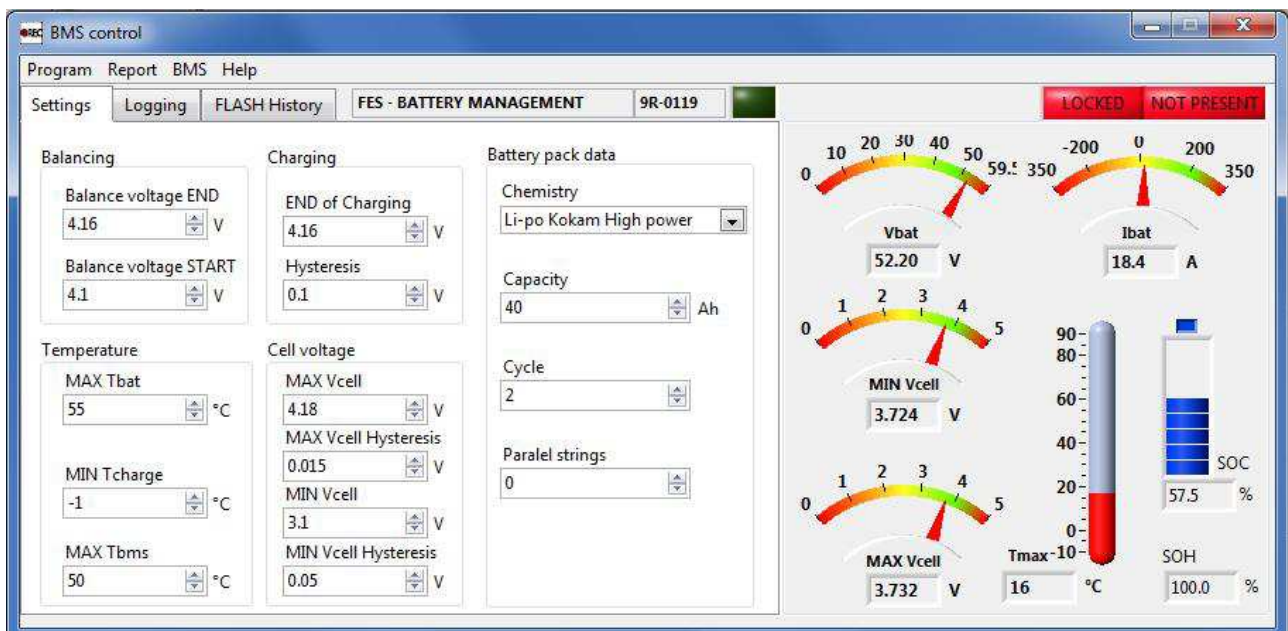




FES BMS CONTROL MANUAL

Version 1.26
for BMS control software version 1.31

Suitable for: -FES BATTERY PACK GEN1 (with external BMS-7R)
-FES BATTERY PACK GEN2 (with internal BMS-9R)



LZ design d.o.o., • Brod 3D, 1370 Logatec, Slovenia • tel +386 59 948 898
info@lzdesign.si • www.front-electric-sustainer.com

Table of content:

1. Important notices.....	3
1.1 Limited Warranty	3
2. Installing the BMS Control Software.....	4
3. Communication cable.....	6
4. Setting communication with BMS.....	8
5. Basic system parameters overview	12
5.1 Data logging.....	14
5.2 BMS settings setup	14
6. Revision history	15

1. Important notices

Please read this manual thoroughly. It contains important information about your system, having a vital importance to the flight safety.

Information in this document is subject to change without notice. LZ design reserves the right to change or improve their products and to make changes in the content of this material without obligation to notify any person or organization of such changes or improvements.



A Yellow triangle is shown for parts of the manual which should be read carefully and are important for proper operation.



Notes with a red triangle describe procedures that are critical and may result in reduced safety or may lead to critical situation.



A bulb icon is shown when a useful hint is provided to the reader.

1.1 Limited Warranty

This LZ design FCU product is warranted to be free from defects in materials or workmanship for two years from the date of purchase. Within this period, LZ design will, at its sole option, repair or replace any components that fail in normal use. Such repairs or replacement will be made at no charge to the customer for parts and labor the customer shall be responsible for any transportation cost. This warranty does not cover failures due to abuse, misuse, accident, or unauthorized alterations or repairs.

THE WARRANTIES AND REMEDIES CONTAINED HEREIN ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED OR STATUTORY, INCLUDING ANY LIABILITY ARISING UNDER ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, STATUTORY OR OTHERWISE. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, WHICH MAY VARY FROM STATE TO STATE.

