User's Manual
of
BMM Toolbox Software

V2.X

All Access Mode
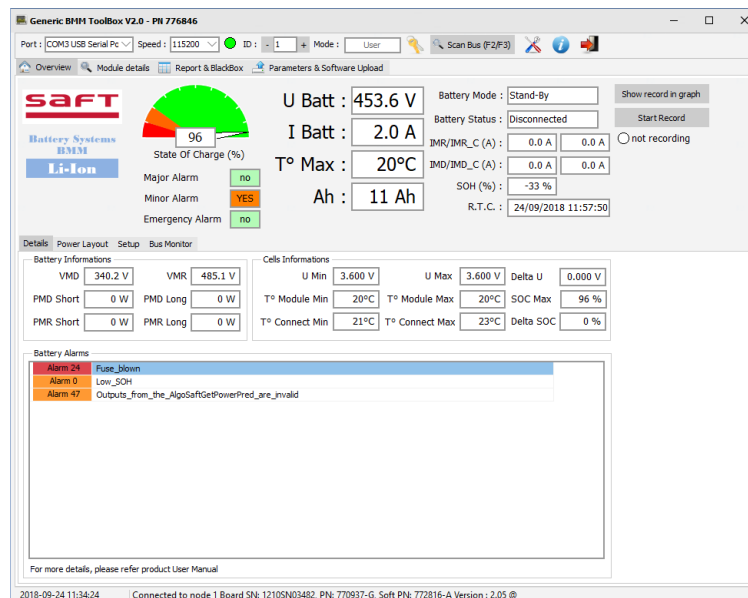
Date: 2018-09-24

UPDATE CHART

VERSION	DATE	REASON	PAGES
1	2017-04-19	Creation	All
2	2017-08-07	Update for version 1.4, with Bootloader function over Ethernet	Chapter 3.3 / 3.4
3	2017-09-07	Document top title update	All
4	2018-09-07	Update for version 2.0, Generic version	All

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ABBREVIATIONS *

ABBREVIATION	MEANING
%	PER CENT
BMM	BATTERY MANAGEMENT MODULE
BMU	BATTERY MANAGEMENT UNIT
CAN	CONTROLLED AREA NETWORK
HMI	HUMAN TO MACHINE INTERFACE
IMD	MAXIMUM CURRENT ALLOWED IN DISCHARGE
IMR	MAXIMUM CURRENT ALLOWED IN CHARGE
Li-ION	LITHIUM ION
MAX.	MAXIMUM
MIN.	MINIMUM
N/A	NOT APPLICABLE
P/N	PART NUMBER
PBIT	POWER ON BUILT IN SELF TEST
POFFBIT	POWER OFF BUILT IN SELF TEST
SOC	STATE OF CHARGE (BATTERY)
SOH	STATE OF HEALTH (BATTERY)
SMP	SAFT MAINTENANCE PROTOCOLE

REFERENCES DOCUMENTS

Reference	Document Name
[DR1]	SED-BP-14-01 - Battery Firmware Update Procedure
[DR2]	D502_ds_d002552-028250 *released 08.08.2016*
[DR3]	D501_Configuration
[DR4]	default_Gateway_Conf.cfg
[DR5]	ICD-KMR-11-113 REV5 Maintenance BMU via MODBUS

1   INTRODUCTION

1.1   DESCRIPTION

BMM TOOLBOX is a diagnostic software that enables to communicate with SAFT Li-Ion Battery for monitoring, installation and service operations on battery.

The different functions of this tool are:

- Identify NodeID and RS Speed of connected batteries

- Monitor the batteries status (voltage, current, temperatures, alarms…)

- Generate status report for remote diagnostic

- Help users during battery commissioning

- Modify battery parameters

- Download and interpret battery BlackBox

- Update battery firmware

- Compatibility with Ethernet/UDP to RS485 Gateway

BMM TOOLBOX Toolbox has advantage to be a All-In-One Software and to be light (13Mo). Its HMI is stable and rugged. Moreover, no installation and admin rights are required.

1.2   WHAT'S NEEDED

To communicate with BMM, the following items are needed:

For Serial communication RS485:

<div style="border:1px solid">

A converter adapter RS485 to USB ex: Brainboxes or FTDI

</div>

For Ethernet UDP communication:

<div style="border:1px solid">

Ethernet/UDP to RS485 Gateway ex:D502G-I-M-BB-TB-LV-UNC

For datasheet [See DR2]

</div>

Minimum computer requirements:

- PENTIUM IV
- RAM memory: 256 Mo
- 15 Mb of free hard disk space
- USB port
- Windows XP,Vista , 7 or later
- 32 bit or 64 bit

No installation and admin rights are required. User has to double click on executable "DiagBMM".

1.3   FIRST BATTERY CONNECTION

1.3.1   SERIAL COMMUNICATION

With the BMM Toolbox Software and an adapter RS485 to USB, communication with the BMM is needed. First, the drivers and the software need to be installed on your computer.

After you have loaded the drivers successfully, execute Windows Device Manager to check the Ports and make sure a COM port number has been assigned. Please note the COM port number that was assigned.

After starting the software, user has to plug cable (Adapter RS485 to USB) from the RS485 communication battery to computer. Then select the right COM port in COM ports list. If only one COM port is detected it is automatically selected and opened.

Select your speed of communication and your NodeId. If you press F2 (for one battery connected), F3 (for more than one battery) or "Scan Bus" button BMM TOOLBOX scans bus communication.

When the communication is established, the BMM Toolbox Software read the embeded software version and loads the "ConfigFileToolbox-V…." corresponding if it's available in the executable directory. If not a pop up asks the user to choose ConfigFile.

Note : See " 2.2 Ressource File" for more information about ConfigFile

When the communication is established, the indicator light is set green and battery data (status, voltage, current, alarms…) are shown. Moreover PN and SN of the connected battery are indicated on bottom of the window.
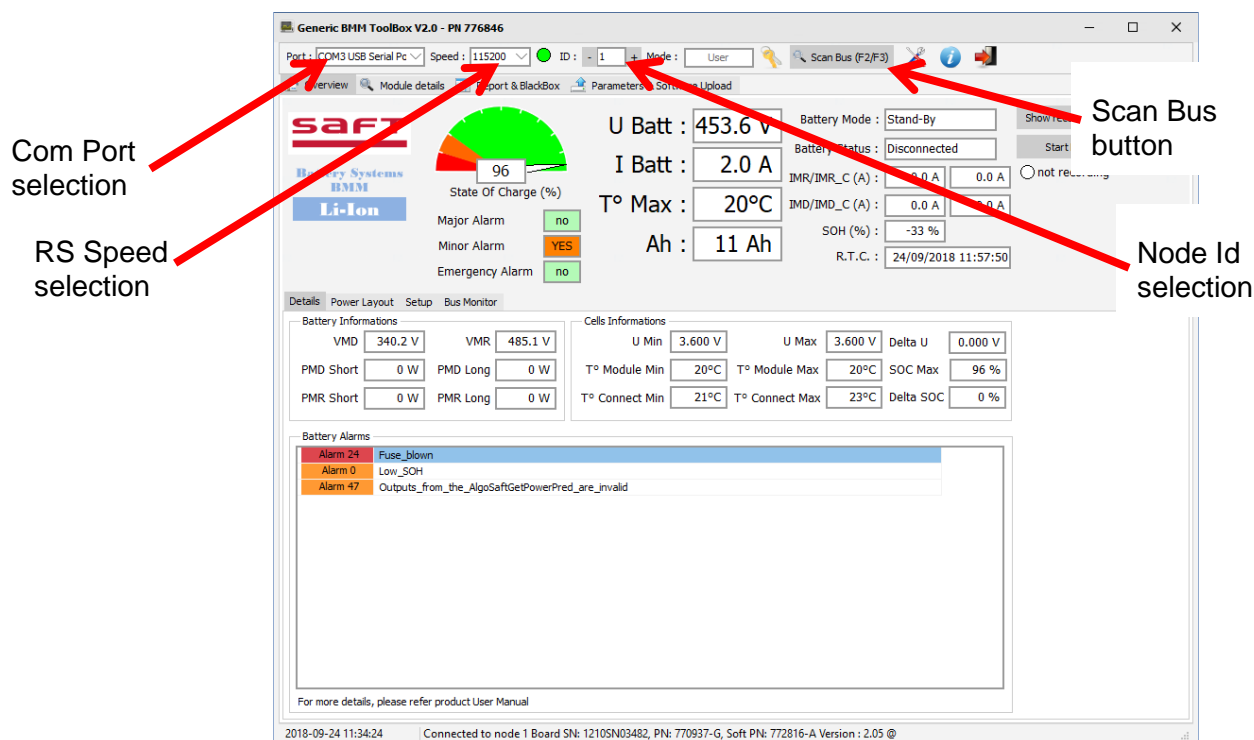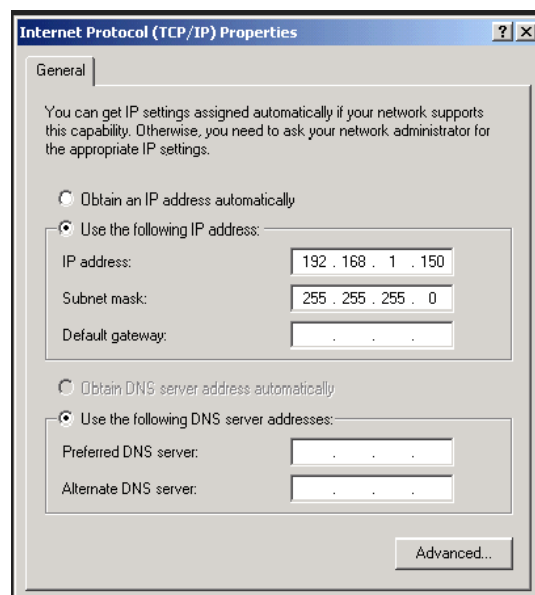
1.3.2   ETHERNET GATEWAY

