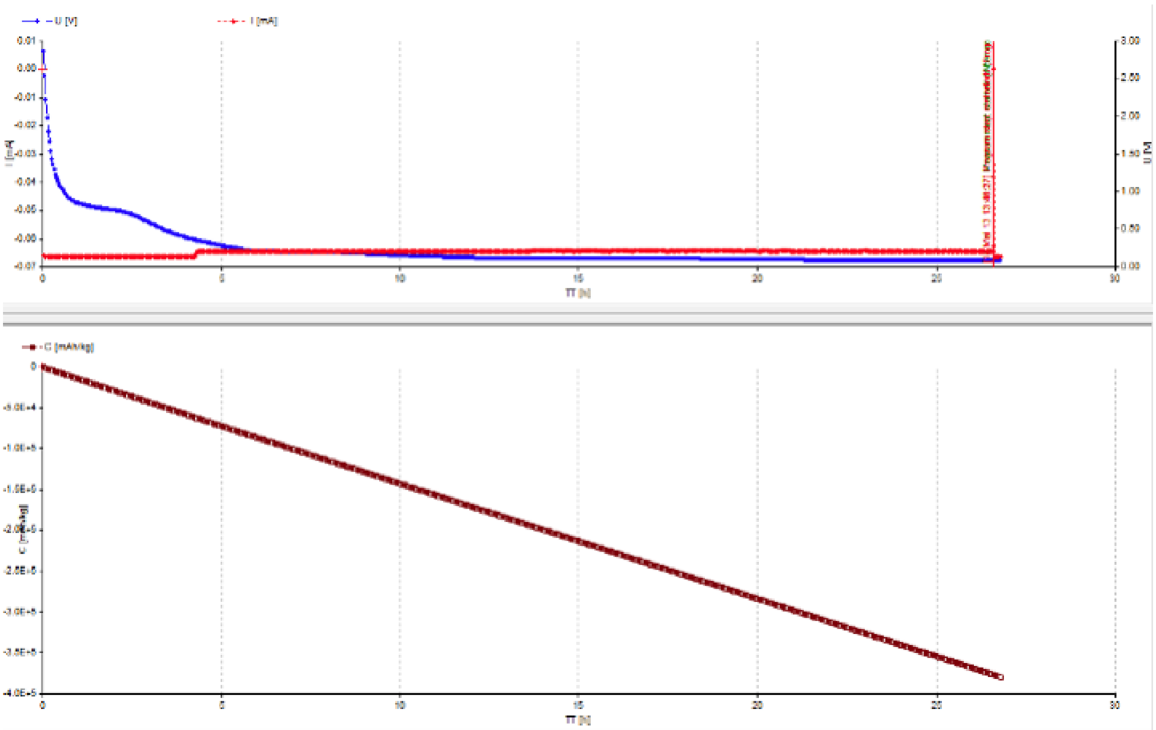
Data Analysis

One can view a plot of the data at any time during a running measurement. After the process is done, the Data File can be opened with the CCCC Tool software to display and filter the results. To filter the results one has to define conditions in the data analysis dialog. CCCC Tool offers two main methods to display the data, as a CV – diagram (Current – Voltage) or as a time dependent diagram.
There are many customizable parameters to get the best view on the desired data:



Export and Printing

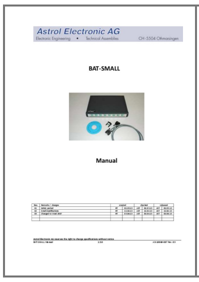
Recorded data can be exported to a text file (similar to the CSV standard, space separated values). There is also an option to print out the plots directly from the CCCC Tool software.



Simulation Channels

The CCCC Software offers 4 simulation channels. They can be used to test a measurement flow. Keep in mind that these channels may not be completely accurate due to a simpler simulation algorithm.

Documents / Resources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Manual

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