

ZEBRA MONITOR

Release 2.7.5

User Manual

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1 - Note on this manual symbology and conventions

Throughout this manual, symbols are used to highlight information relating to software special care elements and personal safety advices



DANGER, physical and property damage



Special care at this element



Step-by-step instructions



references

2 - Software installation guides

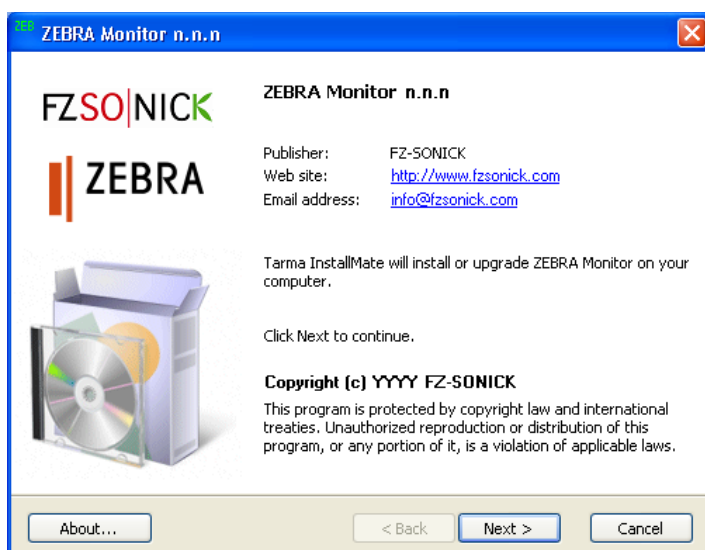
This chapter describes how to install the software on a Windows XP/Vista/7 computer. All the drivers have their own setup programs and have similar installation steps.



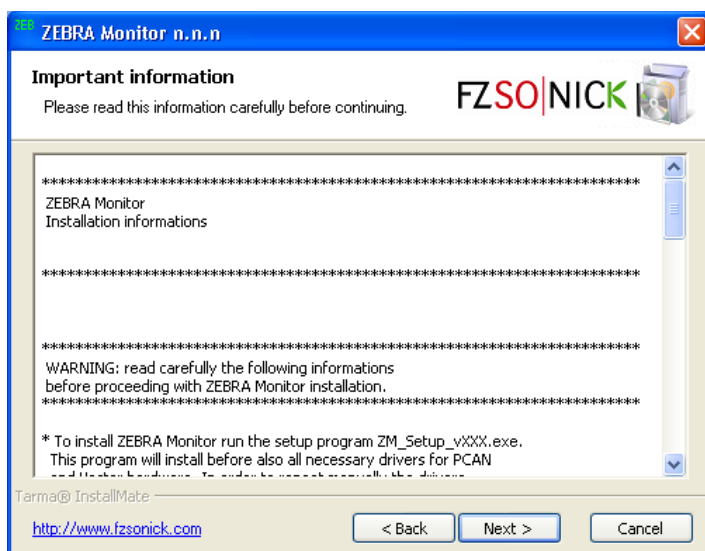
Make sure that you are logged in as user with administrator privileges

2.1 - ZEBRA® Monitor

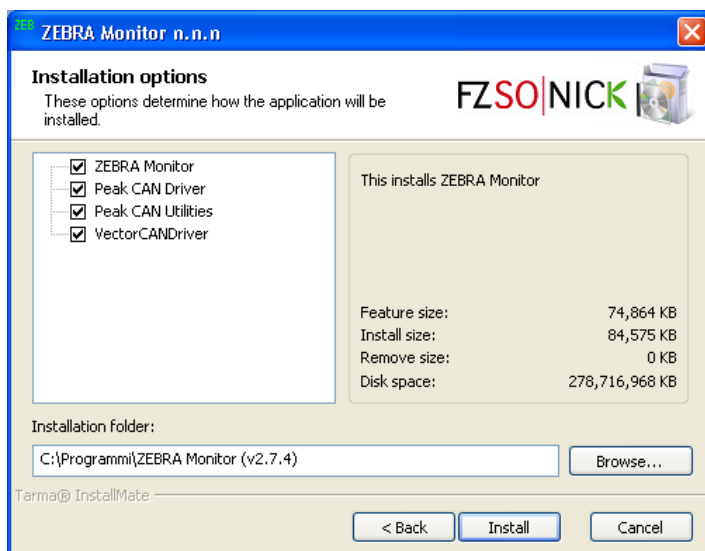
Run the ZEBRA® Monitor setup (ZM_Setup_vXXX.exe) program from user's CD-ROM drive. The directory depends on the user's CD drive and path. Follow the steps below to install ZEBRA® Monitor.



Click the button "Next >" to start the installation.



This Window reports some important information notes, when you are finished reviewing the information, click the button "Next >".

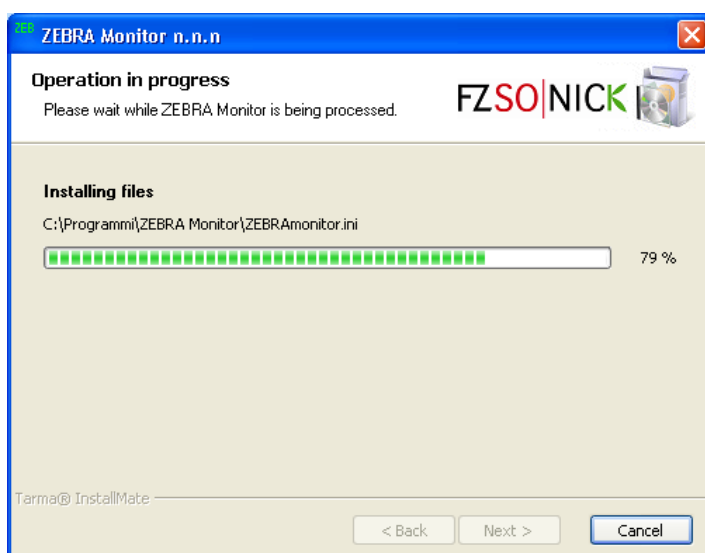


If on PC are not yet installed the interface drivers, here you have to select the installation of the drivers (default choice).

At this step don't insert the PEAK on USB port; if Vector's drivers must be installed the Interface must be connected to the PC. See 2.2.1 and 2.2.2.

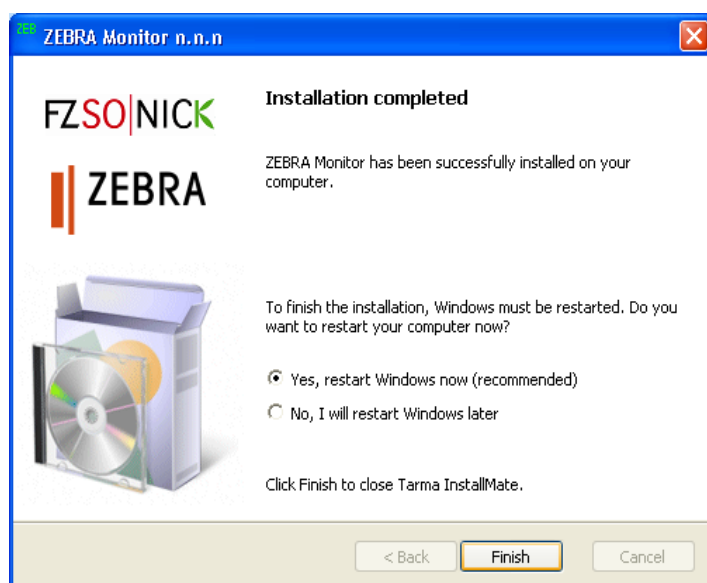
Click "Install" to install the utilities in the default folder or click "Browse..." to specify the destination folder where you would like to install "ZEBRA® Monitor".

ZEBRA® Monitor installation in addition to the specified directory will also create another folder called *ZEBRAAcquisitionDir* on the root of the path just selected. In that folder will be located all the files acquired or saved with the software.



Caution If in the preceding step of the installation wizard you had selected more than only "ZEBRA® Monitor", third party installation programs will be launched at this level (Refer to Chapter: [1.2](#))

The installation will take a few minutes, please wait until the installer has completed all the operation.



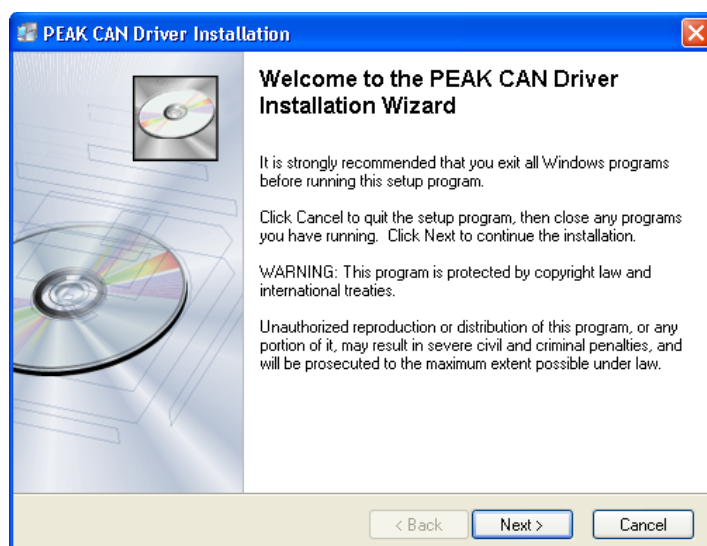
Congratulation, you have successfully installed ZEBRA® Monitor.

2.2 - Optional software installation procedure.

2.2.1 - PEAK CAN Driver- Utils



Don't connect the Peak-Usb at the computer before the end of this procedure .

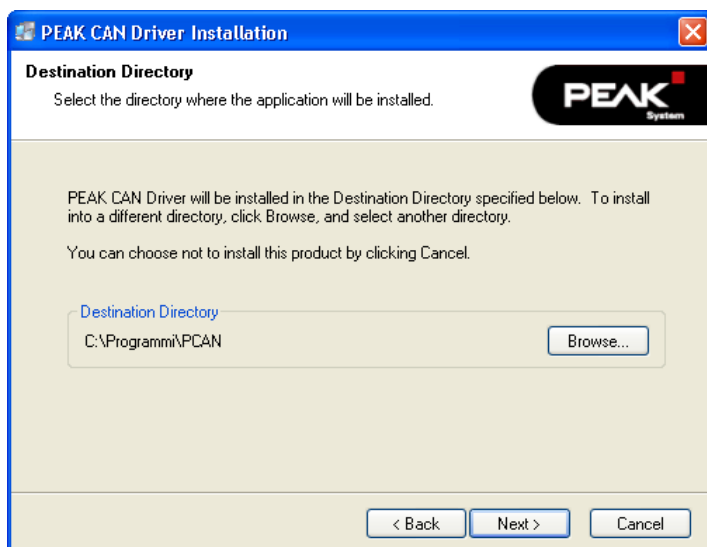


After the selection of Wizard language, the welcome window will be showed.

Click the button "Next >" to start the installation.

Accept the "License Agreement" in the successive window and click "Next >".

Select the desired "Online Help Language" and click "Next >".



Click “Next >” to install the utilities in the default folder or click “Browse...” to specify the destination folder where you would like to install the PEAK driver.

Please wait until the installer has completed all the operation.

Plug the interface into an available USB port of the computer and wait that the system will finish the installation.

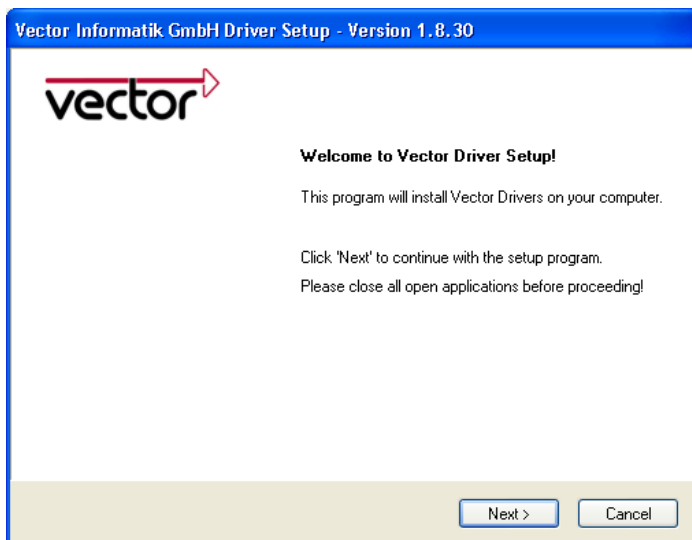
Verify that in Control Panel the “[CAN](#) Hardware” applet has “Active Device” = “USB”, otherwise select “USB”

Now the interface will be correctly installed.

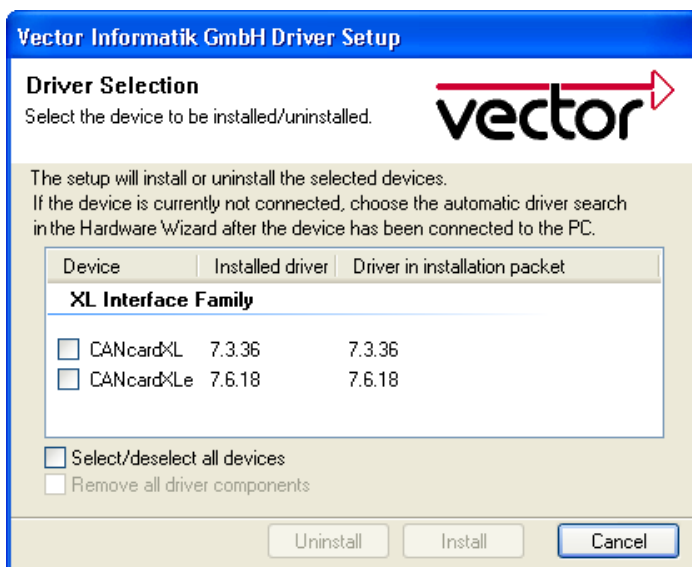
2.2.2 - Vector Driver- Utils



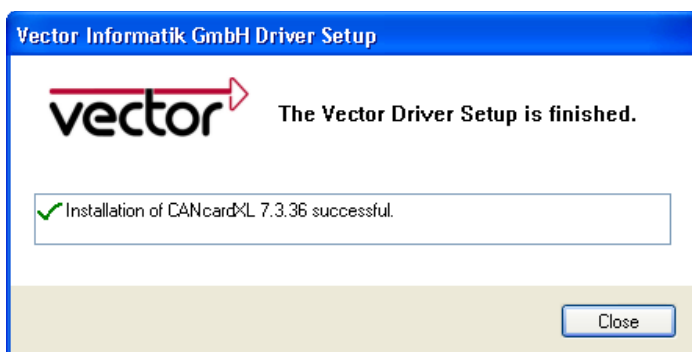
Ensure that the Vector device is connected with PC .



