Step 1: First follow the instructions in "Model 200 BATSIM Hardware Software Installation Instructions" to install your hardware and software.

Step 2: Supply power to the Model 101A and plug it into a USB port on your test computer. If the previous install was performed you will see a balloon in the lower right corner telling you that the driver is being installed and whether it completed correctly. If the computer has seen this hardware before you will not get the "new hardware found" dialog. The "USB" led on the front panel will pulse when connected. Put the Man/Ate switch into the "ATE" position.

Step 3: If you see the following then your computer is not USB2 compatible and *may* have issues.

Step 4: Start the BATSIM program by double clicking the icon on your desktop.

Purpose of this tester: The purpose of the tester is to provide a dataset driven or manually controlled source of power that simulates a Lithium-Ion or other battery. Like a battery it has ESR (Equivalent Series Resistance) which along with the terminal Voltage represents what your device sees when connected to a real-world battery. But working with real-world batteries has its own set of problems. Real batteries can be in any SOC (State Of Charge) when you use them. And as rechargeable are used many times their characteristics change. Many times you will need to show how your product works with a poorly charged battery or a battery near the end of its life.

That is where Model 101A Battery Simulator with the provided software can provide a realistic simulation of many different possible scenarios. Since the dataset was derived (ideally) from the battery you plan to use you can test your product at any point along the curve of Voltage and ESR. If further, you derive a dataset from a new battery and a battery that has been discharge/charged 500-1000 times you will see a different set of curves. Thus you can test your product fairly quickly over a simulated 2-3 year lifespan. And with a set of Voltage/ESR curves you can get repeatable results each time you run a test. That is very hard to accomplish with real batteries. Now back to the features…

Step 5: The program will open as shown below in Figure 1. The following steps will refer to this image unless otherwise indicated.

Description of buttons and meters in Figure 1:

Upper-Left, there are two file selector boxes called "Voltage File Name" and "ESR File Name". This is where you select the data file for the battery you want to run. Some examples are included in your installed folders (C:\Program Files\BatSim\Examples) and more are available on http://www.graellc.net/Downloads%20and%20Documents.htm. You can also generate your own curves by using MatLab, XL or from actual measurements of real batteries. GRAE Instrumentation can also provide you with data from your batteries.

Upper-Middle, there are (8) buttons that do the following:

Man/Ate, is an indicator of hardware status, Enter Data, enters the data sets you have selected to run, Start Test, puts the software into "Run" mode. You will see changes on the meters and the lower graph indicating activities. Pause, stops the program from counting down or up in the data set. Stop Test, stops this test without stopping the program. Stop Program, stops the program. Output Enable, controls the

state of the output "relay". It can be set manually or by software. ESR Enable, normally on but can be used to reduce ESR to zero.

Upper-Right, there are (3) user entry fields for "file path" (the folder where you want to store your data, "file name" and "comment" both of which add text to the file name which includes some automatic text.

LCD Meters, there are (5) "LCD style" meters which indicate:

BatSim Voltage – the voltage measured at the end of the four wire battery simulator wiring.

BatSim Current – the current into or out of your UUT (Unit Under Test)

BatSim Power – the power into or out of your UUT

Voltage to DAQ – the voltage being sent to the Battery Simulator from the data file.

ESR to DAQ – the ESR value being sent to the Battery Simulator from the data file.

Test Time – the time the test has run from when the "Run" button was pushed.

"Done" indicator – shows when the test has reached the end of the file or has stopped from another reason.

"Voltage and ESR Profile" graph – shows the data set being run and the position the program is in the data set. The vertical values can be re-sized if needed to fit your data.

"Starting Joules" – a very important setting . You need to know the average total Joules your battery can provide to set this. The battery V/ESR curves refer to a battery of known total Joules. There are two methods for obtaining the total Joules.

First method: Assume a battery voltage of 3.7V (for Lith-Ion) and a rating of 1000mA/Hr multiply 1A (1000mA) times 3600 times 3.7V gives 13,320 Joules. Substitute your batteries ratings as needed.

