Battery EEPROM Works

Software description and users manual

Overview

Battery EEPROM Works is designed to simplify the process of laptop battery repair. This process can be divided in two parts: cells replacement and fixing the content of EEPROM or integrated Flash of laptop battery controller. While cells replacement is easy and can be made by any technician who can work with welding machine, EEPROM fixing is very complicated and important task and can be made only by the personal with special skills and equipment. Battery EEPROM Works makes this process as easy as 1-2-3. All the technician needs to do is just to connect EEPROM chip to adapter, choose the chip model in menu and press the button. All the necessary work will be made by the software. The laptop battery data will look like a brand new: Full Charge Capacity will be the same as you entered and will reflect real cells capacity, Cycles Count will be set to zero, and Manufacturer Date will be changed to current system date, Permanent Failure Flag will be removed and all the additional necessary changes will be made too. Battery EEPROM Works supports a lot of laptop batteries of different manufactures.

Main features

Battery EEPROM Works can:

- Read SMBus data from laptop battery terminals.
- Save SMBus data in TXT format
- Save SMBus data in proprietary BQD format (BQ208X data file) for further usage in BQ208X chips cloning process.
- Read and write all EEPROM chips used in laptop batteries.
- Read and write Data Flash and EEPROM of chips with integrated memory such as BQ2083, BQ2084, BQ2085, PS401 and PS402.
- Save the dumps of Data Flash and EEPROM in BIN format.
- Reset (renew) the chip data to factory new values in 1-click.
- Clone password protected chips with integrated Data Flash (BQ208X) using new or not protected chips.

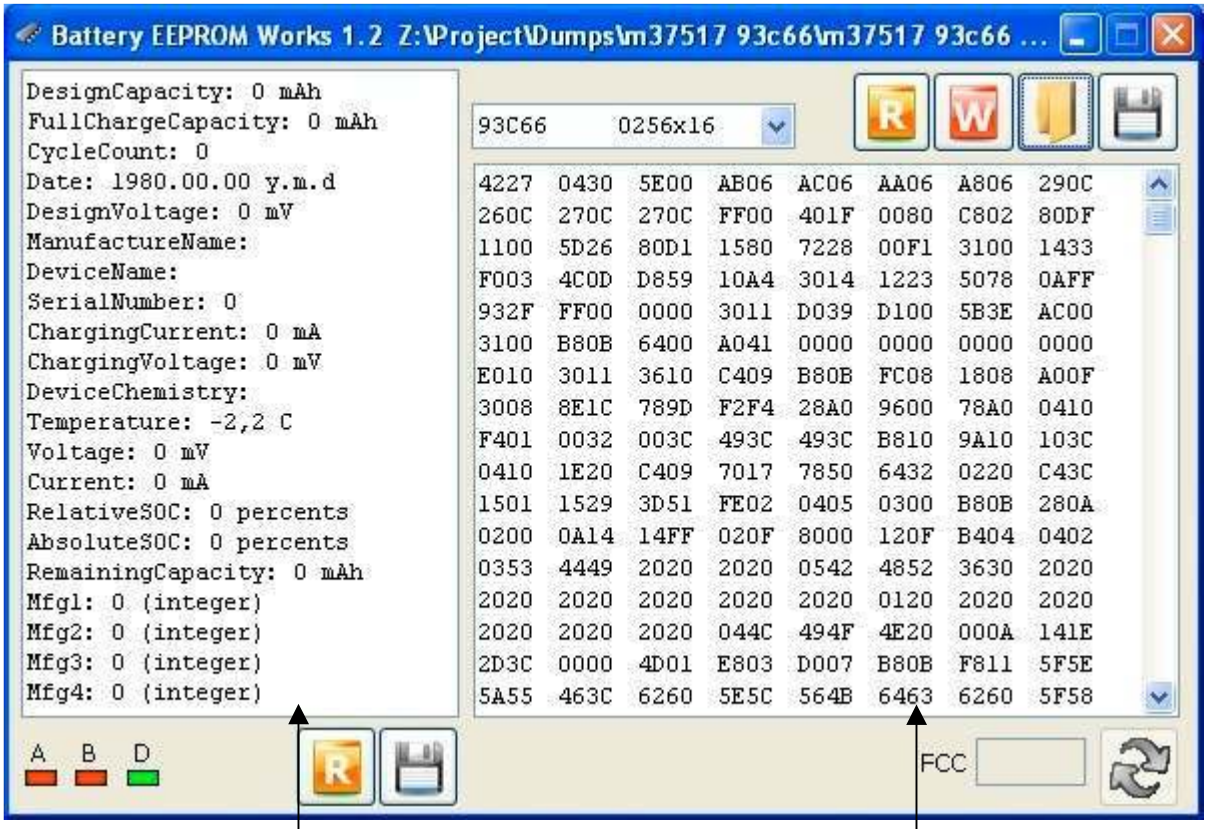
Supported chips

Supported MCU chips:
BQ2040, BQ2060, BQ2063, BQ2092, BQ8011, BQ8012, PIC16C63A, M37515, M37516, AS3XXD, MAX1780

Supported external EEPROM chips used in combination with MCU chips listed above:
24C01, 24C02, 24C04 (24C046), 25LC040, S29190A, S29220A (93C56), 93C56, 93C66, 93C76, S29194A, S29394A, AK93C45A, AK6440A, AK6480A, M95640, BR9040.