Click the button “Next >” to start the installation.



In the driver selection window select your device to be installed.
Click “Install” to execute the driver installation.



A confirmation dialog appears.
Click “Close” to exit.

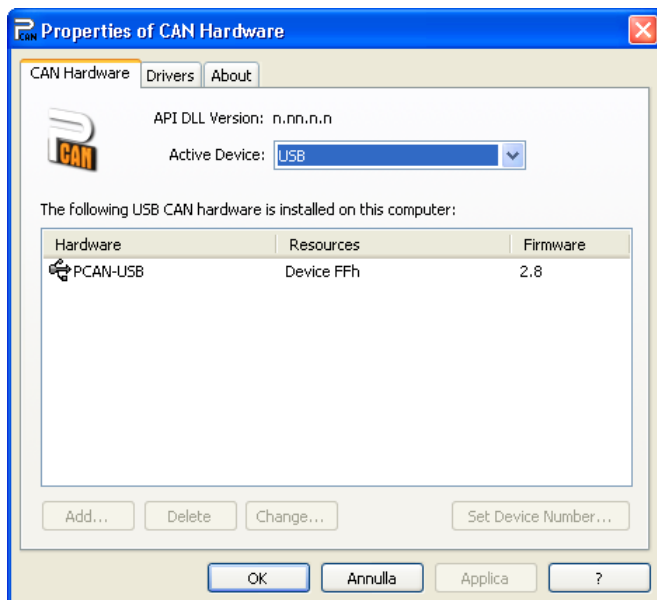


Refer to [Vector](#) help for more documentation

2.2.3 - WinFlash

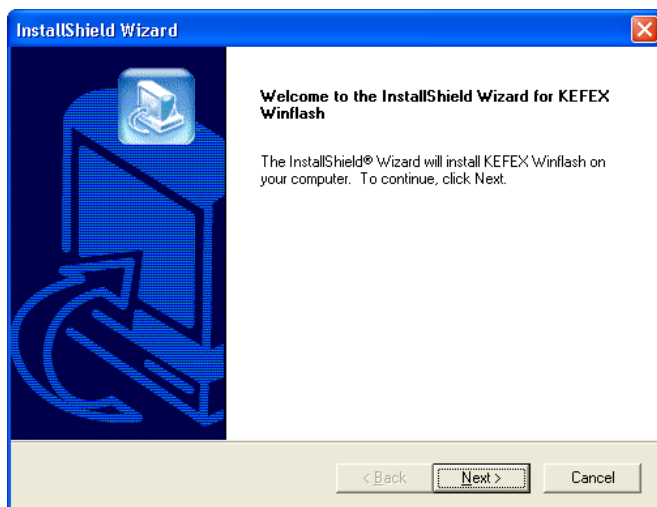


WinFlash has to be installed on a PC only after the installation of HW interface drivers.

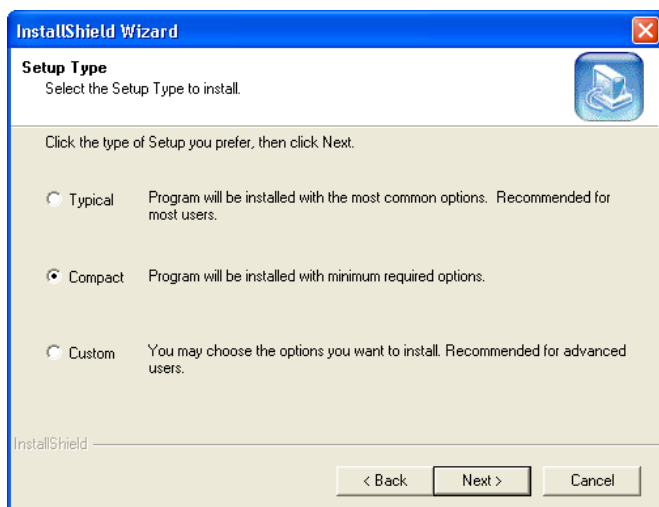


Verify that in "Control Panel" the applet "[CAN Hardware](#)" has "Active Device" set to "USB", as showed below. Otherwise, please set USB as Active Device and press Apply button.

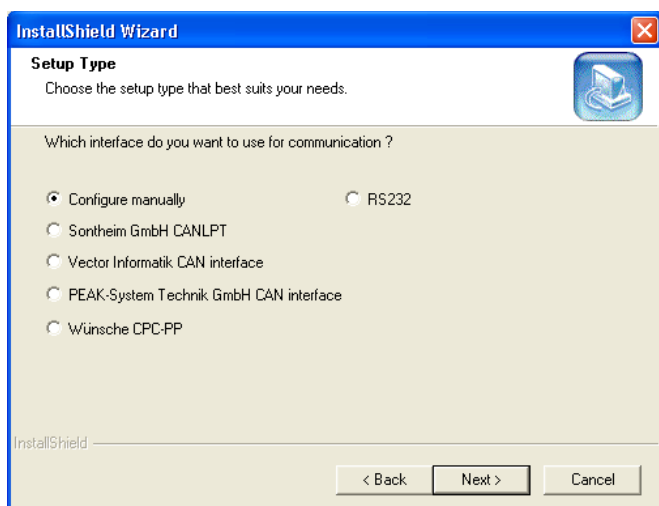
Execute WinFlash setup program:
WinFlash_Setup.exe (Diagnostic Kit CDROM)



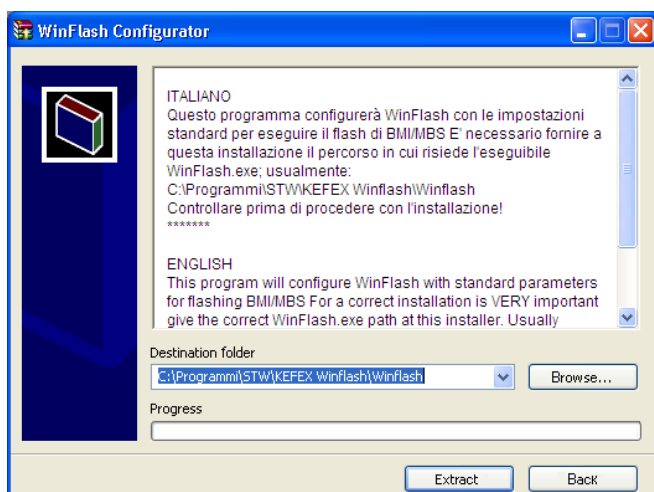
Welcome window will be showed.
Click the button "Next >" to start the installation.
Select Remove if another previous version is already installed and then run again the WinFlash setup program.
Two pages will be showed: the first one the wizard reports a list of supported OS and communication interface (Press "Next >"); the second one is then License Agreement (Press "Yes" to confirm the license).



Click “Next >” to install in default folder or click “Browse...” to specify the destination folder where you would like to install WinFlash. Select Compact installation and then press “Next >”.



Select Configure Manually option and then press “Next >”. Now the interface will be correctly installed.

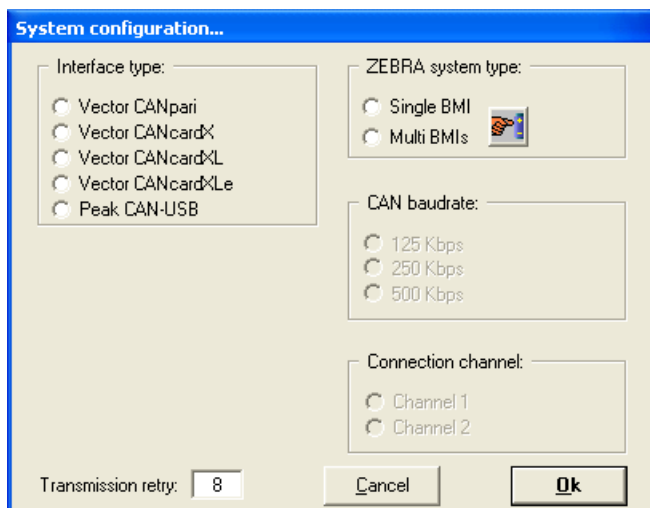


At the end of WinFlash installation will be automatically executed the WinFlash Configurator Utility. This application will configure WinFlash for the use with BMI/MBS. It's very important to provide the correct Destination folder to this program (i.e.: the [former folder](#)).

After the installation run Winflash from Start → Programs → STW → KEFEX WinFlash → Winflash

3 - Connection setup:

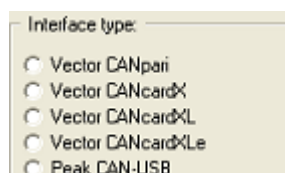
This section describe how to set up the connection.



The ZEBRA® Monitor system configuration windows could be open by a click on  icon ([buttons bar](#)) or dropping down the [system menu](#) and choosing the last voice "System configuration".

The interface is divided in four principal choosing zone, the next chapters are dedicated to describe those options.

3.1 - Choosing hardware interface



Select the radio button corresponding at the hardware configured on your PC, different window section will be enabled or disabled in according with this selection.

3.2 - Choosing system type

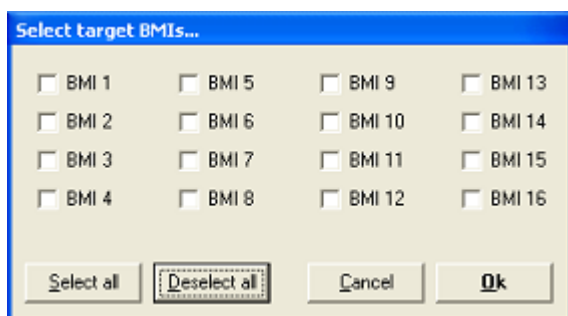


ZEBRA system type: always enabled, allow the choice between [Single and Multiple BMI system](#). The [BMI](#) Selection icon is enabled only when Multiple BMI system is selected (Ref. to [3.3](#)).

CAN baudrate: allow the selection of CAN baudrate (refer to your CAN HW configuration to choose)

Connection channel: is enabled for all the Vector hardware except CANPari

3.3 - Choosing BMIs.



Click the *BMI Selection* icon to open this windows.

Check or uncheck for enable or disable each BMI.



4 - Overview of the main functions of the software

This section provides an introduction to ZEBRA® Monitor software.

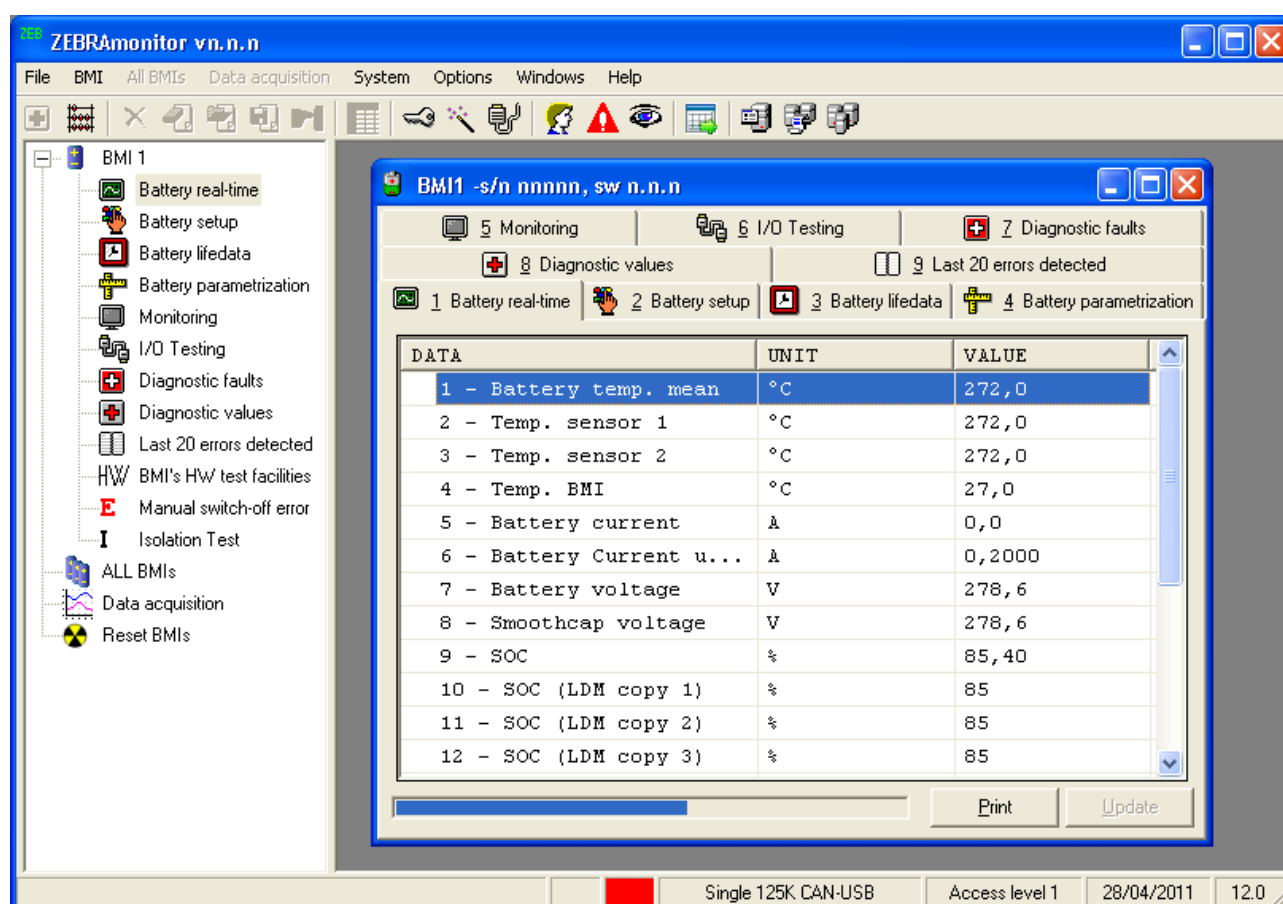
The ZEBRA® Monitor main window includes the path to all features and functions available in the application.

