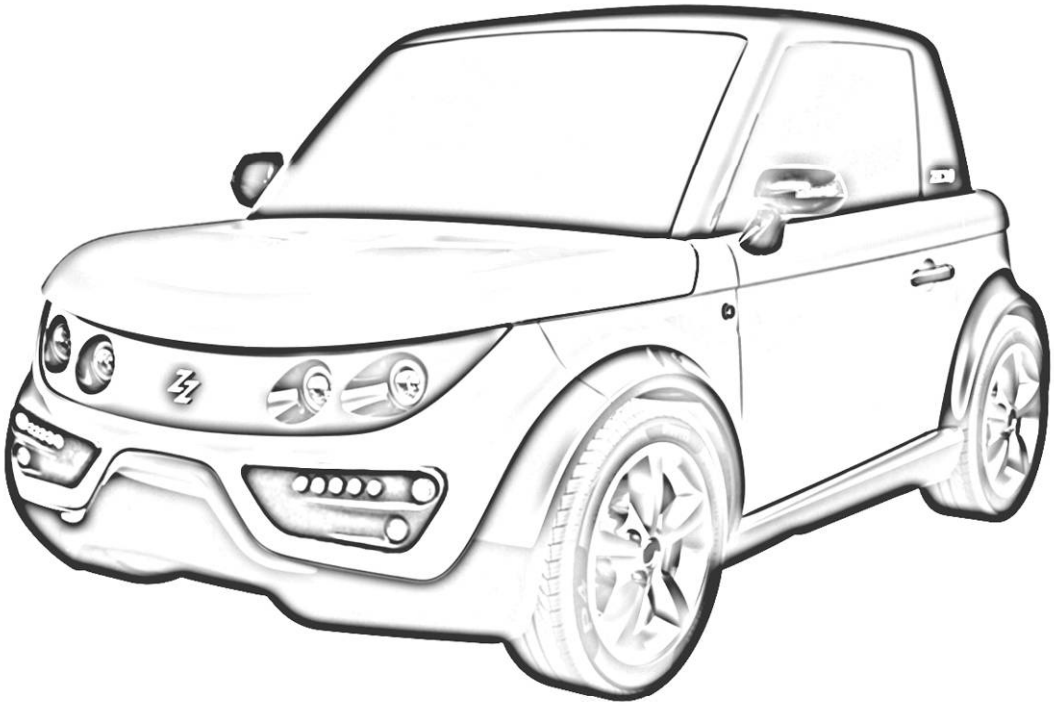
TAZZARI ZERO



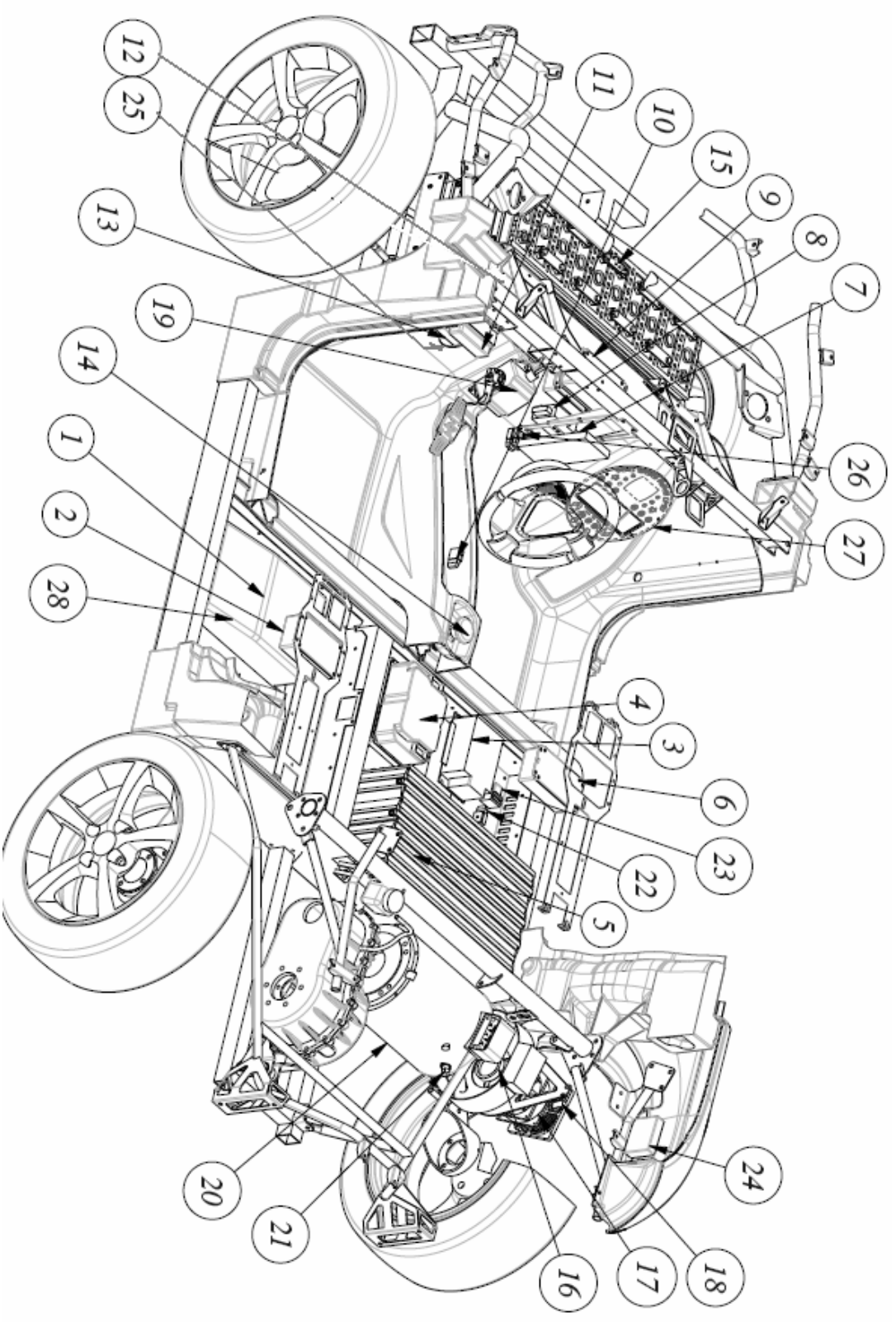
SERVICE MANUAL

SPECIAL EDITION - EVO

List of Contents: ELECTRIC SESSION

List of Contents: SERVICE KIT SESSION

1. Arrangement of electric and electronic components on the vehicle



Number	Descrizione	Description
1	Caricabatteria	Battery Charger
2	BMS Modulo/Equalizzatore 2	BMS Module/Equalizer 2
3	Convertitore Dc/DC	Dc/Dc converter
4	Controller	Controller
5	Pacco batteria	Battery Pack
6	BMS Modulo/Equalizzatore 1	BMS Module/Equalizer 1
7	Scheda Interfaccia SE/EVO	Interface Board SE/EVO
8	Chiusura centralizzata / Antifurto	Central locking / Anti-theft device
9	BMS Modulo/Equalizzatore 3	BMS Module/Equalizer 3
10	Fusibile potenza riscaldatore elettrico**	Electric heater power circuit input**
11	Principali Relè del veicolo	Main box relays
12	Centralina BMS	BMS electronic control unit
13	Principali Fusibili del veicolo	Main box fuse
14	Teleruttore integrato con fungo di emergenza	Integrate main remote switch and emergency swicth
15	Sensore di corrente	Current sensor
16	Encoder	Encoder
17	Ventola raffreddatore motore	Motor cooling fan
18	Resistenza corazzata	Resistor
19	Acceleratore	Accelerator
20	Motore elettrico	Electric motor
21	Termostato ventola raffreddamento motore	Control temperature sensor
22	Fusibile ventola raffreddamento motore, Fusibile riscaldatore Extrapower*	Motor cooling fan fuse, Extrapower Heater fuse*
23	Relè e fusibile lunotto termico*	Heated rear window fuse and relay*
24	Centralina sensori di parcheggio*	Parking sensors control unit*
25	Data-logger di batteria	Battery Data-logger
26	Fusibili: sportello lato guida, sportello lato passeggero, fendinebbia*	Secondary fuses: Electric window raiser on driver's side, Electric window raiser on passenger's side, fog light*
27	Plancia touch	Touch System
28	Fusibile di potenza 425A	Mein power Fuse 425A

***** Se presente/ If fitted

****** Fusibile non presente con riscaldatore a gasolio/ Fuse not present in vehicles with gas oil heater

2. Battery

The Battery

It is a static system able to collect and generate electric current by means of a **reversible** chemical reaction.

EXAMPLE: LEAD-ACID BATTERY
*A traditional 12 V battery for marine or automotive use consists in actual fact of several **cells** (in this specific case, six, each delivering a rated voltage of 2.16 V.*
Batteries are usually composed of multiple cells, where cell means the minimum electrochemical system to generate electricity.

Fig. 2.1 – Section plane of a motor starter lead battery.

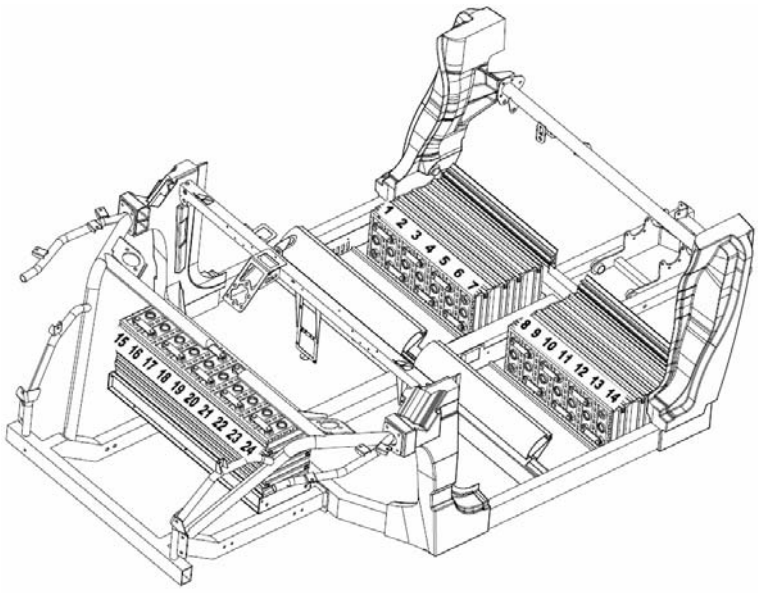


Fig. 2.2 - Battery for an electric vehicle is a set of cells. In the case of Zero they are 24

Main battery parameters

- **Cell rated voltage:** p.d. (potential difference) that can be measured with a voltmeter on the positive and negative poles of the battery cell. The unit of measure is the Volt [V];

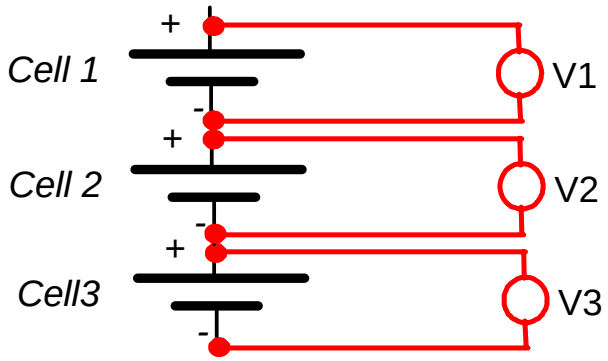


Fig. 2.3 – Cell rated voltage.

- **Battery rated voltage:** p.d. (potential difference) that can be measured with a voltmeter on the positive and negative poles of the battery pack. The unit of measure is the Volt [V];

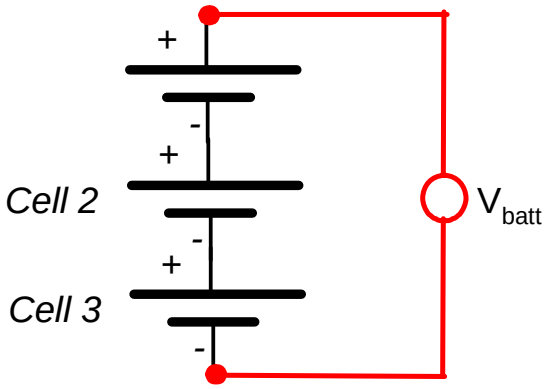


Fig. 2.4 – Battery rated voltage.

- **Capacity (C):** Amount of energy that can be stored in the battery or cell. The unit of measure is the Amp(ere)/hour [Ah];

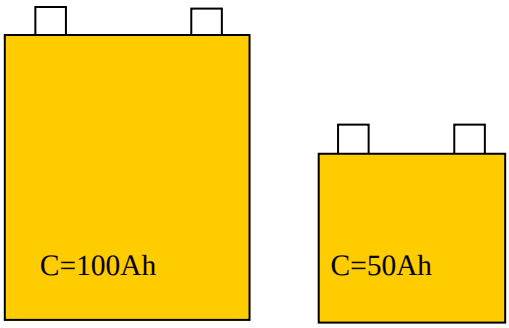


Fig. 2.5 – Batteries having different capacity.

- **State of Charge % (SoC)**: per cent residual capacity stored in the batteries;

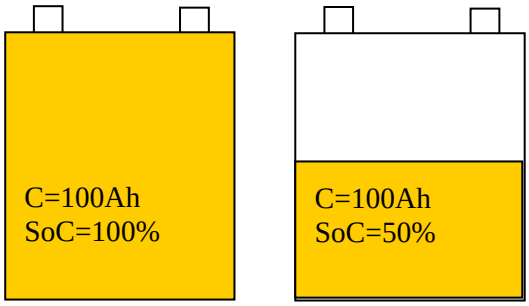


Fig. 2.6 – Batteries with different SoC.

Different types of battery

The existing several types of battery differ not only by their chemical characteristics, but also by the amount of **specific energy** [Wh/kg], number of possible **discharge/recharge cycles** and cell voltage.

Type	Life time [cycles]	Self discharge [every month]	Cell voltage [V]	Specific energy [Wh/kg]
Lead-Acid	300 / 700	20%	2,16	50
Ni-Cd	700 / 1000	15%	1,2	60
Ni-MH	700 / 1000	30%	1,2	80
Li-po	800 / 900	5%	3,7	200
Li-ion (LiFePO4)	**1500 / 2000**	**3%**	**3,3**	**160**

Fig. 2.7 – A comparison among different battery types.

Li-ion Batteries *(LiFePO4 - Lithium Iron Phosphate)*

Lithium (Li) is the **lightest among metals** and has one of the highest **electrode potentials;** this explains why, if several battery types are compared (fig. 2.7), lithium storage batteries feature some of the highest specific energy values.

- Similarly to other alkaline metals, lithium (Li) is, in its pure form, highly flammable and slightly explosive in contact with air and especially water: in fact, contact with water will trigger a violent reaction producing hydrogen.

In our specific case, the ZERO vehicle is equipped with *Lithium-Iron-Phosphate* (LiFePO4) batteries – based on the chemistry of lithium but offering additional advantages including:

- Low environmental impact in the production and subsequent reconditioning/disposal phases;
- Low production cost;
- Improved resistance to ageing;
- Absence of Manganese (Mn), which made the older generation of lithium batteries chemically unstable and easily flammable

A li-ion battery cell consists of the following elements:

- graphite **negative electrode** (anode);
- lithium-iron **positive electrode** (cathode);
- **copper** (negative pole) and aluminum (positive pole) **collector**;
- **a microporous intercalation** between the two electrodes and an electrolyte;
- the **electrolyte** is usually LiPF6 salt dissolved in a carbonate-based organic solvent.

