

Demonstration Guide

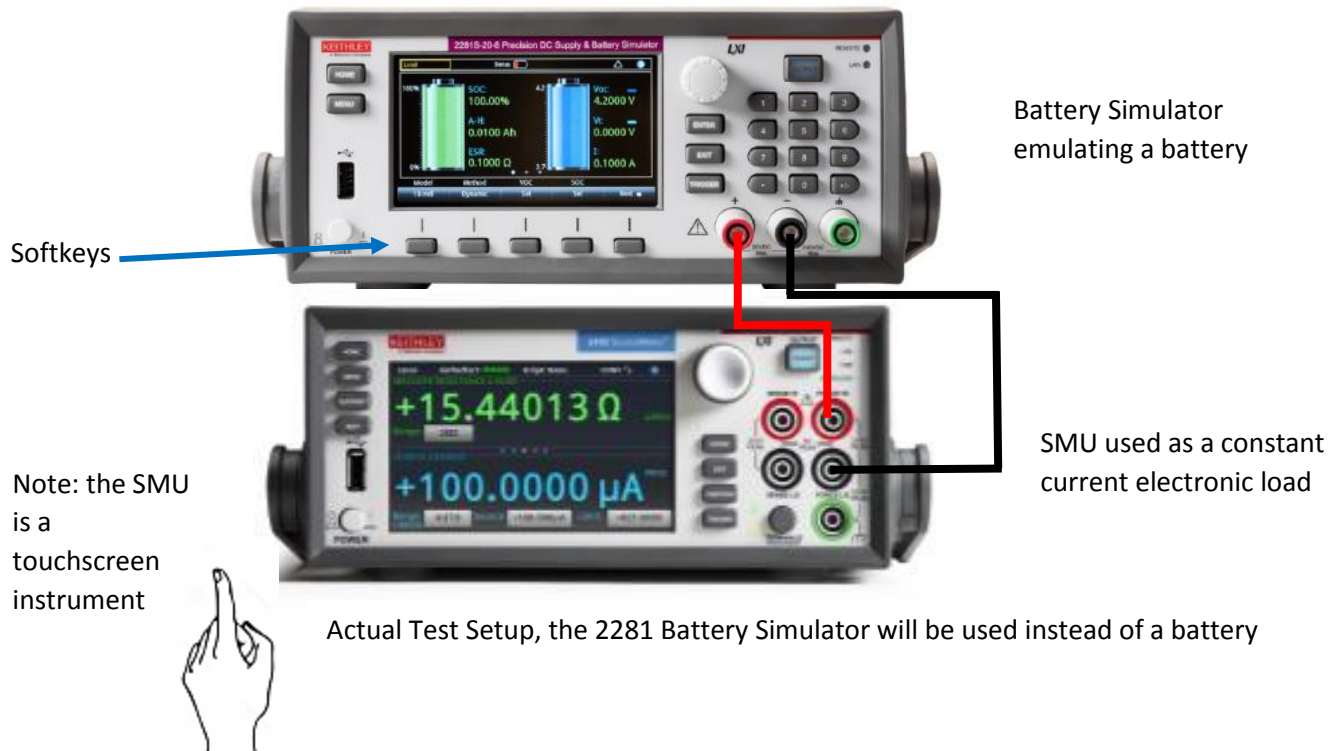
Discharging a Battery and Creating a Battery Model

This guide shows how the Series 2450/60 SourceMeters can discharge a battery and create a battery model. The model would then be installed in the 2281 Battery Simulator to simulate the type of battery that was discharged. The battery simulator can then be used to power the product under realistic and repeatable conditions at any discharge state of the battery.

For the purposes of this demonstration, the battery simulator will be used as the battery to be modeled.