The *menu bar* resides at the top of ZEBRA® Monitor window, contains lists of all the program available functions and options. Just under the menu bar resides the *buttons bar*, a useful collection of shortcuts.

The *status bar* is located at the bottom of the interface

On the left side of the window is placed the tree-view of active battery, where users could select one or more [BMIs](#) on which perform operations.

The central part of the window is used for open the specified function interface.



The *title-bar* displays name and version of the software being used:

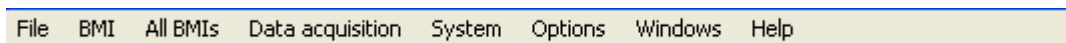


When a [BMI](#) windows is maximized *title-bar* display it's version data too:



4.1 - Menu bar

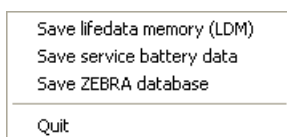
The menu bar gives the access to all the commands and features provided by ZEBRA® Monitor. As in all Windows applications, ZEBRA® Monitor's menus reside below the title bar and are activated by clicking a particular menu name.



The menu bar contain the following menus:

1. [File](#)
2. [BMI](#)
3. [All BMIs](#)
4. [Data acquisition](#)
5. [System](#)
6. [Options](#)
7. [Windows](#)
8. [Help](#)

4.1.1 - File menu



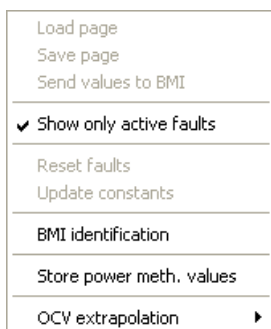
Save lifedata memory: save a txt file (open it with MS-Excel) containing all the [flange](#) data:

- basic battery configuration parameters
- number of cells and of chains
- cell type
- historical data and life data as [SOC](#) and [nameplate cycles](#)

Save service battery data: build a specific list of data that could be used by FIAMM SoNick Service Centre for problem diagnosis.

Save ZEBRA database: make and eventually append a specific list of [BMI](#) variables data to an Access database table. The name of the table is: BatteryId_SerialNumber, so the procedure will create a table for each BMI.

4.1.2 - BMI menu



The [BMI](#) menu is the same menu that could be obtained by a right click on a [BMI window](#).

This menu is divided into six groups:

The first group is enabled only with "[Access level](#)" > 0 and if in the BMI window tabs 3, 4 or 5 (Battery Life Data, Parametrization or Monitoring) are selected:

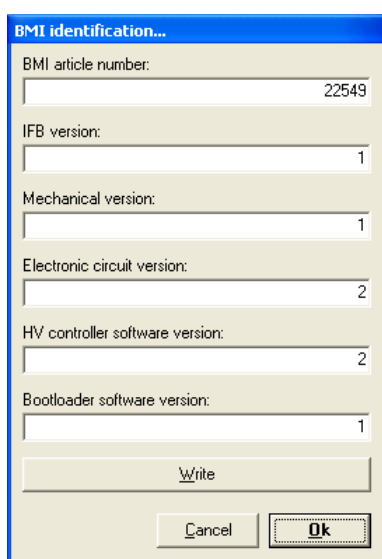
- *Save page:* write into a file (Extension: zbp) the value of every editable variable that could be found in the page
- *Load page:* load from a zbp file the value of editable variables of the page
- *Send values to BMI:* write all the changed value in the BMI memory

The second group is composed by only a voice, if it's checked on the BMI tab 7 (Diagnostic fault), are displayed only that row for who a fault is active. So is easiest have a quick idea of the BMI errors status.

The third group it's enabled if the user [Access level](#) is at least 1:

- *Reset faults* is enabled only on the BMI tab 7 (Diagnostic fault), by clicking on it all the faults be reset and new scan is executed.
- *Update constants* is the function that reload changed constants on BMIs flash memory.

BMI identification pop up a windows that allow user to view some BMI HW parameter :



Write operation is not permitted for "Access Level" < 2 (only FIAMM SoNick)

Store power meth. Values: Read from BMI the ten yellow threshold [SOC](#) values and write acquired data into a file txt (from default putted inside [ZEBRAcquisitionDir]\pwr_data).

OCV extrapolation: Read some Open Circuit voltage information and store acquired data in a txt file (from default putted inside [ZEBRAcquisitionDir]\ocv_extraplolation_data).

4.1.3 - All BMIs menu

Reset all faults
Update all constants
Remove selected values
Select all values
Clear list
Load list
Save list
Select target BMIs
Auto updating
Show Recipe from file
Save Recipe from one BMI to file
Download Recipe from file to all BMI

The All [BMI](#)s menu is the same menu that could be obtained by a right click on [All BMIs](#) window.

[Reset all faults](#) and [Update all constants](#) are the same described in the previews chapter.

Remove selected values and *Select all values* help the user in the list of parameters management.

The third group of function give to user the possibility of load save and clear a particular list of value that the user usually asks (*File Extension: .zeb*).

Auto updating disable the Update button and automatically update the page every 10 seconds.

Select target BMIs allow choose which BMIs is showed in the windows.

The last functions display, save and load on BMI Flash Memory a list of parameters (called recipe) and their settings (*File Extension: .zer*).

4.1.4 - Data acquisition menu

Remove selected values
Select all values
Clear list
Load list
Save list
Select target BMIs
☒ Refresh during acquisition
Open last acquired data file

The Data acquisition menu is the same menu that could be obtained by a right click on Data acquisition window.

In this chapter are described only the last two function of the drop down menu because the others are the same illustrated in [chapter 4.1.3](#)

Data Acquisition window is similar to [All BMIs](#) window, but have data logger capabilities. Here we can create a file with data saved by specifying time intervals (Sampling).

If *Refresh during acquisition* is checked the grid will be reloaded for each time step, if isn't checked those change will be register only in the saved file.

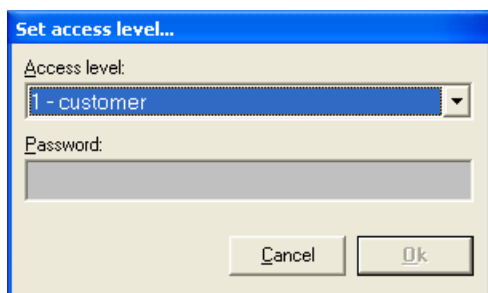
Open last acquired file automatically show the last acquired file (Pay attention MS Excel required).

4.1.5 - System menu

Set access level
Rescan
System configuration

By this menu it's possible control the HW configuration, force a system rescan, and set the ZEBRA® Monitor Access Level

Pay attention: for Access level higher than zero a password is required



4.1.6 - Options menu

Open user events log file
Open CAN/BMI events log file
CAN monitor

Open user events log file show some information about user operation on the system (E.g.: Access level changed)

Open [CAN/BMI](#) events log file show the CAN/BMI report log file

CAN monitor is available only at "[Access level](#)" = 2

4.1.7 - Windows menu

Here are located the common windows functions to organise showed windows:

- Tile horizontally
- Tile vertically
- Cascade
- Arrange icons

4.1.8 - Help menu

Errors list description (english)
About ZEBRAmonitor...

Error list description open a PDF file that report every possible ZEBRA® Monitor message

About ZEBRA® Monitor open a window analogous to the splash screen that display the current version of ZEBRA® Monitor and some FIAMM SoNick information.



4.2 - Buttons bar

Button bar is a useful collection of shortcuts to the main function of the windows.



Icon	Description	Ref.
	Reset faults in the current BMI windows	4.1.2
	Update constants into BMI Flash memory	4.1.2
	Remove all the selected items from the values list (All BMIs – Data acquisition)	4.1.3
	Clear all the items from a value list (All BMIs – Data acquisition)	4.1.3
	Load a value list file	4.1.3
	Save the current value list into a file	4.1.3
	Select the target BMI	4.1.3
	View the last acquired data file with MS Excel	4.1.4
	Change the BMI Access level	4.1.5
	Rescan the system	4.1.5
	Open the system configuration window	4.1.5
	Open the user event log file	4.1.6
	Open the CAN /BMI error log file	4.1.6
	Open the low level CAN message monitor window	4.1.6
	Save all BMI values into a file (save all the tabs data)	5
	Save Lifedata memory file (LDF)	4.1.1
	Save service battery data	4.1.1
	Save ZEBRA Database	4.1.1

4.3 - Status bar

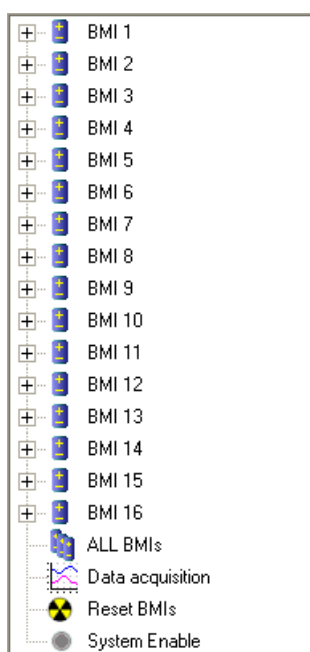
ZEBRA® Monitor uses the status bar to display helpful information for the user.



This bar is divided into six spaces, from the left:

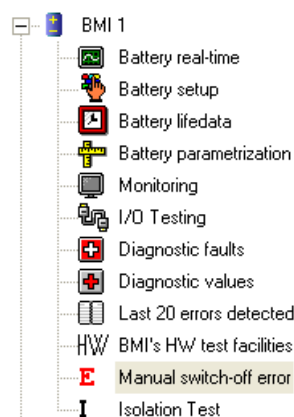
1. Display the actual operation description (e.g.: Changing access level, Saving page, Saving list ,...)
2. Display a red box when software is occupied in a operation
3. Display information about the configuration (Multi / Single, CAN bitrate, type of CAN interface)
4. Display the Access level
5. Date
6. Time

4.4 - Treeview of linked batteries



Here ZEBRA® Monitor show all the linked batteries and all the function that could be done on these (All BMIs, Data acq., Reset, System Enable).

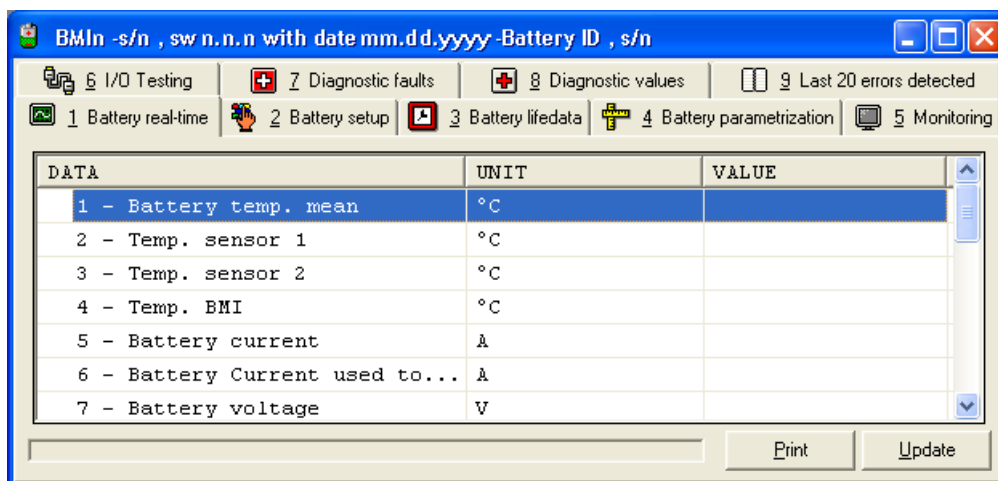
Just a click on “+” open the [BMI interface](#) ([Tabbed pane of selected batteries](#)) in the center part of the screen, and show the tree of available tabs:



Each elements of this sub-tree is the same that could be found in the BMI interface tabs; a click on a tree sub element or on a BMI interface tab do the same thing: show the relative values and data.

4.5 - Tabbed pane of selected batteries

This window is the core of the ZEBRA® Monitor software, in this pane are showed all the available variable and from here is possible set some variable value (depending from variable type and user permission).



Variables that could be modified are signed by a blue "W" on the left side of their row.

The window is organized in tabs depending from variables type and nature:

4.5.1 - Battery real-time (Tab: 1)

Icon: 

main battery operatives data (temperature, capacity, voltage, ...) updated every 10 seconds

4.5.2 - Battery setup (Tab: 2)

Icon: 

main battery settings (Descriptive data, SW and FW data, Serials, ...)

4.5.3 - Battery lifedata (Tab: 3)

Icon: 

all that variables that are recorded in the flange memory. These kind of data principally represent the operative story of the battery (thermal cycle, cells failure, cumulated operating time, ...)

4.5.4 - Battery parametrization (Tab: 4)



main settings of the battery (Heating setpoint, Operating temperature min and max, ...)

4.5.5 - Monitoring (Tab: 5)



here are displayed lots of data that describe battery status (Temperatures, U/I, Fan and heater condition, Isolation test execution status and it's last results, ...)

4.5.6 - I/O Testing (Tab: 6)



Input and output signals state (Ignition key, Battery charge request, ...)

4.5.7 - Diagnostic faults (Tab: 7)



all the faults and the error retrieved on the battery (Battery not grounded, Switch off error,...)