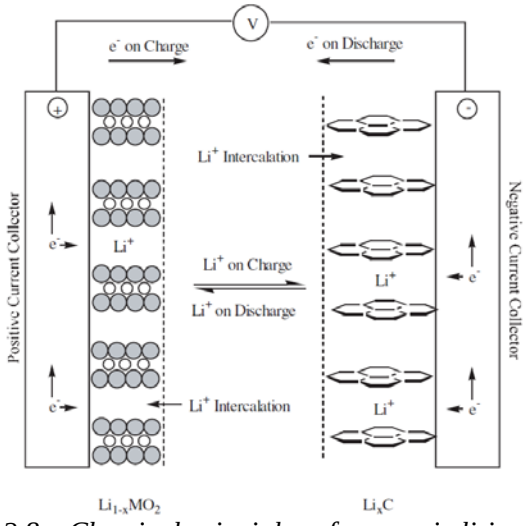


Fig. 2.8 – Chemical principles of a generic li-ion cell.

This technology produces batteries with peculiar voltage trends both at the discharging and at the charging end, depending on the battery ageing level and also on the working temperature.

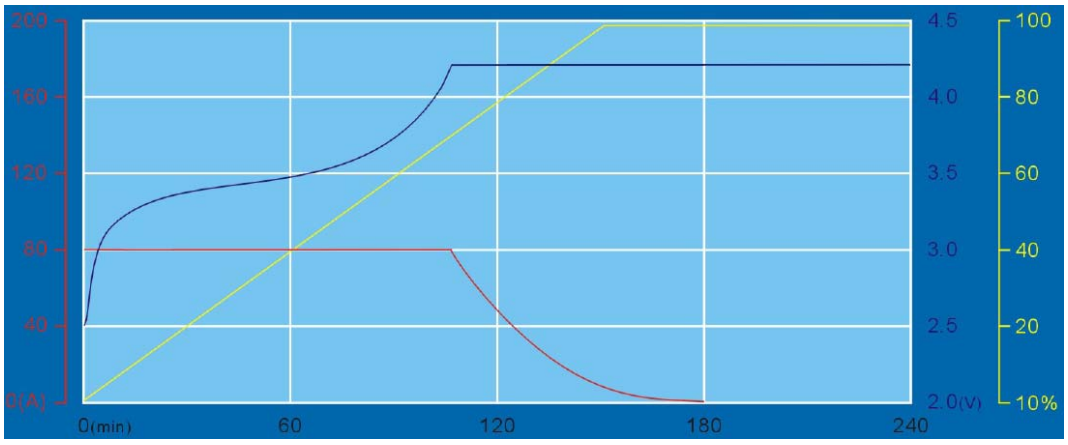


Fig. 2.9 – State during the charge trends of the SoC%, V and A quantities at a temperature of 25°C.

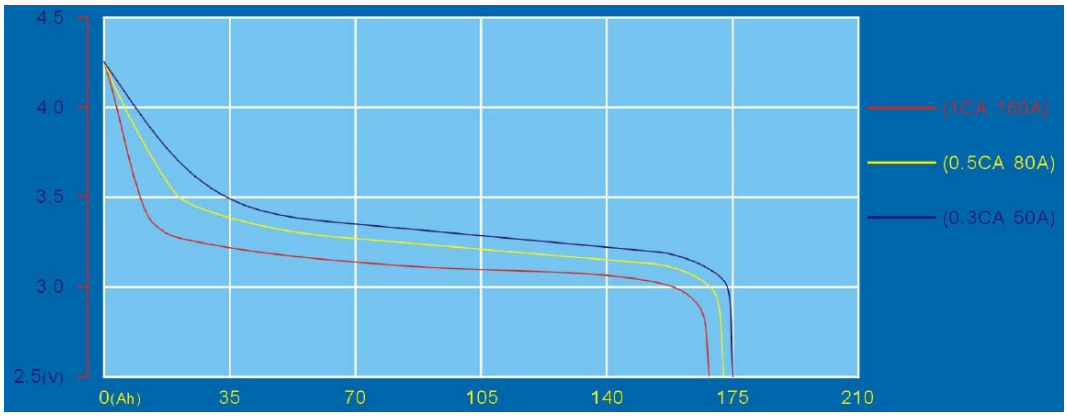


Fig. 2.10 – State during the charge trends of the V quantity at a temperature of 25°C.

- CHARGING: For this type of batteries, it is advisable not to exceed the voltage threshold of 4.2 Volts.
- DISCHARGING: For this type of batteries, it is advisable not to go below the voltage threshold of 2.5 Volts.

Disregarding these limits can, in addition to damaging the batteries, also cause severe damages to persons and property.

The vehicle battery pack includes 24 cells connected in series and having the following characteristics:

TECHNICAL CHARACTERISTICS

	Value
Rated Cell Voltage	3.3 V
Capacity	160 Ah
Min Cell voltage	2.5 V
Max Cell voltage	4.2 V
Weight	5.6 kg

Fig. 2.11 – Cell technical characteristics.

Fig. 2.12 – Cell contained in the battery pack of a ZERO vehicle.

In each ZERO vehicle there are **24 cells all connected in series** to form a battery with a **rated voltage of 80V** and a power storage capacity of around **13kWh**.
In order to improve weight distribution in the vehicle, it was necessary to divide the batteries into 3 packs as shown in the figure.

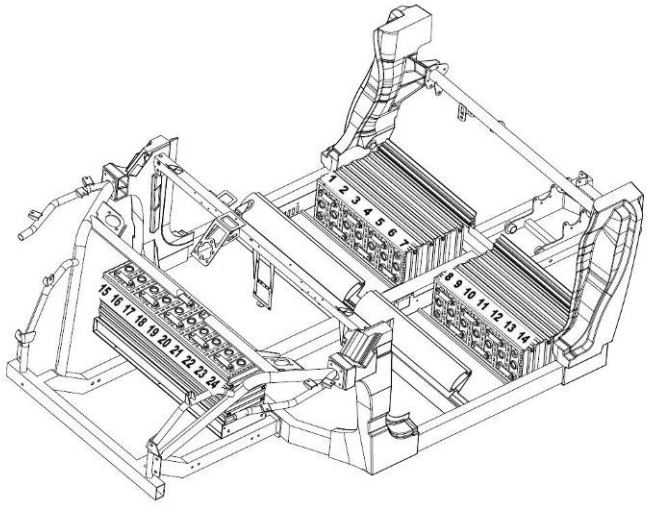


Fig. 2.13 – Arrangement of the three battery packs in the ZERO vehicle.

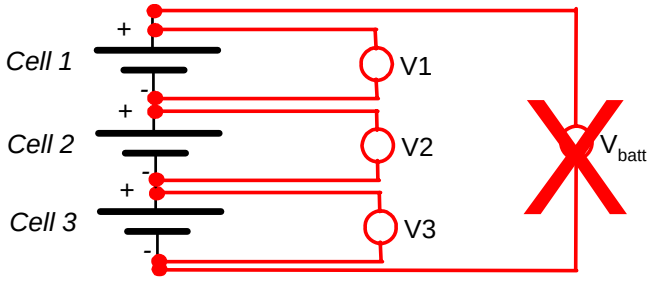
- It is important to stress the fact that the vehicle frame is not connected to the battery negative pole, and that this condition must be maintained throughout the vehicle normal operation. Every time that a vehicle is serviced, check that there never is any voltage (electric potential) applied to the vehicle frame.
- The voltage present at battery terminals is potentially dangerous; in fact, during charging the battery lead voltage can be as high as 100Vdc - a voltage implying an "electric risk".
- The human body is a conductor allowing current to flow through while at the same time offering some resistance to the current flow. The lower the resistance, the higher the current flow rate through the body. This resistance cannot be univocally quantified because it varies according to individuals, also depending on individual conditions at the time of electric contact (age, skin perspiration, general health etc.).The effects caused by the electric current flow through the body are:
  - Muscular contraction;
  - Respiratory arrest;
  - Ventricular fibrillation;
  - Burns.
- Only special insulated tools must be used to service the batteries in order to prevent the risk of short circuits.
- Whenever vehicle electronic parts must be serviced, the fuses F1 and F2 must first be disconnected and the general emergency switch must be pressed; make sure that the vehicle is not under charge and disconnect the battery charger connector (DC end).
  Some sparking can be observed when removing or inserting the fuses F1 and F2: it is caused by the on-board electronic circuit capacitors and should not be regarded as a fault.

3. B.M.S. (*Battery Management System*)

BMS function

The use of (LiFePO4) lithium ion batteries implies **constant monitoring of the cell voltage** to prevent too high or too low voltage values **damaging the batteries** or worse still, **causing injuries to the users**.

- To ensure safe management of the battery pack, monitoring the total battery voltage only is not allowed; the individual voltage of each cell making up the battery pack must be monitored.



During normal battery operation, however, a slight difference between the voltage values of each cell in the battery pack is tolerated. This minimal voltage difference is caused mainly by not perfectly homogeneous construction characteristics. An example is shown in the figure here below.

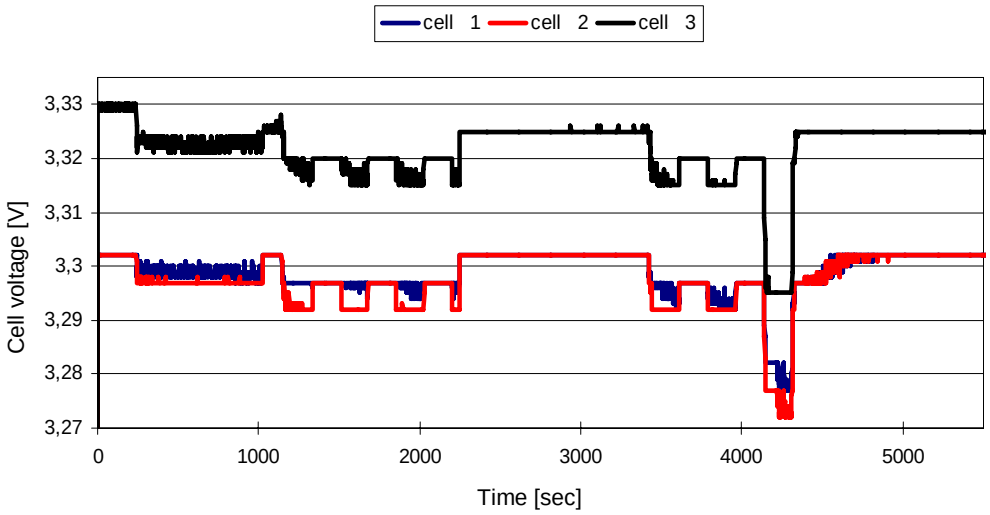


Fig. 3.1 – Different cell voltage trends in one battery pack.

The BMS must prevent any one cell in the battery pack from operating at dangerous voltage levels.
As you can see in the picture here below, three operating zones can be identified.

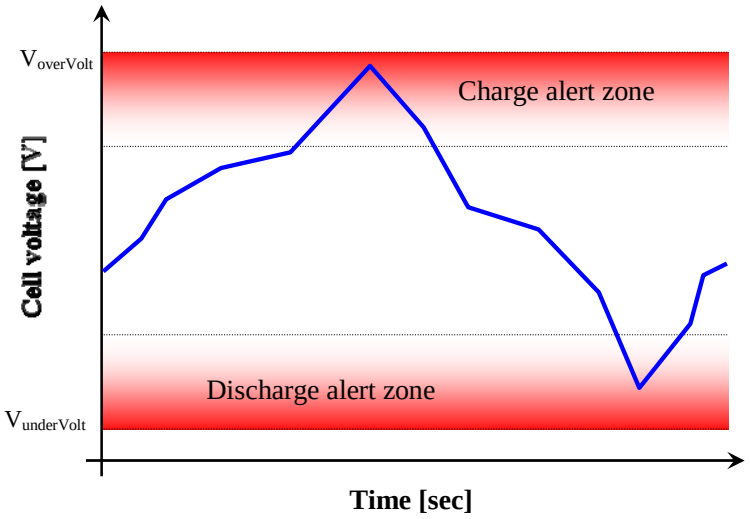


Fig. 3.2 – BMS system operating zones.

The BMS will only introduce corrections if the cell voltage is in the two outermost zones, and in particular:

- **Charge zone:** Normally, cell voltage will be found in this area when the vehicle is charging and the battery is almost completely charged. The BMS must then dialogue with the **Battery charger** to suitably reduce or suspend the recharging current flow.
- **Discharge zone:** Normally, cell voltage will be found in this area when the vehicle is discharging and the battery power is almost depleted. The BMS must then dialogue with the **Controller** to suitably reduce the discharge current.

- It is important to stress the fact that the ZERO vehicle BMS, in addition to continuously monitoring cell voltage, also performs other important tasks such as: battery pack temperature monitoring; residual state of charge evaluation; power system diagnostics etc…

ZERO B.M.S.

The ZERO BMS consists of the following components:

- No. 3 Modules/Equalizers
- No. 1 Current sensor
- No. 1 Electronic control unit

The whole system is active and functioning whenever the key is turned in the instrument panel and when the machine is being charged.

BMS system power-off does not instantly occur when the instrument panel key is turned to OFF but only after a few minutes' delay (usually < 5 minutes).

- If a system error is detected, it is important to wait for the BMS to go off before controlling peripheral device and error coding resetting (as explained further on).

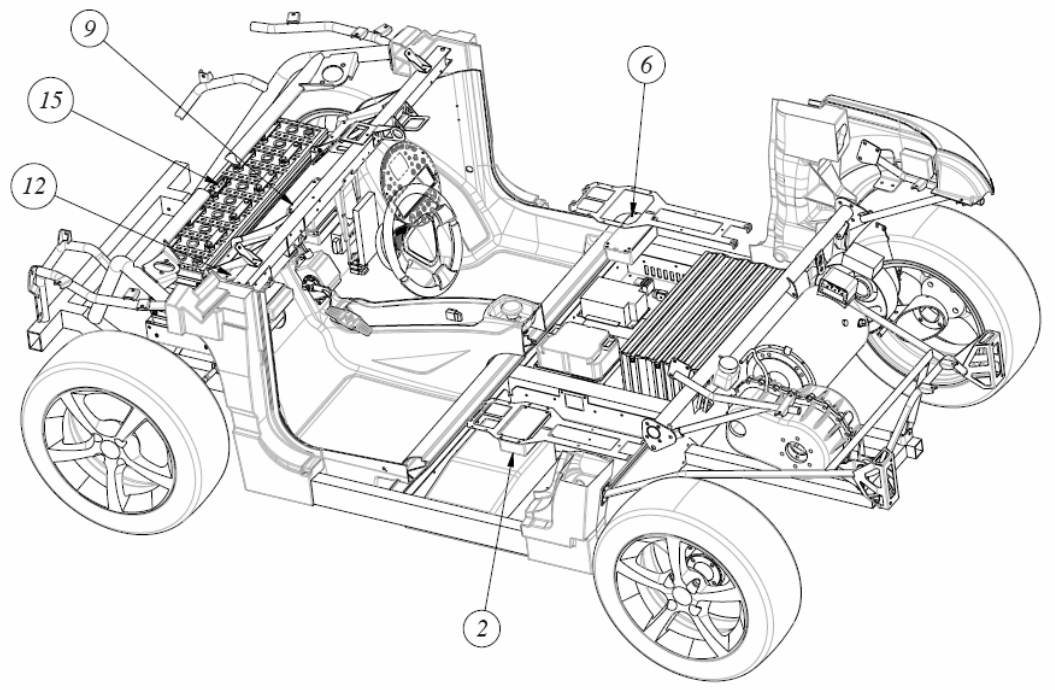


Fig. 3.3 – The BMS installed in the vehicle

Modules/Equalizers

The purpose of the Modules/Equalizers is to measure voltage from each cell. Each Modules/Equalizers can acquire up to 8 voltage ratings, therefore, **3 Modules/Equalizers** are necessary to monitor the 24 cells making up the battery pack.
The Modules/Equalizers identified as **Module/Equalizer 1** and **Module/Equalizer 2** are located below the seat plane on the passenger's and the driver's side - respectively.
The module identified as **Module/Equalizer 3** is located below the vehicle dashboard on the passenger's side; access to this module can be obtained without having to remove any other component.

