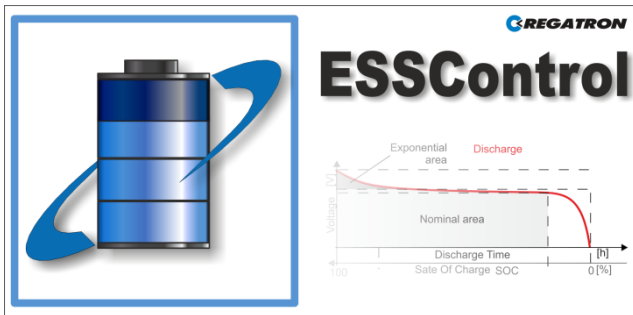# SOFTWARE INFORMATION

BatSim

Software option of Energy Storage Simulation ESSControl

Key features & functionality

- The optional simulation model of batteries is an additional software component option of the application Energy Storage Simulation ESSControl.
- Full integration with TopCon device series: TC.GSS, TC.GXS, TC.GSX, TC.DSS and TC.P hardware (power supplies).
- Implementation of a comprehensive battery model. (Based on Tremblay/ Dessaint, 2009)
- Selection from the most common battery models:
  - Li-Ion, Lead-Acid
  - NiMH, NiCd
  - Further technologies (on request)
- The BatSim model parameters are changeable in the GUI or in simulation scripts.
  - Charge/ discharge current.
  - Number of battery cells in series and parallel.
  - Battery safety by battery cut-off limits.
  - Influence of battery temperature*
- Adaptation and controlling of the individual configured battery simulation models possible with a simple powerful scripting language.
- Multi-channel data-logger with EventMarkers as time stamps and file export in file type: csv
- Reporting/ output-to-file capabilities within the scripting language during process.
- Data analysis (e.g. comparison) of different measurements in the time line via a DataAnalyser component.
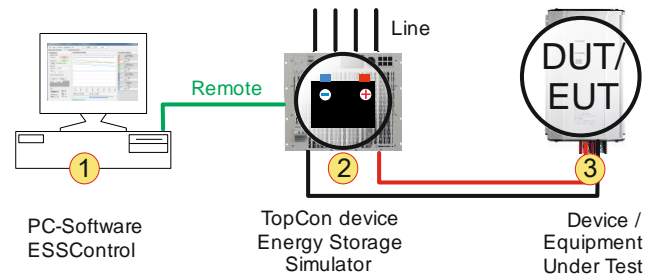
*= under development

Contact information

Regatron AG
Kirchstrasse 11
CH-9400 Rorschach
Switzerland

Tel   +41 71 846 67 67
Fax   +41 71 846 67 77
www.regatron.com
topcon@regatron.ch

Simulation with the hardware

| 1 | 2 | 3 |
| PC-Software ESSControl | TopCon device Energy Storage Simulator | Device / Equipment Under Test |

ESSControl/ BatSim in combination with a TopCon device simulate the behaviour and the properties of a real battery.

- The ESSControl contains the BatSim option, while BatSim includes the mathematical model of battery characteristics.
- The preset values of the TopCon device **-2-** will be set by the charging/ discharging curve of BatSim.
- The BatSim has the same behaviour and its output to the DUT is similar of a real battery.

BatSim – The mathematical model
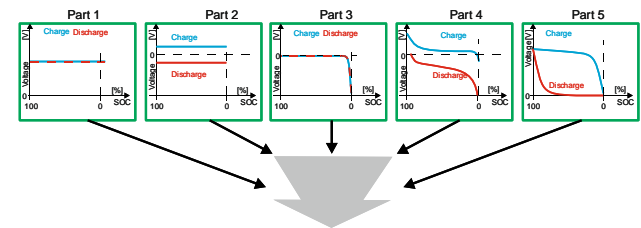
The result is a combination of Part 1, Part 2, Part 3, Part 4 and Part 5
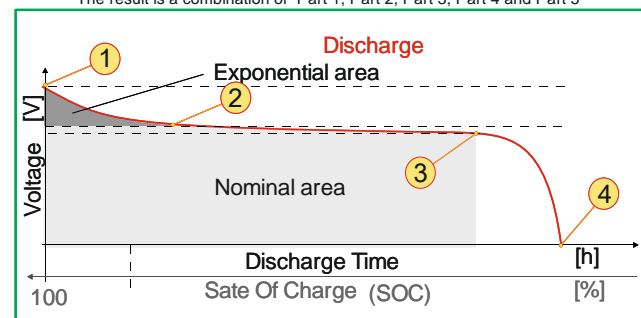