4.5.8 - Diagnostic values (Tab: 8)



variables that are involved in problem investigation/solving

4.5.9 - Last 20 Errors detected (Tab: 9)



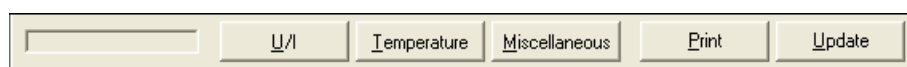
Display a list with the last 20 errors

The bottom part of this window show some elements for the user interaction with the visualized tab. Three different type of commands could be found here:

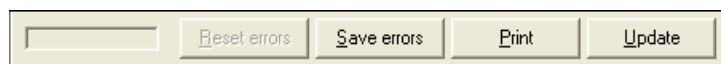
- Tabs 1,2,3,4,6,7,8:
Print: open the common print dialog
Update: force reloading of all the variable in the visible tab
Progress bar: show the update progress



- Tab 5:
Three buttons allow the selection of the kind of variable that could be visualized



- Tab 9:
Reset errors: Enabled only for Access level 2 (FIAMM SoNick)
Save errors: save all the showed error into a txt file

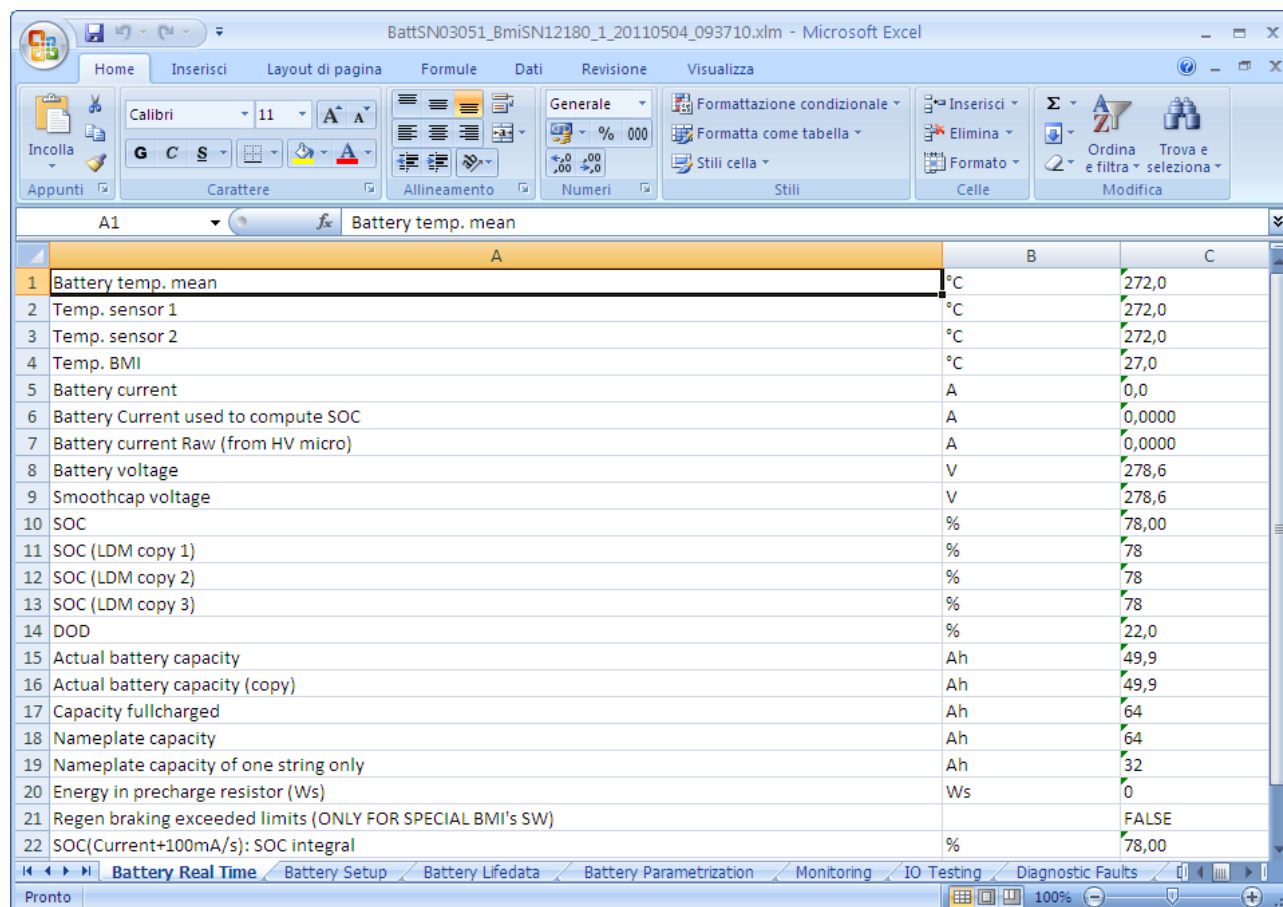


5 - Saving simultaneously all linked BMIs battery data

A click on  icon ([buttons bar](#)) begin the saving process. ZEBRA® Monitor will create in the [ZEBRA acquisition dir](#) a xlm file for each selected [BMI](#). The file name is composed as follows:

BattSNXXXXX_BmiSNXXXXX_ID_YYYYMMDD_HHMMSS.xlm

The xlm file could be opened with MS Excel:



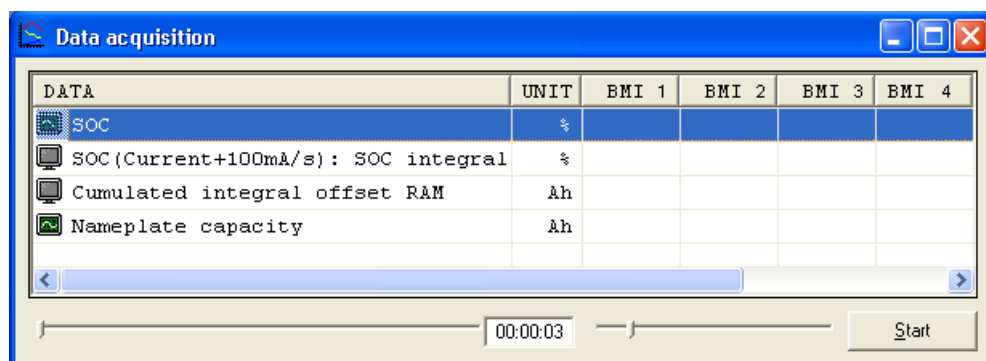
	A	B	C
1	Battery temp. mean	°C	272,0
2	Temp. sensor 1	°C	272,0
3	Temp. sensor 2	°C	272,0
4	Temp. BMI	°C	27,0
5	Battery current	A	0,0
6	Battery Current used to compute SOC	A	0,0000
7	Battery current Raw (from HV micro)	A	0,0000
8	Battery voltage	V	278,6
9	Smoothcap voltage	V	278,6
10	SOC	%	78,00
11	SOC (LDM copy 1)	%	78
12	SOC (LDM copy 2)	%	78
13	SOC (LDM copy 3)	%	78
14	DOD	%	22,0
15	Actual battery capacity	Ah	49,9
16	Actual battery capacity (copy)	Ah	49,9
17	Capacity fullcharged	Ah	64
18	Nameplate capacity	Ah	64
19	Nameplate capacity of one string only	Ah	32
20	Energy in precharge resistor (Ws)	Ws	0
21	Regen braking exceeded limits (ONLY FOR SPECIAL BMI's SW)		FALSE
22	SOC(Current+100mA/s): SOC integral	%	78,00

Tabbed pane windows data will be saved so that for each tab corresponding a worksheet of Excel.

7 - Save variables list sampling data to file

This procedure is possible by the use of the *Data Acquisition* window, that can be open by a click on

 Data acquisition icon in [treeview of linked battery](#).



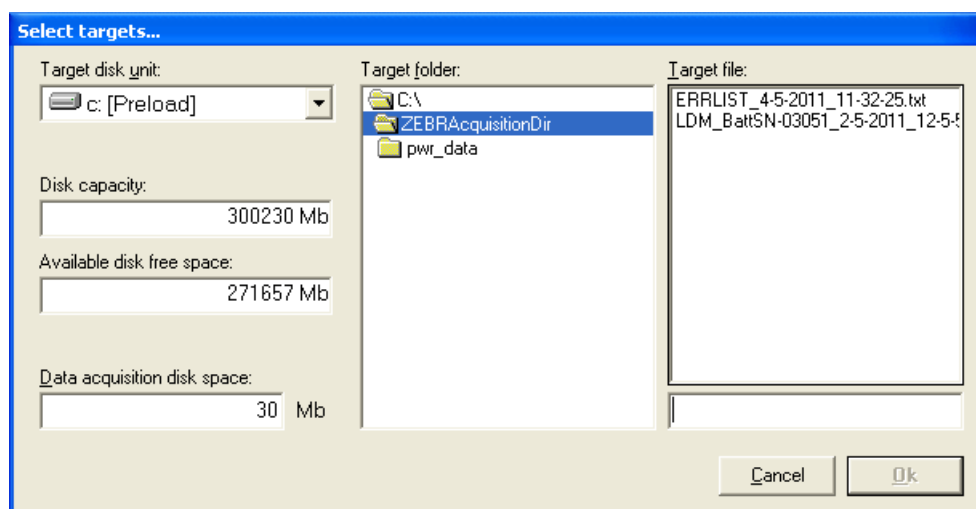
This window allow the creation of a variable list sampling data file.

The contextual menu is similar to the one present in All BMIs windows.

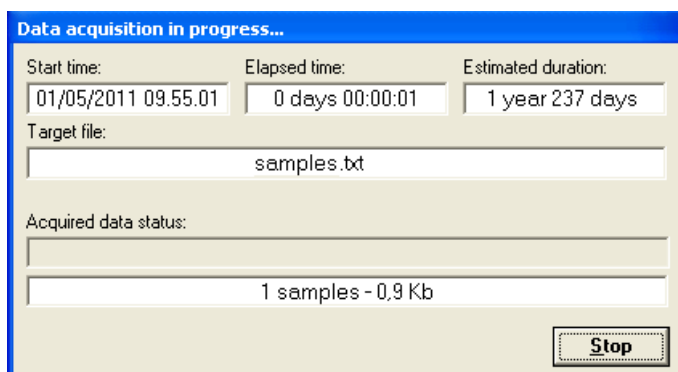
After the selection of the variables list involved in the sampling, the user have to choose the sampling time.

This operation could be done typing the sampling time in the box on the bottom of the window, or scrolling the cursor control placed on the left of the box. The sampling time of 00:00:00 means the acquisition time as fast as possible

Clicking on *Start* button open a window where the user could insert a little comment on the acquisition, after that ZEBRA® Monitor show a save file dialog box, here the user can select the location to put the sampled data file.



Subsequently the sampling window appear:



The 'Data acquisition in progress...' window displays the following information:

Start time:	Elapsed time:	Estimated duration:
01/05/2011 09.55.01	0 days 00:00:01	1 year 237 days

Target file: samples.txt

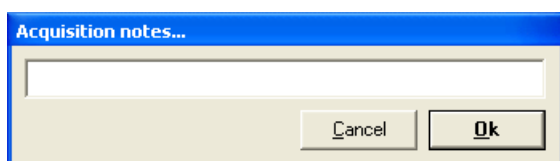
Acquired data status: 1 samples - 0,9 Kb

Stop button

This window show the file name, the sampling start and elapsed time, the number of samples and the file dimension. The *Estimated duration* box shows how long sampling can last in the available space on the selected folder.

To terminate the acquisition process click on Stop.

The last step of an acquisition is put some note, if desired, on the dedicated windows.



The 'Acquisition notes...' window contains a text input field and two buttons: Cancel and Ok.

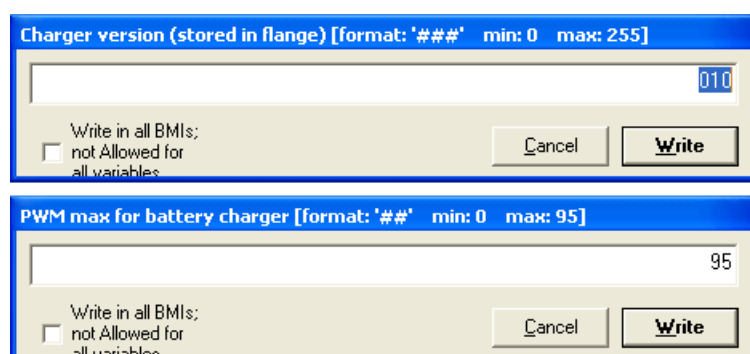
Acquired file have extension *txt*, use MS Excel for a correct visualization of it; in order to view the last acquired data file with MS Excel use  button placed in the [Buttons bar](#)

8 - Changing values of variables (if it's possible)

User with Access level greater than 0 could edit the value of some variables.

DATA	UNIT	VALUE
W 1 - Battery address		0
W 2 - Charger version (stored in flange)		BC-Z-3
W 3 - Load's Max Power on traction net when Charger NL...	W	2000
4 - T1-T2 sensor position (flange ROM sector)		02H

In the BMI tabbed window some rows begin with this icon: **W**. Double click on it show a dialog that allow the variable value change:



The top of the window report the variable name, where the value will be written, and the range of values that could be assigned.

On the bottom left corner is placed a check box, if checked will write the selected value in all the BMIs present in the system. This option isn't possible for all the variables because some parameter like Serial Number or [BMI](#) ID can't be replicated in all BMIs.

For some variables the writing process begin when the *Write* button is pressed, other kind of variables have a different writing process: those are written in a temporary buffer, and putted on the BMI memory only when the user select [Update contents](#).

If a user try to close the software before the updating of changed variables, ZEBRA® Monitor will remember it and ask what it have to do.

Not all variables can be modified even the Access Level of user is 1, some particular parameters are editable only with the consent of FIAMM SoNick. For this reason, in these cases will be showed a password request dialog.

Some passwords can be obtained by consulting the [FIAMM SoNick WEB Reserved Area](#):

- Soc calibration password
- XIm files upload
- Cmu password: errors erasure & cmu test
- Internal iso password: errors erasure



Refer to [WEB Reserved Area Manual](#) for more information

9 - Faults Reset of selected BMI.

When in the [BMI](#) tabbed pane, the *Diagnostic fault* tab is selected in the [contextual menu](#) the row "Reset faults" is enabled and the reset fault icon () on [buttons bar](#) is enabled too.

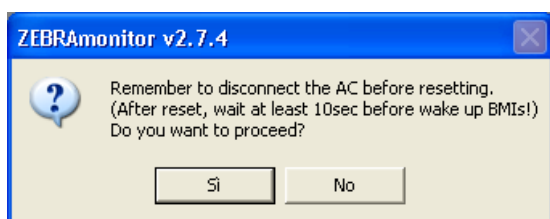
A click on this function will erase faults and redo a system faults scan so if there was a problem and was fixed after a *Fault reset* the problem is not showed more.

10 - BMIs Reset.

This function reset selected [BMIs](#).

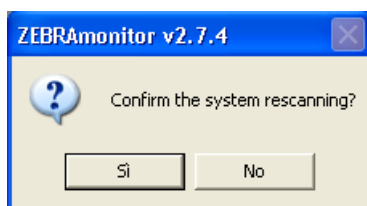
To execute click  Reset BMIs on [treeview of linked battery](#).

A pop up window warn the user that is necessary disconnect the AC to perform resetting .



If the user accept to continue The BMIs Selection interface is showed.

After the choice the Reset process begin. At the end ZEBRA® Monitor will ask for a system rescanning.