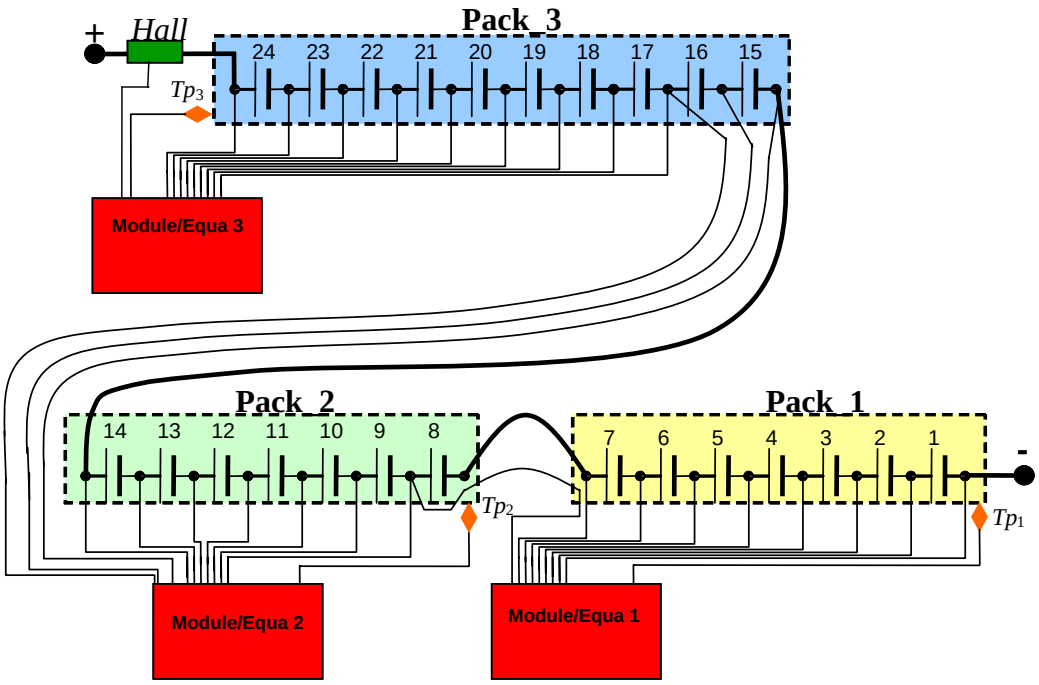


Fig. 3.4 – Connections between the modules and batteries.

As is shown in the figure, each module can measure the voltage of each battery sub-pack and additionally, the Module/Equalizer 3 is connected to a Hall effect sensor to measure the instantaneous current flow through the battery pack.

The Modules/Equalizers are also used to maintain voltage values as homogeneous as possible in the various cells during the phase charge.
This system allows for extended vehicle range and battery performance integrity over time.
Each Module/Equalizer is additionally equipped with a cooling fan, which is only activated during the final charging phase.

- When the equalization system is working the battery voltage can exceed 100Vdc.
- On average, the maximum voltage difference that can be measured is below 300 mV.
- It is highly advisable to regularly check the condition of the plastic case containing the equalizer. A damaged plastic case may be indicative of a system fault (e.g. cooling fan locked or damaged).

The correct operation of the Equalizer system can be checked during the vehicle final recharging phase only through the special **red LEDs** lighting up inside the device. Each LED represents one cell (see photo below); when the cell is going through the equalization phase the red LED must light up.

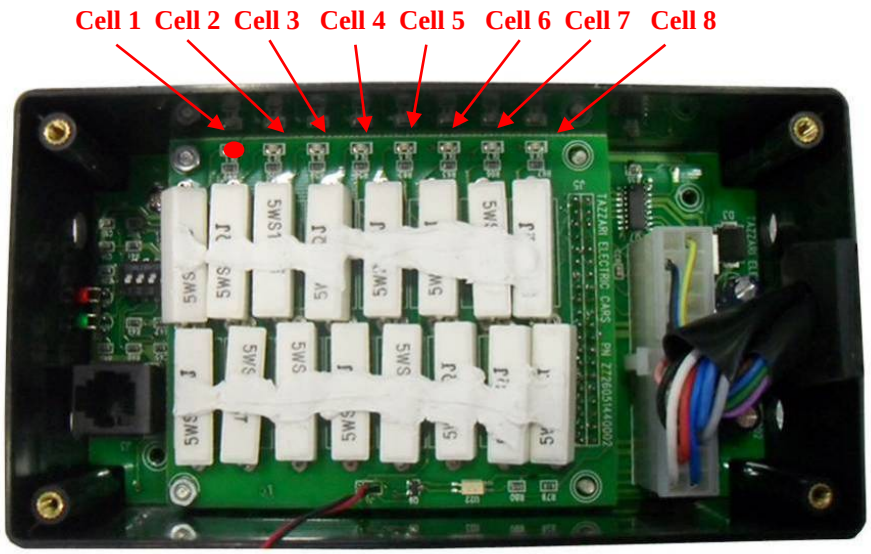


Fig. 3.5 – Operating BMS Module/Equalizer (red LEDs on).

- If the vehicle is in any other condition different from the charging condition, the red LEDs on the equalizers must be off.

The data acquired and processed by each module are made available for the BMS system through the CAN (*Controller Area Network*) communication bus.

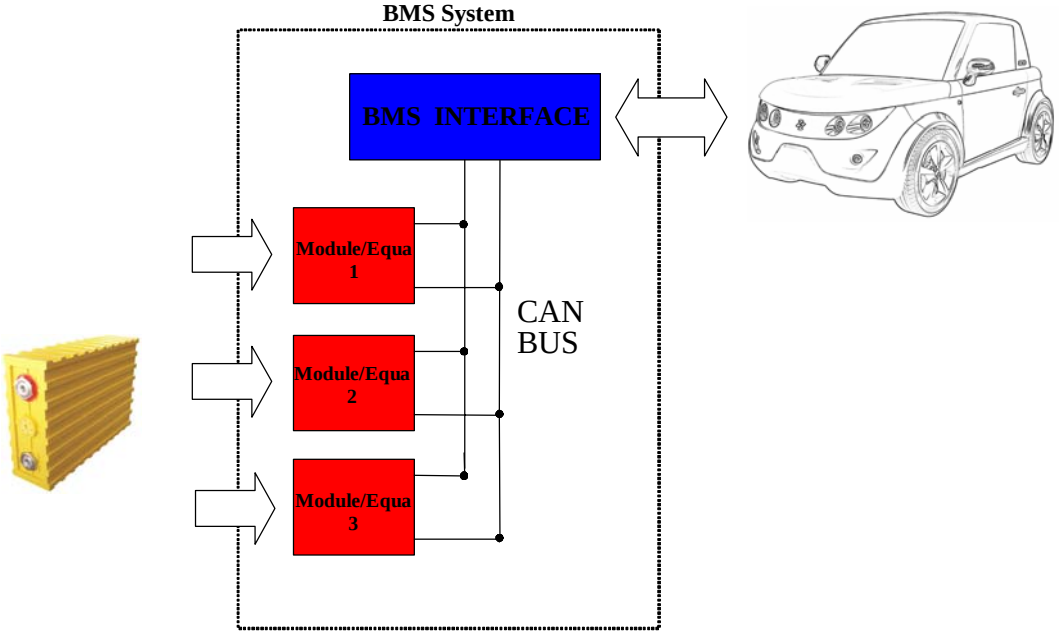


Fig. 3.6 – Communication among different BMS devices.

Each module is equipped with two LEDs indicating the module status:

- **Red LED**: Peripheral device powered and operating.
- **Green LED**: CAN system ready and operating.

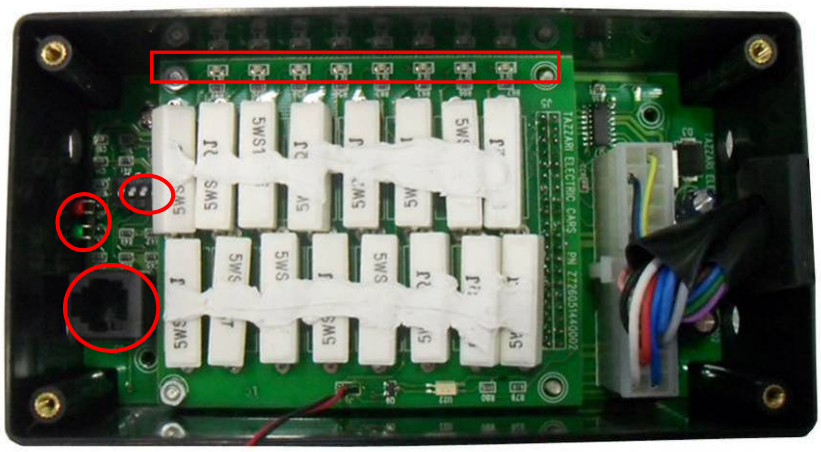
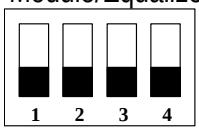
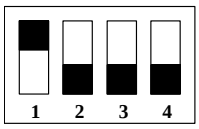


Fig. 3.7 –BMS Modul7Equalizere (with the two LEDS and programming connector circled).

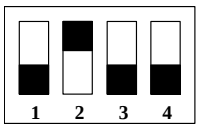
- On each BMS Module/Equalizer, a programming connector is provided (RJ12) for the necessary device software updating.
- Each BMS Module/Equalizer is provided with switch selector to program the Module/Equalizer as 1, 2 or 3.



Module/Equa 1



Module/Equa 2



Module/Equa 3

Current sensor

The current sensor is installed directly on the connection between two front battery cells. Access to this component can be obtained by removing the front tank and the front plastic cover. The sensor is coated with resin to protect it from bad weather.

- This component should not show signs of weather wear and tear. If necessary, clean thoroughly then apply a new coat of resin.
- Residual state of charge miscalculation can be caused by this component's malfunction.
- To replace this component, if necessary, the F1 and F2 fuses must be disconnected, the machine must be off, the main emergency switch must be depressed and the battery charger connector (DC end) must be deactivated.
- Observe installation polarity instructions on the PCB print
- Only special insulated tools must be used to prevent short circuits.

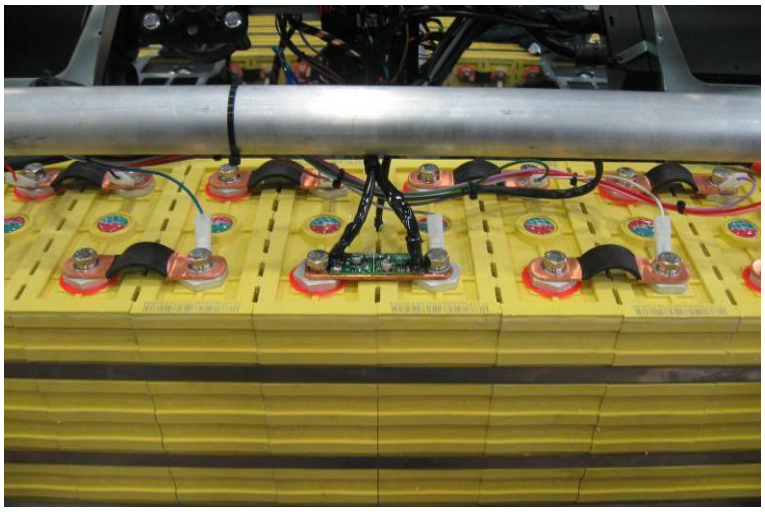


Fig. 3.8 – Current sensor.

Electronic control unit

As we mentioned here above, the control unit task is to collect and process all the information available on the CAN bus and then dialogue with all the other vehicle devices such as the battery charger, controller and instrument panel.
The control unit is located below the dashboard on the passenger's side; access to this unit can be obtained without having to remove any other components.

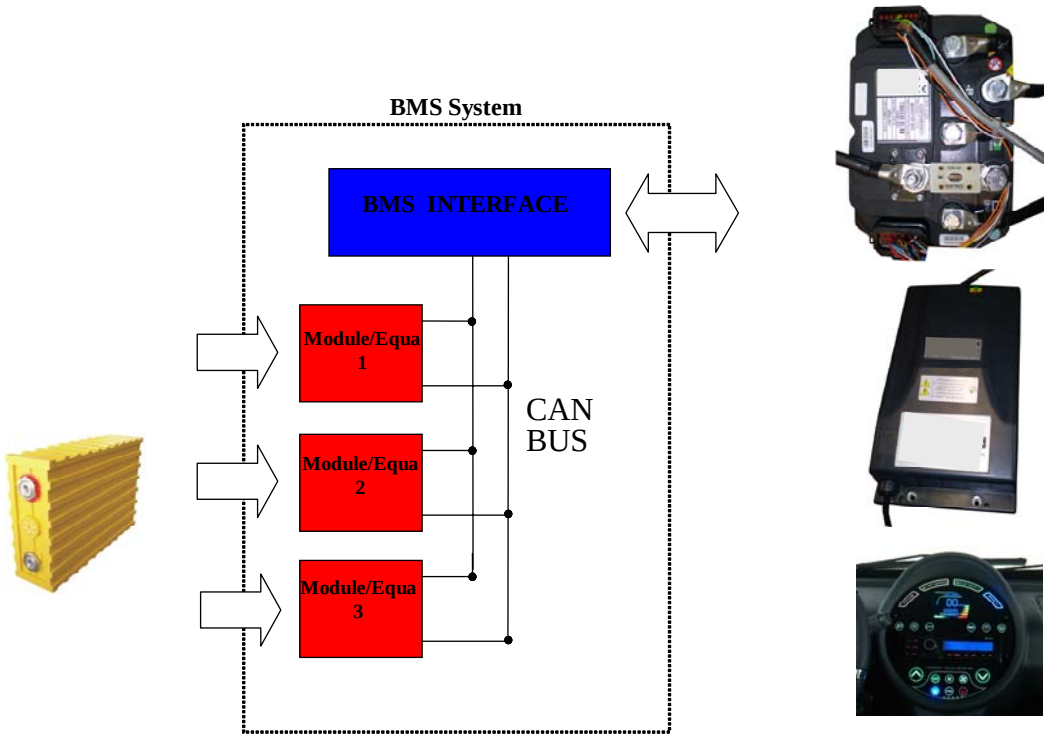


Fig. 3.9 – Communication among different BMS devices and vehicle components.

The control unit includes three (green, yellow and red) LEDs that should normally be off.