Supported chips with integrated Data Flash or EEPROM:
BQ2083, BQ2084, BQ2085, PS401, PS402, BQ8020, BQ80201, BQ20Z70, BQ20Z80,BQ20Z90.

Program window



LED “A” indicates status of adapter. Green – OK, red – ERROR
LED “B” indicates status of battery. Green – OK, red – Not found
LED “D” indicates status of dump loaded in Dump window. Green – Supported, red - Unsupported

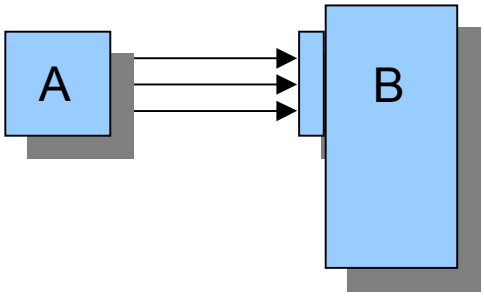
Buttons to read Battery data from battery terminals and to save the data in TXT or BQD format.

Buttons to read, write EEPROM chips and chips with Integrated memory, load binary files in Dump window and save the contents of the window in binary file.

FCC – Full Charge Capacity value
Button – Reset button

How it works

Reading and saving Battery data:

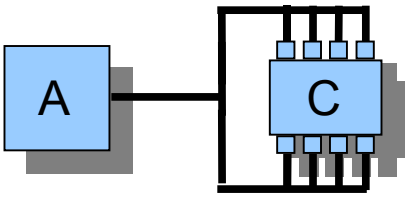


Connect SCL, SDA and GND pins of adapter to battery terminals.

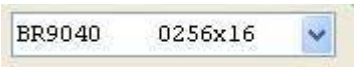
Press button to read the Battery data.
LEDs “A” and “B” must change to green and you will see the data in Battery Data window. Then you can press button to save data in TXT or BQD format.

Note: Cells must be connected and battery must be placed in normal mode.
To place battery in normal mode momentary apply the voltage about 10V to its terminals.
To find SCL and SDA terminals just try different combinations. These terminals are always next to each other. Avoid to connect positive terminal of the battery to adapter.

Reading and writing chips:



Connect chip to adapter



and choose its type in Chip menu.

Use the buttons to read, write and save the chip data.

Note: If the dump in Dump window is supported by the software, LED “D” will change to green.
To read and write BQ208X or PS40X chips you must to connect battery to adapter as it's described in Reading and saving Battery data section.

Reseting chip:

If you want to reset external EEPROM chip then connect it to adapter as described in Reading and writing chips section, if you want to reset BQ208X or PS40X chips then connect battery to adapter as it's described in Reading and saving Battery data section.

Choose chip in Chip menu.

Press button to read the chip. You will see the data in Dump window.

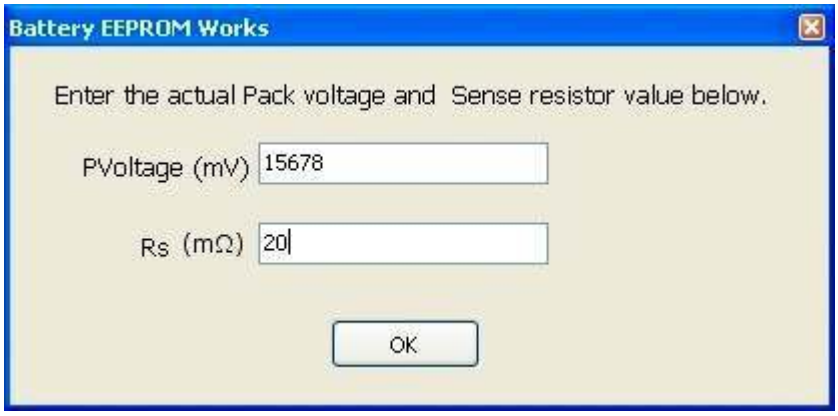
If the dump is supported,then LED "D" will change to green, FCC field and Reset button will change to enabled. Enter FCC value and press button. If reset is successful then corrected data in Dump window will change to blue.