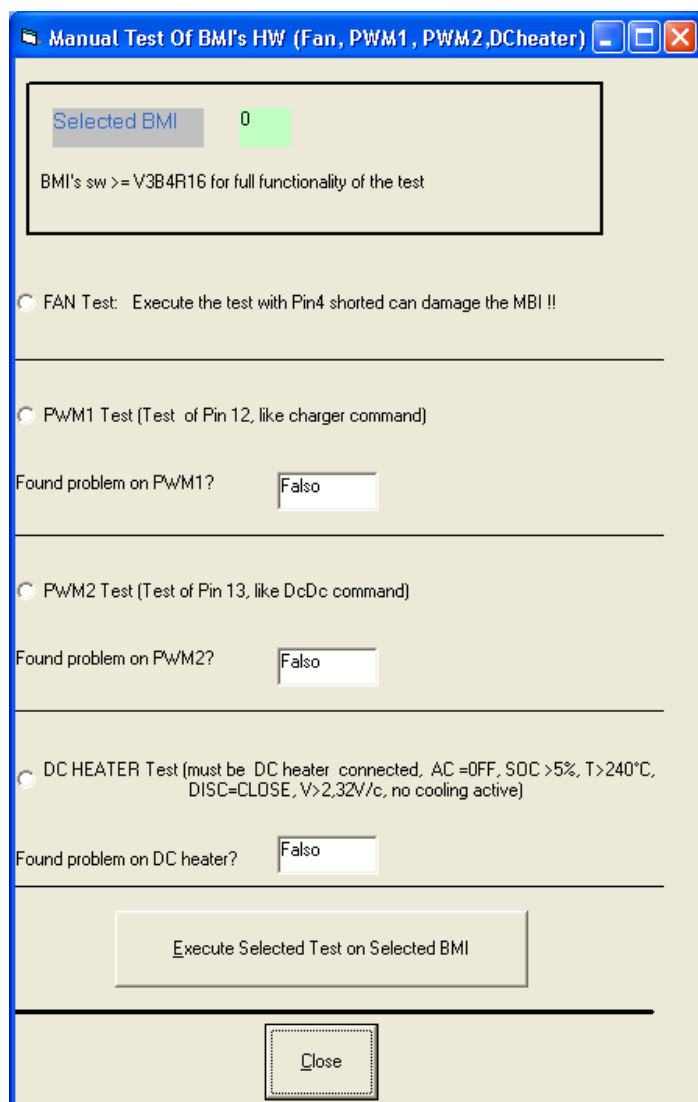


11 - BMIs Hw Test

In order to open the BMI HW Test dialog select [BMI's HW test facilities](#) from desired BMI ([Treeview of linked batteries](#))



A click on this function open a dialog box named *Manual Test Of BMI's HW*.



Manual Test Of BMI's HW (Fan, PWM1, PWM2, DCheater)

Selected BMI: 0

BMI's sw >= V3B4R16 for full functionality of the test

☐ FAN Test: Execute the test with Pin4 shorted can damage the MBI !!

☐ PWM1 Test (Test of Pin 12, like charger command)

Found problem on PWM1?

☐ PWM2 Test (Test of Pin 13, like DcDc command)

Found problem on PWM2?

☐ DC HEATER Test (must be DC heater connected, AC =OFF, SOC >5%, T >240°C, DISC=CLOSE, V >2,32V/c, no cooling active)

Found problem on DC heater?

In this window there are four kind of test:

- FAN test: depending on the model, a sodium metal halide battery can be air cooled. Each battery requires a dedicated cooler, the fan is automatically activated by the BMI battery controller when necessary. Execute this test while someone working on the battery could be dangerous, so ZEBRA® Monitor ask a confirmation before launch test.
- PWM1 is a test on Vehicle control connector pin 12 (like charger command)
- PWM2 is a test on Vehicle control connector pin 13 (DC/DC or MCU enable)
- DC HEATER test

To select a test, use the radio buttons, and to run it click on “Execute Selected Test on Selected BMI” key on the bottom of the window.

The test result is written on the related text box. If the result is *True* (problems on BMI) , more information could be find on “*last 20 errors detected*” tab.

12 - Manual switch-off error

This function generate a *Manual switch-off error* for diagnostic purpose (e.g.: unbalanced batteries).

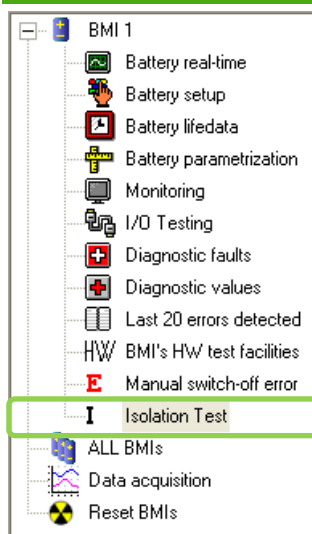
To execute this test click  Manual switch-off error on the selected [BMI](#) sub-tree of [treeview of linked battery](#).

A pop up window warn the user that the error has been raised.



This error is visible on “*last 20 errors detected*” tab and in “*diagnostic fault*” tab too.

13 - Isolation Test



Included in the BMI is a circuit to measure the battery isolation resistance. The BMI can measure the isolation resistance between the range of 10 to 1000 Kohm. The measurement is performed by a temporary connection of a resistor between the battery terminals HV+ or HV- and the chassis ground. The procedure includes a self test that checks the circuit for proper operation. To performed an Isolation Test from ZEBRA® Monitor, click on the “Isolation Test” row under the BMI of interest and confirm the text execution. A progress bar is showed during the execution of the ISOTEST procedure.

Results are showed in “5 – Monitoring” Tab:

3 - ISO test enable from MBS		FALSE
4 - ISO test enable from ZebraMonitor		FALSE
5 - ISO test in progress		FALSE
6 - ISO measurement verification cycle		FALSE
7 - ISO res measured	kOhm	0
W 8 - Minimum ISO res measured	kOhm	1000
W 9 - Number of ISO errors removed after verification		0

The minimum value to set an isolation error depends on the BMI type.

In case of isolation resistance which is lower than expected the BMI will set an error condition and the information isolation error will be available on the vehicle [CAN](#).

An isolation error can be internal or external:

- an isolation error is defined external if detected when the battery contactor S2 (HV-) is closed
- an isolation error is defined internal if detected when the battery contactor S2 is open.

The ZEBRA® Monitor diagnostic program can display the error type.

A battery that shows an external ISO error can be discharged but not charged.

A battery that shows an internal ISO error cannot be operated.

In case of an internal ISO error the BMI will stop the operation of the heaters and of the fan and the battery will let cool down. An external isolation error can be erased automatically; an internal isolation error can be reset only by the ZEBRA® Monitor diagnostic program.

To avoid false detections, the set of an internal ISO error must be confirmed by 3 consecutive tests.

If the external isolation error appears in discharge mode:

- the discharge is allowed for a maximum of 9 minutes.
- regen braking is not allowed
- as soon as the BMI is set in park mode (S2 open) the BMI will automatically check for an internal ISO error.

If the isolation resistance is correct the External iso error will be removed and the counter **Number of ISO error removed after verification will be incremented**.

If the counter **Number of ISO error removed after verification** reaches the maximum of errors removed, the External ISO error will be not removed automatically and will be required to delete the error and reset the counter to 0 by ZEBRA® monitor. In this case it is recommended to have additional checks to find the cause of repetitive external isolation errors. If the internal isolation resistance of the battery is found to be too low, an internal ISO error is set, and the BMI will perform two additional checks before a definitive set

of the error is arisen. This is performed to avoid false detections. If in additional tests the isolation resistance is good, the error is erased.

If the external isolation error appears in charge mode:

- the charge is stopped
- as soon as the BMI opens the main contactors the BMI will automatically check for an internal ISO error.

If the isolation resistance is correct the External iso error will be removed and the counter **Number of ISO error removed after verification** will be incremented. In this case the charge can restart.

If the counter **Number of ISO error removed after verification** reaches the maximum of errors removed, the External ISO error will be not removed automatically but it is necessary to delete the error and reset to 0 the counter by ZEBRA® monitor. This means that in case of a real isolation problem, the charge can proceed and will stop when the counter **Number of ISO error removed after verification** reaches the maximum. The maximum number of **Number of ISO error removed after verification** depends on the BMI software release.

If the internal isolation resistance of the battery is found to be low, an internal ISO error is set, and the BMI will perform two additional checks before of a definitive set of the error to avoid false detections. If in one of the two additional tests the isolation resistance is good, the error is erased.

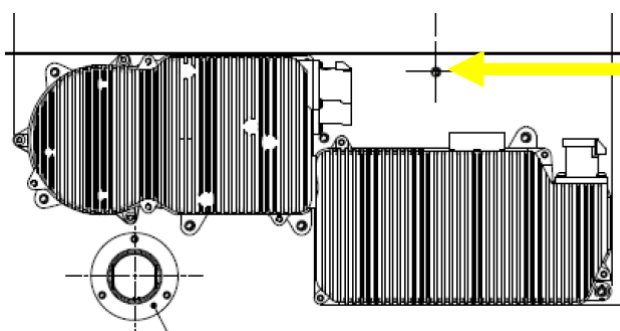
In the case of a detection of a problem in the circuit, the BMI will set an isoself test error and a warning message, which will be available on the vehicle can. The ZEBRA® Monitor diagnostic program can display the error type. In a single battery system the isolation test is performed automatically every 10 minutes. In a multi-battery system the isolation test is enabled by the MBS: every 10 minutes, the MBS will start an ISOTEST cycle and activate the test on all the batteries sequentially. If an external ISO error is set, the check of the internal ISO error is performed automatically by the BMI as soon as the main contactor S2 is open.

In multi-battery system the ISOTEST of the BMI, when interfering with other system to measure the ISO on the vehicle, can be disabled with a can message : in this case the user must be aware that the safety-detection of iso error is executed only by devices different from BMI.

For a new battery the typical isolation resistance is higher than 50 MOhm. And the BMI shows 1000 KOhm.



After the replacement of a BMI or BMI software update the counter Number of ISO error removed after verification can have wrong values and must be checked.



GND connection
(tight the nuts at 5 Nm max)

It is necessary to coordinate with FIAMM SoNick the return of the battery for evaluation and repair.



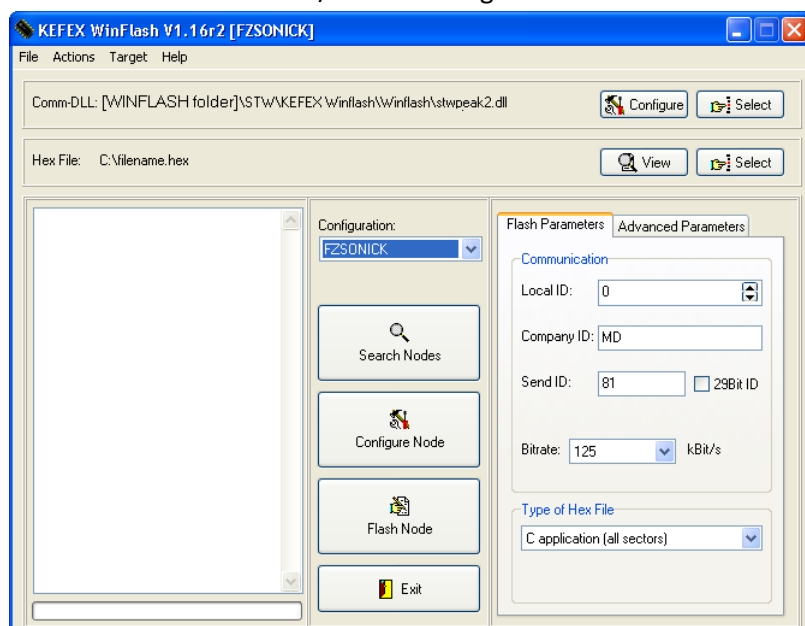
Trying to operate a battery that showed an internal ISO error can be dangerous.

14 - Using optional software

This chapter describes how to use optional software for [CAN](#) monitoring and for flash the [BMI](#) or [MBS](#) firmware.

14.1 - WinFlash

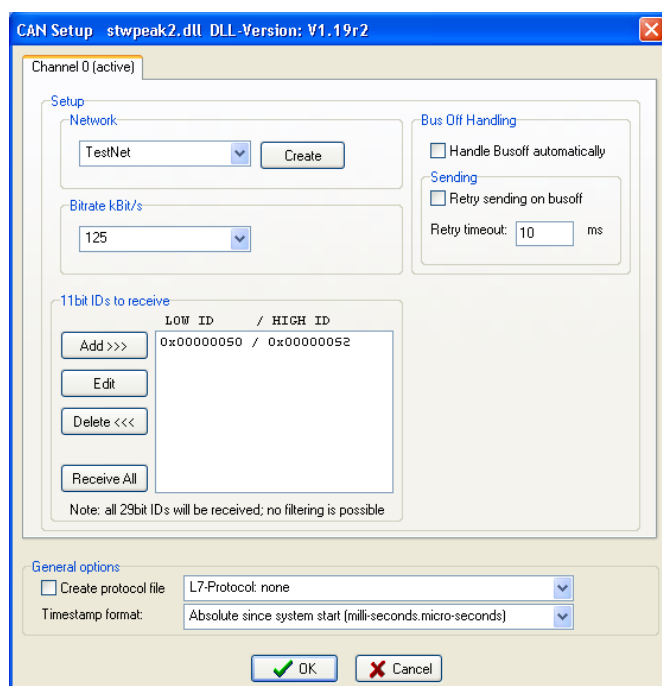
Use this software for MBS/BMIs Flashing



- Single Battery System ID=0 is BMI
- in Multi Battery System ID=0 is MBS and ID from 1 to 16 are used for BMIs

Run Winflash and check the following setting:

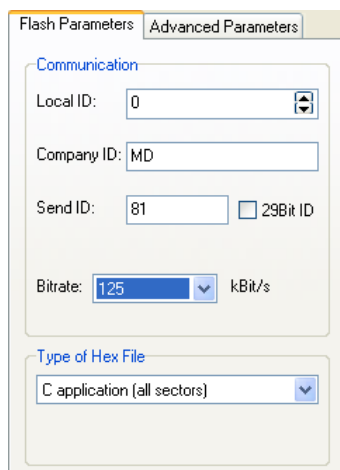
- **For PEAK interface:** (refer to [chapter 2.2.3](#) for the automatic configuration procedure)
Comm-DLL: [WINFLASH folder]\STW\KEFEX Winflash\Winflash\stwpeak2.dll



Configure: select TestNet as Setup network with 125K bit rate and 11bit ID to receive at 0x00000050 / 0x00000052.