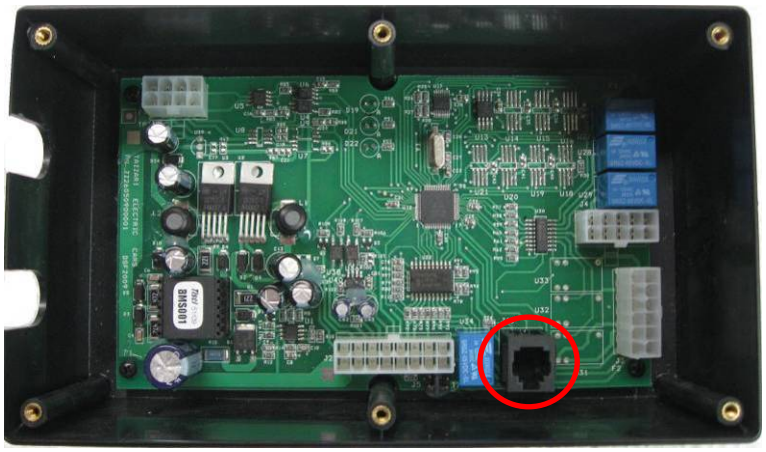


Fig. 3.10 – BMS control unit (with programming connector circled).

- A programming connector (RJ12) necessary for device software upgrades is located in the BMS control unit.

The BMS status is shown by a special indicator light on the instrument panel (pictured below):

Fig. 3.11 – Power reserve or BMS fault code indicator light.

This indicator light has several functions:

- **Steady light**: the **power** has reached **reserve levels**. Unless the batteries are recharged, the estimated operating range will be less than 30% of the total figure.
- **Flashing three times** repeatedly at short intervals: the BMS (Battery Management System) has been operated **to protect the batteries** for one of the following reasons: maximum temperature reached, minimum cell voltage reached, maximum cell voltage reached (during recharging).
- **Flashing four times** repeatedly followed by a short pause: **BMS malfunctioning.** The vehicle can only operate at reduced speed and must be recharged with reduced current up to approximately 30% of the battery capacity.

4. Tazzari Touch System

Fig. 4.1 – Tazzari Touch System.

The Tazzari touch dashboard incorporates many features that are described in detail in the "manual for use and maintenance of the vehicle. "
This device is connects many other devices of the vehicle such as: BMS system, the Controller, the interface board SE/EVO, lighting, heating, etc..
Here, in quick succession, all the features of the Tazzari Touch System.

Tachometer, Indicator lights and controls

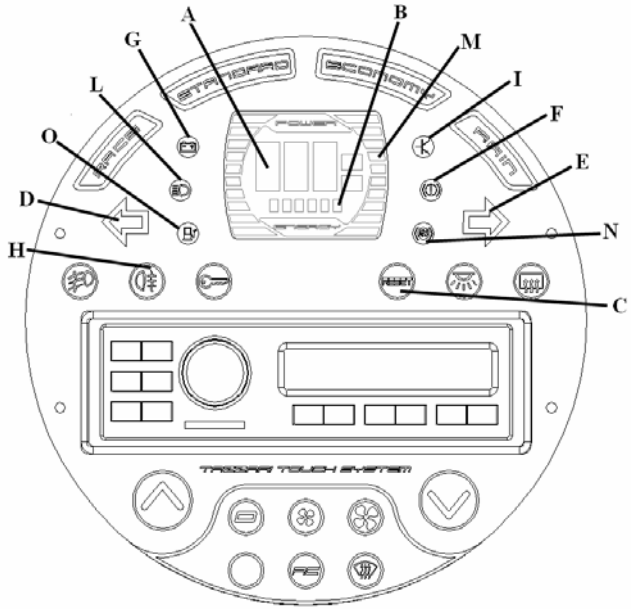


Fig. 4.2 – Tazzari Touch System

A. Speedometer **– B.** Odometer / trip **– C.** Button switch odometer / trip **– D.** Left turnsignal indicator light **– E**. Right turn signal indicator light **– F**. Parking brake warning lightor brake fluid low **– G**. Energy or fuel reserve abnormalities in the coding system power management **– H.** Fog lamps control **– I.** Motor and controller fault light indicator **– L.** High beam indicator **– M.** Charge of batery level indicator **– N.** ABS warning light / central locking system **– O.** Extrapower heater fuel reserve .

Mode selector

With the 4 illuminated buttons positioned on the Tazzari Touch System, it is possible to select the best driving mode to suit any driving styles or road conditions. On switching on the vehicle, the STANDARD mode will be automatically selected, suitable for a lively driving style and perfect for everyday use. This driving mode is selected when the **yellow** button lights up.
Connector used for this function is: B20a

Fig. 4.3 – Tazzari Touch System, Mode selector.

Econometer (Power)

A digital econometer is provided on the Tazzari Touch Systems with a bar that becomes colored to reflect the motor instant absorption. With this instrument it is possible to customize one's driving style making it compatible with the mileage to cover. The green coloring means low battery absorption (< 200A), the orange color means absorption between 200 and 300A, while the red color means that the current delivery from the batteries is comprised between 300 and 400A.
Connector used for this function is: IC2a

Fig. 4.4 – Tazzari Touch System, Econometer (Power)

- This device malfunctioning can be caused by an econometer fault or by current sensor malfunctioning.

Forward/reverse travelling selector

The travelling direction selector consists of 2 green buttons located in the Tazzari Touch System near the heating controls. During the starting phase, both buttons are off and the vehicle is in neutral; to start travelling, the brake foot control must be pressed first, followed by the selected direction button.
Connector used for this function is: B20a

Fig. 4.5 – Tazzari Touch System, Forward/reverse travelling selector

Electric heating

The Touch dashboard has two rows of three buttons, where the upper one controls the regulation of ventilation and the second row adjusts the air temperature
Front row: left position the fan is off, central position is fan speed 1, right position is fan speed 2.
Second row: Blue - cold temperature (environment)
Red - hot temperature
AC - air conditioning (optional)
Connector used for this function is: H3a

Fig. 4.6 – Tazzari Touch System, Electric heating

Service switches

The functions of this switch are described in the table below:
Connectors used for this function are: J14a, J4a, B13a, G13a, B22a.

SYMBOL	COMMAND
	CENTRAL LOCKING
	COURTESY LIGHT
	REAR FOG LAMP
	HEATED REAR WINDOW
	FOG LIGHT
	TOTAL SWITCH ODOMETE R / TRIP

Fig. 4.7 – Tazzari Touch System, Service switches

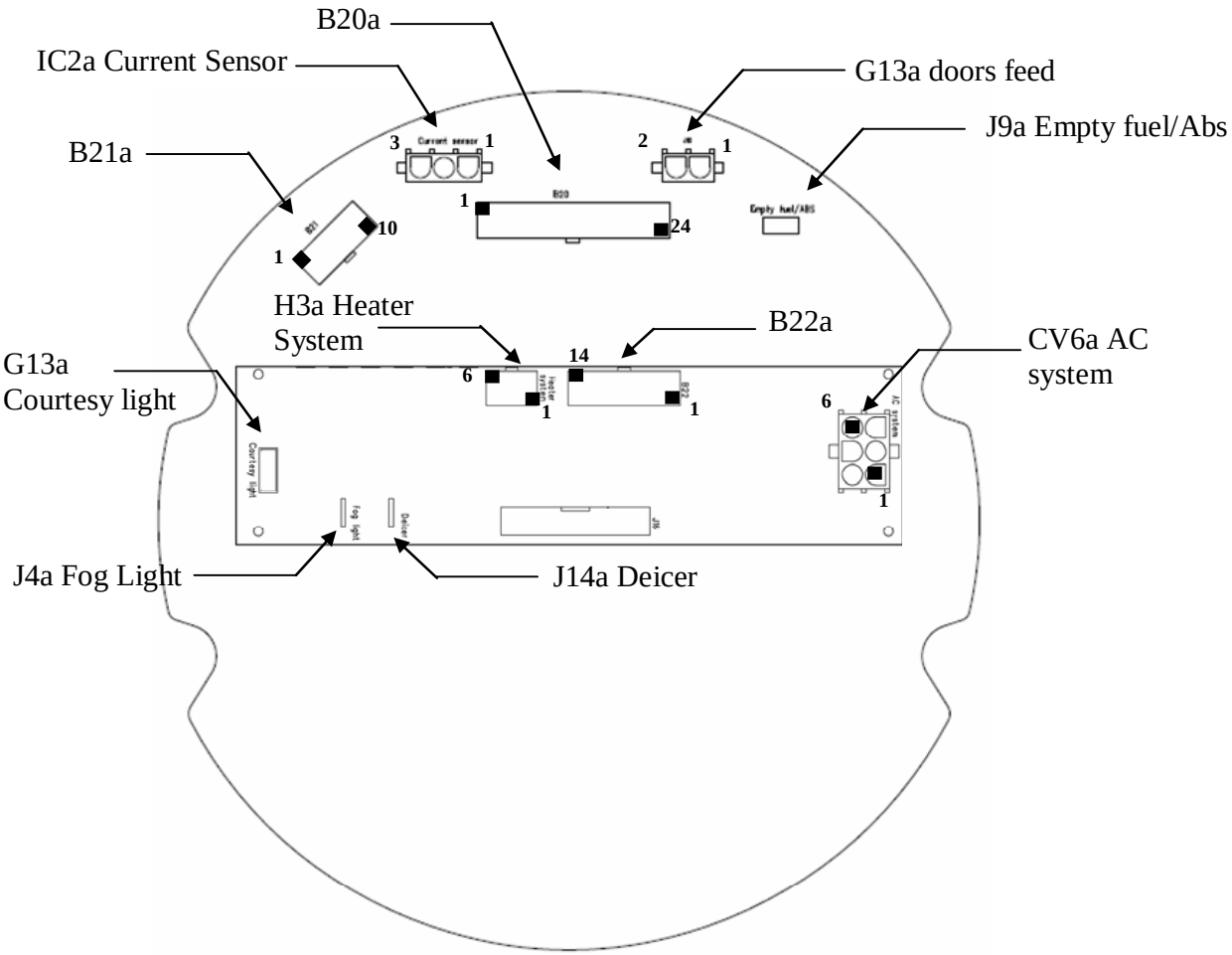


Fig. 4.8 – Tazzari Touch System, main connectors desciption.

Main trouble-shooting connectors

Connector	N° Pin	Type	Function	Wire color
B20a	2	IN	+12Vdc under F5	M-1
	5	OUT	forwarder direction	A – 0,5
	6	OUT	backward direction	B – 0,5
	7	OUT	Economy mode	V – 0,5
	8	OUT	Rain mode	L – 0,5
	9	OUT	Race mode	S – 0,5
	10	OUT	Standard mode	G – 0,5
	11	IN	GND	N - 1
	14	IN	Changing	R/V – 0,5
	16	IN	backlight	C – 0,5
	18	IN	+12Vdc under key switch and F7	R - 1
B21a	2	IN	+12Vdc Battery LED	G – 0,5
B22a	1	IN	+12Vdc under F5	M-1
	3	IN	GND	N - 1
	4	IN	GND	N - 1
	8	IN	+12Vdc under key switch and F7	R - 1
	9	IN	+12Vdc under key switch and F7	R - 1
	10	IN	+80V under key switch and F1	S - 1
	11	IN	+12Vdc permanent from mini Dc/Dc converter (3W) under FS1	R – 0,5
IC2a Current Sensor	1	OUT	GND	N - 0,5
	2	OUT	+12Vdc under key switch and F7	B - 0,5
	8	IN	Signal Battery current (+2,5Vdc)	V - 0,5
H3a Heater system	1 and 4	OUT	Low speed fan (+12Vdc)	R - 1
	2 and 5	OUT	High speed fan (+12Vdc)	C - 1
	3 and 6	OUT	Heater ON (+12Vdc)	V - 1
B13a Courtesy light	1	OUT	+12Vdc permanent from mini Dc/Dc converter (3W) under FS1	B-0,5
	2	OUT	GND	M – 0,5
J9a Empty fuel/ABS	1	IN	+12Vdc to fuel empty lamp	R - 0,5
	2	IN	GND	N - 0,5
G13a Doors feed	1	IN	+12Vdc	L/G – 0,5
J4a Fog light	faston	OUT	+12Vdc to fog light	R - 1
J14a Deicer	faston	OUT	+12Vdc to deicer	G - 1

Tabella dei colori / Colours table			
M	Brown / Marrone	C	Orange / Arancio
V	Green / Verde	A	Blue / Azzurro
Z	Violet / Viola	B	White / Bianco
N	Black / Nero	L	Dark Blue / Blu
S	Pink / Rosa	G	Yellow / Giallo
R	Red / Rosso	H	Gray / Grigio

Optional Programming

In case of replacement of the Tazzari Touch Sysetm this device can be programmed according to the optional that are installed on the vehicle.
To access the programming menu of the dashboard you must do the following:

1. Turn On the key of the vehicle
2. Press 10 times the brake pedal of the vehicle within 10 seconds.
3. The following screen will appear on the dashboard Touch

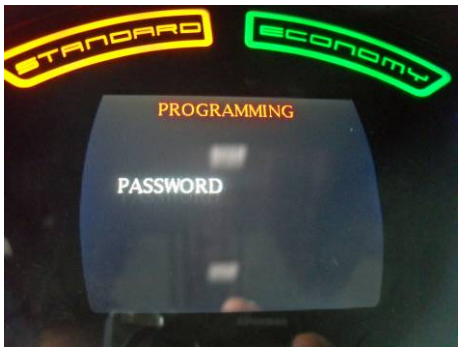


Fig. 4.9 – Tazzari Touch System, Optional programming

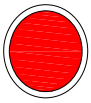
4. Enter the password by pressing the following keys in succession:

- RACE	
- RAIN	
- REVERSE TRAVELLING SELECTOR	
- FOG LIGHT	
- RACE	

5. The display shows the following screen:

Fig. 4.10 – Tazzari Touch System, optional programming

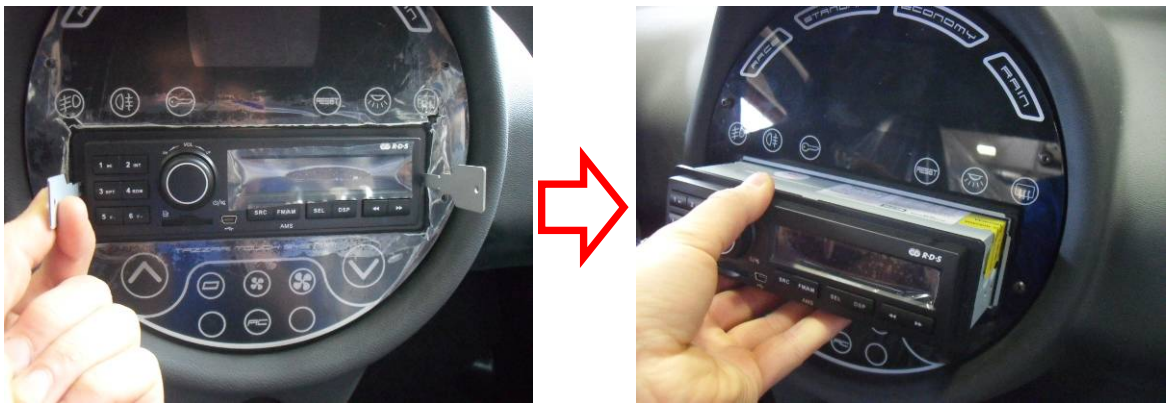
6. Now you can program the optional activating or deactivating various functions by pressing the associated button as shown below:

Optional	Default value	Selectable values	Associated button	Enable and Disable Functions
Fog light	*Not Active*	*Active - Not Active*		Enabled when ACTIVE: button and relay associated
Air conditioning	*Not Active*	*Active - Not Active*		Enabled when ACTIVE: button and relay associated
Extrapower Heater	*Not Active*	*Active - Not Active*		Disable when ACTIVE All the buttons relating to fan speed and select the hot-cold-AC
Rear Deicer	*Not Active*	*Active - Not Active*		Enabled when ACTIVE: button and relay associated
Unit	*km/h*	*km/h – Mph*		Enable: display km / h mph on the TFT display and the unit of km ormiles on the odometer
Race	*Active*	*Active - Not Active*		Disable when ON: RACE button and associated output

How to remove the Tazzari Touch System

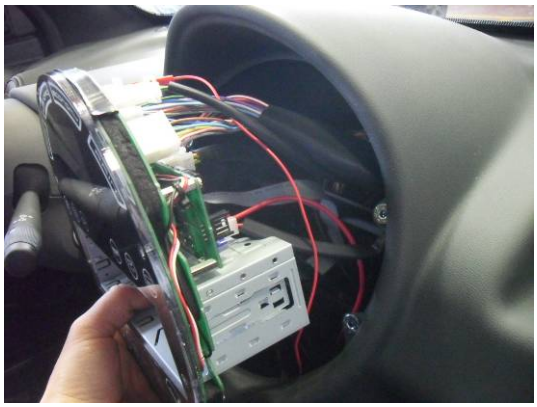
To remove this device you must perform the operations listed below:

1. Remove the radio using the special tools

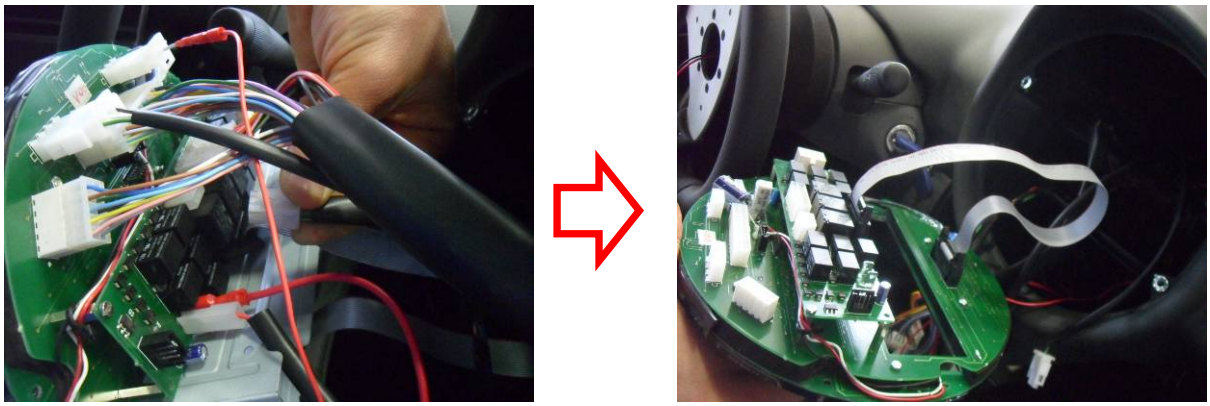


2. Remove the four screws;

3. Now remove the Touch panel from the dashboard;



4. Then unplug all the connectors from the Touch panel.



5. Battery Data-logger

Battery Data-logger function

This device samples and stores battery voltage information every 30 minutes, by associating each value with an absolute reference time:
Hour:minutes:seconds - day/month/year

Fig. 5.1 – Battery data-logger.

This device has been designed to **protect the manufacturer and dealers** from battery pack replacement claims during the guarantee period, when users have used the batteries incorrectly without following the instructions contained in the ZERO vehicle "**USE AND MAINTENANCE**" manual.
The device is connected to the battery pack positive (+) and negative (-) poles going under the F1 fuse as shown in the figure; it is installed below the dashboard on the driver's side.
Access to this component can be obtained without having to remove any other components.

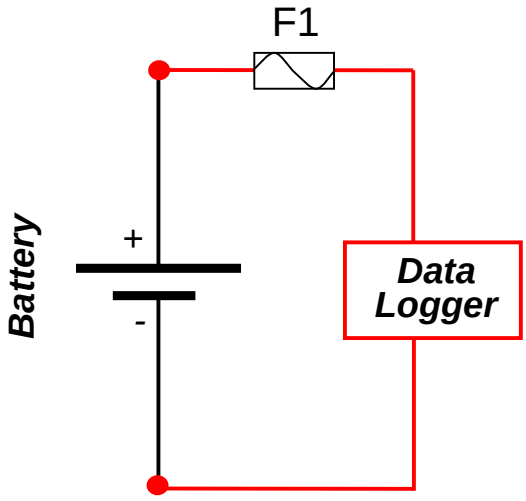


Fig. 5.2 – Battery data-logger connection to the vehicle battery.

- The device wiring should not be altered nor disconnected.
- The fuse F1 cannot be disconnected for prolonged periods of time, otherwise, the battery guarantee will no longer be valid.

A connector for communication with the service PC is provided on the data logger. This connection is necessary to view and save the data contained in the device.

6. Dc/Dc converter

Dc/Dc converter function

It enables to convert the battery voltage (60Vdc to 100 Vdc) to the stabilized 12 Vdc necessary to power most of the vehicle's auxiliary services. Basically, the Dc/Dc converter replaces the traditional 12Vdc lead battery that is part of the standard equipment of any car, **considerably reducing the likelihood of breakdowns and minimizing maintenance requirements.**
This device, however, **is not always on:** this reduces the amount of energy absorbed from the battery pack to a minimum while the car is not used.
This device power-on and power-off are piloted via the remote ON/OFF signal; its operation status is indicated by the green LED on the peripheral device.

TECHNICAL CHARACTERISTICS

	Value
Input voltage	60 ÷ 100 Vdc
Output voltage	12 Vdc
Max power	350 Wp

Fig. 6.1 –Dc/Dc converter technical characteristics.

Fig. 6.2 – Dc/Dc converter

This device is also provided with a thermostat-equipped cooling fan preventing the device from locking up due to overheating.

- If this component has to be replaced, the fuses F1 and F2 must first be disconnected and the general emergency switch must be pressed; make sure that the vehicle is not under charge and disconnect the battery charger connector (DC end).
- Only special insulated tools must be used to service the batteries to prevent the risk of short circuits.
- Observe nut terminal polarity instructions on the PCB when connecting the cables.
- Always ensure that the connecting terminal strip nuts have been tightened hard.
- The terminal strip should not show signs of weather-induced corrosion.

7. Controller and Electric Motor

Controller and Electric Motor function

This is the section of the vehicle converting battery power into the mechanical power needed to ensure vehicle drive.

Fig. 7.1 – Controller and Electric Motor.

- Before carrying out any controller and/or electric motor maintenance operations, switch off the vehicle and disconnect the main emergency switch. Make sure that the vehicle is safely stopped with the parking brake pulled.

Controller

The controller is located below the seat plane on the passenger's side. It has the task of converting the battery direct current into three-phase alternating voltage, variable in terms of both frequency and width.
Additionally, the controller will receive and process the signals coming from other vehicle peripheral devices such as: the accelerator, foot brake control signal, mode selection, direction selection, parking brake signal and BMS.

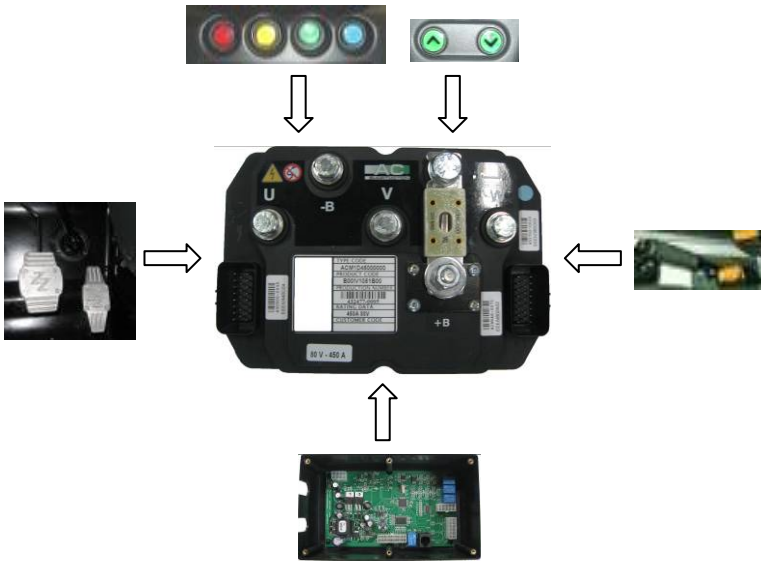


Fig. 7.2 –Controller and peripheral devices.

The controller shows its operation status via a special indicator on the instrument panel (pictured below):

Fig. 7.3 –Drive electronic control fault code indicator light.

In the electric and electronic trouble-shooting section (pag. 38), the codes corresponding to the faults signaled by this light can be checked.

Electric motor

The Zero vehicle electric power unit is a four-pole, three-phase asynchronous motor. The motor is therefore brushless.
The motor is provided with a Hall effect encoder necessary to check the motor instantaneous rpm and direction of rotation.

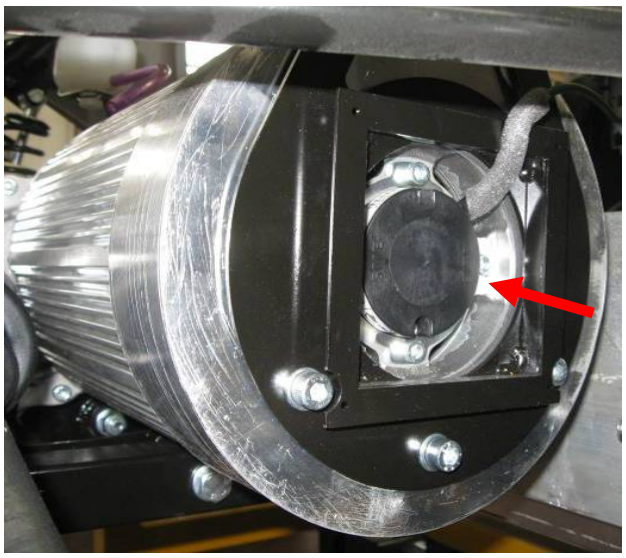


Fig. 7.4 – The electric motor (with the encoder circled).

- A fault affecting this component is not signaled by any error coding indicator light.
- This component operation can be monitored via the software EyePlus.
- If, during travelling, the vehicle speed is very low (< 10km/h) and jolting is observed, the possible cause of this malfunction could be an encoder fault.

To guarantee electric motor cooling, a 80Vdc fan has been installed with a power-on control temperature sensor.

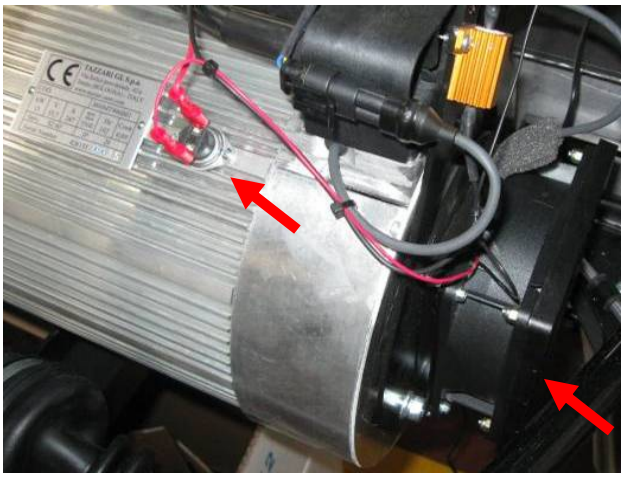


Fig. 7.5 – The electric motor (with the fan and thermostat circled).

Electric power circuit

Very high current values are measured across this section of the ZERO electric system during normal vehicle operation.
It is therefore necessary to regularly check the wear levels of the components making up this system (e.g. cable insulation, emergency switch contacts, remote switch contacts etc.).

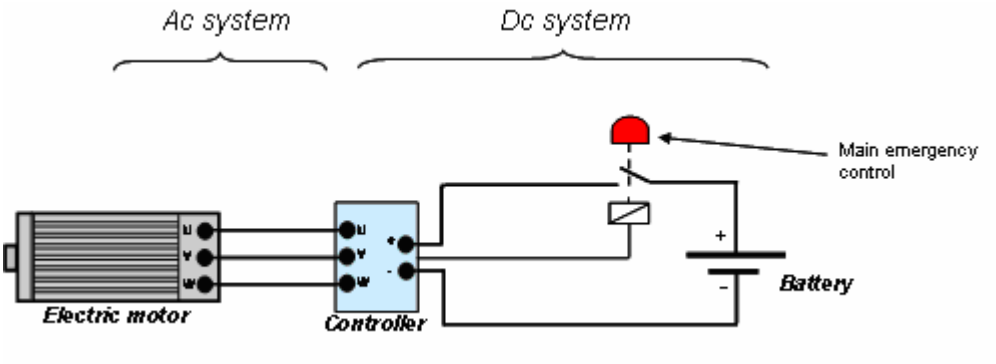


Fig. 7.6 – The drive system electric power circuit.

- Wherever possible, check that the cable insulating sheath is intact and that the cables are not in contact with sharp surfaces or corners.
- Only special insulated tools must be used to service the batteries to prevent the risk of short circuits.
- Ensure that the power cable fixing nuts have been tightened hard and do not show signs of wear.

TECHNICAL CHARACTERISTICS

Input voltage	Max input curren	Output current	Motor power	RPM motor
80 Vdc	450 A	247A	15 kW	5500

Fig. 7.7 – Technical characteristics of the drive system.

8. Battery charger

Battery charger function

The battery charger enables to absorb power from the plant line and store it to the batteries.
Battery recharging can be done by using the on-board battery charger ("*Standard*" – "*Multifast*"*), by using the portable charger "*MiniSuperfast*"* or, alternatively, with a faster battery charger named "*Superfast*"*. The vehicle can be recharged fully in a single cycle or in partial recharging cycles – according to what's more convenient for the user each time.
An accurate description of the various battery charger models' operation can be found in the "Use and maintenance" manual supplied with each vehicle.

Fig. 8.1 – Standard or Multifast Battery Charger.

The on-board battery charger is equipped with three connectors (as shown in the photo):

a. Signal connector;
b. Speed selection switch connector (this operation mode is only active with the "*Multifast*" optional battery charger);
c. DC end power connector (80Vdc – 50A max).

Fig. 8.2 – MiniSuperfast Battery Charger.

* Optional

The *MiniSuperfast* charger is equipped with three connectors:

a. DC power connector (80Vdc – 175A max);
b. Signal connector;
c. Plug IEC309 400Vac 16A (3P+H).

Fig. 8.3 – Superfast external battery charger.