For Duagon D502 hardware and software configuration See [DR2] and [DR3]

With the BMM Toolbox Software and Ethernet/RS485 Gateway, communication with the BMM is possible. First, you have to know the IP adress and the Port number of the gateway which the battery is connected (depended of the configuration file loaded in the Gateway, See **[DR4]**)

After you have to set the service computer Ip address and net-mask properly.

Ex: with IP gateway = 192.168.1.20 set the service computer as shown:

After starting the software, user has to plug the Ethernet cable (from the Gateway) to computer. Then write the IP address and port of the gateway port in COM ports list like this formalism:

When the communication is established, the indicator light is set green and battery data (status, voltage, current, alarms…) are shown. Moreover PN and SN of the connected battery are indicated on bottom of the window.

To save the preferred IP and Port communication See §0.

Note: Over the Ethernet Gateway, functionalities like "SWupdate" or "Blackbox downloading" are slower.

2   HMI OVERVIEW

The HMI is composed of 4 main elements:

1 - *Communication setup:* This area is dedicated to communication setup. User is able to modify COM port number, communication speed using a combo box and select Node ID using a numerical selector. By default, software uses parameters set as default by user. A indicator light shows communication status.

2 - *HMI Configuration:* This area shows user mode (user, maintenance or expert) allows user to scan the bus communication and to modifiy user configuration.

3 - *Main monitoring:* This area is dedicated to battery monitoring

4 - *Details, Setup anb bus monitoring:* This area shows detailed informations of battery (alarms, battery details, power layout and bus monitoring).
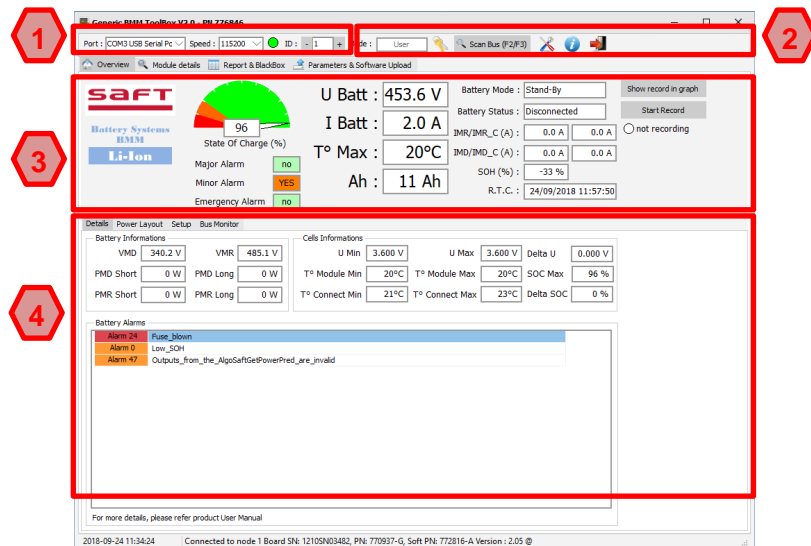
2.1   COMMUNICATION SETUP

User can select by a combo box the COM Port number. By default, BMM TOOLBOX detects available Serial COM Ports and connects automatically. In case of an Duagon Ethernet Gateway use, User have to write the IP and port configurated inside Gateway.

Ex: UDP192.168.1.2:41001

User can set a preferred Serial COM Port or Ethernet IP in HMI parameters and if this port is available is automatically selected and opened on BMM TOOLBOX start-up.

User can also select speed of communication (9600, 19200, 56000 or 115200 bauds) by a combo box. A value of RS_Speed can be set by default in HMI parameters and is used on BMM TOOLBOX start-up.

Speed Selection is not used over Ethernet Gateway because it's set directly in device configuration. See **[DR4]**

User can select the Node ID (1 to 40). A value of Node ID can be configured by default in HMI parameters and is used on BMM TOOLBOX start-up.

The light indicator inform user of communication status. It is purple if no COM port is opened, red if COM port is open but the device ping was unsuccessful and green if COM port is open and the device ping was successful.

2.2   RESOURCE FILES

BMM TOOLBOX is compatible with BMU emebeded software using RS485 communication (define in **[DR5]**) from the version 0.65.

For that the ressource files need to be placed in the same folder as the software executable.
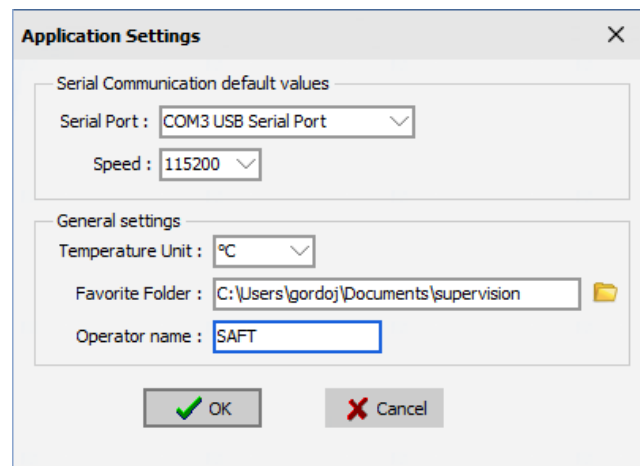
The resource file is link to a embedded version :"ConfigFileToolbox-**VX.XX**.ini".