Be careful: updating the software of BMI on a vehicle with different settings of the CAN bus, eg. 250Kb, no others CAN node must be active during the communication between BMI and WinFlash.



Flash Parameters

Communication

Local ID: 0

Company ID: MD

Send ID: 81 ☐ 29Bit ID

Bitrate: 125 kBit/s

Type of Hex File

C application (all sectors)

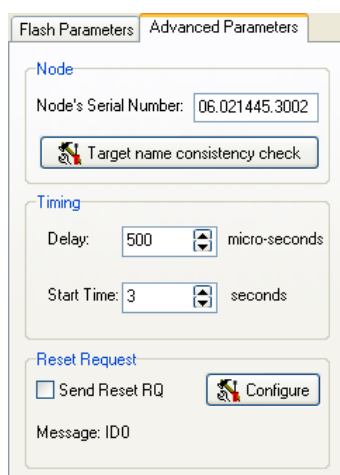
Local ID = let 0 for now

Company ID = MD

Send ID= 81

Bitrate= 125K usually

Type of HexFile= C application (all sectors)



Flash Parameters

Advanced Parameters

Node

Node's Serial Number: 06.021445.3002

☐ Target name consistency check

Timing

Delay: 500 micro-seconds

Start Time: 3 seconds

Reset Request

☐ Send Reset RQ

Message: ID0

Node's Serial Number = don't care

Delay= 500 micro sec

Start Time= 3s usually or higher

Send Reset RQ= disabled

• For VECTOR interface

Comm-DLL: [WINFLASH folder]\STW\KEFEX Winflash\Winflash\stwvec32.dll

Configure: select the used Vector channel.

Only if you do modifications, save the current configuration as FIAMM SoNick with command File → Save Current Configuration.

To download software:



1. be sure that pin 10 (external voltage) and pin 3 (ignition key) of all the BMIs are off, and that pin 3 (ignition) of the MBS is off too;
be sure that the power supply is applied at BMI's pin 11 and MBS's pin 9
2. [send a reset to the BMIs](#) using ZEBRA® Monitor, or power on pin 2 (reset input) of the BMIs and assure that the devices are off.
3. close ZEBRA® Monitor and open WinFlash.



Check if all the settings of the WinFlash program window are correctly configured as explained above.

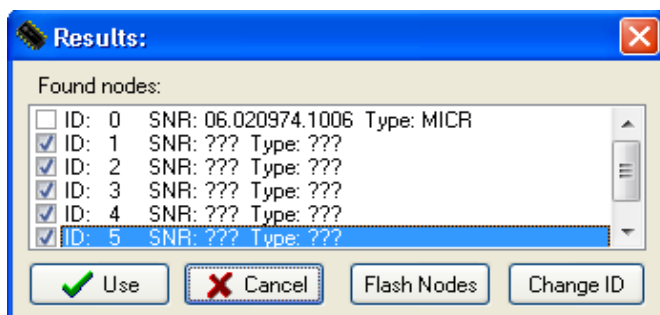
4. select the right software version that you want to download on the BMI/MBS using the "select" key on "Hex File" row. If both BMI and MBS must be updated, start downloading software on BMI.



Please pay attention to use the BMI software only for the BMIs and to use the MBS software only for the MBS device. You mustn't use the same software for the BMI and the MBS.

5. click on “Search Node” and wait the “start time” (the message “Power on” will be showed in about 3 seconds) then:
 - a. On BMI: power on pin 3 or pin 10
 - b. On MBS: power on pin 3

Note: The power on must start after the message “Power on” and within the 3 sec indicated in start time of windows “Advanced parameters”
6. in the Results window, select the node to be updated. In a multi battery system you can select all BMIs at once like in this picture or only MBS.

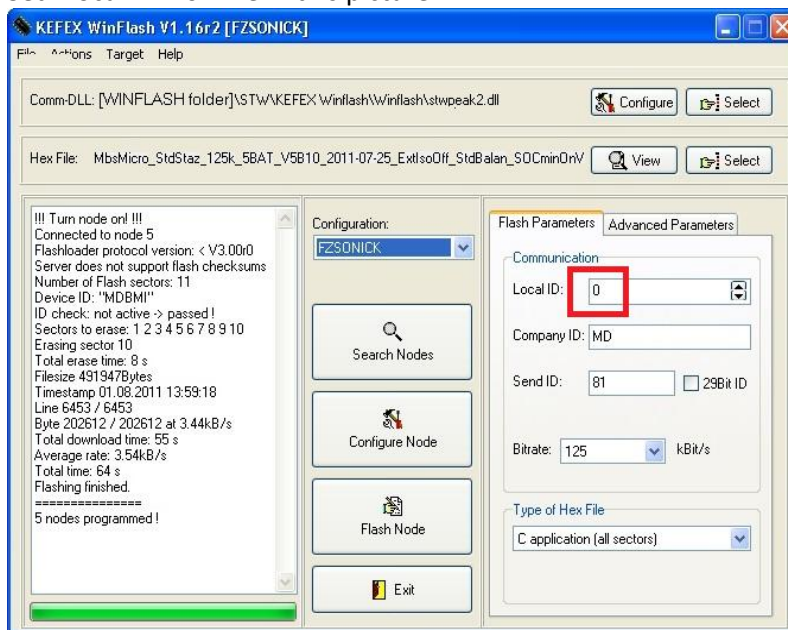


7. always in the Results window, click on “Flash Nodes” to start the download.
8. in a multi-battery system the node 0 is the MBS device and the nodes 1-16 are the BMIs devices.



Be sure to use the right software version for the MBS and for the BMI, these two software are different.

9. If after BMI must be updated also the MBS, select the right software version that you want to download on the MBS, using the “select” key on “Hex File”
10. Set “Local ID = 0” like in this picture



11. click on “Flash Node” to start the download on MBS
12. power off:

- a. On BMI: pin 3 or pin 10 and also pin 2 if was powered at point 2
- b. On MBS: pin 3

Note: The power on must start after the message "Power on" and within the 3 sec indicated in start time of windows "Advanced parameters"

13. close WinFlash

At the end of the download:



14. wait 20seconds and then:

- a. On BMI: power on pin 3 or pin 10
- b. On MBS: power on pin 3

in order to wake up in normal mode the devices and leave power up at least for 20sec.

15. check with ZEBRA® Monitor in "battery setup" if the "software version" and the "software release date" are the same for all the BMIs and that everything works correctly.



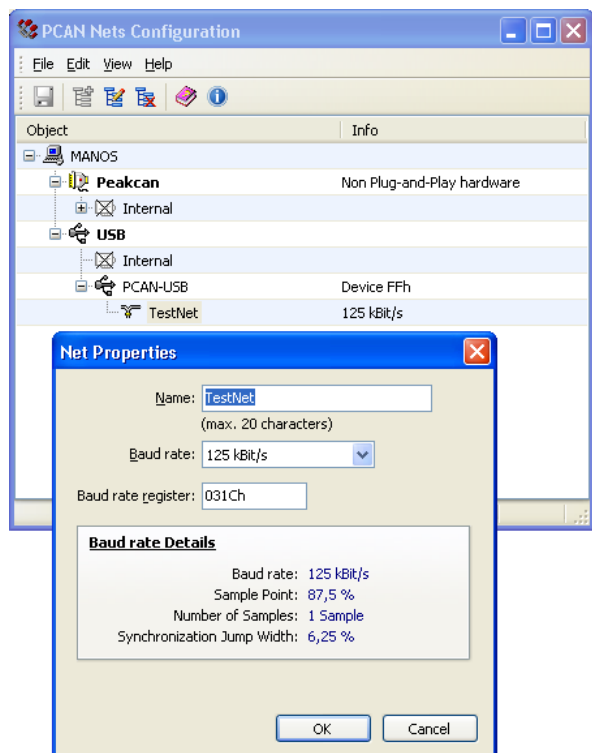
If an error occurs after search nodes command while PEAK CAN USB hardware is used, please see the file "WinflashTroubleshooting.txt" in the folder:

"[WINFLASH folder]\STW\KEFEX Winflash\Winflash".

In this file can be found useful information to fix the problem. For more information contact FIAMM SoNick's Customer Service.

14.2 - PCAN Nets Configurations

Before starting the PCAN Nets Configuration tool you should quit all running PCAN programs (clients).



You can use this tool to create and configure PCAN nets. These are used by the various PCAN programs to establish a connection to a [CAN](#) hardware and communicate with its connected physical CAN bus. The displayed tree structure shows the installed hardware and their affiliated nets.

The virtual hardware Internal is always present. Based on it, internal nets can be defined, which are usually used for developing PCAN programs (clients) and simulating a physical CAN bus. External nets can be “parked” here, if the corresponding hardware has been removed temporarily.

Nets can be simply moved from one hardware node to another one by using Drag-and-Drop.

Create a new net:

In the tree, select the hardware entry for which a new net shall be created, right click on it and select “New Net”. A dialog box for entering the net properties is shown. Enter the name of the new net into the Name field. Select the desired transfer rate from the Baud rate drop-down list. Selecting the Baud rate automatically sets the value for the CAN controller’s Baud rate register (BTR0/BTR1). The **Baud rate details** field will display detailed information about the selected Baud rate. Press OK. The new net appears as a branch of the selected hardware. In the File menu, choose the Save All command, or press the corresponding button in the tool bar. The new net can now be accessed by PCAN programs.

Editing Nets:

An existing net can only be edited if no client is connected to it. If a net is currently locked by a client, this is indicated by a lock icon next to the net name. In the tree, right click on the net which shall be edited and select Properties. A dialog for the definition of the net properties is shown. Edit the net properties. Press OK. In the File menu, choose the Save All Command.

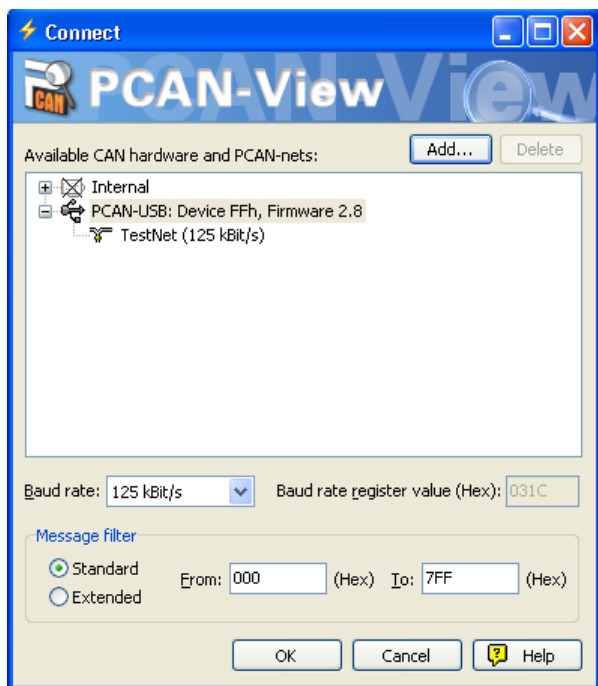
Deleting Nets:

Deleting a net is only possible if no client is connected to it. In the tree, right click on the net which shall be deleted and select “Delete Net”. Confirm the deletion by choosing Yes in the message window. In the File menu, choose the Save All command.



Refer to [PCAN- Nets Configurations help](#) for more information

14.3 - PCAN View



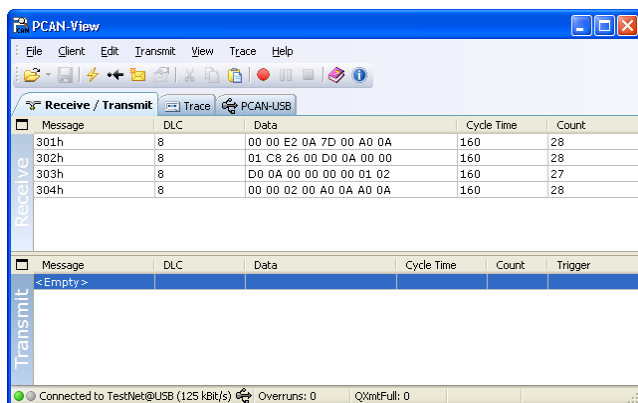
PCAN-View is an easy to use monitoring program to supervise the data flow on a Controller Area Network ([CAN](#)).

PCAN-View has the following principal features:

- Received CAN messages are displayed with ID, Data Length Code, and data bytes in a list. Additionally, the number of messages that have the same ID, and the time delay between the last two of those messages are shown.
- Received Remote Request frames are shown.

The initial window allow the selection of the PCAN HW and Net.

Select the desired HW-Net and click “OK”.



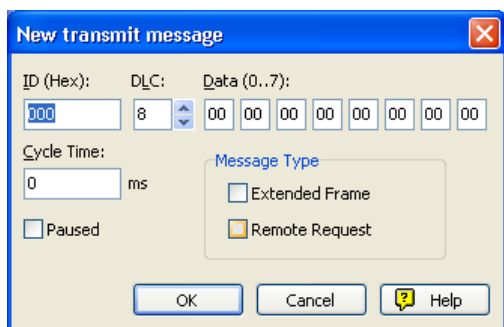
After PCAN-View has been successfully connected all CAN messages on the bus that pass the message filter of the CAN controller are shown in hexadecimal notation in the Receive list.

The message filter can be configured in the Connect Dialog Box.

CAN messages can be transmitted to other CAN nodes by creating a new transmit message in the Transmit list. See Edit the Transmit List.

After a transmit message is created, the message will be transmitted either periodically, or can be transmitted manually by the user, according to the configured transmission cycle time.

Right click on the Transmit List open the “New transmit message” dialog.



Here it's possible to set all the parameters of the message that should be transmitted on the CAN.