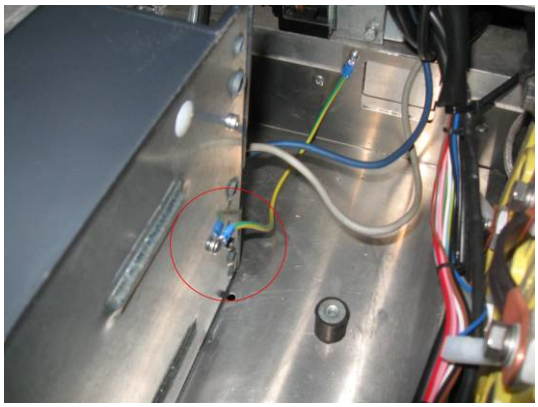
The "*Superfast*" external battery charger is equipped with three connectors:

a. DC power connector (80Vdc – 175A max);
b. Signal connector.
c. Plug IEC309 400Vac 32A (3P+H)

An LED is provided on each battery charger. The meaning of the three possible LED colors is as follows:

- **Red LED:** The battery charger is delivering its maximum current output, this means that the battery is flat.
- **Orange LED**: The battery charger is delivering about half of its maximum current output, this means that the battery is almost completely charged.
- **Green LED**: The battery charger is delivering only a small fraction of its maximum current output, this means that the battery is completely charged and the equalization process in under way.

- Potentially dangerous voltage levels are reached on this device.
- Always check that there is an efficient grounding connection between the battery charger and the vehicle frame.



- The battery charger has its own ventilation system, check that the air intakes are clean and unobstructed.

A bi-tonal sound and a flashing LED are indicative of an active alarm condition – identifiable by checking the coding table here below:

Condition	Alarm type	Description
Warning tone + RED flash	Battery Presence	Battery disconnected or not up to standard. (Check the connection and rated voltage)
Warning tone + GREEN flash	Timeout	The charge phase has exceeded the maximum permitted duration.
Warning tone + RED-YELLOW flash	Battery Current	Loss of output Current control. (Control logic failure)
Warning tone + RED-GREEN flash	Battery Voltage	Loss of output Voltage control. (Battery disconnected or control logic failure)
Warning tone + YELLOW-GREEN flash	Selection	An unavailable configuration has been selected (Check the selector position and the selector connections)
Warning tone + RED-YELLOW-GREEN flash	Thermal	Overheating of the semiconductors. (Check fan operation)

Fig. 8.4 – Battery charger fault coding.

TECHNICAL CHARACTERISTICS

STANDARD Battery charger	
	Value
Max Battery Current	16 A
Max Absorbed Power	1.7 kW
Theoretical Time to Full Charging	9 h
Supply	230±10% V 16A

"MULTIFAST" Battery charger	
	Value
Max Battery Current	Slow: 10 A Fast: 16 A Extra Fast: 25 A
Max Absorbed Power	Slow: 11kW Fast: 17kW Extra Fast: 27kW
Theoretical Time to Full Charging	Slow: 14 h Fast: 9 h Extra Fast: 6 h
Supply	230±10% V 16A

Battery charger "MINISUPEFAST"	
	Value
Maximum Battery Current	60A
Absorbed Maximum Power	5 kW
Theoretical Time of 80% charge	2,5 h
Supply	400±10% V 16A

"SUPERFAST" Battery charger	
	Value
Max Battery Current	115A
Max Absorbed Power	14 kW
Theoretical Time to 80% charge	50 min
Supply	400±10% V 32A

Fig. 8.5 – Battery charger technical characteristics.

9. Interface logic board for EVO version

Interface logic board function

The purpose of the interface board is to collect and redirect all the signals from/to the vehicle electric and electronic devices.

Fig. 9.1 – Interface logic board.

Access to the interface board can be obtained by removing the touch-screen dashboard, as showed in the in Chapter 4 in this manual.

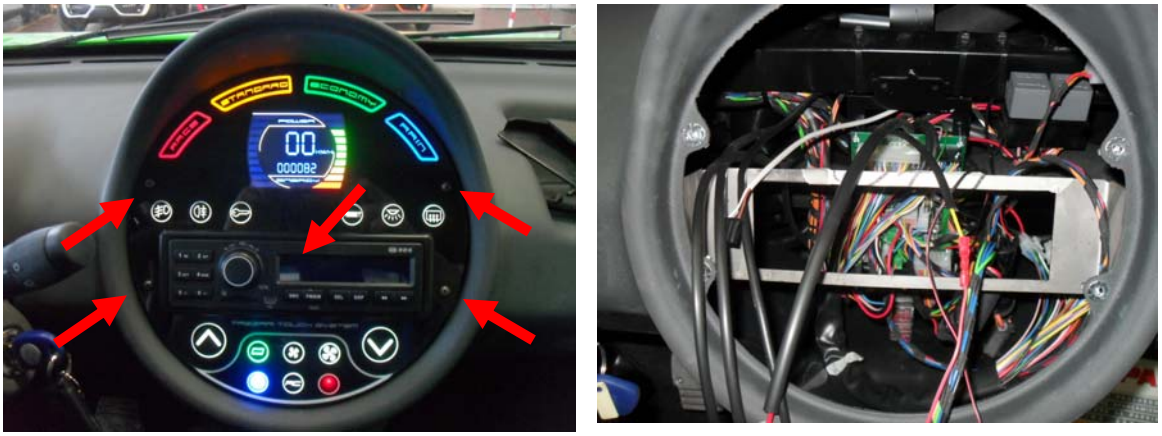


Fig. 9.2 – To remove the touch-screen first remove the radio, then remove the 4 screws indicated by the arrows and pull the electrical connectors

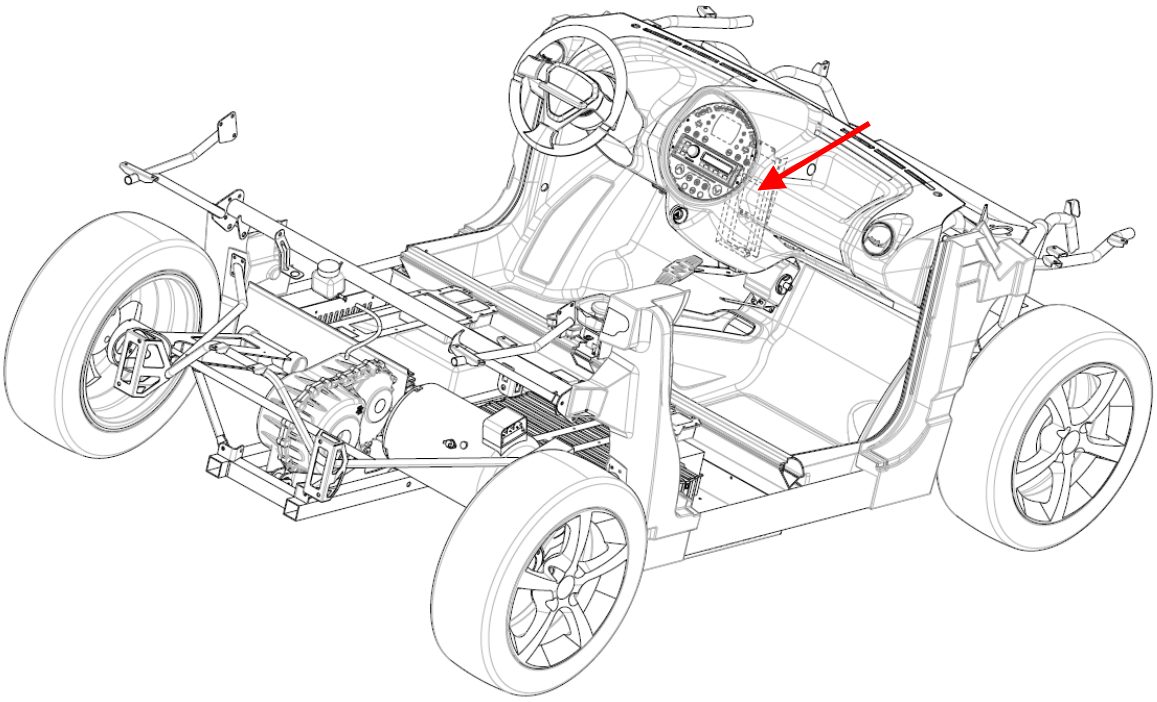


Fig. 9.3 – Interface board positioning.

On this peripheral device, the electronic components necessary to process signals are provided.
In addition to the protective fuses Fs1 and Fs2, the mini Dc/Dc converter supplying power to all the devices requiring 12V input even when the vehicle is off is located here.
Some of the devices powered off this mini-converter are listed here below:

- Centralized locking system;
- Front hood LED light
- Car radio memory;
- Interior light.

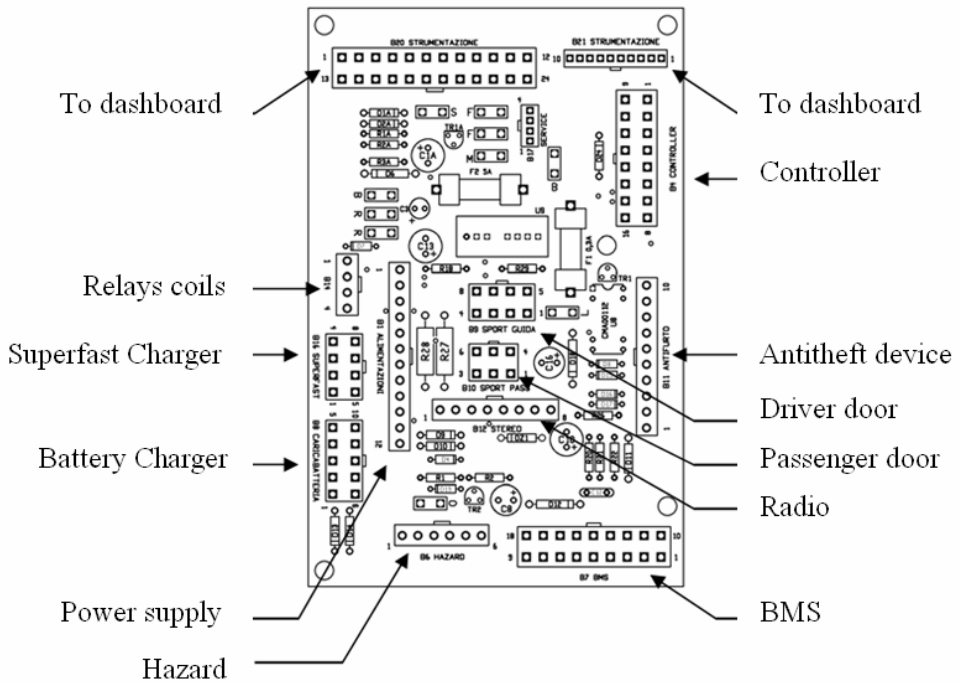
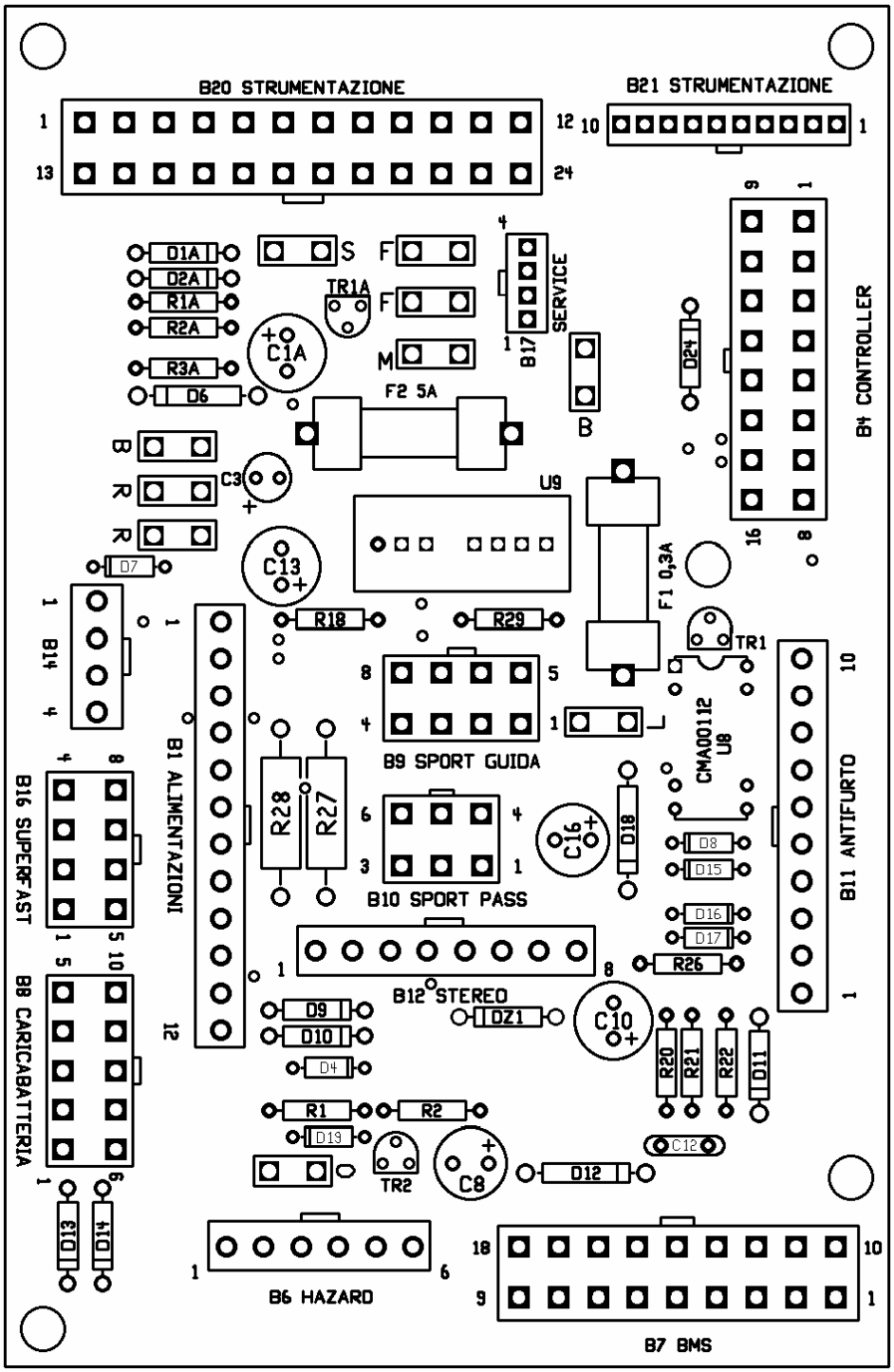


Fig. 9.4 – Interface board connectors.