Mathematical model based on Tremblay/ Dessaint, 2009

- The curve areas of a dis-/charge curve are given in the Data sheets of batteries:
  - Full charged battery **-1**
  - Start of the exponential zone **-2-**
  - End of the nominal **-3-** and start of the exponential zone
  - End of the discharging/ Start of charging **-4-**
- The following mathematically curves built the dis-/charge curve:
  - Part 1: Nominal voltage
  - Part 2: Internal resistance loss
  - Part 3: Polarisation Voltage
  - Part 4 Polarisation resistance
  - Part 5: Exponential Zone voltage

Tabs of the user interface software ESSControl

- **<BatSim> tab**
  Display and setting of the actual and preset values.
  Configure the battery model parameter.
  Control of the model simulation.
- **<Live Viewer> tab**
  Real-time display of collected simulation data. Multi-channel logger and setting of EventMarker as time stamps. The data channels are configurable.
- **<Data Analyzer> tab**
  Load and display of the recorded values. Data analysis of different measurements in the time line via a data analyser component. The data channels are selectable to get a better overview.
- **<Script Editor> tab**
  Programming, debugging and modifying scripts.
- **<Device info> tab**
  Information about the connected system.

<BatSim> tab
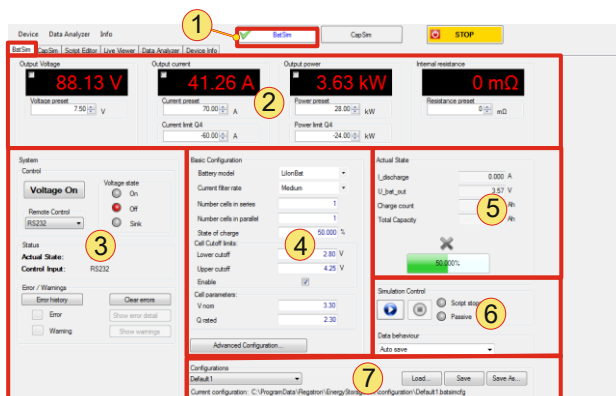
<BatSim> tab

The <BatSim> tab contains:

- Indication of the installed option BatSim **-1-**
- System settings and display **-2-**
  - Setting reference and display of actual values like voltage, current power and internal resistor.
  - Indication of controller mode (CV,CC,CP)
- System control **-3-**
  - Switching the energy flow on/ off to the load.
  - Indication of warnings and errors details and access to the logged error history.
  - Remote interface selection.
- Battery simulation parameters of the BatSim model **-4-**
  - Battery chemistry/ kind of electrolyte
  - Several battery parameters e.g. Cut-off thresholds, State Of Charge (SOC)
  - Number of battery cells in parallel/ serial.
- Simulation control **-6-** and state display **-5-**
  - Start, stop, break the simulation
  - Display of SOC and the model output parameters.
- Handling of different BatSim configurations **-7-**:
  - Selection of defined BatSim configurations.
  - Load, store of new BatSim configuration files.

## Enabling of the BatSim option

- Required conditions:
  - Newest Software TopControl V4.02.24 or higher for the enabling procedure.
  - Newest Version of device firmware V4.20.99 or higher includes all functionality that is needed by BatSim.
- Please note that you need to purchase BatSim option before you can enable it.
- The option has to be enabled with an option code via the Software TopControl.
- BatSim is stored on the device.
- A trial time period is available for the option.
- Contact your sales partner or Regatron to get support for the BatSim activation.

General information

- Swiss made
  developed, implemented and tested in Switzerland by Regatron AG, manufacturer of TopCon product family.