When communication is started, BMM TOOLBOX request the emebedded software version and load automatically the right resource file. In the case or the resource file doesn't exist in the executable folder, a popup windows invites the user to select the resource file manually.
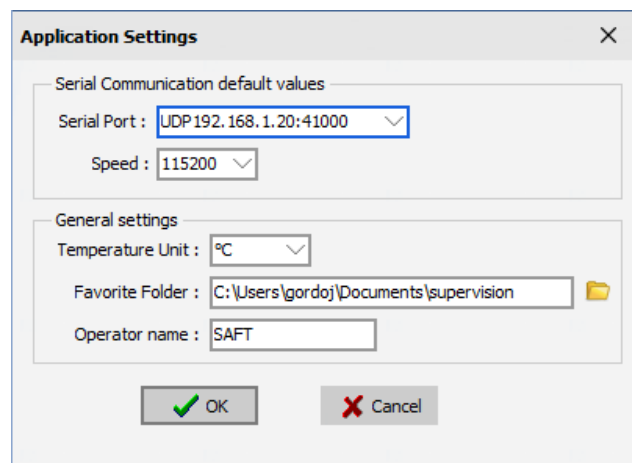
2.3   HMI CONFIGURATION

- By the "tool" button ![tool button] BMM TOOLBOX allows user to save its personal information and pre-ferred configuration

Preferred configuration with Serial communcation
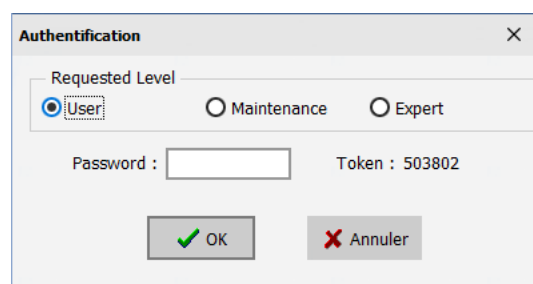
Or with Ethernet communication :

Setup information is stored in configuration file named "Data.dat" and created in BMM TOOLBOX folder. All HMI parameter changes is automatically saved to "Data.dat".

- User can select the user mode by clicking on button ![key button]. To modify the user mode to Mainte-nance or Expert, a password is required.

With Token key, SAFT can give user a temporaly maintenance or expert password.

- "Scan Bus (F2/F3)" button allows user to scan bus communication. BMM TOOLBOX scans bus from Node 1 to 40 among all values of RS_Speed. As soon as battery is found, scan bus is stopped and the communication is established.
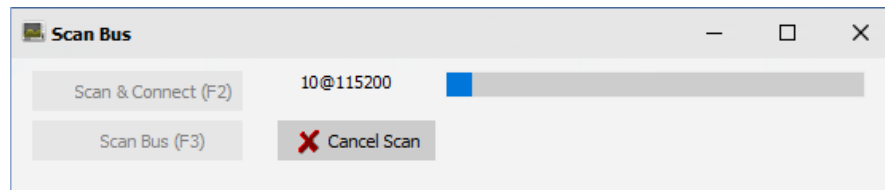
Two scan mode are available:

- Scan & Connect: Scan bus and connects to first battery found. As soon as first battery is found, scan is cancelled and battery set for monitoring.

- Scan Only: launch deep scan of the bus, all speed and NodeId 1 – 40. Monitoring tab is activated and each battery found is shown on monitoring table. No battery is set for monitoring; user has to select battery.

"Scan Bus" not awailable over Ethernet, because it's set directly in device configuration. See **[DR4]**

2.4 MAIN MONITORING

2.4.1 CRITICAL INFORMATIONS

In the area of main monitoring, the critical informations are displayed:

- Battery State of Charge (SOC) (%)

- Battery Voltage (V)

- Battery Current (A)

- Battery Maximum Temperature in °C or °K de pending on user preferences

- Battery Available (Ah)

- Battery State: Init, Standby, Nominal, Safe…

- Battery Status: Connected or deconnected

- Battery Maximum Current in Charge IMR and IMR_C (A)

- Battery Maximum Current in Discharge IMD and IMD_C (A)

- Battery State of Health (SOH) (%)

- Alarm Status (Major, Minor or Emergency Alarm): no or YES highlightned in red if raised else in green

All data are refreshed in real time.

2.4.2 DATA RECORDER AND CHART PLOTER

The button "Start Record" allows user to record all data of main monitoring, battery details and 10 data defined by user.
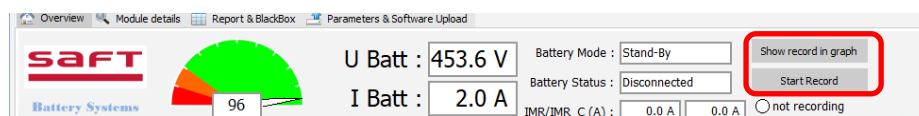
By clicking on button, user has to configure:

- The name of record file and its destination

- The sample period of recording

- The length of recording file. BMM TOOLBOX splits the recording file according to the defined length without loss of information.The file name number is also increase.
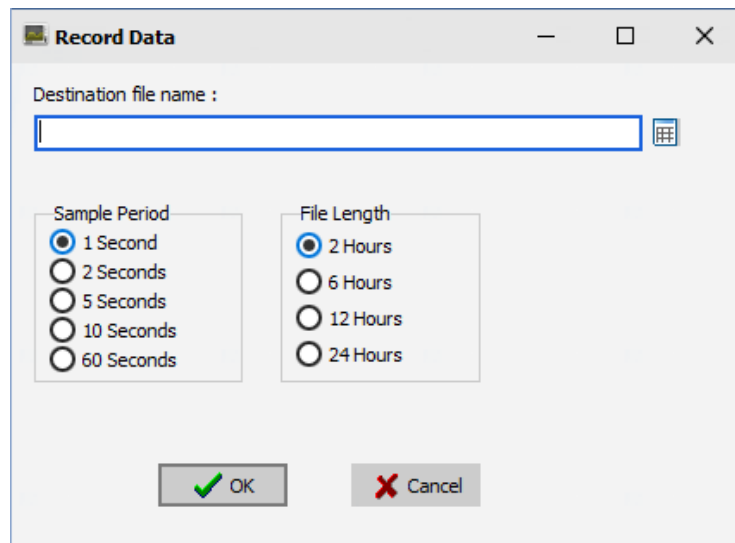
The 10 customAddr data that user can add to the recording are defined in Expert tab (cf §0).

User has to click on button "OK" to start the recording. The light indicator next to "Start Record" button becomes red and displayed "Recording". To stop the record user should click on "Stop Record" button.

The recording file is a .TSV and can be opened by Microsoft Excel or a text editor.

At header of recording file there are:

- Date of start of recording
- Date of end of recording
- PN and SN of BMU
- PN and version of BMM software
- Version of BMM TOOLBOX

Recorded data named files are also dated YYYY/MM/DD_hhmmss

During recording it's possible to display the data in a chart by a click on button "Show record in graph".
The Chart plotter gives the possibility to display the data on two axes (Left or Right). Axes fits automatically depending data values. If it's necessary user can open another chart by a click on button "New chart on same file".
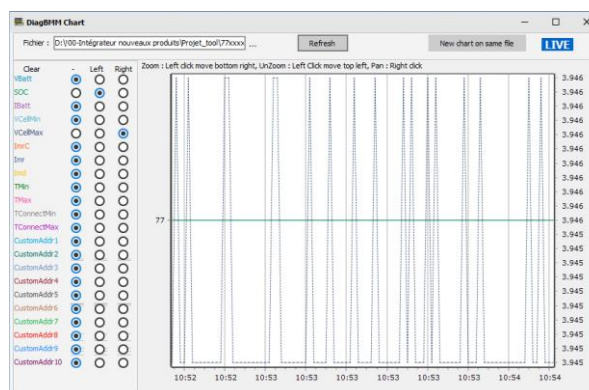
The button "Show record in graph" also allows to display older record files. User has to select the file to display in the left top corner.

2.5   DETAILS, SETUP ANB BUS MONITORING

2.5.1   BATTERY DETAILS

BMM TOOLBOX allows user to get details of connected battery by clicking on the button "Details". The informations shown are:

  - Battery informations:

- Battery Minimum Voltage in Discharge (VMD) (V)

- Battery Maximum Voltage in Charge (VMR) (V)

- Battery Maximum Power in Discharge for a long term (PMD_long) and short term (PMD_short)(W)

- Battery Maximum Power in Charge for a long term (PMR_long) and short term (PMR_short)(W)

  - Cells informations:

- Battery Minimum Cell Voltage (V)

- Battery Maximum Cell Voltage (V)

- Cells Voltage Difference (UMax – Umin) (V)

- Maximum State of Charge (%)

- Cells SOC Difference (SOC Max – SOC Min) (%)

- Battery Minimum Module Temperature in °C or °K depending on user preferences

- Battery Maximum Module Temperature in °C or °K depending on user preferences

- Module Maximum Connection Temperature in °C or °K depending on user preferences

- Module Maximum Connection Temperature in °C or °K depending on user preferences

  - Battery alarms : Number and details of alarms or/and Self-Test are shown and are highlightned in red for a major alarm, orange for a minor alarm and purple for a Seft-Test alarm.