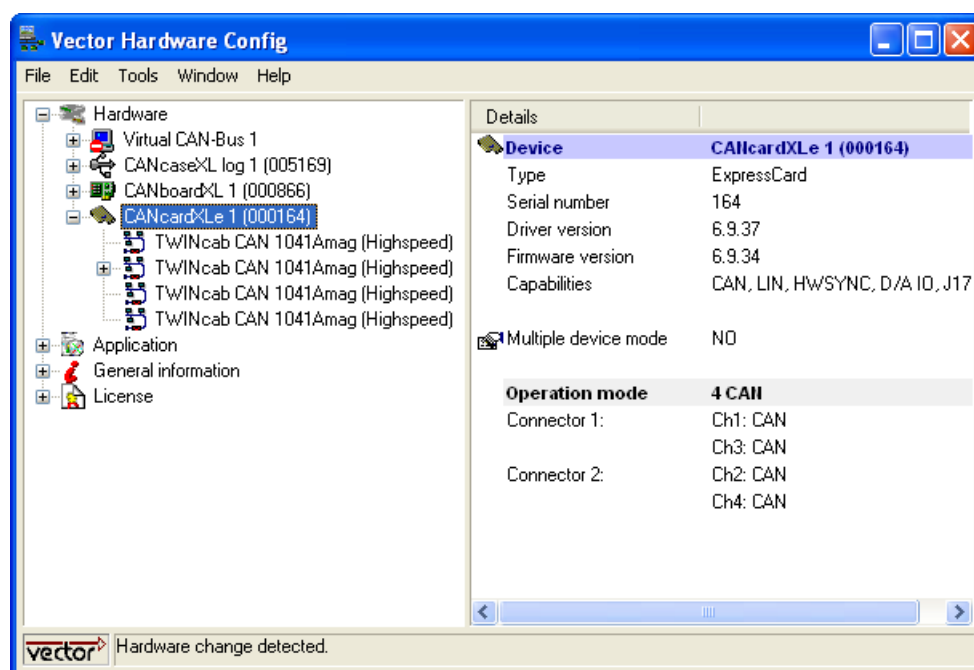
Refer to [PCAN-View](#) help for more documentation

14.4 - VECTOR HW Configurations

After a successful installation of Vector driver the user will find the configuration application *Vector Hardware* in the MS Windows Control Panel.



The tool gives information about the connected and installed Vector Devices

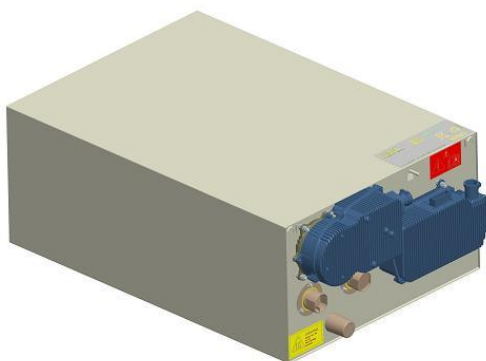


The interface is split in two windows. The left one show the installed Vector Devices and the right one display the details of the selection.

The following nodes are available on the left window:

- Hardware: here is shown each installed Vector Device. Sub-trees contain additional information of available channels.
- Application: show all available application with their configured channels
- General information.
- License.

15 - System overview



The sodium metal halide battery is built with single cells of the same type which are interconnected by brazed connectors. Several different connection configurations are possible for each battery design, i.e. the cells are connected in series and parallel inside the battery to obtain the required battery voltage and rated capacity. The battery terminal voltage is determined by the number of cells connected in series (also called “strings”) and the battery capacity is determined by the number of cell chains connected in parallel. These cells operates with an high internal temperature.

Different types of cells will have different capacity, current ratings and can require a different thermal management. The cells assembled in a battery are enclosed in a double vacuum insulated metal box, which is necessary for insulation and heat loss. On the Box are located three probes for the inside temperature detection, one of these have spare function and have to be manually wired if one of the others probes go wrong.

Each battery is connected to an interface device called BMI (Battery Management Interface) that include connectors for high voltage DC Traction Power, the main relay and the shunt for the on board measurement of the current.

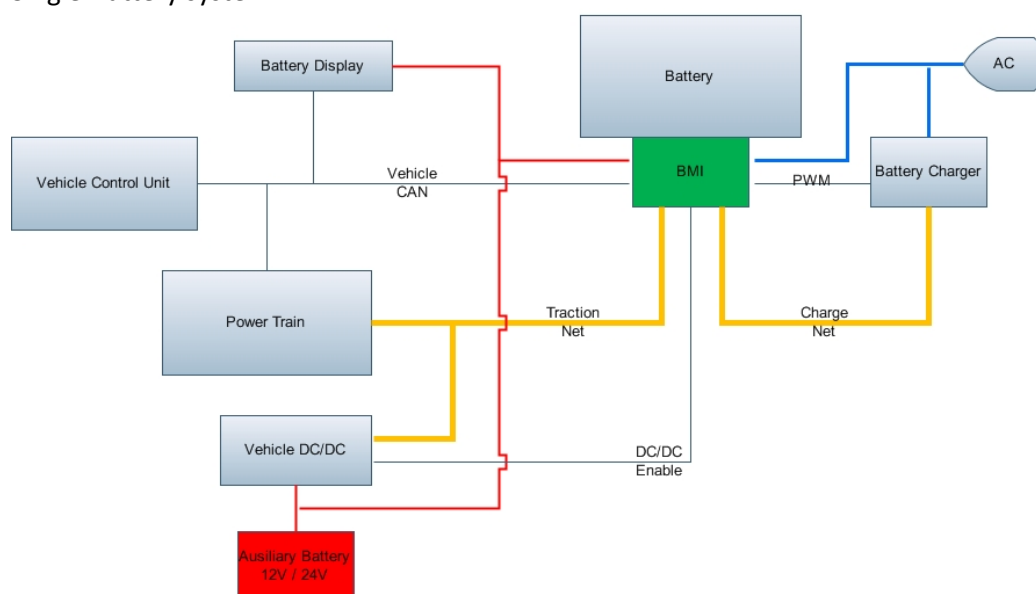
It also provide control functions and monitoring of parameters such as:

- Current
- Terminal voltage
- Temperature
- Status of charge
- Insulation resistance between the main circuit and the battery box.

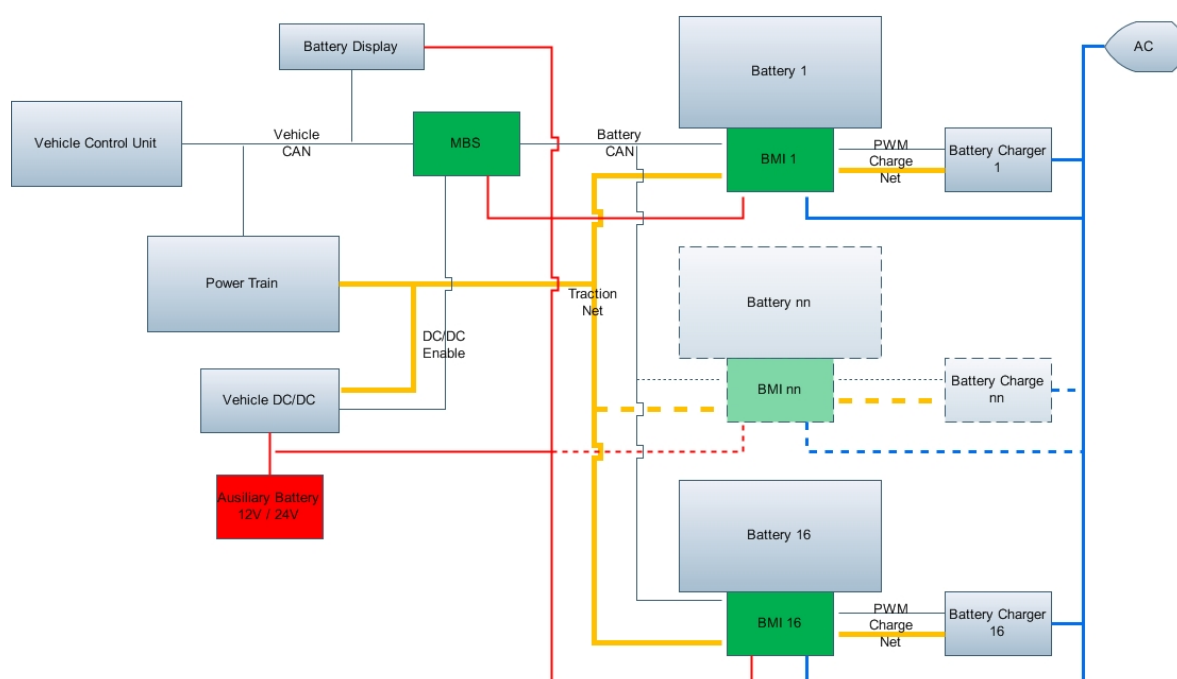
15.1 - Single and multi battery system

Different configurations of sodium metal halide batteries can be used to reach the necessary energy and power to cover the requested operation:

- Single-Battery system:



- Multi-Battery system (sodium metal halide batteries can be used in parallel, up to a maximum of 16 on one vehicle):



A multi battery system requires the use of **MBS** (*Multiple Battery Server*), a system supervisor that works as interface between the battery system and the vehicle. The MBS will communicate with all the batteries on the Battery [CAN](#) and with the vehicle on the Vehicle CAN.

In general the MBS collects the operational conditions of all batteries and will inform the vehicle about [SOC](#), Voltage and Current limitations available for operation.

The aging of batteries can determine the failure of some cells.

As a NaCl-Ni cells typically fails to short circuit, a sodium metal halide battery can be operated with the presence of failed cells, with a reduced [Open Circuit Voltage](#).

If batteries with different number of failed cells are operated in parallel, the charge and discharge rates can be different, so the SOC of the batteries can be unbalanced.

If the difference between sodium metal halide batteries is higher than 5% in terms of cell failures, then it can be difficult to operate all the batteries because of possible pre-charge problems during the start up of parallel operation.

It is possible to reduce the SOC unbalance between batteries by applying some control algorithms.

For example, a vehicle can be operated with a battery disconnected. The MBS can apply the standard Balancing algorithm to try to keep the SOC difference below 5% SOC. Alternative solutions are possible depending on hardware configuration.

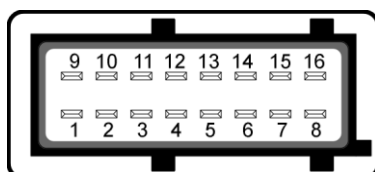
15.2 - BMI - Hardware connection check



15.2.1 - Vehicle control connector (Manufacturer: AMP)

Protection class:

- not connected :
 - solids: finger or similar object;
 - liquid: Not protected;
- connected:
 - solids: dust tight;
 - liquid: immersion up to 1 m;



description	pin number (lower side)	pin number (upper side)	description
Ground	1	9	Emergency Switch
Reset Software	2	10	DC Supply 12...30v
Ignition	3	11	U _B 8...35v
Output Cooling Fan	4	12	Output 1
Reserved	5	13	Output 2
Reserved	6	14	Halt Input 1
CAN2-H (charge)	7	15	CAN2-L (charge)
CAN1-H (battery CAN)	8	16	CAN1-L (battery CAN)

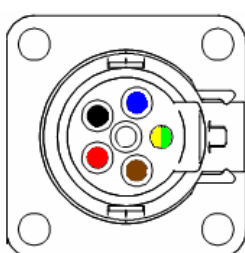


Refer to [NaCl-Ni Battery Handbook](#) for more information

15.2.2 - AC-mains and battery charger connector (Manufacturer: Pfisterer)

Protection class:

- not connected :
 - solids: finger or similar object;
 - liquid: Not protected;
- connected:
 - solids: dust tight;
 - liquid: immersion up to 1 m;

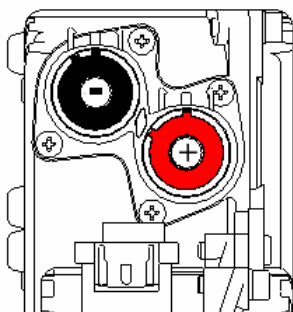


pin position	description	BMI	Notes
	UCharge -	female	(max 20A / 670V)
	Power Line N	male	(max.8A)
	n.c.		
	Power Line L1	male	(max.8A)
	UCharge +	female	(max 20A / 670V)
	Power Line PE	male	Protective ground



Refer to [NaCl-Ni Battery Handbook](#) for more information

15.2.3 - HV DC voltage connector(Manufacturer: FIAMM SoNick)



Protection class:

- not connected :
 - solids: finger or similar object;
 - liquid: Not protected;
- connected:
 - solids: dust tight;
 - liquid: immersion up to 1 m;

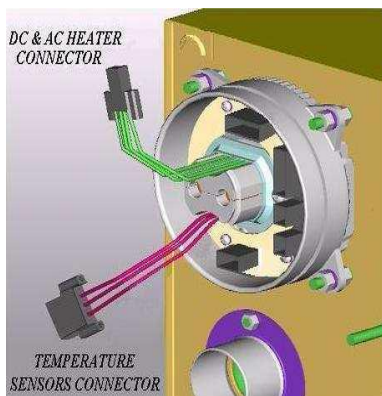


WARNING: DANGEROUS VOLTAGE – DC Line Supply: 40V...600 VDC



Refer to [NaCl-Ni Battery Handbook](#) for more information

15.2.4 - The Battery Flange



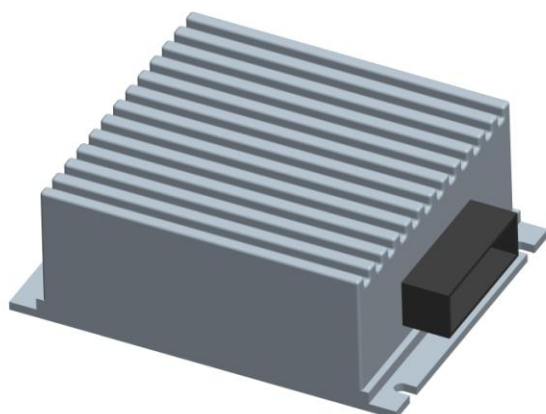
The battery flange is part of a sodium metal halide battery and must not be removed: in case of [BMI](#) replacement the flange must not be dismantled.

The battery flange includes the connectors for the battery positive and negative poles, for the heaters and for the temperature sensors and the circuits for the storage of the main parameters and the life data (basic battery configuration parameters as number of cells and of chains, cell type, historical data and life data as [SOC](#) and nameplate cycles).



Refer to [NaCl-Ni Battery Handbook](#) for more information

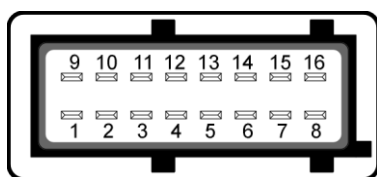
15.3 - MBS - Hardware connection check



15.3.1 - Vehicle control connector (Manufacturer: AMP)

Protection class:

- not connected :
 - solids: finger or similar object;
 - liquid: Not protected;
- connected:
 - solids: dust tight;
 - liquid: immersion up to 1 m;



description	pin number (lower side)	pin number (upper side)	description
CAN1-H (battery CAN)	1	9	U _E 12...32v
CAN1-L (battery CAN)	2	10	AGND
Ignition	3	11	Ground
CAN2-H (vehicle CAN)	4	12	CAN2-L (vehicle CAN)
Reserved	5	13	Reserved
Reserved	6	14	Reserved
Reserved	7	15	Reserved
Reserved	8	16	Reserved



Be sure that pin 10 and 11 must be short circuited and grounded



Refer to [NaCl-Ni Battery Handbook](#) for more information

15.4 - Security conditions

Due to the potential risk of the voltage of the battery, the personnel that operates on the battery system (installation, fault clearance, and all other phases of handling, etc) must be qualified and well trained.