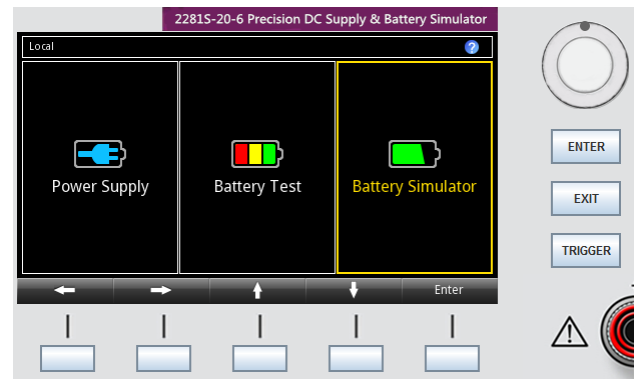


Test Set up Concept

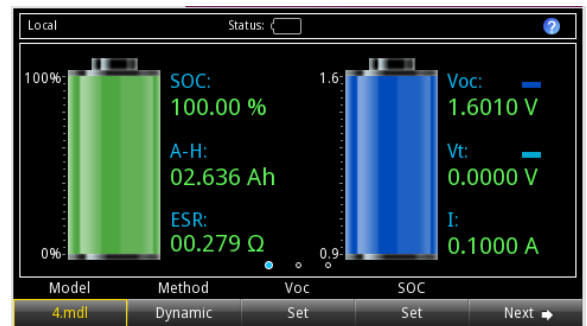


Actual Test Setup, the 2281 Battery Simulator will be used instead of a battery

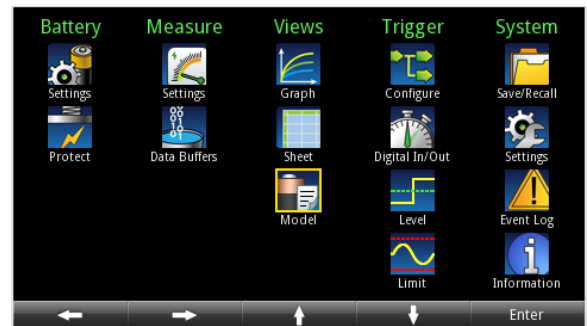
1. Connect the 2281 Battery Simulator to the 2450, 2460, or 2461 SourceMeter instrument using the banana-banana cables as shown above. Insert the memory stick into the USB port of the 2281 Battery Simulator.
2. Power the 2281.
3. Turn the knob to highlight “Battery Simulator” and press the ENTER button. The screen shows the main battery simulator display.
 - a. The softkeys can also be used to move the cursor to highlight functions.



Load an AA battery Model into the 2281 Battery Simulator



4. Press the MENU button.
5. Use the knob or arrow softkeys to highlight the Model icon. Press ENTER to see matrix of a model displayed.

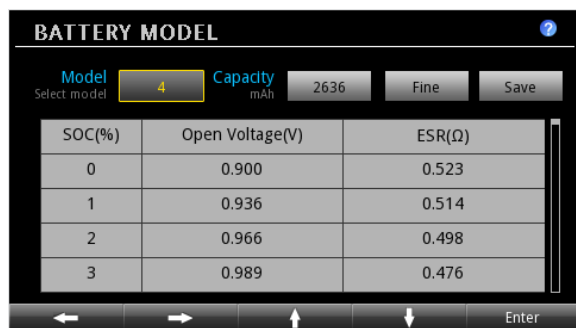
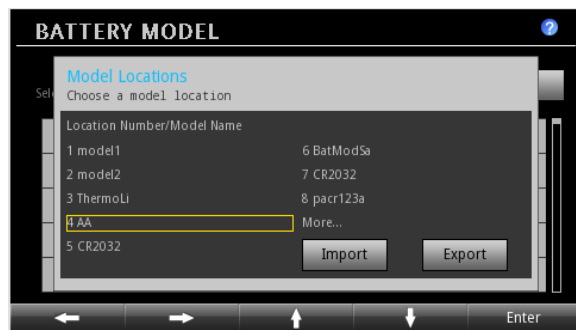


BATTERY MODEL

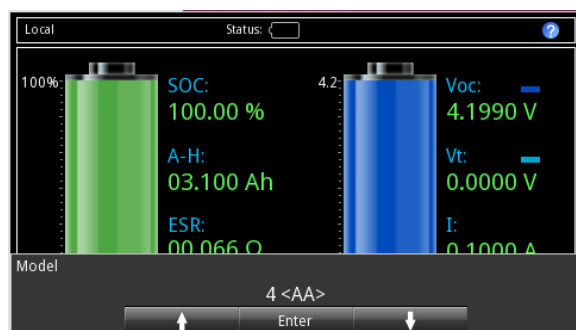
Model: 1 Capacity: 485 mAh [Fine] [Save]