Scope of delivery

- Newest version of TopCon firmware includes all functionality that is needed by BatSim.
- Installer package for PC including:
  - The ESSControl.exe (ESSControl user interface)
  - TCIO.DLL (communications functions), TCIOWrapper DLL (enhanced communications + .NET support)
  - ESSControl.DLL (BatSim related functions)
- Program operation manual
- ESSScript function reference is coming in the future.
- Installed standard BatSim-ESSScript. (It can be modified)
- Installation support from your sales partner or Regatron customer support.

ESSControl

User interface Software of Energy Storage Simulation
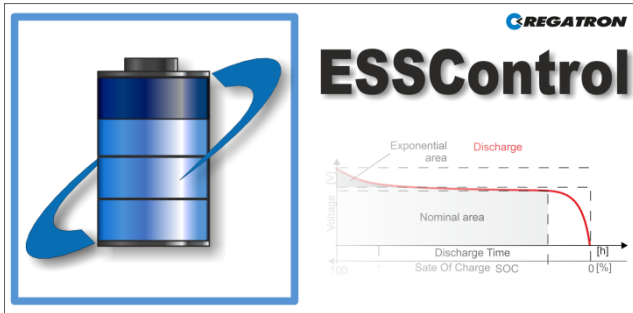
Key features & functionality

- ESSControl is the user interface software and script environment for the additional software options BatSim or CapSim.
- Full integration with Regatron TopCon device series: TC.GSS, TC.GXS, TC.GSX, TC.DSS and TC.P hardware (power supplies).
- Remote connection via PC interfaces E.g. RS-232 or USB interface.
- Adaptation and controlling of the individual configured simulation models possible with simple and powerful scripting language.
- Multi-channel data-logger with EventMarkers as time stamps and file export in file type: csv
- Reporting / output-to-file capabilities from within the scripting language during process.
- Data analysis (e.g. comparison) of different measurements in the time line via a data analyser component.

Contact information

Swiss made: Developed, manufactured and tested in Switzerland by Regatron AG.

Regatron AG	Tel +41 71 846 67 67
Kirchstrasse 11	Fax +41 71 846 67 77
CH-9400 Rorschach	www.regatron.com
Switzerland	topcon@regatron.ch

Simulation with the hardware
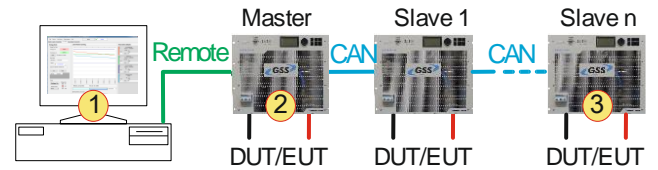
ESSControl with a simulation model options CapSim or BatSim in combination with a TopCon device simulate the behaviour and the properties like a real component.

- Scripts in the ESSControl environment control the simulation model, while the simulation model runs in the characteristic simulation curve.
- The preset values of the TopCon device **-2-** will be set by the charging/ discharging curve of the simulation.
- The simulation has the same behaviour and its output to the DUT is similar of a real component.
- Using ESSControl in combination of several devices to simulate high power applications.
  The software ESSControl **-1-** remotes the master **-2-** device and the master device controls the slave **-3-** devices. Only for the master device the options has been enabled.