Cloning BQ208X chips:

If the battery based on BQ208X chip is password protected (Sealed) you will be notified by the software about it when you try to read the chip. The most effective way to fix the battery with sealed chip is to consider the chip as "dead" and replace it with unsealed one (brand new or used). But you can't simply replace the chip. It's necessary to transfer configuration data from sealed chip to unsealed. Battery EEPROM Works has a special feature to make it.
Connect battery with the sealed chip to adapter as it's described in Reading and saving Battery data section.

Read the Battery Data. Press Save button and in Save dialog choose "BQ208X data file".
Save the file.
Replace the chip and connect the battery again.

Read the dump of the new chip. Data will appear in Dump window, FCC field and Reset button will change to enabled. Press button and open saved BQD file.
Then enter FCC and press . New window will appear.



Measure your real cells pack voltage with voltmeter and enter it in PVoltage field. Value must be measured with 1mV accuracy.
Enter Sense Resistor value in Rs field. Value must be entered in Milli-Ohms. For example if Sense Resistor is marked "R02" then you need to enter 20, if "R025" then 25 etc. Some batteries have several resistors connected in parallel or in series or both. You need to calculate the total resistance and enter it in Rs field. For example if you have two resistors on PCB marked "R02" connected in parallel then you need to enter 10.
Cloning and reseting procedure will be performed. After the process complete the changed data will be displayed in Battery Data window.

Note: In many batteries you can replace QB8020 or BQ80201 chips with BQ2084 using cloning procedure. Check if pin 11 of BQ29312 is connected to pin 1 of BQ80201 via resistor. If so then you can reset this BQ80201 or replace it with BQ2084 using cloning procedure. If pin 11 of BQ29312 is connected to pin 4 of BQ80201 then this firmware is not supported yet.

.GG files

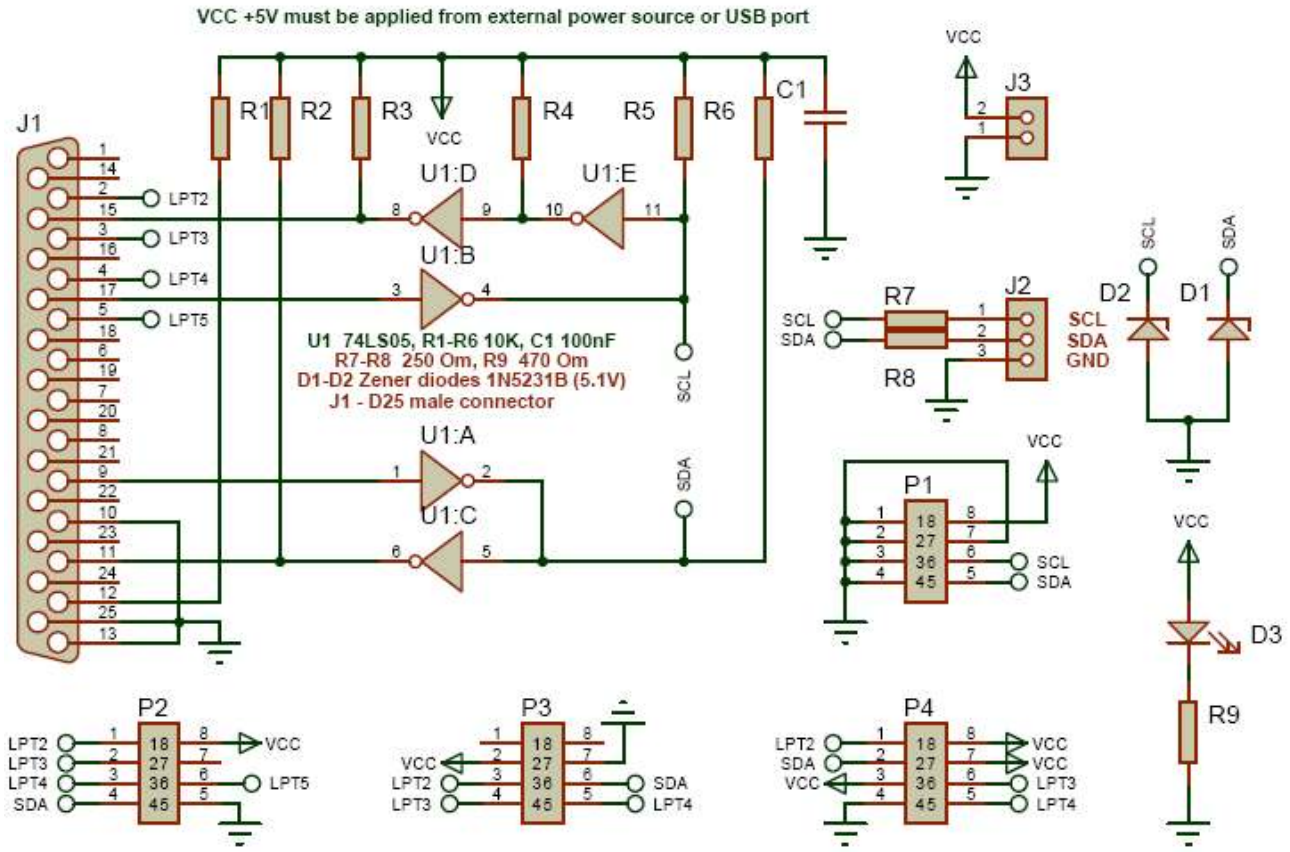
Starting with version 1.82 we include support for .GG (Gas Gauge) files that is a proprietary format of Texas Instruments company. Actually its a text file with a set of data flash parameters for BQ20XX chips. Just read the chip or open a binary file of BQ20XX data flash and then open the .GG file you. Values in dump window will change. Then just press Write button and new parameters will be stored in data flash. In your installation directory you can find two samples of .GG files for BQ2083/85 and BQ2084. The values stored in the files a default values from datasheet. You can change any number of values. For example if you want to change Manufacturer Name , Date and Cycles count you need to create a text file with 3 strings:

Manufacturer Name=Test
Cycle Count=0
MfrDate(yyyy-mm-dd)=2009-07-07

Save the file as mytest.gg. Read the chip or open a binary file of BQ20XX and then open mytest.gg file. The data will change. Pres Write button. The data will be stored in data flash. Now if you read the battery you will see that Manufacturer Name become "Test", Cycles count become 0 and Manufacture Date changed to 2009-07-07.
In 1.82 version .GG files are supported for BQ2083, BQ2085 and BQ2084 chips only.

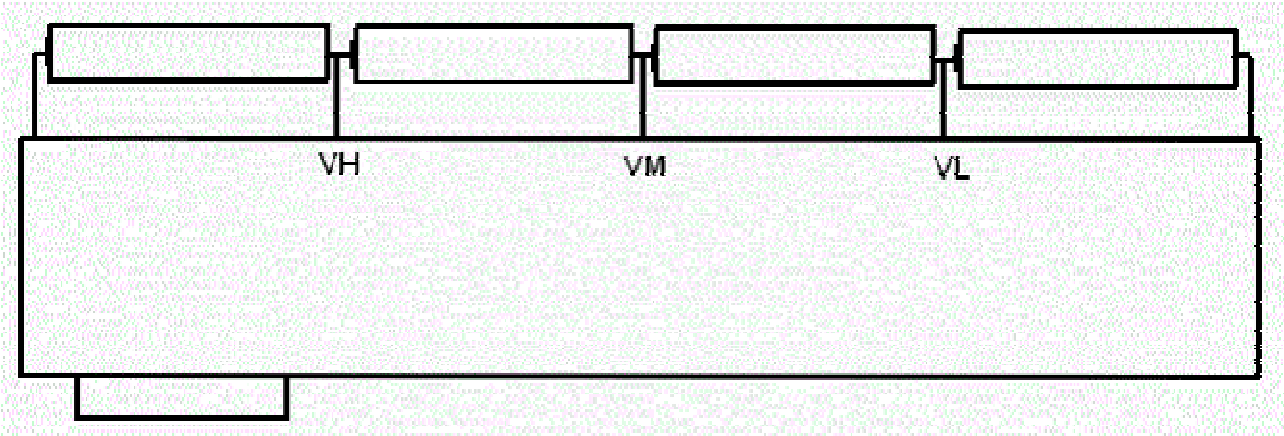
Hardware

The hardware of Battery EEPROM Works is based on Philips I2C Parallel Port adapter.
Socket P1 is used to connect 24C0X chips, P4 is used to connect 25LC040 and M95640. Other supported chips must be connected to sockets P2 or P3 depending on package. The fastest way to find the right socket (P2 or P3) is just to try to read the chip.
R7, R8, D1 and D2 are used to protect adapter and LPT port from overvoltage.
PCB design for single sided board can be found in your installation directory .



Cells tester

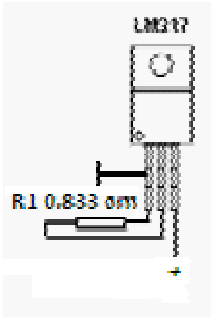
Cells tester is designed to check the cells condition
When you buy new cells you must to check if they meet your needs or not.
The most important parameters are cells impedance (internal resistance) and cells capacity.
You don't need to check all the cells you bought. Check just several cells in the stock.
If they match the parameters stated in specification then most likely whole stock is OK.
First check the cells voltage. If you buy them from trusted manufacturer then all of them must have the same voltage.
Battery must support transmitting each cell voltage via SMBus. You can use PCB with BQ2060 or BQ2085 chips. Battery must have cells connected only in series. No parallel connections are allowed for measurement.