IN NO EVENT SHALL LZ DESIGN BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, WHETHER RESULTING FROM THE USE, MISUSE, OR INABILITY TO USE THIS PRODUCT OR FROM DEFECTS IN THE PRODUCT. Some states do not allow the exclusion of incidental or consequential damages, so the above limitations may not apply to you. LZ design retains the exclusive right to repair or replace the unit or software, or to offer a full refund of the purchase price, at its sole discretion. SUCH REMEDY SHALL BE YOUR SOLE AND EXCLUSIVE REMEDY FOR ANY BREACH OF WARRANTY.

To obtain warranty service, contact your local LZ design dealer or contact LZ design directly.

2. Installing the BMS Control Software

FES BMS Control setup file is available for download at our dedicated FES website, in download section, under software.

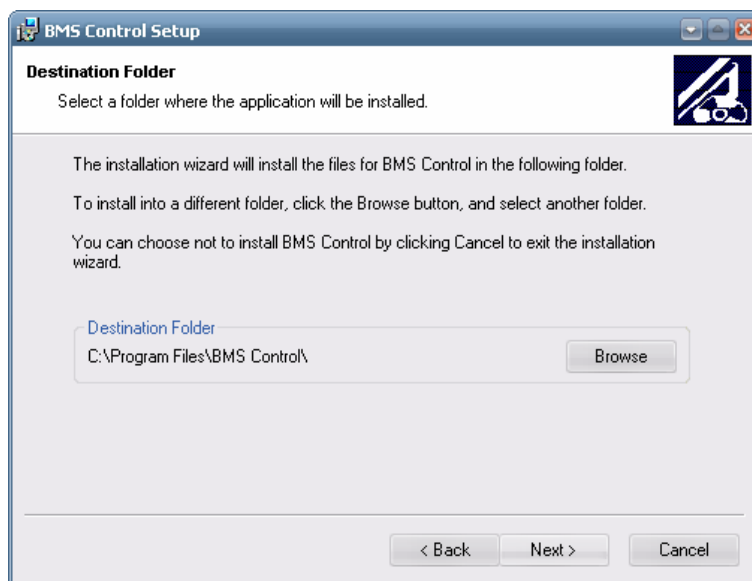
<http://www.front-electric-sustainer.com/download.php>

After download is completed, run the Setup.exe application in the BMS Control Setup folder.

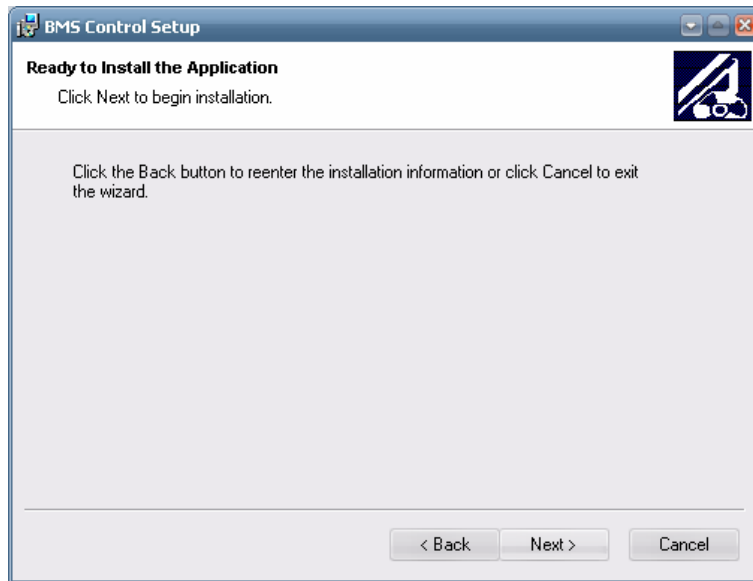
Click "Next" at the **Welcome to the BMS Control Installation Wizard**.



Choose the Destination folder where the application will be installed.



Confirm the installation information by clicking "Next" button or reenter the installation information by clicking "Back" button.



You have now successfully installed the software. Click the "Finish" button to exit the installation.