SOC(%)	Open Voltage(V)	ESR(Ω)
0	0.800	0.256
1	1.166	0.118
2	1.257	0.090
3	1.269	0.084

6. Press ENTER to access the model memory display.
7. Highlight “Import” to load a model from the memory stick.
8. Select the “DemoAA” battery model. Press ENTER.
9. Select a number from 1 – 9 that represents an empty location. Press ENTER. The model is now loaded into memory.
10. Press EXIT to return to the model matrix screen. Now the screen shows the AA model that was loaded into memory from the memory stick.
11. Press the HOME key to return to the main battery simulator display.



12. Press the “Model” softkey (far left softkey) to activate the DemoAA battery model.
13. Use the arrow keys to display the location and the name of the model and press ENTER.



Set the simulated AA battery for a Low Capacity and Set the current limit to 1.1A to enable a fast discharge

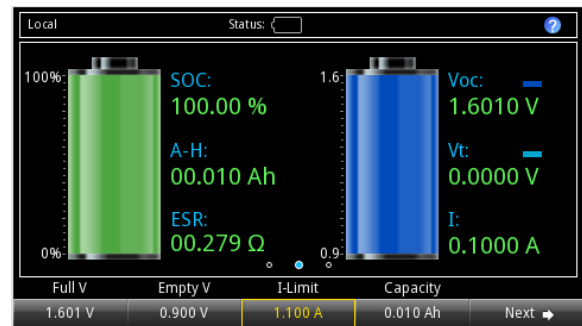
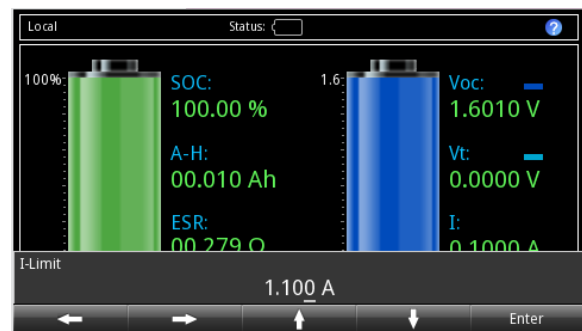
14. Press the Next softkey.
15. Press the Capacity softkey.
16. Use the keypad or softkeys to enter 0.01A-Hr. Press ENTER.

The battery capacity is now only 0.01A-Hr.



17. Press the I-Limit softkey.
18. Use the keypad or sofkeys to enter 1.1A and press ENTER.
19. Press the Output button to turn the output on.

The maximum discharge current the battery simulator will output is 1.1A



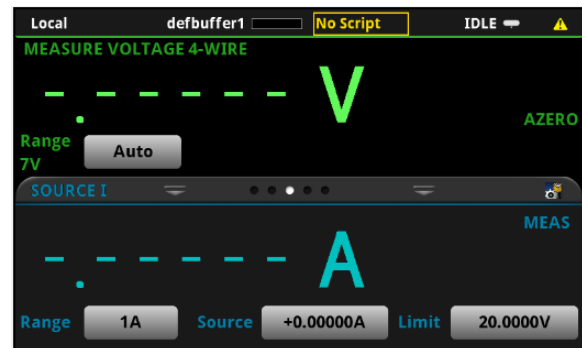
Load a program into the SMU to discharge the AA battery and create a battery model based on the discharge data

1. Power the SMU.
2. Insert the memory stick into the SMU USB port.
3. Press the “No Script” text on the touchscreen. The program files on the memory stick will be displayed.



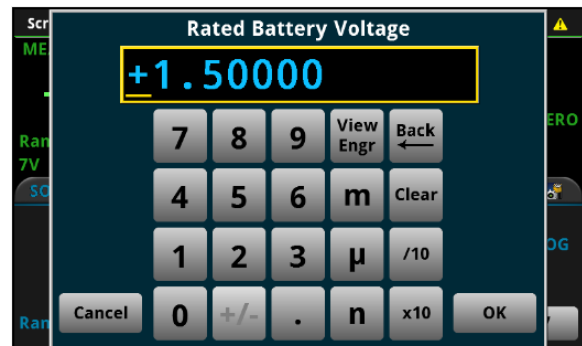
4. Press “usb1/Battery_Setup.tsp” application. The application is very short and requires no user interaction.