Second method: Measure actual battery samples of your intended battery to obtain the voltage, ESR and total Joules. GRAE Instrumentation can run your battery on our battery test stations.

The six grey numerical indicators next to "Starting Joules" are not set by the user.

The next (3) grey indicators in a box are used as a semi-manual mode between the time that the "Enter Data" button is pushed and the "Start Test" button is pushed. During this time the yellow cursor in the Voltage and ESR Profile graph can be pulled left and right. This lets you manually adjust the output of the 101A Battery Simulator using values from the data set. It also lets you start the test from a position other than the beginning of the data set such as near the end where your UUT may be ready to shut down.

"Current Measure" – selects the current readback mode of "Sampled" or "Integrator". The integrator has a better capability to capture sporadic bursts of current which on average are very low. The integrator is reset every one second and accumulates a value corresponding to what occurred during that interval. The Sampled mode takes a reading every one second and is useful when the UUT power usage is smoother.

"Add Marker" – adds a dotted purple line to the BatSim DAQ graph and a value change into the output data file. Use for marking a special event.

"Overvoltage Limit" – disconnects the Battery Simulator if the voltage goes beyond this value. The overvoltage could occur because of dataset values, "charging" by the UUT or other reasons. The disconnect helps protect the UUT and the Battery Simulator from damage.

"Current Limit" – disconnects the Battery Simulator from the UUT when this current is exceeded.

"Low Limit V" – Stops the program and disconnects the Battery Simulator when the data set outputs values below this limit or when the UUT or wiring cause a short. The usual use is to stop the test when the Simulated battery is discharged.

""Low Limit Mode" – selects whether the "Low Limit V" gets it's input from the Pre or Post ESR values of the data set.

(5) green voltage indicators – show the power supply status of the Battery Simulator. If these voltages are out of bounds the software will not run and the output will be disconnected.

"BatSim DAQ" – this graph shows data from the UUT. There are four sets of data and their corresponding vertical scales. The vertical values can be re-sized if needed to fit your data.

Voltage trace: (WHITE) records the voltage at the end of the four-wire connection to you UUT. This is the voltage that your UUT (product) sees.

Current trace: (RED) records the current to your device. Values above the middle of the graph are "Discharge". Values below the middle are "Charge".

Power trace: (GREEN) records the power used by your product. Values above the middle are "Discharge". That is power taken from the simulated battery. Values below the middle are "Charge". That is power supplied to the simulated battery.

Joules trace: (BLUE) records the Joules used by your device. This is an accumulated value or trend indicator.

Marker trace: (PURPLE) recorded in the output data set but has no real meaning. Use to mark a particular or special event.

Output Files:

The software stores a new measurement file each time it is run provided the "Enter Data" button is pushed first. If the "Start Test" button is pushed without first pushing the "Enter Data" the measurement file will be written over. The output filename only has a resolution of one minute so restarts in the same minute will be written over.

Output File Example:

DataSet Size	3600
Starting Joules	10000
Joules per Step	2.778
Remaining Joules	9740.68
Joules Used	259.32
Run On:	Wed Jan 06 2010 1 55 PM

BatVoltSet	BatESRSet	BatVActual	BatIActual	BatPActual	BatJAccumulated	Position	Marker	Time
4.115	0.222	3.781	0.754	3.453	3.453	1	0	0
4.115	0.222	3.781	0.754	2.817	6.27	1	0	1
4.114	0.223	3.781	0.754	2.798	9.068	3	0	2
4.114	0.223	3.781	0.754	2.759	11.828	3	0	3
4.133	0.223	3.781	0.754	2.798	14.626	5	0	4

The output files can get large when run for extended lengths. Try to give your file name consistent and descriptive names as this will help identifying the later. Files are in CSV (Comma Separated Values) which can be opened in Microsoft Excel and other programs.