3. Communication cable

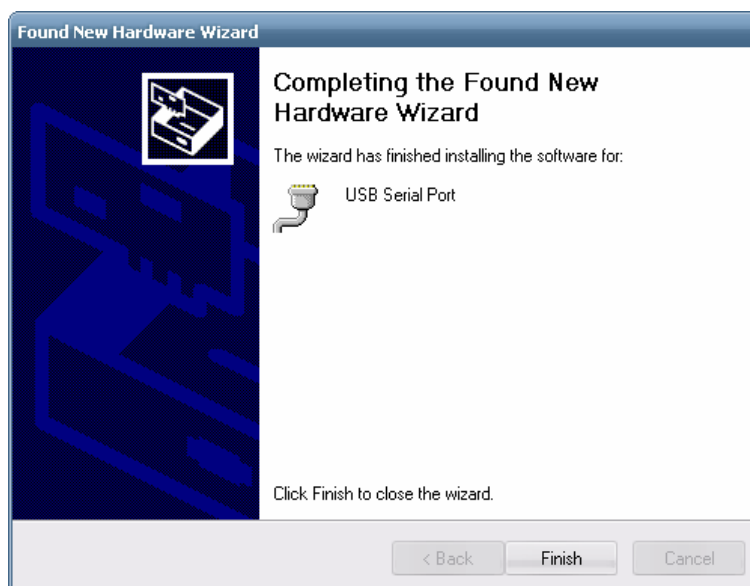
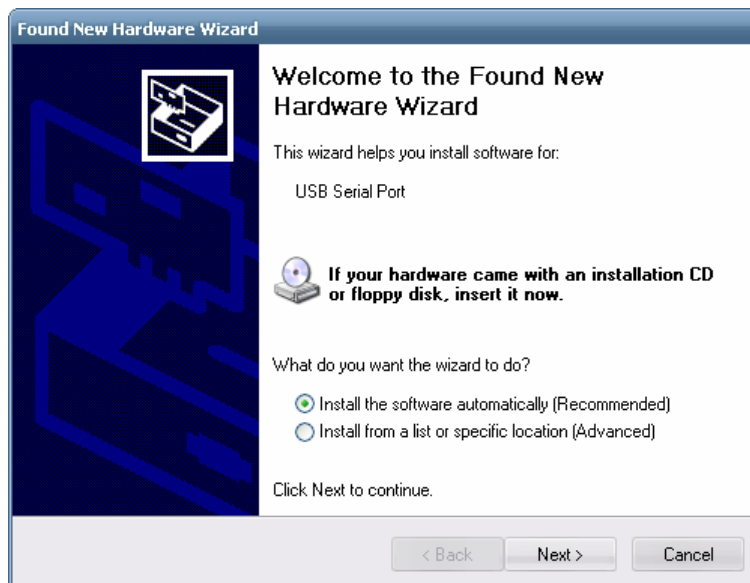


BMS-PC communication cable (suitable for external BMS, GEN1 battery packs)



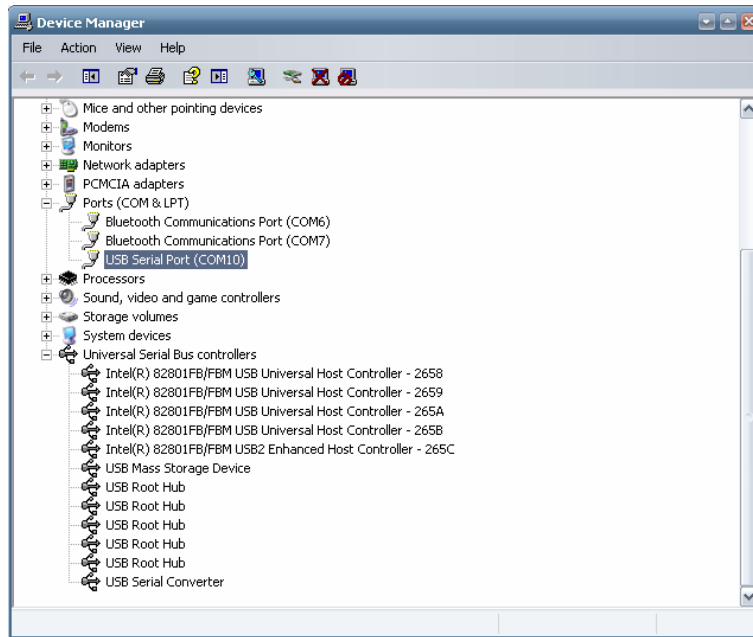
BMS-Charger-PC communication cable (suitable for GEN2 battery packs)

When the BMS-PC cable is inserted in the USB port of PC for the first time, drivers need to be installed. The **Found New Hardware Wizard** pop-up window appears. Choose "Install the software automatically" option and click Next.



To complete the Found New Hardware Wizard click the "Finish" button.

The BMS-PC cable behaves as virtual com port (VCP). A number is assigned to the VCP in the Control panel/System/Device Manager under Ports (COM & LPT). This port number is used to set the communication parameters in the **Set communication properties** window of the BMS Control software.