All data are refreshed in real time.

2.5.2   BATTERY POWER LAYOUT

The Power Layout is a representation of electrical system of the battery and shows clearly the contactor status (open or close)
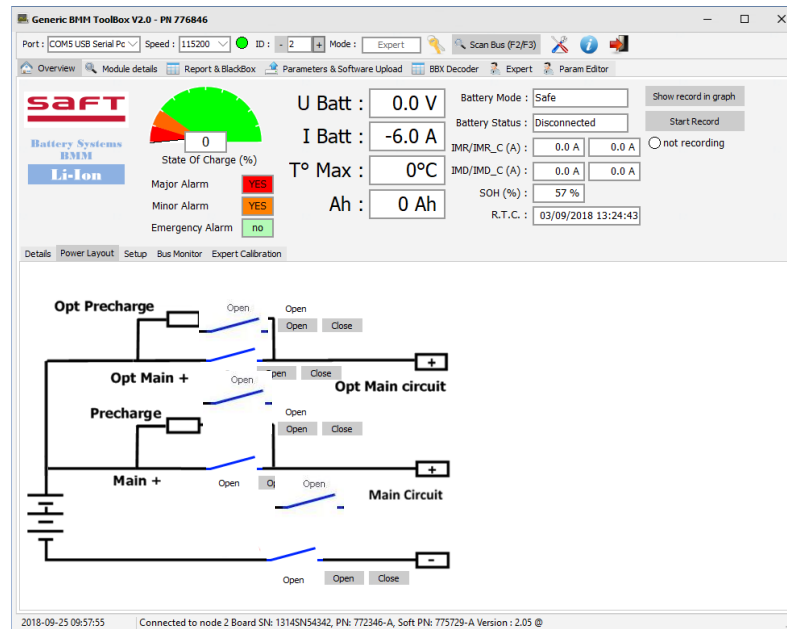
Only in Expert mode, user can open or close the contactors by clicking on "open" or "close" button.

2.5.3   SETUP
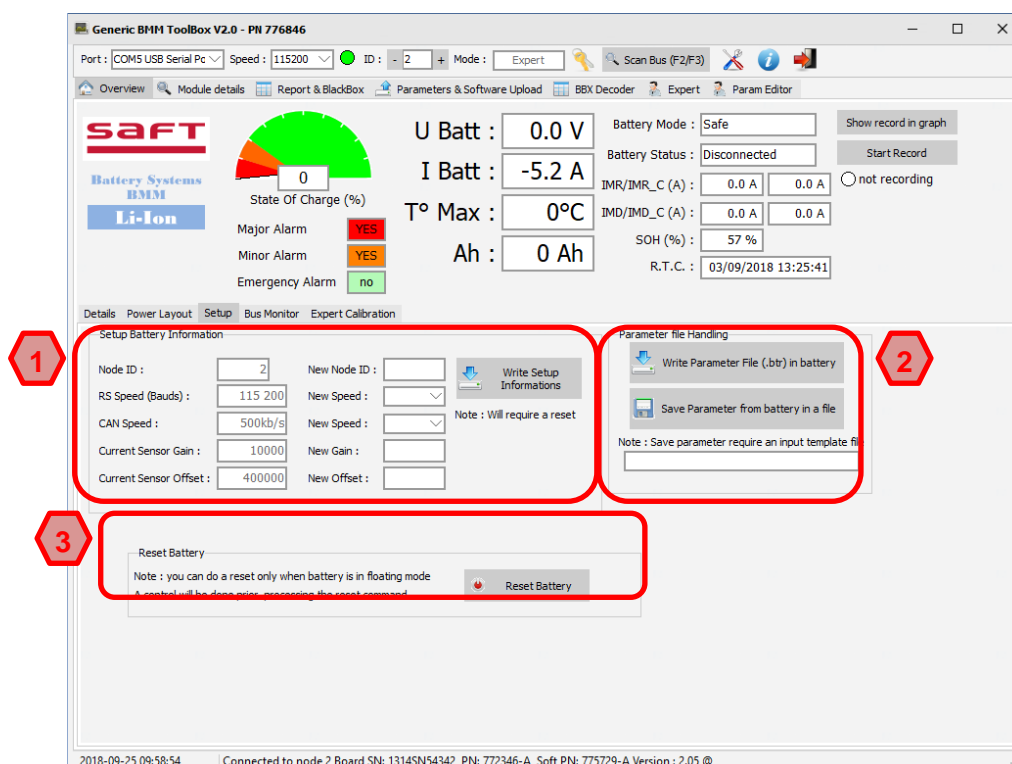
In the field "Setup Battery Information" **1** BMM TOOLBOX allows user in user mode to modify the Node_Id from 1 to 40, RS Speed communication from 9600 to 115200 bauds and CAN Speed from 100kb/s to 1Mb/s by a combo. To save modification, user has to click on "Write Setup Informations". A reset is done automatically after writing.

In Maintenance or Expert mode, user can modify current sensor gain and offset. User has to indicate the new value and then clicks on "Write Setup Information" button.

Note : In case of Duagon Ethernet Gateway use, if the RS Speed communication is modified this setup has to be modified also in the Gateway configuration (see**[DR2]**)

BMM TOOLBOX allows user to write parameter file (.BTR) into BMM or save the BMM parameters into a file (.BTR). **2**

To write, user has to click on "Write parameter file" button and then select the .btr file. To save parameters or calibration of BMM, user has to click on "Save parameters" button and then select a template file .BTR. Then BMM TOOLBOX writes BMM data, defined in the selected template file, in a .BTR file and saves it according to user setting.

If needed, user can reset battery by clicking on "Reset Battery" button in the field "Reset Battery **3** Expert button

2.5.4   BUS MONITOR

"Bus Monitor" allows to display reduced data of all BMM connected on the same BUS.

1 By a click on the buttom "Scan Bus", BMM TOOLBOX scans bus from Node 1 to 40 among all values of RS_Speed.

2 After the reduced data of all BMM connected on the same Bus is display. Bus Monitor highlights the minimum and maximum of SOC, cell voltage and temperature. User can set another active node ID by a click on the link "View".