The SMU is now in a standby state and no current is being drawn.

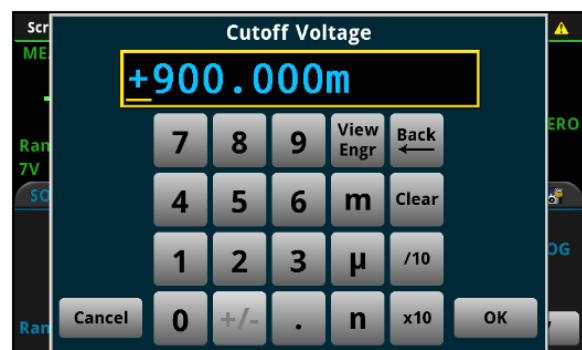


5. Press the “No Script” text on the touchscreen again. Then press the “usb1/Battery_Discharge.tsp” application. The application prompts for a set of parameters.

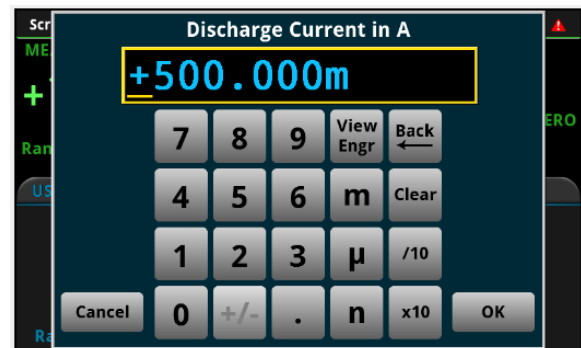
6. Enter 1.5V, the nominal battery voltage. Then press OK.



7. Enter 0.9V, the end-of-discharge battery voltage. Then press OK.

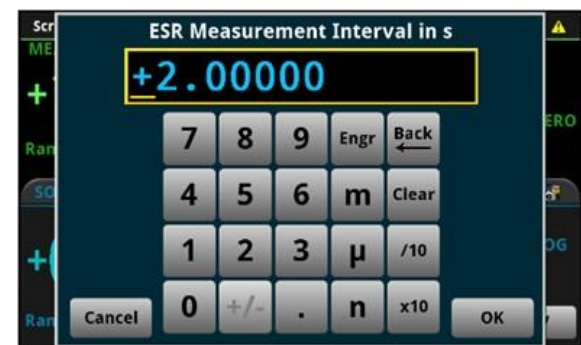


8. Enter the discharge current, 500mA. Then press OK.



9. Enter the interval for making internal resistance (ESR) measurements, 2s. Then press OK.

Note: This interval can be much longer for an actual battery with a reasonably-sized capacity.



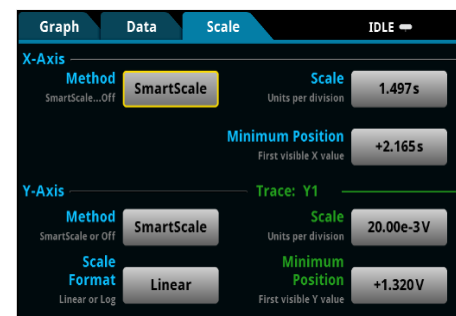
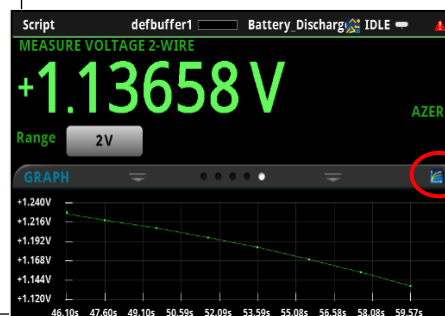
10. Swipe the bottom of the touchscreen to the left three times to show the plot.