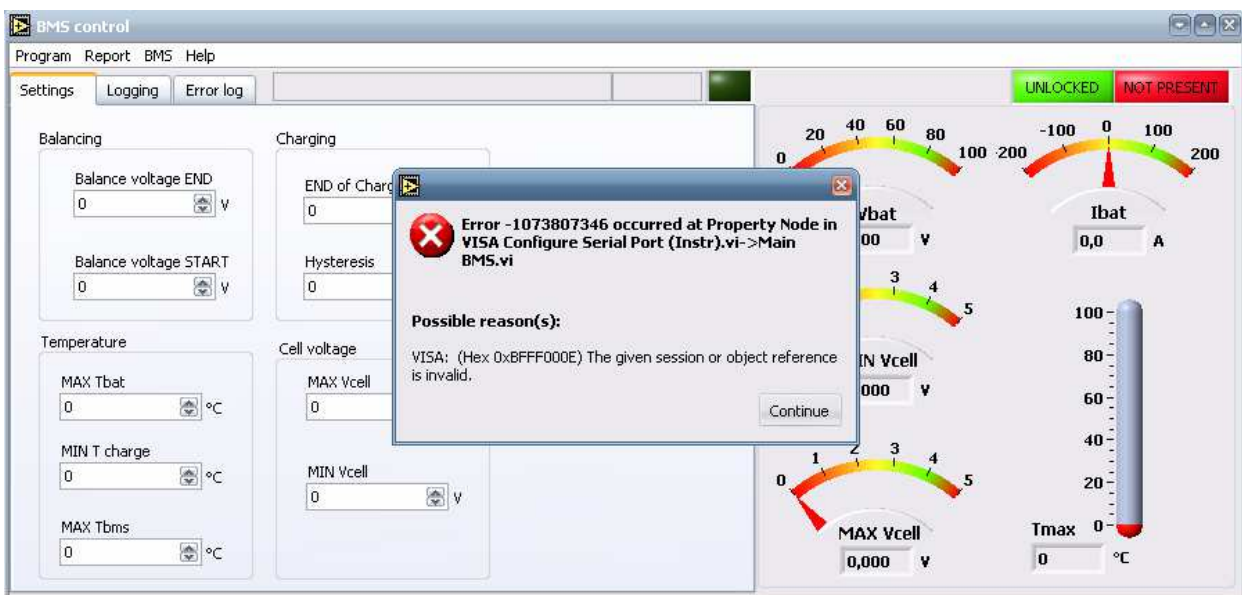
If drivers were not installed automatically you can find them also on the FTDI web site

<http://www.ftdichip.com/Drivers/VCP.htm>

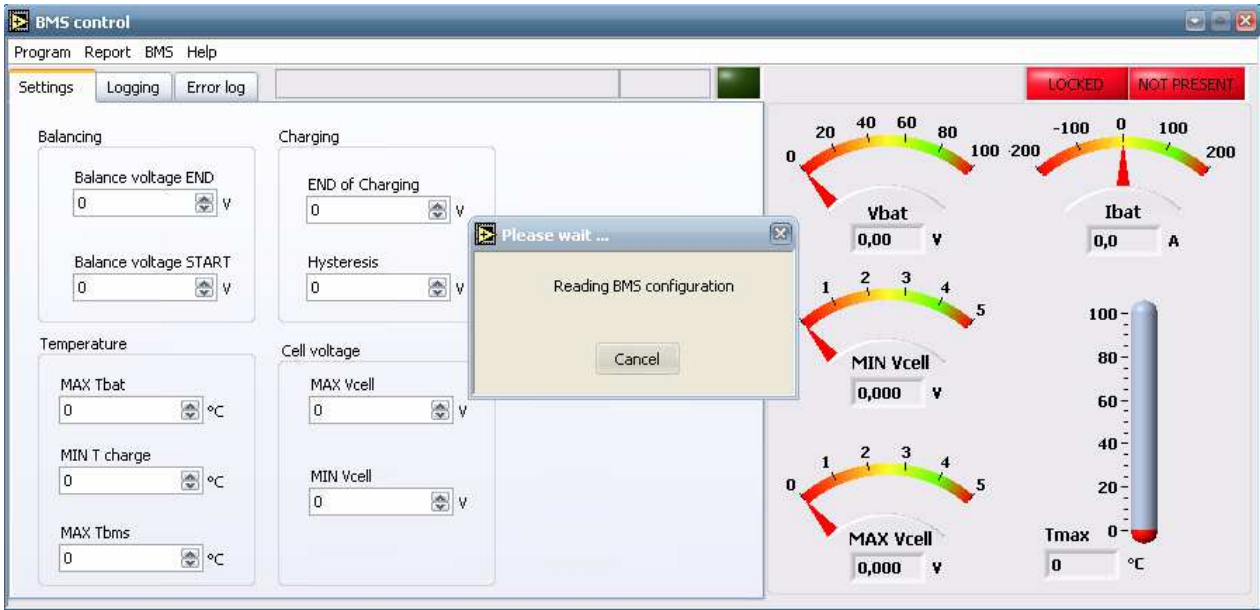
In case of troubles contact LZ design.