Fully charge the battery using external adjustable power source.

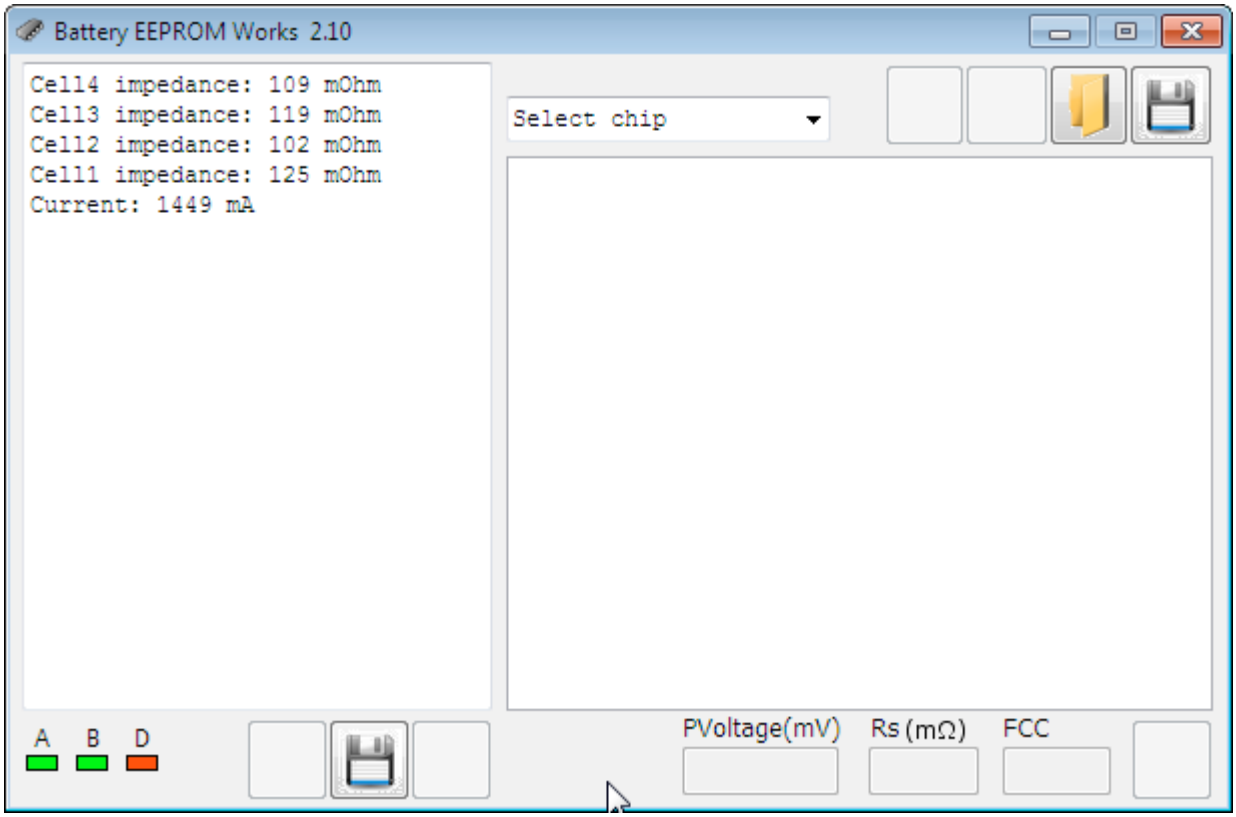
While charging limit the current with 1.5A and the voltage with number of cells in series * 4.2V.
For battery shown on the picture (4 cells) it's 16.80V (4.2V*4).

To check impedance and capacity connect the battery to adapter and apply external load.
Use load shown on the picture:

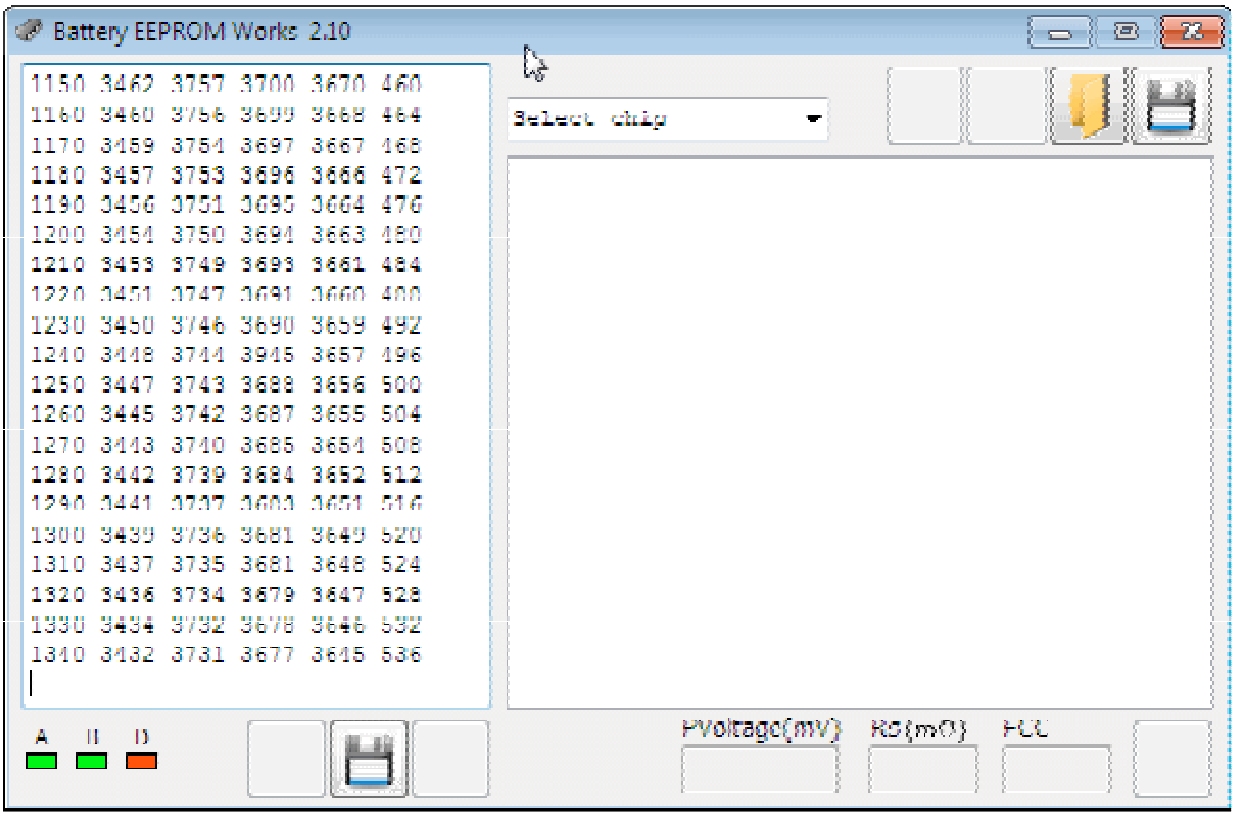


So you must:

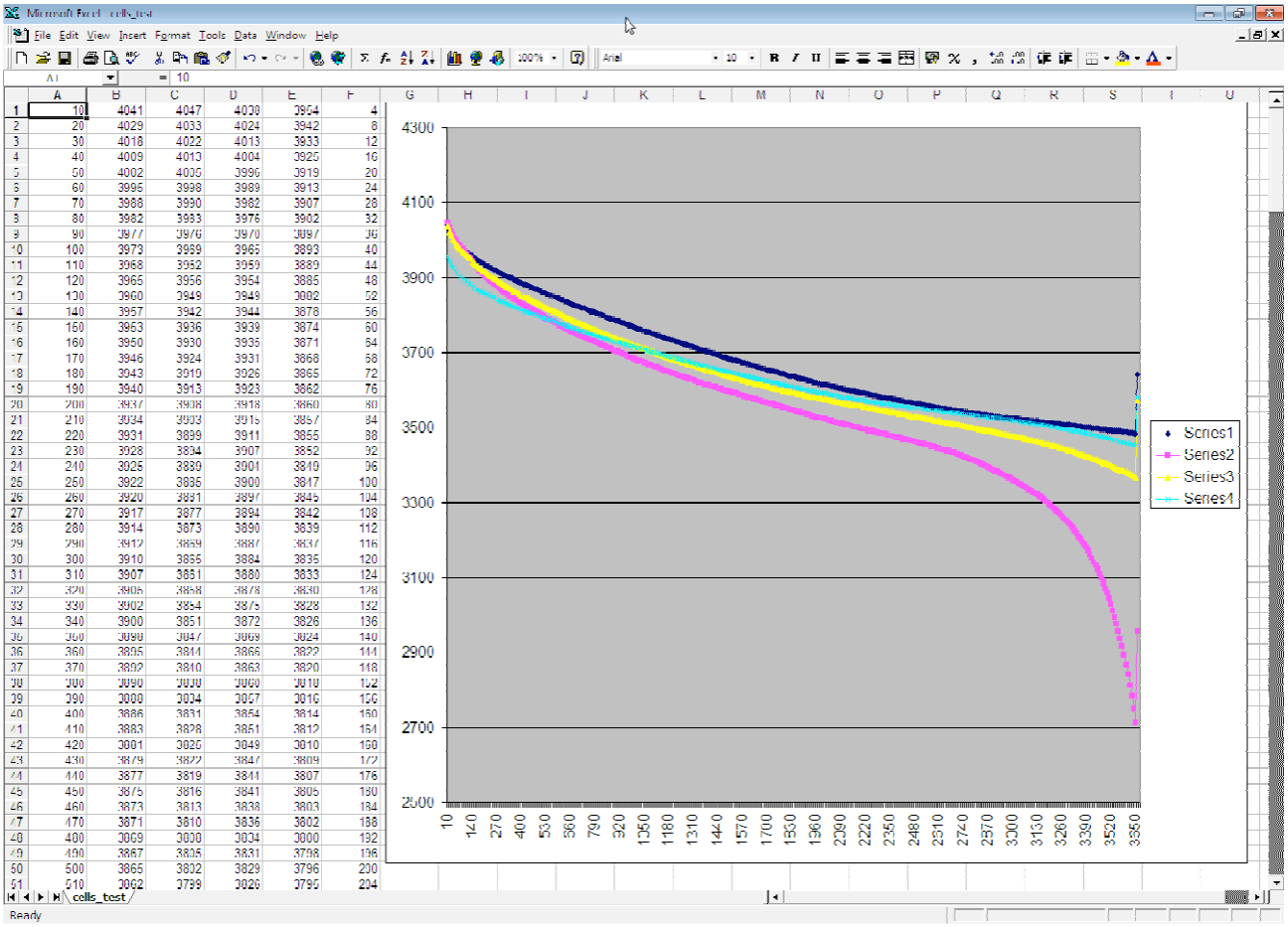
1. Connect the battery to adapter.
2. Try to read it.
3. If you can read the battery then press "Cells Tester" button.
4. Connect load.
5. The process will start automatically.