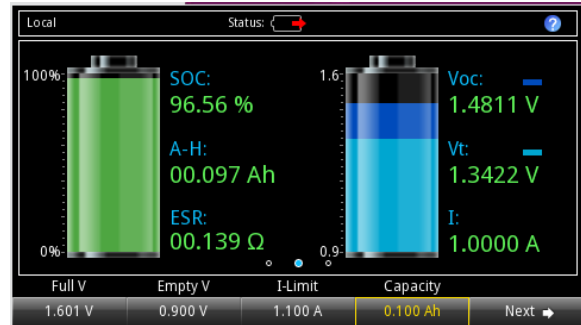
11. Touch the small picture of the graph on the right center of the screen to fill the screen with the plot. (See the red circle on the screen graphic for the location.)

12. Press "Scale."

13. Press X-Axis "Method", then press SmartScale. Then press ALL to show all data points.

14. Press "Graph" in the upper left hand-corner of the screen to return to the full screen plot.

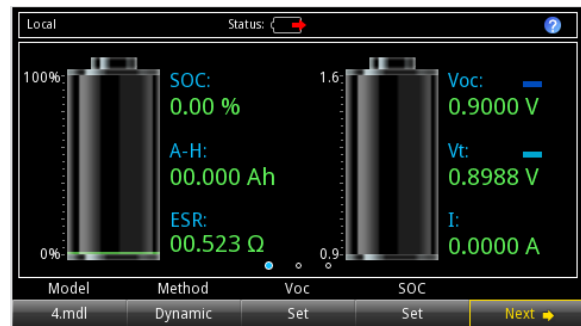
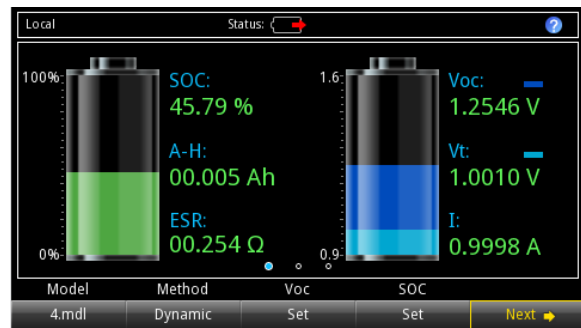




The 2281 display is showing the battery discharging.

Note $V_{\text{open circuit}}$ is falling, State-of-Charge is falling, and ESR, internal resistance, is rising.

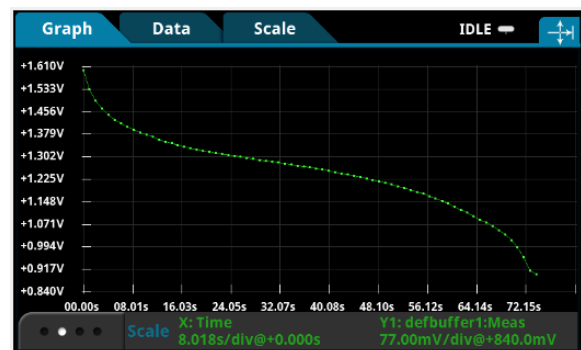
The battery is fully discharged when the displayed batteries are depicted as being empty.



The SMU display is showing the discharge curve that was generated.

The SMU will ask if you want to store the data. For this demo, press No.

To repeat the discharge, press the Next softkey on the 2281 twice and set SOC (State-of-Charge) to 100%. On the SMU press the Home button, then repeat SMU steps 4 (page 5) through 14.



Recharging the Battery

Re-charge the battery by using the SMU as a constant current source and supplying 0.5A to the battery.



Test Setup Concept, The Battery Simulator will be used in place of the battery

1. Press the HOME key on the SMU.
2. Swipe the lower portion of the touchscreen to the right until the current source value is shown.
3. Press the number to the right of "Source" on the touchscreen. (Source is at the bottom and middle of the screen).
4. Enter 0.5A and press OK on the bottom right of the keypad.
5. Press IDLE on the top right of the screen. The battery discharge script ends and puts the SMU in an idle trigger state. Press Continuous Measurement to put the SMU in a continuous source and measurement state. The SMU will now source +0.5A.
6. The battery will now re-charge.
7. When the battery has fully re-charged, press CONT and put the SMU in MANual trigger mode. Now, turn off the SMU output.