4. Setting communication with BMS

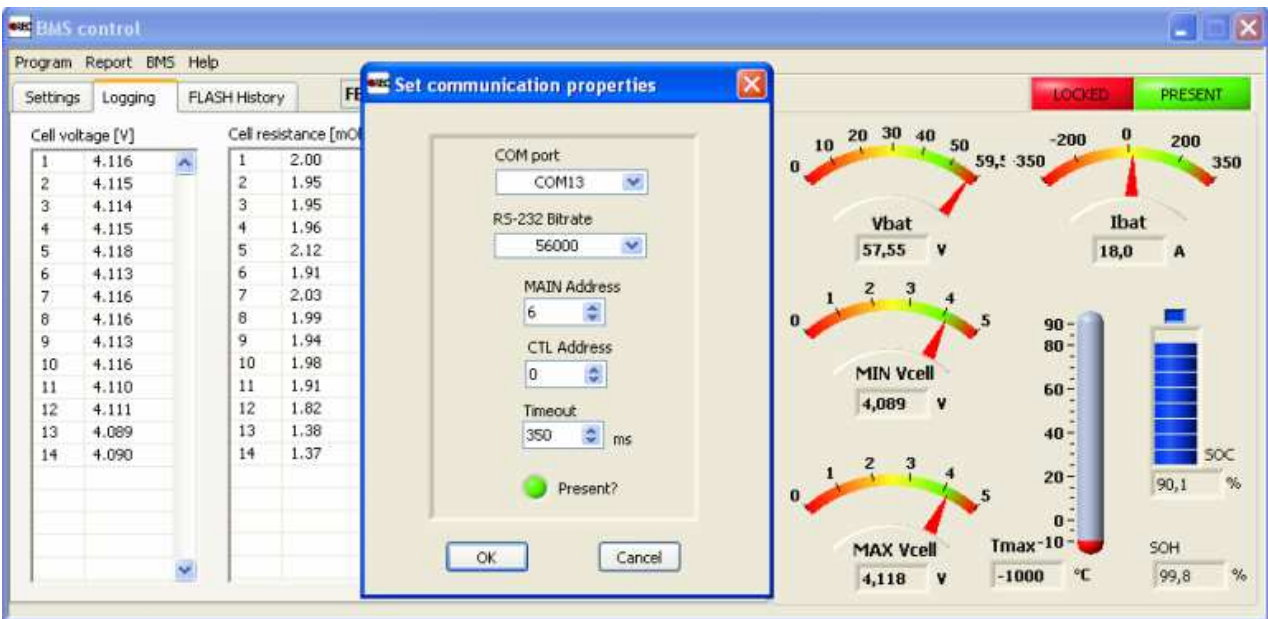
You can now run the BMS Control software. If this is the first time you have been running the program, the Serial ports has not been set yet and the Error occurs. You must follow the procedure described below. Click the "Continue" button.



The BMS is not connected to the BMS Control software, the sign **NOT PRESENT** is turned on and **Reading BMS configuration** window pops out. Click the "Cancel" button and



open **Set communication properties** in the Program menu.



Select the proper COM port number that was assigned to and also check that other parameters are set as they are listed below.

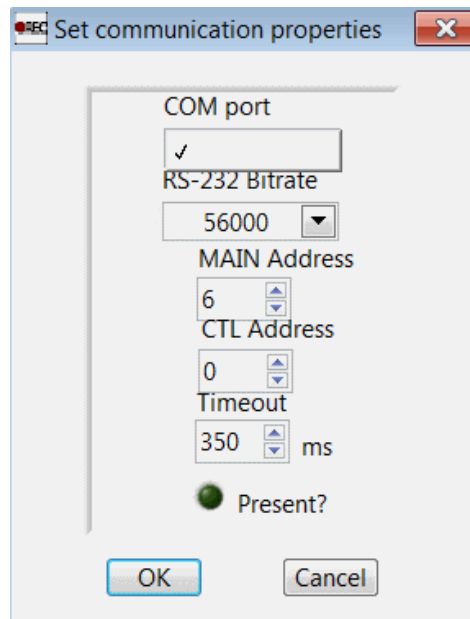
RS-232 Baudrate: 56000

MAIN Address: 6

CTL Address: 0

Timeout: 350 ms

In some cases there is visible tick only and so you are not able to choose a COM port.