3 On the left the voltage, SOC, temperature and cell voltage dispersions (difference between min and max) are given.
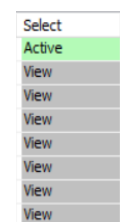
☑ Monitor Bus   When "Monitor Bus" is check, the reduced data are refreshed periodicaly, but this can charge the RS communication. So it's recommended to uncheck the "Monitor Bus" when it is not usefull, BMM Toolbox stops to refresh the data and it starts again when user checks it again without need of another "scan bus".
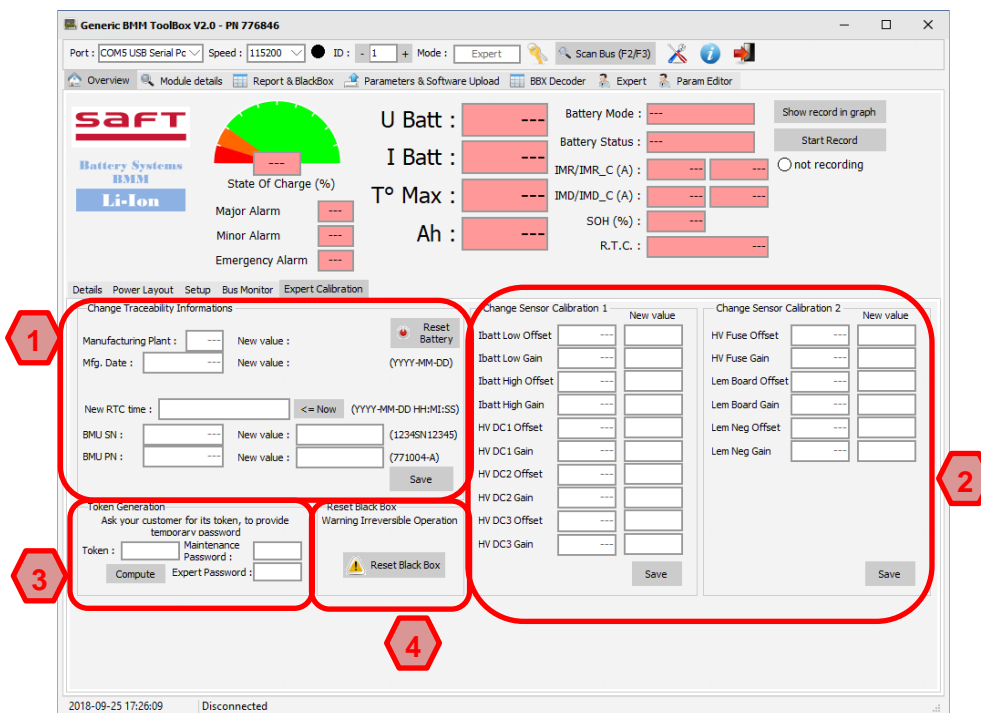
Create Report   "Create Report" buttom give the possibility to generate report status of all the BMM connected on the same communication bus.
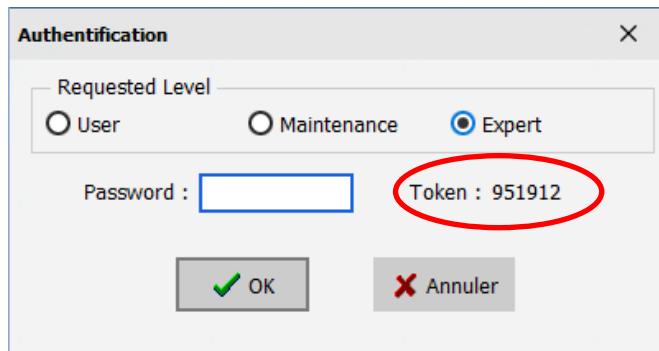
Reset BUS "Reset BUS"
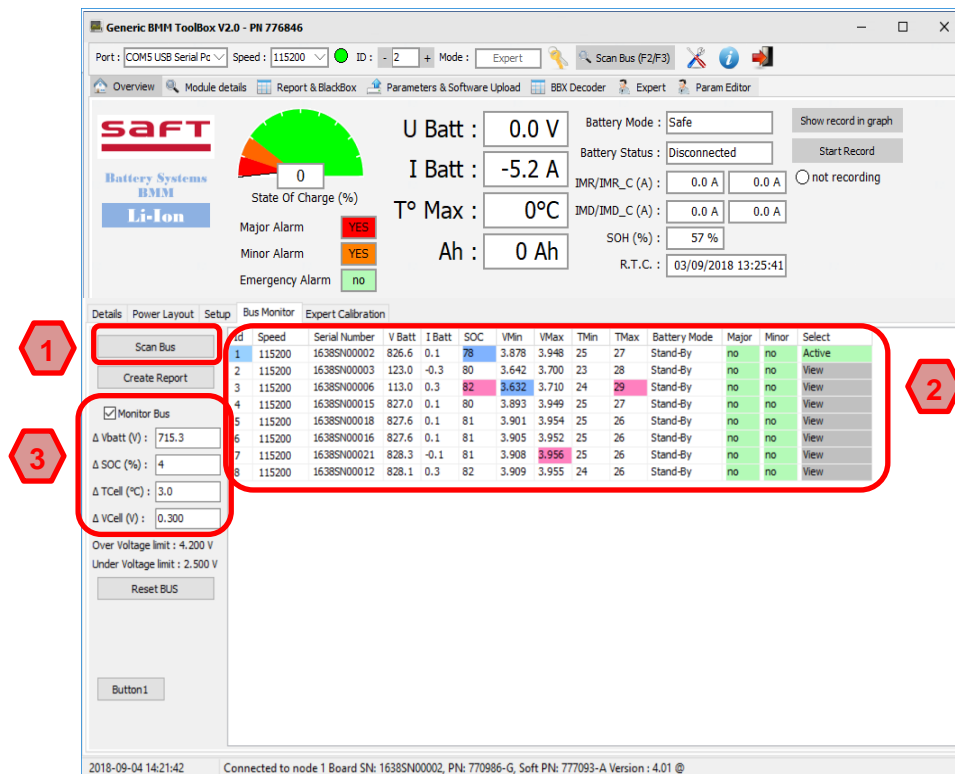
2.5.5   EXPERT BUTTON

This tab appears in maintenance or expert mode.

In maintenance mode, user can read values of tracability informations and sensor calibration of the BMM. Selected in the "Monitor bus" or the current BMM.
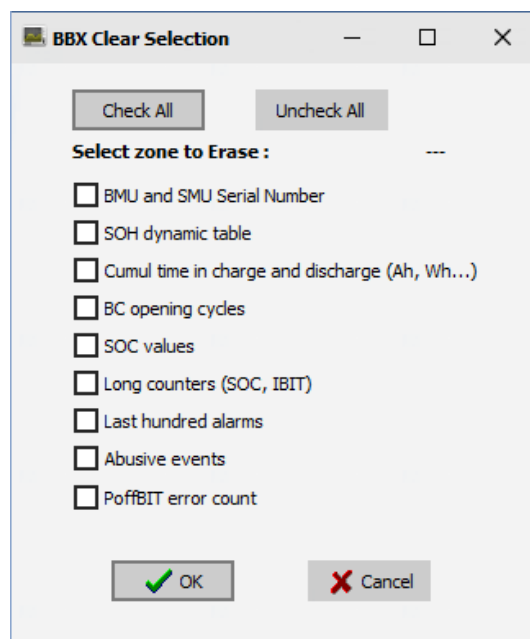
In expert mode, user can read and modify tracability informations and sensor calibration of current BMM. To modify parameters, user has to write the new values and click on "save" button.

(3) In this tab, user in expert mode can create a temporaly password. For that user has to write the Token key displayed in Authentification windows and click on "compute" button. A maintenance and expert password is created.

(4) BMM TOOLBOX allows expert user to reset the BlackBox of BMM.   User has to click "Reset BlackBox" button and select the zone to erase.

After selecting the zone, user has to click "ON" button to start BlackBox erasing.

3 OTHER OPERATIONS

3.1 MODULE DETAILS

"Module details" allows user to have a detailed status of modules of the connected battery. For each module, data displayed are:

- SMU PN and SN

- Umin, Umax et Delta U (V)

- Module cell temperature (t° or K° depending on user's preferences)

- Module Maximum and Minimum Connection Temperature (t° or K° depending on user's preferences)

- SMU board software version

- SMU board parameters CRC

- All cells voltage: Min/Max are highlighted in blue if difference is above 50mv and for any out of range cell voltage it is highlighted in red if cell voltage is below of Vcell_undervoltage or above of Vcell_overvoltage.

On the top of the tab, it is indicated validation of the criteria:

- Emergency alarm

- Availability: connected number of modules is equal to the number of modules defined in BMM parameters

- Software version: all modules should have same SW version

- Parameters CRC: all modules should have same parameters CRC

All data are refreshed in real time.

3.2   SYSTEM REPORTING AND BLACKBOX

BMM TOOLBOX allows user to make report in "Report & BlackBox" tab for current battery or all connected batteries and save it at HTML format.

User has to click on "Download" button to generate a detailed report of battery status. "Save File" allows user to save the report. If the favorite folder is informed in HMI information it is saved automatically on it else user has to select a folder. The name by defaut of report file is "Battery_report_YYYYMMDD_PN"
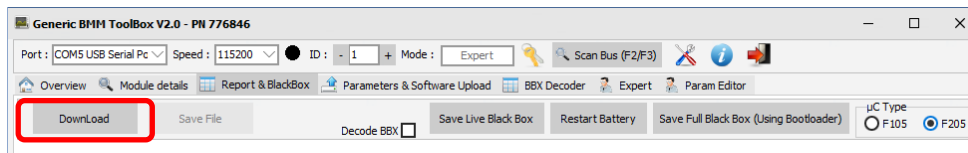
The report is also displayed on the area below buttons.