If you want only to test cells impedance then disconnect the load after impedance measurement is finished.
In battery data window you'll see the log of measurement.
The columns are time, VC1, VC2, VC3, VC4 and capacity.



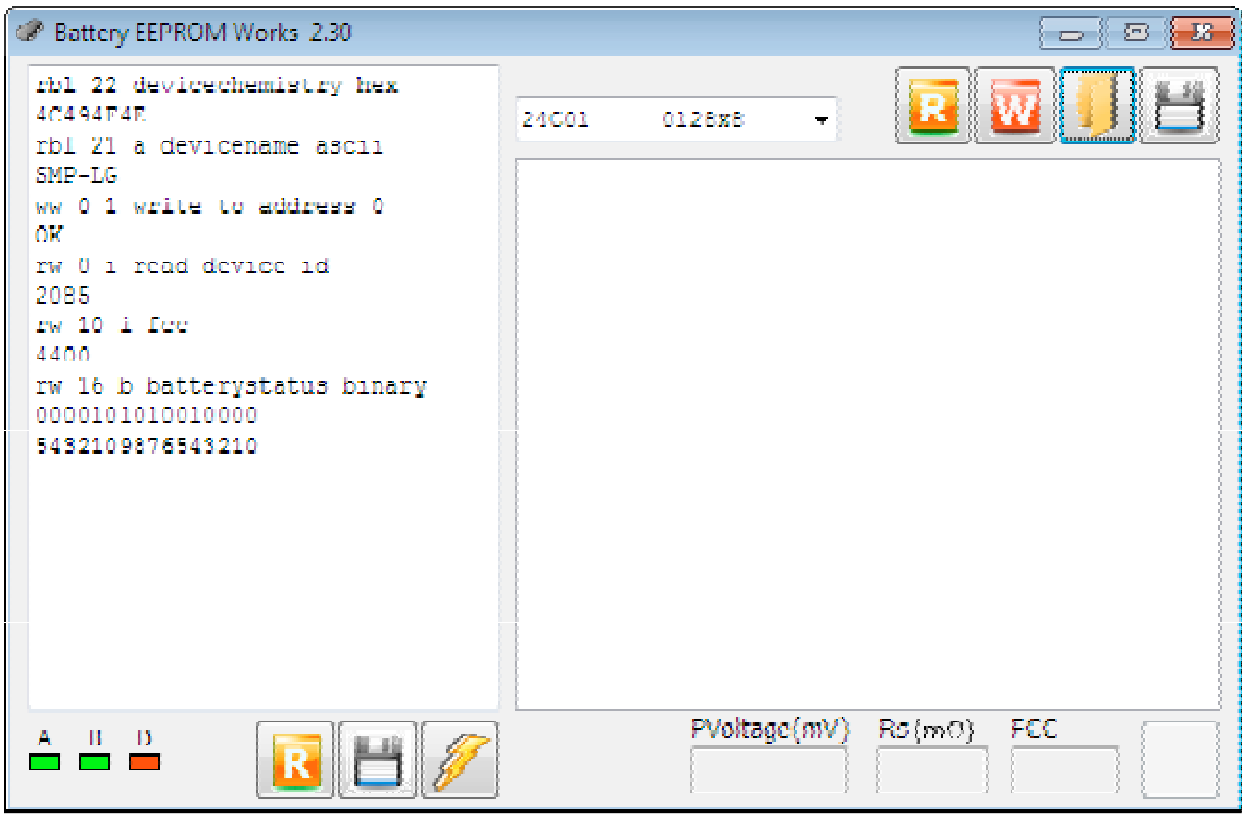
Disconnect load when any of cells reach 3V, The measurement will stop automatically.
After measurement is complete you can save the data to text file.
For better result you can export the text file to spreadsheet software for example Excel to see the graphs.