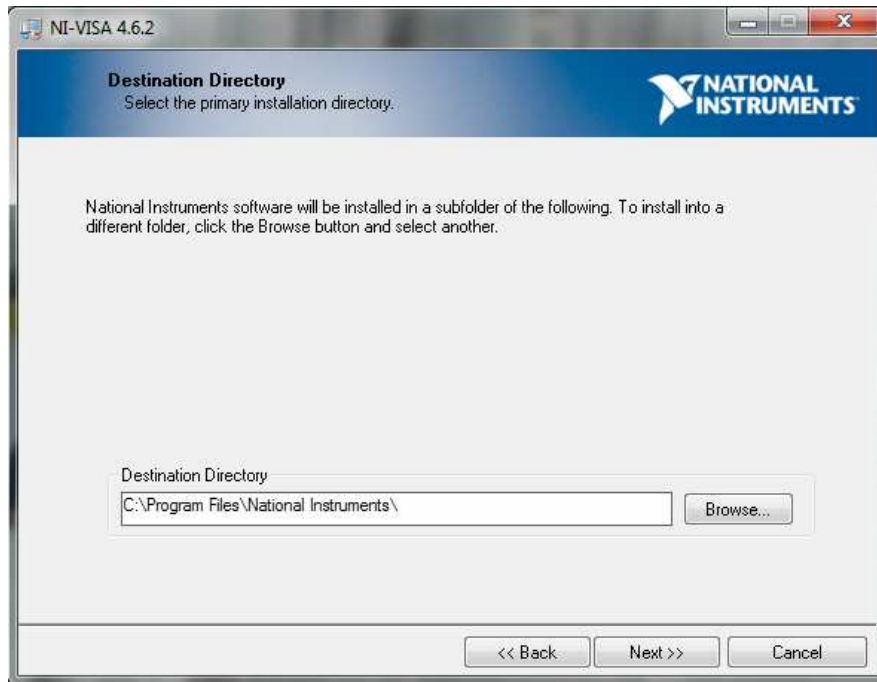
This usually happen if you have on your PC installed Windows Vista or Windows home premium edition operating system. In such case it is required to install additional Visa USB & COM drivers, as some operating systems do not have them included already.

You can download installation file for a Visa USB & COM from this link:
<https://www.dropbox.com/s/j5uarkxjk2oxriy/visa462full.exe?dl=0>

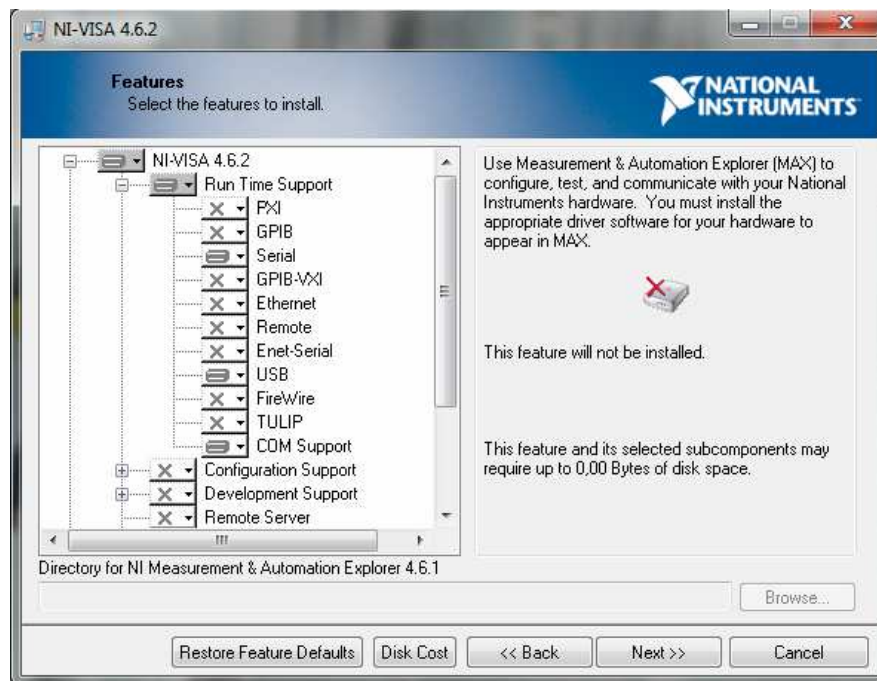
Open Visa426Full.zip file and wait until it extracts to a temporary location on your computer. Continue the installation by selecting "Next".



Select the location for National Instruments VISA Drivers.



For the RS485 Cable to work, only Serial, USB and COM Support Drivers under "Run Time Support" should be chosen.



When VISA drivers are successfully installed, restart the computer.