Data are not refreshed in real time but by clicking on "Download".

BMM TOOLBOX allows user to extract the BlackBox of connected BMM. User can export with SMP protocol or Bootloader protocol.

With SMP protocol, only the most recent zone is extracted.

With the bootloader protocol all zones of BlackBox are extracted.
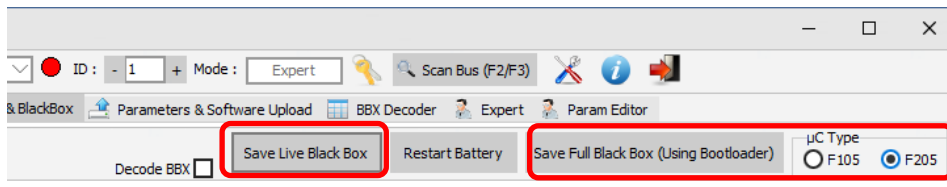
When user clicks on "Save BlackBox" or "Save Full BlackBox" button BMM TOOLBOX extracts BlackBox and saves it in favorite folder else user has to select a folder. The extracted file of BlackBox is a dump of the memory that is to say without decoding. It is saved at .s19 format. The name by defaut of BlackBox file is "BlackBox_YYYYMMDD_PN.s19"

Note : For the Full BlackBox it's important to select the CPU type (F105 or F205) because the memory area are not the same.

In maintenance and expert mode, user can decode(*) automatically the BlackBox by checking "Decode BBX".

The decoding is saved automatically in favorite folder else user has to select a folder and with the same name of .s19 file. The decoding is also displayed on the area below buttons.

*In maintenance mode, only four tabs is decoded and available:

- Tab, « t_Abusive_Event_Timing »

- Tab, « t_BMU_SOH_D_ABS »

- Tab, « t_Saft_Cycle_Data »

- Tab, « t_Cumul »

In expert mode, All tabs is decoded and available.

After a full blackbox save, which used Bootloader function, User can click on "Restart battery" button to send a "GO" to start again the BMU embedded software.

3.3   Firmware Update

3.3.1   DESCRIPTION

BMM TOOLBOX allows user to update the BMU software or battery parameters by "Parameters and Software" tab thanks to an "update package".

Update Package takes place in a .zip file, with .pkg extension, including two kinds of files:

-    One or more firmware source file using .s19 standard (ex: BMU Soft, FlashParam BMU, Parameters and Calibration of Battery)

-    A single text configuration conform using .ini format which define all operations to perform during update process. See **[DR1]** for description of the configuration file.

Example of Update Package:
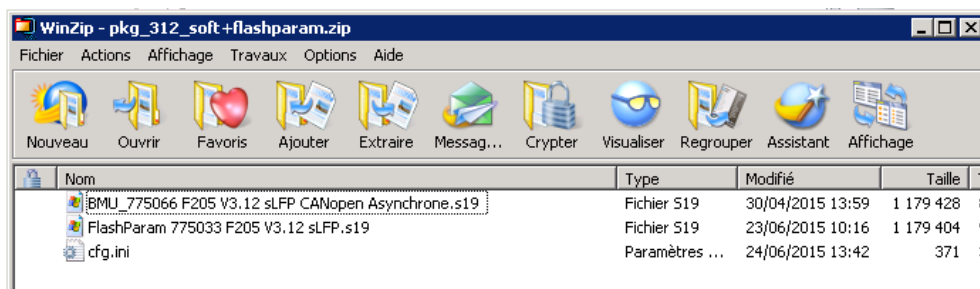
With:

-    BMU_775066 F205 V3.12 sLFP CANopen Asynchrone.s19: BMU soft v3.12

-    FlashParam 775033 F205 V3.12 sLFP: BMU FlashParam v3.12
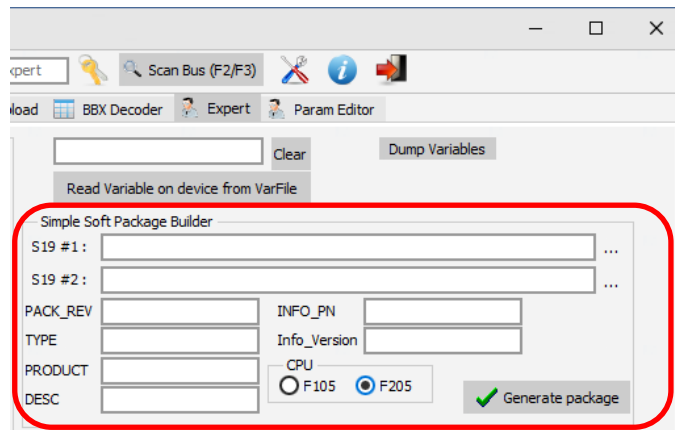
-    Cfg.ini: configuration file

Example of Configuration file Cfg.ini:
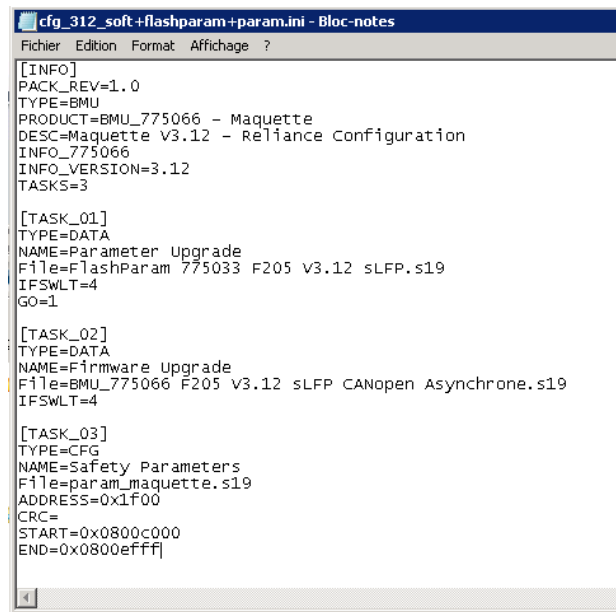
3.3.2   GENERATE SIMPLE PACKAGE

The generation of simple software package is possible by using the builder in tab "Expert".

Expert user has to select the two *.s19 file (flash param in #1), fill the informations about the package and select the CPU target (F105 or F205).