B20 STRUMENTAZIONE
B21 STRUMENTAZIONE
B4 CONTROLLER
B17 SERVICE
B1 ALIMENTAZIONI
B9 SPORT GUIDA
B10 SPORT PASS
B12 STEREO
B11 ANTIFURTO
B16 SUPERFAST
B8 CARICABATTERIA
B14
B6 HAZARD
B7 BMS
F2 5A
F1 0,3A
CMA00112
U8
U9
TR1A
TR2
C1A
C3
C13
C16
C10
C8
C12
R18
R29
R28
R27
R26
R20
R21
R22
R1
R2
D1A
D2A
R1A
R2A
R3A
D6
D7
D9
D10
D4
D19
D18
D8
D15
D16
D17
DZ1
D11
D12
D13
D14
D24

Main trouble-shooting connectors

Connector	N° Pin	Type	Function	Wire color
R	faston	IN	+12Vdc under key switch and F7	B/R-1
B	faston	OUT	GND	N-2,5
L	faston	OUT	+12Vdc permanent from mini Dc/Dc converter (3W) under FS1	A-0,5
B1 ALIMENTAZIONI "Power supply"	1	IN	+12Vdc back light	B/N-1
	2	IN	+80Vdc under F1	R-1
	8	IN	+80Vdc under key switch	L/R-0,5
	10	IN	+12Vdc from Brake pressure switch	G-0,5
	12	IN	+12Vdc under F5	R-1
B4 CONTROLLER	6	IN	+12Vdc from controller	R-0,5
	11	OUT	Reverse signal to controller (GND)	A/B-0,5
	12	OUT	Forward signal to controller (GND)	S-0,5
	16	OUT	+80Vdc to start Dc/Dc converter	M/B-0,5
B6 HAZARD	1	OUT	+12Vdc permanent from mini Dc/Dc converter (3W) under FS1	R-0,5
B7 BMS	8	IN	+12Vdc only in charge mode	M-0,5
	13	IN	+12Vdc from controller	B/R-0,5
	16	IN	+12Vdc under F5 (+12Vdc under F7 when the key is switch ON)	R-1,5
	18	IN	GND	N-1,5
B8 CARICA BATTERIA "Battery Charger"	2	IN	+12Vdc only in charge mode	G-0,5
	5	OUT	+80Vdc under F1	B-0,5
	6	OUT	+12Vdc under F5 (+12Vdc under F7 when the key is switch ON)	S-0,5
	10	IN	+80Vdc only in charge mode	H-0,5
B9 SPORT GUIDA "Driver door"	1	OUT	+12Vdc permanent from mini Dc/Dc converter (3W) under FS1	S-0,5
	4	IN	+12Vdc when the door is closed	A/R-0,5
B10 SPORT PAS "Passenger door"	1	OUT	+12Vdc permanent from mini Dc/Dc converter (3W) under FS1	S-0,5
	3	IN	+12Vdc when the door is closed	A/R-0,5
B11 ANTIFURTO "Anti-theft device"	1	OUT	+12Vdc under F5	R-1
	3	OUT	GND	N-1
	8	OUT	+12Vdc under key switch and F7	C-0,5
	10	OUT	+12Vdc permanent from mini Dc/Dc converter (3W) under FS1	R/V-1
B12 AUTORADIO "Car hi-Fi"	5	OUT	+12Vdc under key switch and F7	C-1,5
	7	OUT	GND	N-1,5
	8	OUT	+12Vdc permanent from mini Dc/Dc converter (3W) under FS1	R-1
B14 BPBINE RELE' "Relays coils"	1	OUT	+12Vdc when rear fog light is ON	V-1
	2	OUT	+12Vdc doors latches locking	A/N-0,5
	3	OUT	+12Vdc doors latches opening	V-0,5
	4	IN	Park brake signal (GND)	G-0,5

B16 SUPERFAST B16 SUPERFAST	2	OUT	+12Vdc under F5 (+12Vdc under F7 when the key is switch ON)	S-0,5
	3	IN	+12Vdc only in charge mode	G-0,5
	4	OUT	+80Vdc under F1	R-0,5
	8	IN	+80Vdc only in charge mode	V-0,5
B20 STRUMENTA-ZIONE "To dashboard"	5	IN	Forward signal from dashboard (GND)	A-0,5
	6	IN	Reverse signal from dashboard (GND)	B-0,5
	14	OUT	+12Vdc in charge mode	R/N-0,5
	18	IN	+12Vdc under key	R-1
	19	IN	+12Vdc under key	R-1
	21	OUT	+80Vdc under key	S-1
B21 STRUMENTA-ZIONE "To dashboard"	2	OUT	BMS warning light signal (GND)	G-0,5
	3	OUT	Charge indicator signal (PWM)	A-0,5
	9	OUT	Antitheft signal (GND)	V-0,5
	10	IN	To backlight relay coil (GND)	C-0,5

Tabella dei colori / Colours table			
M	Brown / Marrone	C	Orange / Arancio
V	Green / Verde	A	Blue / Azzurro
Z	Violet / Viola	B	White / Bianco
N	Black / Nero	L	Dark Blue / Blu
S	Pink / Rosa	G	Yellow / Giallo
R	Red / Rosso	H	Gray / Grigio

10. Fuses

The vehicle electric system is protected by several fuses, the number of which can vary according to the fitted optional devices.

Main fuses

Fig. 10.1 – Main fusses box

The main fuse box is located in the vehicle interior, next to the steering column.
To be able to obtain access to the fuses, open the compartment, removing the cover after unscrewing its fixing screw.
(In right-hand drive vehicles, this compartment is located to the right of the steering column).
Some sparking can be observed when removing or inserting the fuses F1 and F2: this is caused by the on-board electronic circuit capacitors and should not be regarded as a fault.
The fuses are numbered from left to right.

Main box fuse description and their functions

N.	Function	Amps
1	Main panel	15
2	12V converter input	10
3	Light switch and windshield washer controls	5
4	High – low beams	15
5	Windshield wiper motor	15
6	Reverse light, centralized locking, and parking sensors*	10
7	12V interface board, car hi-fi radio	10
8	Turn signals, gas oil heater*	10

* : if fitted

Fig. 10.2 – Main fuses.

Secondary fuses

Other fuses are arranged inside the vehicle to protect onboard devices and circuits. Shows the fuses F9 and F10, located in the fuse compartment under the right-hand seat. To access these fuses, the two screws on the right-hand seat front should be removed and the seat and its support tray should be removed.

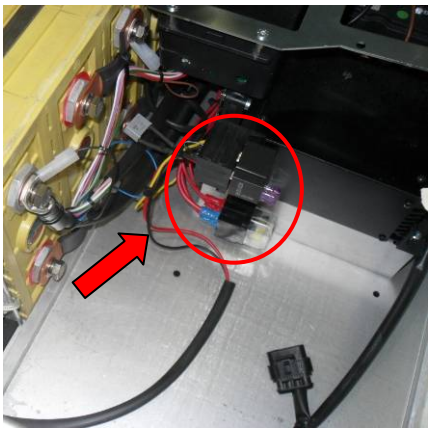


Fig. 10.3 – Secondary fuses (F10 Upper, F9 and F16).

N.	Function	Amps
9	Motor cooling fan	1
10	Heated rear window*	3
16	Extrapower Heater*	20

* : if fitted

To access the fuses F12, F13 and F18 need to remove the capacitive keyboard. To remove it, unscrew the 4 screws shown in the figure, and then lift it from its housing (for details see the section on the dashboard Touch).

Fig. 10.4 – Touch panel removing.

N.	Function	Amps
12	Electric window raiser on driver's side	10
13	Electric window raiser on passenger's side	10
18	Fog light	10

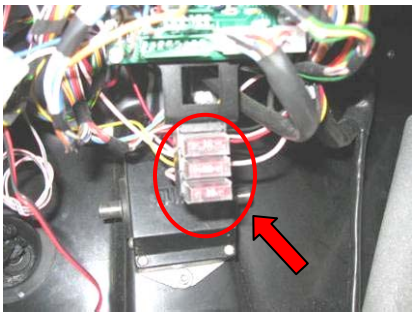


Fig. 10.5 – Secondary fuses inside the dashboard

In the versions with electric heater a fuse is provided inside the vehicle's interior central tunnel. Access can be obtained by removing the service switch cover: to do this, unscrew the main emergency control knob and the four fixing screws.

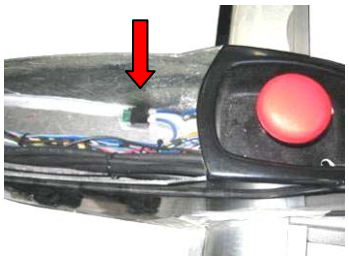


Fig. 10.6 – Electric Heater Fuse

N.	Funzione	Ampere
15	Electric heater power circuit input *	30

* : fuse not present in vehicles with gas oil heater

Power Fuses

The vehicle is provided with a two power fuses:

N.	Funzione	Ampere
1P	Controller power line protection	425 A
17	Battery power line protection	425A

The first fuse is installed directly on the controller and protects the input of this devicefrom possible internal short circuits.
The second fuse F17, protects cables from possible battery short circuits.
This fuse is directly mounted on the driver side battery pack as shown below.

Fig. 10.7 – Battery power line protection

Fig. 10.8 – Controller power line protection

- The use of incorrect amp rating fuses may imply serious risks for the vehicle, including the risk of fire.

11. Electric and electronic trouble-shooting

For a correct approach to electric and electronic trouble-shooting, it is important to first of all be familiar with the vehicle operation, described also in the "Use and maintenance manual", as well as with the wiring diagrams, arrangement of the main electric and electronic components and fuses.
The greatest importance should be attached to safety, as you could become exposed to numerous risks by carrying out not recommended or not authorized maintenance or servicing operations.

IMPORTANT SAFETY INFORMATION

- The measured voltage at battery leads is comprised between 65 and 90 Volts, according to charge levels. This is a potentially dangerous voltage.

- The drive batteries contain flammable substances and irritants. Do not tamper with the batteries in any way and do not force open or break the plastic casing containing the active cells.

- The motor can potentially reach high temperatures. Avoid parking the vehicle when the motor is still hot next to dry scrub or other flammable materials.
- Do not perform any adjustment or maintenance operations before having switched the motor off and allowed it to cool down.
- The oil contained in the reduction gear will heat up with use. Wait until the motor has cooled down before changing the oil.

The main purpose of the BMS is to guarantee the maximum possible vehicle safety, in particular by protecting the Lithium batteries from the risks connected with over-/under-voltage or overheating.

The BMS or the controller may occasionally limit the vehicle performance or cause a vehicle stop, if the performance requested from the vehicle exceeds the design performance. These occurrences, however, should not be considered faults, unless the reason for BMS/controller operation is some component malfunctioning.

CORRECTION OF THE FAULTS DETECTED BY AUTO-TESTING

Most of the possible faults that may occur on the vehicle are detected by the trouble-shooting system and then signaled via dashboard indicators or by connecting the vehicle to tester devices.

Faults signaled by dashboard indicator lights

Faults affecting the drive system (motor and controller) are signaled by the indicator light shown opposite. The specific fault code can be identified on the basis of the number of this indicator light flashes.

A description of the faults and their possible corrective actions is given here below

Flashes	Detected Error	Corrective action
1	Maximum voltage	• Check that the battery voltage value is actually outside the permitted range, i.e. > 100V.
2	Minimum voltage	• Check the battery voltage and put the vehicle under charge if necessary.
3	Start error	• Check for battery voltage at the terminal leads –B and +B, after turning the instrument panel key to its ON position. • Check that the accelerator pedal is operating correctly by using the EyePlus software.
4	Motor overheating	• Check that the filter of the cooling fan located on the motor is clean. • Check that the cooling fan is working by short-circuiting the thermostat fitted on the motor. • Check that there is no dust/foreign matter build-up on the motor aluminum casing.
5	Power module overheating	• Check that the dissipator under the vehicle is clean and in good operating condition.
6	Open power circuit	• Check for battery voltage at the terminal leads –B and +B, after turning the instrument panel key to its ON position. • Check that the remote switch becomes energized when the instrument panel key is turned to its ON position.
7	Starter switch contacts fused	• Check the remote switch efficiency and wear level.
8	Eeprom	• Re-program the controller software by using the EyePlus program.
9	Input voltage + 5V	• Replace the controller.
10	Input voltage + 12V	• Replace the controller.
11	Motor current offset	• Re-program the controller software by using the EyePlus program.
12	Overcurrent	• Check battery current absorption during operation. If unusual values are measured, check the power wiring looking for any insulation faults. • Disconnect the power cables on the motor (U, V, W), isolated carefully and try to turn on the vehicle. If the problem persists, replace the controller. If the error no longer appears replace the electric engine.
13	Accelerator potentiometer alarm	• Check the accelerator pedal efficiency by using the EyePlus program.
14	Flat battery	• Check the battery voltage and put the vehicle under charge if necessary
15	Internal capacitors alarm	• Replace the controller
16	B.M.S. system Fault	• The warning light indicates a malfunction of the BMS system, thencheck with the appropriate diagnostic tools, the type of malfunction.
17	Active thermal derating	• Check that the filter of the cooling fan located on the motor is clean. • Check that the cooling fan is working. • Check that the dissipator under the vehicle is clean and in good operating condition.

Fig. 10.1 – Electronic drive control system error coding.

The BMS operation status can be monitored through the indicator light shown opposite.
If a serious BMS system fault is detected, this indicator light will flash 4 times.
3 flashes indicate that the machine performance is being limited possibly due to a (however minor) battery pack fault.
This indicator's steady light means that the battery is almost flat.

List of Contents: SERVICE KIT SESSION

1. Case content

The supplied hard case contains all the instruments necessary to quickly trouble-shoot all the main electric and electronic components of a Zero vehicle.

Fig. 1.1 – Service case content.

The case is supplied with

1. A service PC with power supply and battery;
2. USB/Serial adapter;
3. Controller cable;
4. 232/TPL Data-logger converter;
5. Breakdown movement control device;
6. BMS Console;
7. PICkit 2 programmer;
8. USB 2Gb data storage key;
9. 13mm double open end wrench;
10. CAN to USB adapter (stored under the service PC);
11. Workshop manual (behind the tool support partition).

Workshop manual
It contains a description of the vehicle main electric and electronic components.
It also describes the components' maintenance and replacement procedures.

Service PC

It contains all the software required to carry out main vehicle electronic components' trouble-shooting.

The PC is factory-configured: no installation operations required.

- Do not install any software not supplied by Tazzari GL.
- Tampering with the PC software and/or hardware will imply the loss of all guarantee rights.
- Never connect two USB devices to the PC at the same time. Failure to observe this recommendation may cause PC failure.

USB/Serial adapter

This cable is necessary to connect both the controller test cable and the 232/TPL converter for battery Data logger device data reading to the service PC USB port.

Controller cable

It must be used for Controller interfacing with the service PC to trouble-shoot the drive system and upgrade its *software* .

232/TPL Data-logger Converter

It must be used connect the battery Data-logger to the service PC.

Breakdown movement control device
This peripheral device can be connected to the interface board to control vehicle movement also in the event of malfunctioning.

BMS Console
It enables to monitor the BMS status, monitor the battery pack condition and check battery charger operation.

CAN to USB adapter
It must be used for BMS interfacing through the CAN communication bus with the service PC.

PICkit 2 programmer
With this device, it is possible to carry out BMS *software* updating.

USB 2Gb data storage key
Memory stick where all the data acquired via the various software can be stored and then copied to other PCs.

Insulated 13mm double open end wrench.
Tool necessary to carry out maintenance on the batteries or any other normally live parts without any risk of short-circuiting.

2. Service PC

Service PC function

The service PC is supplied factory-configured and with all the necessary tools to carry out efficient vehicle testing.
The service PC is supplied with batteries and a power supply to plug the device directly into the power line.

Fig. 2.1 – Service PC.

After switching on the PC by pressing the power button, the operating system desktop will look as pictured:

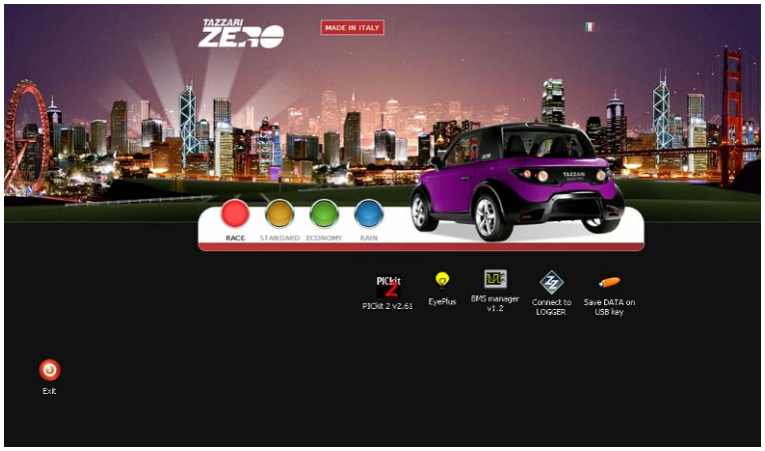


Fig. 2.2 –Service PC desktop.