Tabs of the User interface software ESSControl

- **<BatSim> tab**
  Display and setting of the actual and preset values.
  Configure of the battery model parameter.
  Control the model simulation
- **<CapSim> tab**
  Display and setting of the actual and preset values.
  Configure of the capacitor model parameter.
  Control of the model simulation.
- **<Live Viewer> tab**
  Real-time display of collected simulation data. Multi-channel logger and setting of EventMarker as time stamps. The data channels are selectable.
- **<Data Analyzer> tab**
  Load and display of the recorded values. Data analysis of different measurements in the time line via a data analyser component.
  The data channels are configurable to get a better overview.
- **<Script Editor> tab**
  Programming, debugging and modifying scripts as well.
- **<Device info> tab**
  Collected information about the connected system.
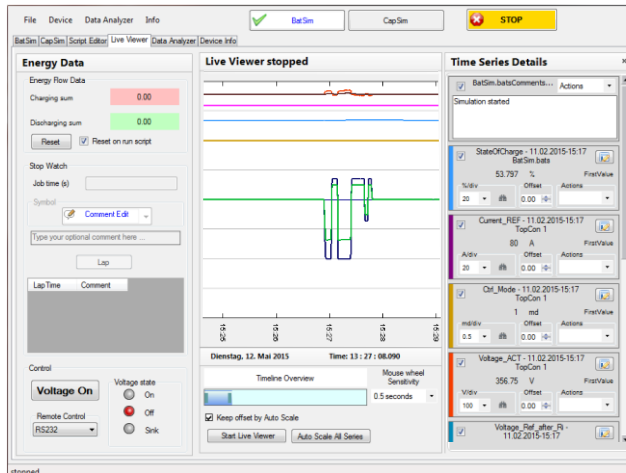
<CapSim>/ <BatSim> tab

For further Information,
refer to the CapSim and BatSim SOFTWARE INFORAMTION

<Live Viewer>/ <Data Analyzer> tab

<Live Viewer> tab example – Screenshot

The <Live Viewer> tab contains:

■ Real-time display of recording simulation data.
  Multi-channel data-logger. The Channels are selectable in the "Time Series" group.
■ EventMarker
  setting as time stamps for the <Data Analyzer> tab.
■ The data channels are configurable in the "Time Series" group.
■ Scope over the total time line with zoom-Window functionality.

The <Data Analyser> tab additional contains:

■ TimeMarker
  □ Set a TimeMarker in the time line.
  □ Comparing of two sessions that have been recorded at different time. The signals can be shifted to the TimeMarker position.
■ Display of EventMarker that are set in the <Live Viewer> tab.
■ Load data sessions from files and store session in new files.

<Device Info>

The tab contains information of the TopCon device; the information is combined into various groups, e.g. the device data, the device identification and Software version.

<Script Editor> tab
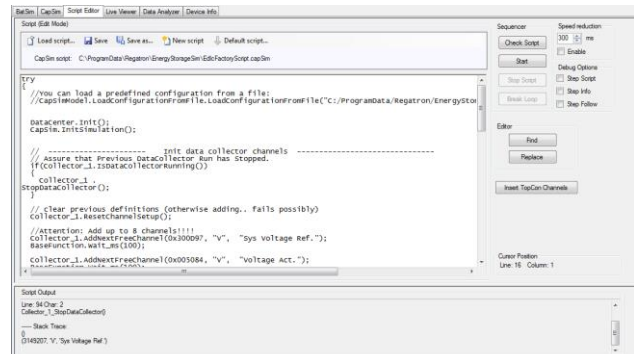
<Script Editor> tab – Screenshot

The tabs contains:

■ Customize the factory model script.
  □ Add data channels to the DataCollector for the live scoping and the DataAnalyzer.
  □ Initialize the controlling of the simulation model
  □ Define the outputs
■ Script handling
  Load, store, reset to factory script.
■ Running script
  Run, stop and break of a script.
■ Edit script
  □ Script debugging via "Step mode".
  □ Grain syntax script checking.
  □ Highlighting of search strings.

General information

■ Swiss made
  developed, implemented and tested in Switzerland by Regatron AG, manufacturer of TopCon product family.
■ For further Information about the available simulation models CapSim and BatSim, refer to the according SOFTWARE INFORMATION.

Scope of delivery

■ Newest version of device firmware including all functionality that is needed by simulation options.
■ Installer package for PC including:
  □ The ESSControl.exe (ESSControl user interface)
  □ TCIO.DLL (communications functions), TCIOWrapper DLL
    (enhanced communications + .NET support)
  □ ESSControl.DLL (BatSim related functions)
■ Program operation manual
■ ESSScript function reference is coming in the future.
■ Installed standard simulation model-ESSScript. (It can be modified)
■ Installation support from your sales partner or Regatron customer support.