The shipment, installation, use and maintenance as well as the selloff of the batteries must be executed following the instructions contained in the [User Manual](#).

The batteries are suited to be used on electric or hybrid vehicles, in the traction system.

Is required that the batteries are located in a space not accessible by the driver during the normal usage.

The sodium metal halide battery must be electrically connected to the chassis of the vehicle in order to have all the accessible parts at the same potential. FIAMM SoNick is available to provide any information to analyse the battery location inside the vehicle. The producer of the vehicle must follow all the normative related to the use of the batteries in electric vehicles such:

- avoid motion of the vehicle when the AC plug is connected
- motion of the vehicle can be possible only after a start up sequence that, for [BMI](#), is a positive edge on pin 3, ignition key
- provide to the driver an emergency switch to allow the disconnection of the battery
- provide to the driver information of state of charge, reduced power, etc using the “BMI or [MBS](#) User interface manual” with the description of the can messages sent by BMI or MBS

Contact FIAMM SoNick for any other additional information not contained in user manual.



Dangerous voltage could be present on the BMI connectors.

The BMI includes the mains voltage contactors, which, when are open, insulate the battery. In case of faulty BMI, there is the remote possibility that the mains contactors remain closed. The power connectors, when unplugged, have a protection by direct physical contact.



The connectors must be connected/disconnected, only when the power lines (220V) or 12/24V auxiliary voltage are not plugged in and the emergency switch is in the EMERGENCY position.

The BMI unit is rated as protection class [IP67](#) (solids: dust tight; liquid: immersion up to 1 m), if all connectors, correctly mounted and sealed, are plugged in.

If the connectors are disconnected, the protection class of BMI is [IP20](#)(solids: finger or similar object; liquid: Not protected).



Sealing: To guarantee the protection from water and obtain the IP67 the connectors must be mounted correctly, including the o-ring those ensure the seal.



Attention: If it is necessary to disassembly the BMI, before reset the BMI by pin 2 on AMP16 connector and then remove all the connectors. Do not supply mains voltage to the BMI while disconnected from the battery.



Refer to [NaCl-Ni Battery Handbook](#) for more information about Battery management, Security conditions, handling.

Appendix A: Description of ZEBRA® Monitor variables



Warning: This document is a preliminary version, only some variables have been described

Tab 1: Battery real-time

Name: Battery temp. mean	Description: Battery temperature read by the average of the two temperature probes	
	Range: -40°C ÷ +400 °C	Unit: °C
	Page: Battery real-time	Row: 1
	See also: Temp. sensor 1, Temp. sensor 2	
	BMI identifier: DPH_RI_TEMP_AVERAGE	
Name: Temp. sensor 1	Description: Battery temperature read by probe 1	
	Range: -40°C ÷ +400 °C	Unit: °C
	Page: Battery real-time	Row: 2
	See also: Battery temp. mean, Temp. sensor 2	
	BMI identifier: DPH_RI_TEMP1	
Name: Temp. sensor 2	Description: Battery temperature read by probe 2	
	Range: -40°C ÷ +400 °C	Unit: °C
	Page: Battery real-time	Row: 3
	See also: Battery temp. mean, Temp. sensor 1	
	BMI identifier: DPH_RI_TEMP2	
Name: Temp. BMI	Description: Temperature inside the BMI	
	Range: -40°C ÷ +150 °C	Unit: °C
	Page: Battery real-time	Row: 4
	See also:	
	BMI identifier: DPH_RI_TEMPBMS	
Name: Battery current	Description: Battery current read by the BMI. Average value of ten samples acquired every 20 ms	
	Range: -300A ÷ +400A	Unit: Amp
	Page: Battery real-time	Row: 5
	See also: Battery Current used to compute SOC	
	BMI identifier: DPH_RI_BATTERY_CURRENT	
Name: Battery Current used to compute SOC	Description: Battery current used to calculate the State Of Charge of the battery. Instantaneous value acquired every 20 ms, plus the eventual integral offset.	
	Range: -300A ÷ +400A	Unit: Amp
	Page: Battery real-time	Row: 6
	See also: Battery current, Current offset for SOC calc	
	BMI identifier: DPH_RL_BATTERY_CURRENT	

Name: Battery voltage	Description: Battery voltage read by the BMI every 20ms	
	Range: 0V ÷ 800V	Unit: Volt
	Page: Battery real-time	Row: 7
	See also: Smoothcap voltage	
	BMI identifier: DPH_RI_BATTERY_VOLTAGE	
Name: Smoothcap voltage	Description: Voltage read by the BMI every 80ms on the filter capacitors placed on the traction net after the switch coil S2 and S3	
	Range: 0V ÷ 800V	Unit: Volt
	Page: Battery real-time	Row: 8
	See also: Battery voltage	
	BMI identifier: DPH_RI_SMOOTHCAP_VOLTAGE	
Name: SOC	Description: State Of Charge of the battery, 100% means battery full charged 0% means battery empty . The SOC is computed as the ratio of the actual battery capacity, calculated by BMI, and the full charged capacity.	
	Range: 0% ÷ 110%	Unit: %
	Page: Battery real-time	Row: 9
	See also: DOD, SOC (LDM copy n), Actual battery capacity	
	BMI identifier: DPH_RI_SOC	
Name: SOC (LDM copy 1)	Description: Copy of SOC stored in the battery flange. Saved without decimals	
	Range: 0% ÷ 100%	Unit: %
	Page: Battery real-time	Row: 10
	See also: SOC, SOC (LDM copy n), DOD	
	BMI identifier: DPH_LMUC_SOC	
Name: SOC (LDM copy 2)	Description: Copy of SOC stored in the battery flange. Saved without decimals	
	Range: 0% ÷ 100%	Unit: %
	Page: Battery real-time	Row: 11
	See also: SOC, SOC (LDM copy n), DOD	
	BMI identifier: DPH_LMUC_SOC_MIRROR	
Name: SOC (LDM copy 3)	Description: Copy of SOC stored in the battery flange. Saved without decimals	
	Range: 0% ÷ 100%	Unit: %
	Page: Battery real-time	Row: 12
	See also: SOC, SOC (LDM copy n), DOD	
	BMI identifier: DPH_LMUC_SOC_PREV	

Name: DOD	Description: Depth Of Discharge of the battery, 0% means battery full charged 100% means battery empty . The DOD doesn't go negative also if the SOC is higher 100%.	
	Range: 0% ÷ 100%	Unit: %
	Page: Battery real-time	Row: 13
	See also: SOC, SOC (LDM copy n)	
	BMI identifier: DPH_RI_DOD	
Name: Actual battery capacity	Description: The actual battery capacity is computed by the BMI with an integration of the measured current over time.	
	Range:	Unit: Ah
	Page: Battery real-time	Row: 14
	See also: SOC, Actual battery capacity (copy), Capacity fullcharged, Battery Current used to compute SOC	
	BMI identifier: DPH_RDW_CAPACITY_X1000	
Name: Actual battery capacity (copy)	Description: Copy of the actual battery capacity.	
	Range:	Unit: Ah
	Page: Battery real-time	Row: 15
	See also: Actual battery capacity	
	BMI identifier: DPH_RDW_CAPACITY_PREV_X1000	
Name: Capacity fullcharged	Description: Value of capacity when the battery is fully charged. Corresponds to the Nameplate capacity.	
	Range:	Unit: Ah
	Page: Battery real-time	Row: 16
	See also: Actual battery capacity, SOC, Nameplate capacity	
	BMI identifier: DPH_LMUC_CAPACITY_FULLCHARGED	
Name: Nameplate capacity	Description: Value of the nominal battery capacity.	
	Range:	Unit: Ah
	Page: Battery real-time	Row: 17
	See also: Capacity fullcharged	
	BMI identifier: DPH_LMUC_BATTERY_NAMEPLATE_CAPACITY	
Name: Nameplate capacity of one string only	Description: Value of the nominal capacity of only one string of cells. If the battery has only one string it corresponds with the nameplate capacity.	
	Range:	Unit: Ah
	Page: Battery real-time	Row: 18
	See also: Nameplate capacity, Number of strings	
	BMI identifier: DPH_RI_NOM_CAP_X_STRING	

Name: Energy in precharge resistor (Ws)	Description: In the BMI there is a special resistors that has a limit of energy dissipation, this variable counts the accumulated energy to be dissipated in this resistance. After a precharge reaches its maximum value and then is decreased during the cooling of the resistance.	
	Range:	Unit: Ws
	Page: Battery real-time	Row: 19
	See also: BMI identifier: DPH_RI_PRECH_ENERGY	
Name: Regen braking exceeded limits (ONLY FOR SPECIAL BMI's SW)	Description: In some special application indicates when the regenerative braking has exceeded the limits.	
	Range: FALSE, TRUE	Unit:
	Page: Battery real-time	Row: 20
	See also: BMI identifier: DPH_RB_FCH_GE_EXCEEDED_LIMITS	
Name: SOC(Current+100mA/s): SOC integral	Description: State Of Charge calculated as the ratio between the Actual battery capacity plus the Cumulated integral offset and the Capacity fullcharged. This value of SOC is not affected by the integral offset correction.	
	Range:	Unit: %
	Page: Battery real-time	Row: 21
	See also: SOC, Actual battery capacity, Cumulated integral offset, Capacity fullcharged BMI identifier: DPH_RI_SOC_INTEGRAL	

Tab 2: Battery setup

Name: Battery address	Description: Address identification of the battery. In a single battery system must be always 0, in a multi battery system can be from 1 to 16.	
	Range: 0 ÷ 16	Unit:
	Page: Battery setup	Row: 1
	See also:	
	BMI identifier: DPH_NTUC_BATTERY_ADDRESS	

Tab 3: Battery lifedata

Name: N° of communication error with the flange	Description: Counts the communication errors between BMI and the Life Data Memory in the flange of the battery. It can provide information on the amount of electromagnetic disturbances on the vehicle or system	
	Range: 0 ÷ 65535	Unit:
	Page: Battery lifedata	Row: 1
	See also:	
	BMI identifier: DPH_NTW_LDM_ERR_COUNTER	

Tab 4: Battery parametrization

Name: PT1000 variation (stored in BMI eeprom / to detect change of BMI- Battery)	Description: Batteries may differ according to the position of temperature probes. This value indicates which type of position of the probes is configured in the BMI's software. This value must be equal to the PT1000 position stored in flange. 0 means both probes in centre, 1 means one probe in the centre and one probe in the front, 2 means both probes in the front.	
	Range:	Unit:
	Page: Battery parametrization	Row: 1
	See also: PT1000 position	
	BMI identifier: DPH_CI_PT1000_VARIANT	

Name: PT1000 position (from flange obtained / actual Battery)	Description: : Batteries may differ according to the position of temperature probes. This value indicates which type of position of the probes is configured in the Life Data Memory of the battery. This value must be equal to the PT1000 variation stored in BMI. 0 means both probes in centre, 1 means one probe in the centre and one probe in the front, 2 means both probes in the front.	
	Range:	Unit:
	Page: Battery parametrization	Row: 2
	See also: PT1000 variation	
	BMI identifier: DPH_RI_PT1000_POS	

Tab 5: Monitoring

Name: System enable from MBS	Description: In a multi battery system the BMI must receive the enable signal via CAN Bus from the MBS to go in charge or discharge.	
	Range: FALSE, TRUE	Unit:
	Page: Monitoring	Row: 1
	See also:	
	BMI identifier: DPH_RB_SYS_ENABLE	

Tab 6: I/O Testing

Name: Ignition Key	Description: Status of the Ignition key connected to the BMI's pin 3.	
	Range: OFF, ON	Unit:
	Page: I/O Testing	Row: 1
	See also: Ignition can message	
	BMI identifier: DPH_RB_IGNITION	

Name: Ignition can message	Description: In the stationary application the commando to go in discharge must be received via CAN Bus.	
	Range: OFF, ON	Unit:
	Page: I/O Testing	Row: 2
	See also: Ignition Key	
	BMI identifier: DPH_RB_STZ_IGN_REQUEST	

Tab 7: Diagnostic faults

See Error List Description

Tab 8: Diagnostic values

Name: Reason for last DIS open	Description: Before opening the disconnection relay in this variable is stored the cause of the malfunction.	
	Range:	Unit:
	Page: Diagnostic values	Row: 1
	See also: Disconnection relay	
	BMI identifier: DPH_NTUC_REASON_FOR_LAST_DIS_OPEN	

Tab 9: Last 20 errors detected

See Error List Description



Appendix B: F.A.Q.

Appendix C: Definitions

OCV

Open-circuit voltage (abbreviated as OCV or V_{oc}) is the difference of electrical potential between two terminals of a device when there is no external load connected (i.e.: the circuit is broken or open). Under these conditions there is no external electric current between the terminals, even though there may be current internally (e.g. self-discharge currents in batteries).

Nameplate cycles

Cumulated discharged capacity (Ah) / nameplate capacity (Ah)

SOC

State Of Charge: actual battery capacity (Ah) / nameplate capacity (Ah)

DOD

Depth Of Discharge: discharged capacity (Ah) / nameplate capacity (Ah) is an alternate method to indicate a battery's state of charge (SOC). The DOD is the inverse of SOC: as one increases, the other decreases.

CAN

Controller–area network (CAN or CAN-bus) is a vehicle bus standard designed to allow microcontrollers and devices to communicate with each other within a vehicle without a host computer. CAN is a message-based protocol, designed specifically for automotive applications but now also used in other areas such as industrial automation and medical equipment.

IP Code

International Protection Rating consists of the letters *IP* followed by two digits and an optional letter. It classifies the degrees of protection provided against the intrusion of solid objects (first digit) and water(second digit) in electrical enclosures.

First digit: From 0 (= No protection) To 6 (= Dust tight)

Second digit: From 0 (= No protection) To 8 (= Immersion beyond 1 m)

Appendix D: References (Click on image to open)