SMBus commands

Create a text file with "smb" extention.
Open the file in BE2Works.

Now you can enter SMBus commands in Battery data window and execute them.



If file is empty then type commands in the window and press CTRL+ENTER to execute.

Supported protocols:

Red word (rw)
Write word (ww)
Read block (rbl)

With or without PEC.

The commands have the following format:

Red word (rw):
rw aa f
Where: aa - address, f - output format (optional).
Valid output formats for this command: d - date, i - integer, b - binary and hex if empty.

Write word (ww):

ww aa dddd
Where: aa - addres, dddd - data to write.

Read block (rbl):
rbl aa f
Where: aa - address, f - output format (optional).
Valid output formats for this command: a - ascii and hex if empty.

You can enter comments directly in command line (see example).

You can edit commands and execute them directly.

To save a set of commands save it as *.smb file.
Only command lines will be saved and you can reuse this set later.
You can find example (test.smb) in your installation directory:

rbl 22 devicechemistry hex
rbl 21 a devicename ascii
ww 0 1 write to address 0
rw 0 i read device id
rw 10 i fcc
rw 16 b batterystatus binary

To save whole result save it as *.txt.

BQ20Zxx support

To use the software with BQ20Zxx chips you must to have constant power source and constant electronics load.
We recommend to use load based on LM317.
Generally the process flow is the follow:

1. Replce cells with 470 ohms resistors.
2. Connect power source. Ground must be connected to battery ground terminal for sence resistor to be included into circuit. Positive must be connected to most positive point of cells pack.
3. Fill in the calibration file (*.CLB) The sample of the file can be found in your BE2Works directory.
4. Read battery data first.
5. If battery data is OK then read device Data Flash.
6. After Data Flash reading is complete open your calibration file (*.CLB)
7. Follow the wizard.

Now the chip is ready for usage. Remove resistors, connect cells an send SMBus command ww 0 21 to start Impedance Track algorithm.
Begin with calibration cycles. It's very important coz battery will learn its capacity and update impedance table at this step.
1. Fully charge the battery.
2. Let it relax for 2 hours.
3. Discharge the battery with the current that is normal for your laptop. Let's say it's 1500mA.
4. Let it relax for 5 hours.
5 Charge the battery.
6. Check MaxError value sending SMBus command rw 0c i If calibration is OK the value must be 1% If not then repeat the cycle.

For better accuracy Chemistry ID of your cells must match the Chemistry ID of Data Flash.
Most cells use Chemistry ID 100 then if your Data Flash has another Chemistry ID then fill the chip with default Data Flash Image (DFI)
that can be found at your BE2Works directory before calibration. Double check if firmware version of your chip matches the firmware version of Data Flash Image.

Cells with 0100 ChemistryID:

1=A&TB: LGR18650OU
2=ATL: 604396
3=BAK: 18650 C4 (2200 mAh)
4=LG: ICR18650A2
5=LG: ICR18650S2
6=Moli: ICP1003450B
7=Moli: ICR-18650G
8=Moli: ICR18650H (2200mAh)
9=Panasonic: CGR-18650A
10=Panasonic: CGR-18650C
11=Panasonic: CGR-18650D
12=Panasonic:CGR-18650E
13=Sanyo: 18650 JCBFK16
14=Sanyo:UR18650F (FK)
15=Sanyo:UR18650F (JH)
16=Sanyo:UR18650F (JT)
17=SDI: ICR18650-20
18=SDI: ICR18650-22E
19=SDI:ICR18650-20B
20=SDI:ICR18650-20C
21=SDI:ICR18650-20E
22=Sony: 18650GR
23=Sony: US 18650G6C
24=Sony: US 18650GR G6F
25=Sony: US18650S
26=Sony:US18650G4
27=Sony:US18650G5

If you have any questions then post them to our forum http://be2works.com/forum/