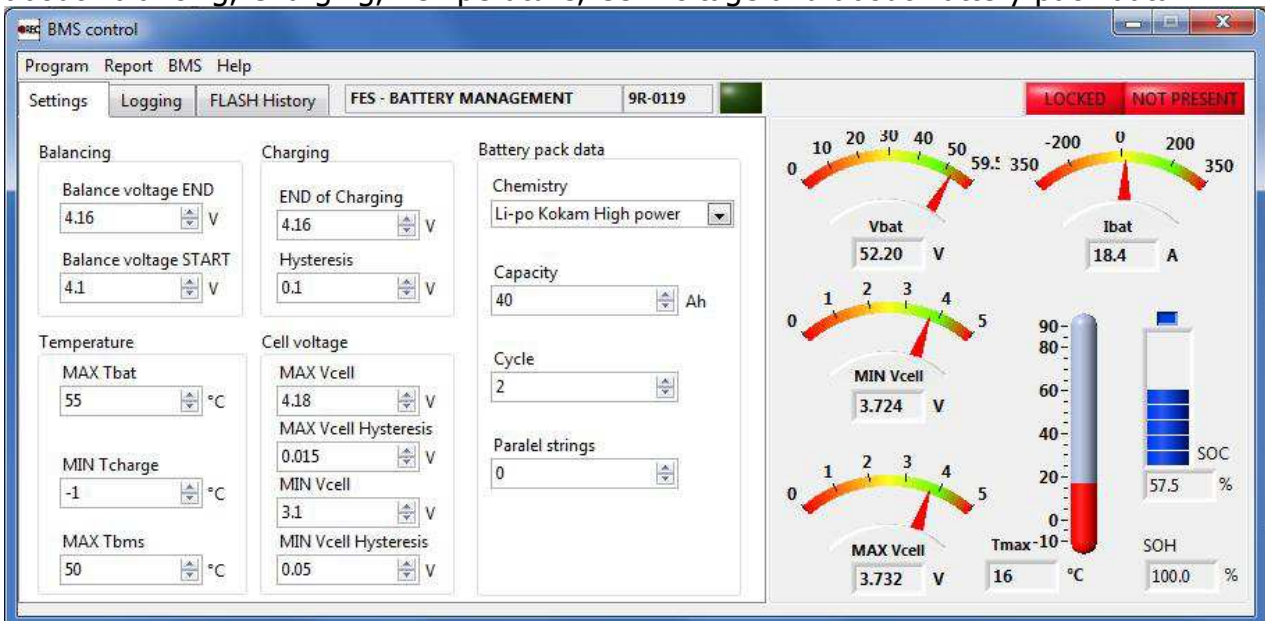


If your computer has installed Windows 7 Starter, you should follow procedure, as described on this link:

<http://digital.ni.com/public.nsf/allkb/1817F501D7BA67F28625768F0000B260>

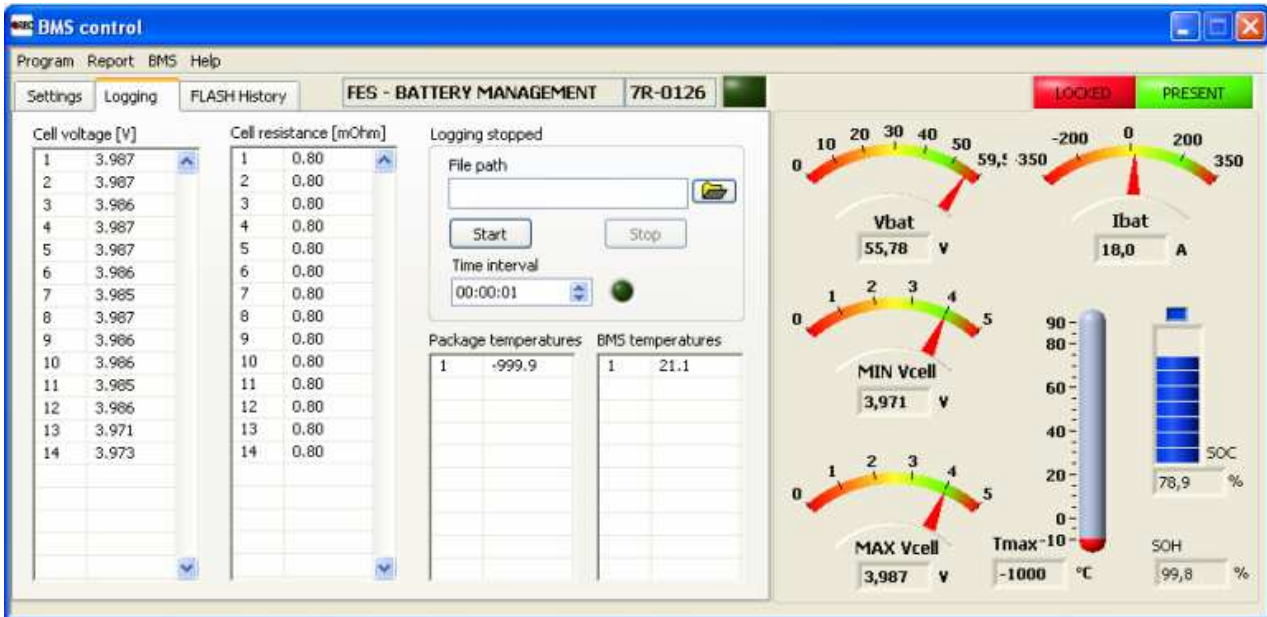
5. Basic system parameters overview

When BMS and your PC are connected, the program presents all system parameters in the original Settings window. You can read all the pre-set parameters, about Balancing, Charging, Temperature, Cell voltage and about Battery pack data.