3.3.3   PROCESS

Firstly, select the package and enter a site name. BMM TOOLBOX verifies if all files are consistent with the configuration file and then displays informations about it.
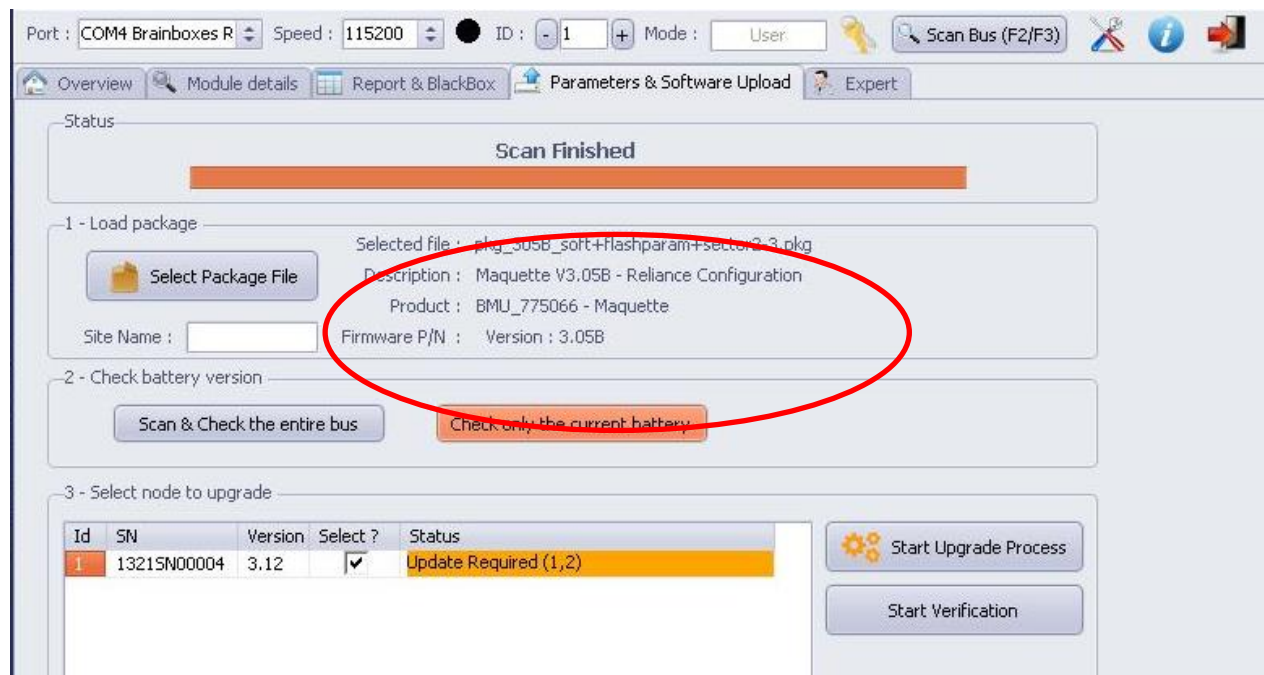
Then, check battery version by clicking on "Scan & Check the entire bus" or "Check only the current battery" button. BMM TOOLBOX displays informations (SN and software version) about the current battery or the entire connected batteries.

BMM TOOLBOX informs user, by comparing version, which task has to be upgraded in the field "Select node to upgrade/Status". Here, in this example, is task 1 and 2.

Select the battery which needs to be upgraded and then click on "Start Upgrade Process" button to start the upgrade.The progression of upgrade is displayed in the field "Status". A popup informs user when the upgrade is finished and suggests to save upgrade report.

In the end, BMM TOOLBOX verifies automatically if the upgrade is done correctly.

In "Report & BlackBox" tab the Upgrade report is displayed.

3.4 BBX DECODER TAB

BBx Decoder Tab is awailable in Maintenance and Expert mode only.

BBx decoder tab allows user to decode BlackBox file .s19 directly on BMM TOOLBOX. User can open the decoding in Excel file.

Click on "Decode BlackBox File" and select BlackBox file .s19. BMM TOOLBOX decodes .s19 file and displays the results. By clicking on "Open Excel File", the decoding is displayed in Excel format.

The decoding is automatically saved in the same folder of .s19 with the same name and in .xlsx format.

In expert Mode all the Blackbox is decoded.

In Maintenance Mode only Five Tab is decoded:

- Decod_BBX

- t_Abusive_Event_Timing

- t_BMU_SOH_D_ABS

- t_Saft_Cycle_Data

- t_Cumul

3.5   EXPERT TAB

In Expert tab, BMM TOOLBOX allows user to display results of variables from a Varfile written by user or displays directly results of 4 variables in real time.

- To read variable from a Varfile user has to write a Varfile which is a document .ini defined as following:

[Variables]

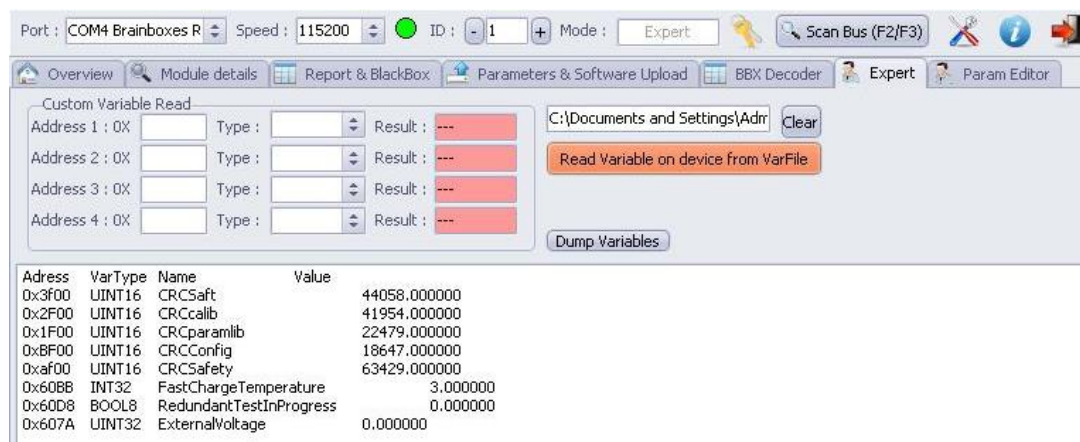VAR1= Variable_name1 Type Dimension Address
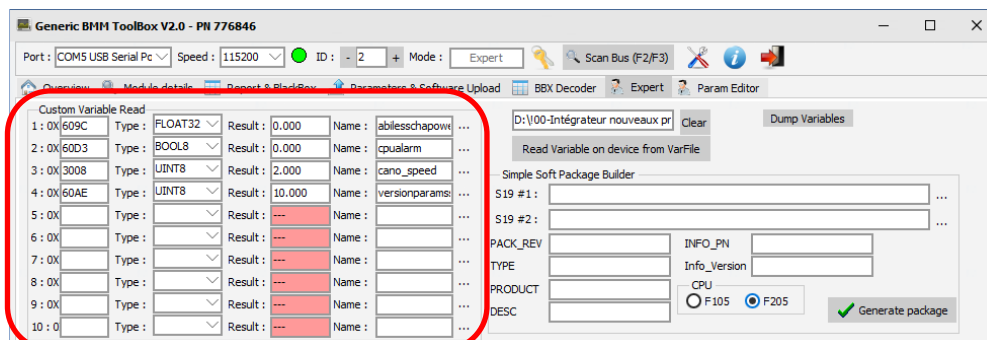
VAR2= Variable_name2 Type Dimension Address
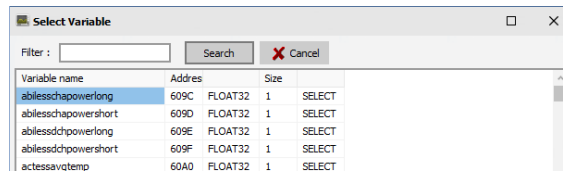
…

Example:

Then click on "Read Variable on device from VarFile" and select the .ini. BMM TOOLBOX displays the results of variables on the area

- User can also select to display the variables available in the resource file. The results is displayed on the field "Result".

For that click on "…" (on the right), and select the variable on the popup windows after a search

- Expert user can also write directly the address and type of the variable if it's necessary.

  The 10 custom variables are added to the recording (cf §2.3.2).

3.6   PARAM EDITOR TAB

Param Editor Tab is awailable in Expert mode only.

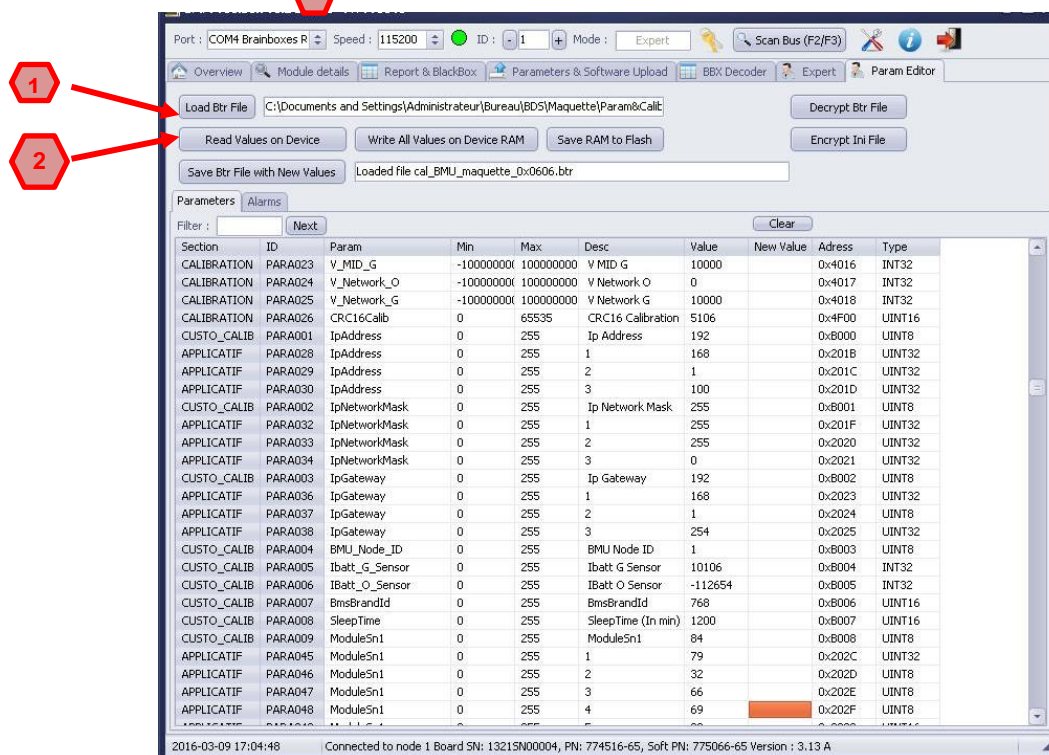Param Editor tab allows user:

- To read parameters and calibrations of battery
- To import parameters and calibrations to battery
- To save parameters and calibrations of battery in .BTR file
- To decrypt btr file or encrypt ini file

3.6.1   READ DATA ON BATTERY

To read data of calibrations or parameters of battery BMM TOOLBOX needs the BTR file as template.

Click on "Load Btr File" button and then select BTR file (ex: ParaCalibBMM.btr, ParaSaftBMM.btr or VarSaftBMM.btr). ①
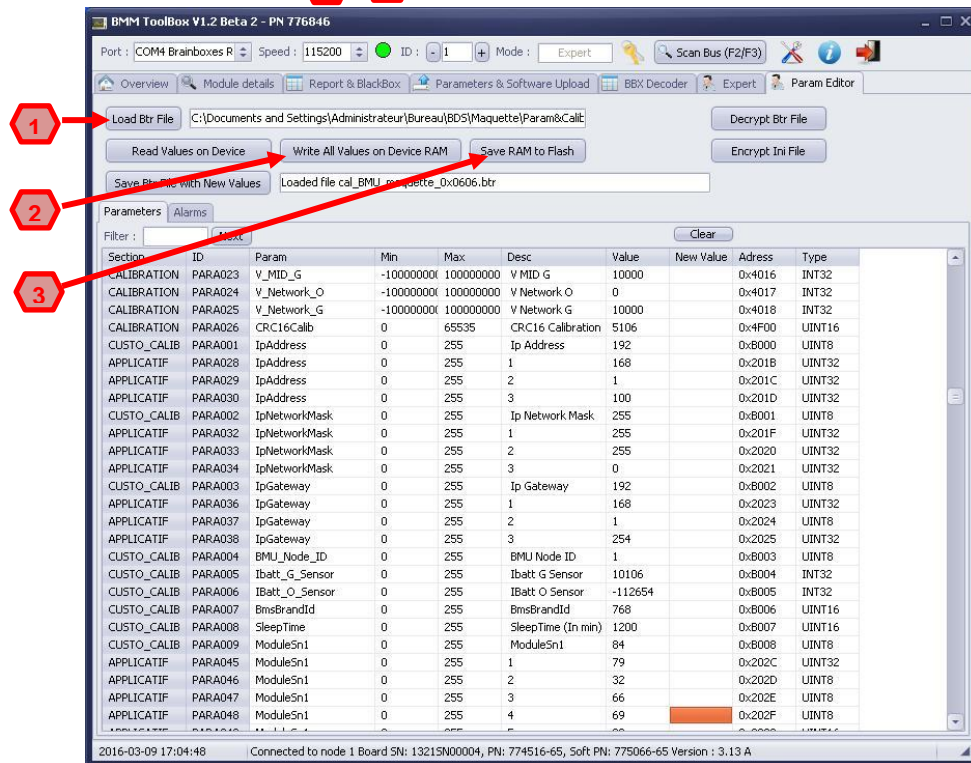
Then click on "Read Value on Device" and BMM TOOLBOX displays all data of battery defined in the selected BTR file. ②

3.6.2   IMPORT DATA TO BATTERY

Click on "Load Btr File" button and then select BTR file (ex: ParaCalibBMM.btr, ParaSaftBMM.btr or VarSaftBMM.btr).   **1**

To import directly all data of BTR file, click on "Write All Value on Device RAM" button and then click on "Save RAM to Flash".   **2** **3**

To import only modified data, enter new values of data in "New Value" column by double clicking on the box. Click on "OK"bouton to validate the new value.

Then click on "Write All Values on Device RAM" button and then click on "Save RAM to Flash".

3.6.3   SAVE PARAMETERS AND CALIBRATIONS OF BATTERY

To save parameters or calibrations of battery, user has to read data of battery. So click on "Load Btr File" button and then select BTR file (ex: ParaCalibBMM.btr, ParaSaftBMM.btr or VarSaftBMM.btr).

Then click on "Read Value on Device" and BMM TOOLBOX displays all data of battery defined in the selected BTR file.
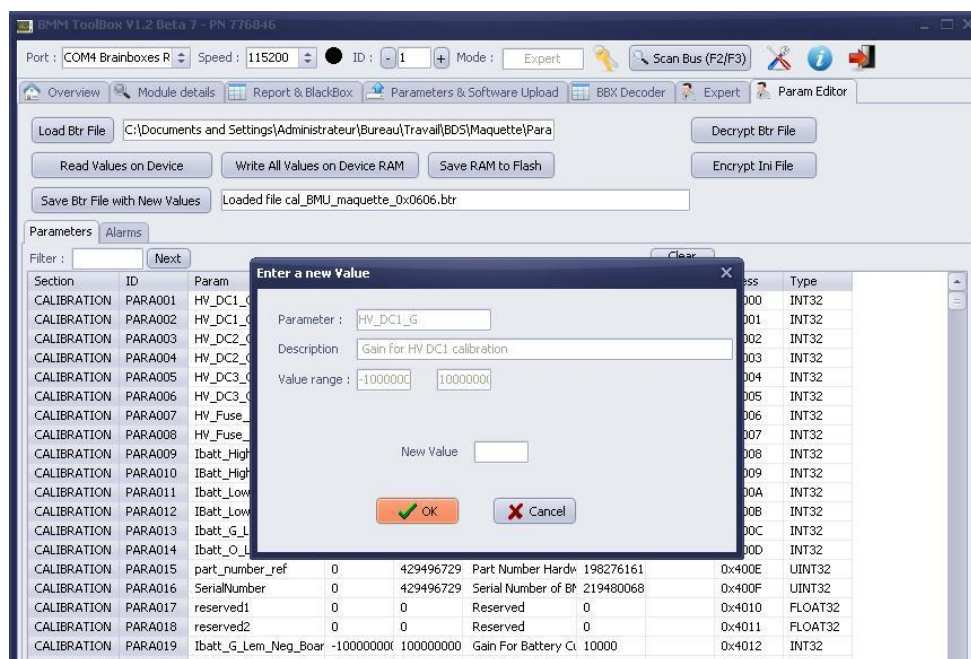
Finally, click on "Save BTR File with New Values"

3.6.4   DECRYPT BTR FILE OR ENCRYPT INI FILE

Param Editor tab allows user to decrypt the BTR file to INI file readable by a text editor and allows user to encrypt INI file to BTR file.

To decrypt, click on "Decrypt Btr File" button and select the BTR File. Then select a folder where the INI file is saved.

To decrypt, click on "Encrypt Ini File" button and select the INI File. Then select a folder where the BTR file is saved.