Balancing	
Balance voltage END	Voltage level to which each individual cell will be balanced (default value is 4,16V).
Balance voltage START	Average battery pack voltage above which the BMS performs the balancing while charging (default value is 4,1V).
Charging	
END of Charging	End of charge voltage of the individual cell (default value is 4,16V).
Hysteresis	Charging hysteresis of individual cell (default value is 0,1V).
Temperature	
MAX Tbat	If temperatures of battery pack reach this value, charging will be stopped (default value is 55°C).
MIN Tcharge	If temperature of battery packs is bellow this value, charging is not allowed to start (default value is -1°C).
MAX Tbms	Maximum allowable temperature of the BMS due to the balancing. If BMS reach this temperature, balancing and charging will stopped. Balancing and charging will start again, when BMS temperature drop 10°C below the set value (default value is 50°C).
Cell voltage	
MAX Vcell	The highest allowed voltage of the individual cell. Above this voltage alarm turns on (default value is 4,18V).
The MAX Vcell Hysteresis	(default value is 0,015V).
MIN Vcell	The lowest allowed voltage of the individual cell under which the alarm turns on (default value is 3,1).
MIN Vcell Hysteresis	(default value is 0,05V).
Battery pack data	
Chemistry	(default setting is Li-po Kokam High power)
Capacity	(default value is 40Ah)
Cycle	Counting of charging cycles
Paralel strings	(default value is 0)

To see the **single cell voltage**, switch the view from Settings to Logging.



On this second Logging screen you can see accurate Cell voltage of each 14 cells, so this is the most used screen during monitoring charging process!

After a few minutes of charging it will also start calculating Cell internal resistance of each cell.



Internal resistance is possible to calculate only during charging. BMS which is inside of battery pack, gives instructions, to the charger how to charge, by PWM signal through BMS-Charger signal cable. This means when to start, when to stop, and charging current value (from 0...9A, with 600W charger). After initial start, charging current ramps from 0 to 9A slowly. When it reaches 9A, then BMS gives instructions to suddenly reduce charging current to 0A, but just for a short time. When this happens, BMS measure, voltage drop on each cells, and calculates internal resistance. This usually happened the first time in about 3-5 minutes from start of charging. Accuracy of calculation is just approximate (but good enough for relative comparison of cells resistance), as there is not accurately measured charging current, but BMS knows how high it should be as BMS instruct charger about.

If charger is not connected, BMS do not know that, so still calculates, but as there is no voltage drop the result is close to zero mOhm after some time...

Right side of screen shows, pack voltage, minimum and maximum voltage of cells, approximate charging current (based on data which is BMS is sending to charger), SOC as state of charge, SOH as state of cells health. Temperature of pack is not visible if sensor is not connected.

Third screen Flash History is not important for FES users!

5.1 Data logging

If you might have some problems during charging is it suitable to record charging process data in a *.txt file, which you can send it later by email to FES manufacturer. Such file is very helpful for troubleshooting the problem.

Choose the **File path** and set suitable **Time interval** you want BMS to report. In most cases is OK if you set time interval to 2 seconds.



If the Time interval is set to 00:00:00 the software logs the data with its maximum achievable speed

By pressing the "Start" button you start the logging, to stop recording, just press the button "Stop".

The data is recorded in *.txt file you chose as follows:

date	time	Pack voltage [V]	Curren t [A]	Cell ₁ [V]	Cell ₂ [V]	...	Cell _n [V]	T _{BAT} [°C]	T _{BMS} [°C]
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5.2 BMS settings setup

It is possible to change some BMS parameters in Settings window. This is possible only if BMS is in unlocked state. To unlock BMS you need to enter proper password, which you will get from FES manufacturer if necessary.

6. Revision history

February 2011	Initial release of manual
February 2013	Updated to Version 1.11
March 2013	Updated to Version 1.12
December 2013	Updated info about Visa drivers, Version 1.2
July 2014	Minor updates to Version 1.21
December 2014	Added info about calculation of cell internal resistance 1.22
May 2015	Added info about installation of Visa drivers
November 2015	Added info about installation of Visa drivers to Win 7 Starter
March 2016	Corrected broken link to Visa drivers, window with a thick
February 2017	Added info about default settings, Version 1.26