From the desktop, the required programs can be started by double-clicking with the mouse left-hand button. The following is a list of the programs pre-installed on the PC and described in detail in the following sections of this manual.

Allows BMS software updates to be carried out.

Allows the controller software to be updated and drive system trouble-shooting to be performed.

Allows battery condition to be monitored.

Allows the battery voltage trend to be monitored and saved over time.

Allows all the files on the 2Gb USB key to be saved.

This application must be used to switch off and restart the system.

- Do not install any software not supplied by Tazzari GL.
- Tampering with the PC software and/or hardware will imply the loss of all guarantee rights.
- Do not attempt to connect your service PC to the Internet.
- When the software used requires plugging a peripheral device into a service PC USB port, exclusively use the port indicated by the arrow in this photo or the PC USB port indicate by the label "← USE THIS USB"

- Never connect two USB devices to the PC at the same time. Failure to observe this recommendation may cause failure of your PC.

3. EyePlus

EyePlus software function

The EyePlus software allows the correct operation of the drive system (controller and electric motor) and of its connected peripheral devices to be verified.
The EyePlus software can also be used to upgrade the controller software whenever a new version is released by Tazzari GL, or when this is required to correct a detected controller problem.

How to connect peripheral devices

- Always work with a pressed main emergency switch (open power line)
- Do not install any software not supplied by Tazzari GL.
- When the software used requires plugging a peripheral device into a service PC USB port, exclusively use the port indicated by the arrow in this photo or the PC USB port indicate by the label "← USE THIS USB"

- Never connect two USB devices to the PC at the same time. Failure to observe this recommendation may cause failure of your PC.

Plug the USB/Serial Adapter into the service PC USB port, and then plug the Controller cable into the adapter.
The figure here below shows that it will then be necessary to connect the other Controller cable end into its special connector under the protection cover of the passenger seat.

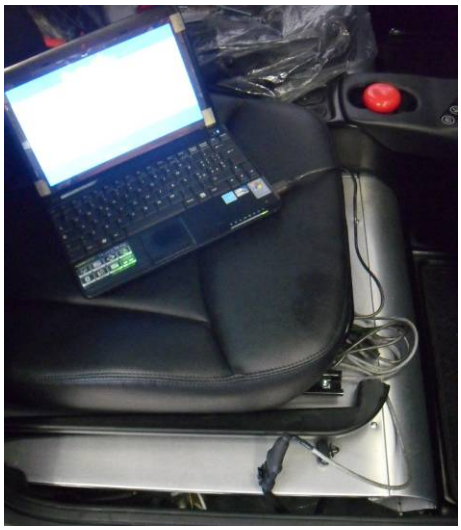


Fig. 3.1 – Controller trouble-shooting and programming connections.

EyePlus software

Launch the EyePlus software , the following screen page will be displayed:

Fig. 3.2 – Main screen display.

After turning the vehicle key to ON, the following screen page will be displayed:

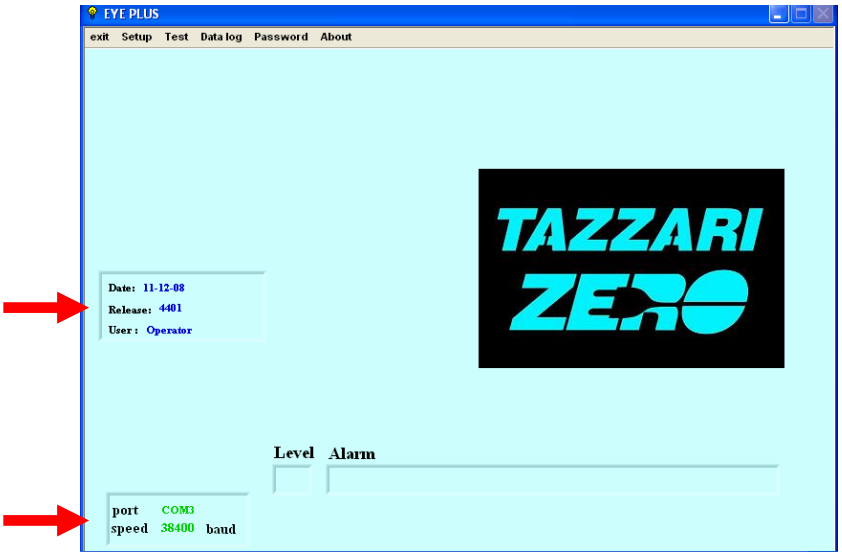


Fig. 3.3 – EyePlus screen – connection established in Operator mode -.

In the left part of the screen, information is displayed concerning the software version, the (Operator or Supervisor) operating mode and the serial port configuration.
Below the TAZZARI ZERO image the most serious active alarms (level and description) are displayed; if several same-level alarms are active at the same time, the one displayed at the top of the list is the first one to have occurred.

In the "**Operator"** mode, access to the following menus is possible:

- To quit the program: "**Exit**"
- Configuration: "**Setup**"
- Trouble shooting: "**Test**"
- Data recording : "**Data logging**"
- Password entering: "**Password**"
- Information on the Eyeplus software: "**About**"

If interaction with the Zero vehicle has not been established yet, access will still be possible to the "*Exit*" "*Setup*", "*Password*" and "*About*" menus (Fig. 3.2). In this particular situation, some information will not be displayed.

EXIT
To close the application or quit a sub-menu, press ESC or select the Exit menu.

SETUP
From the Setup menu it is possible to select the serial communication port and the format of the images created by the **Print** function.
In Communication Port , **COM1** must be selected.

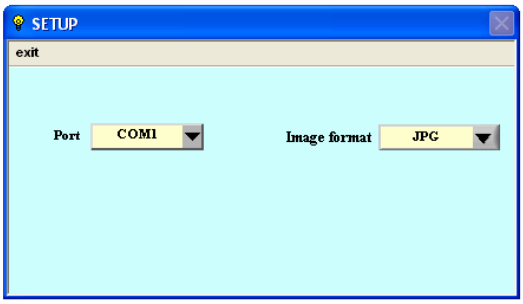


Fig. 3.4 – EyePlus screen - Setup menu-.

TEST

This pop-up menu includes the following items:

- "Drive": drive testing
- "Battery": battery status and alarm testing
- "Timers": timer function testing

TEST > **DRIVE**

In this sub menu, most of the signals relating to the electric drive system can be viewed

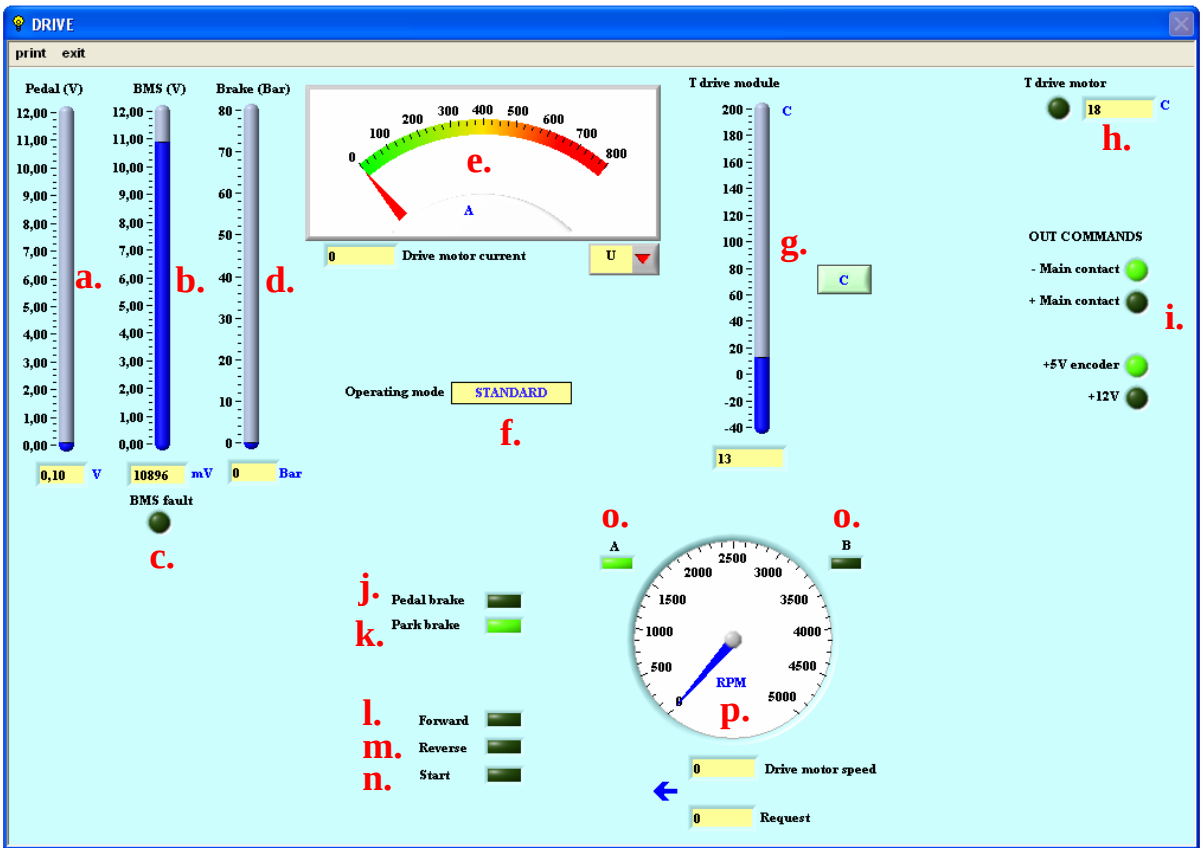


Fig. 3.5 – EyePlus screen – Drive menu -.

The following quantities (from left to right) can be monitored in this screen page:

a. **Accelerator pedal reference:** voltage value ranging between a few mV and approximately 11V. This voltage value will change as a function of the accelerator pedal rotation angle. Through viewing the voltage you can easily valuate an anomaly on the accelerator pedal. It 'should always check that a little pressure to the accelerator pedal will have the light “Start” comes ON (point n).
b. **BMS reference:** voltage value ranging between a few mV and approximately 11V. When the BMS is not producing any limitations or the BMS is not in Fault Mode the signal voltage is 11V. The signal value will decrease as a result of limitations imposed by the BMS.
c. **BMS Fault Indicator:** this indicator light will go red if the BMS has detected a serious system fault and the controller Recovery status is consequently forced. Normally the indicator is power OFF.
d. **Brake:** not used
e. **Drive Motor Current:** motor current absorption
f. **Operating Mode:** indicates the active (Standard, Race, Economy or Rain) operating mode.
g. **Drive module Temperature:** indicates the controller temperature.
h. **Drive motor Temperature:** indicates the electric motor temperature; if the light is red the system overheating protection is active.
i. **Out Commands**
    - **- Main Contact:** a steady light must be on.
    - **+ Main Contact:** an asynchronous flashing light must be on.
    - **+ 5v encoder:** a steady light must be on.
    - **+12V:** the light must be off.

j. **Pedal brake:** a green light indicates that the brake foot control has been pressed. In this state the vehicles can’t move.
k. **Park brake:** a green light indicates that the parking brake is engaged. In this state the vehicles can’t move.
l. **Forward:** a green light indicates that the forward travelling direction has been selected.
m. **Reverse:** a green light indicates that reverse travelling has been selected.
n. **Start:** a green light indicates that the accelerator pedal travel start switch has been operated. If the light doesn’t turns green at the beginning of the pedal accelerator race this may indicate a fault on the accelerator pedal or the wiring connected to it.
o. **A B (encoder signal):** indicates the encoder operation status. When the vehicle is in motion these indicators must light up at random. If the lights stay on or off all the time while the vehicle is in motion, the encoder may be faulty.
p. **RPM:** motor revolutions per minute.

TEST > **BATTERY**

This sub-menu includes the following items:

a. Battery voltage
b. Inverter voltage
c. Code, description and level of the most serious currently active alarm; if several same-level alarms are active at the same time, the first one to have occurred is displayed.

d. Latest 10 active alarm log showing the following information: code, description, time of alarm activation and module temperature. The alarms are listed from top to bottom in chronological order.

In the "**Reset alarms**" menu the alarm log can be deleted.

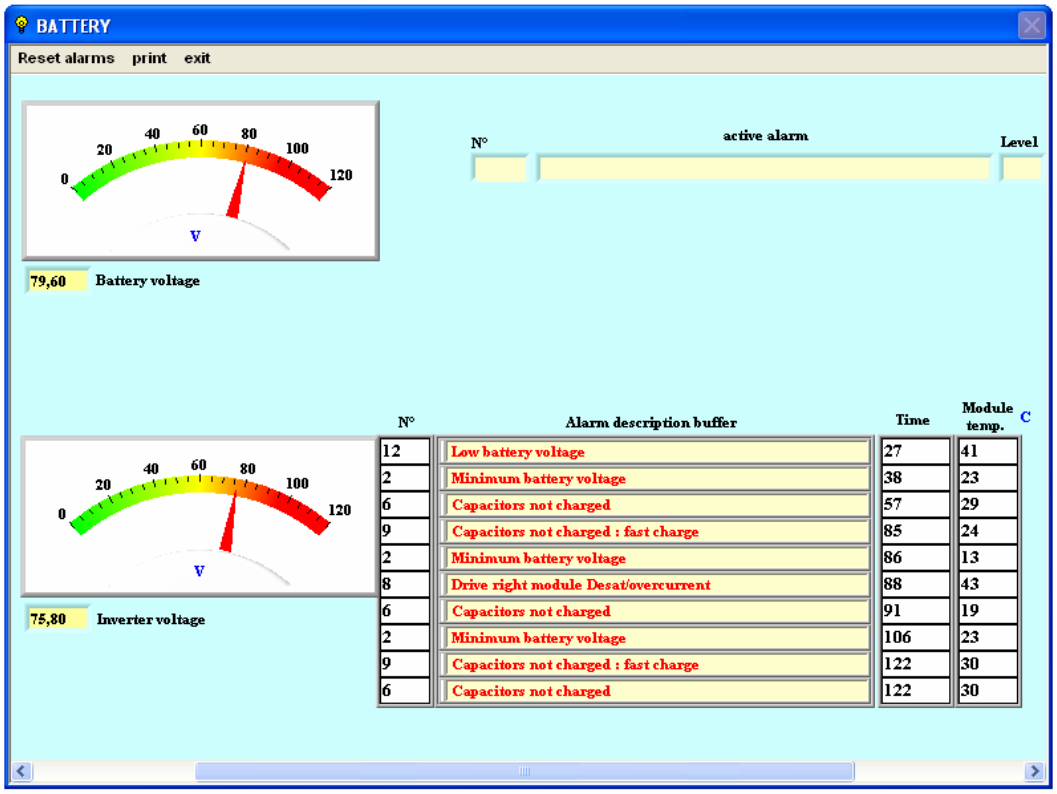


Fig. 3.6 – EyePlus screen - Battery menu -.

PASSWORD

By clicking on the Password menu the "Insert Password" box will be activated. Enter your Password supplied by Tazzari GL.

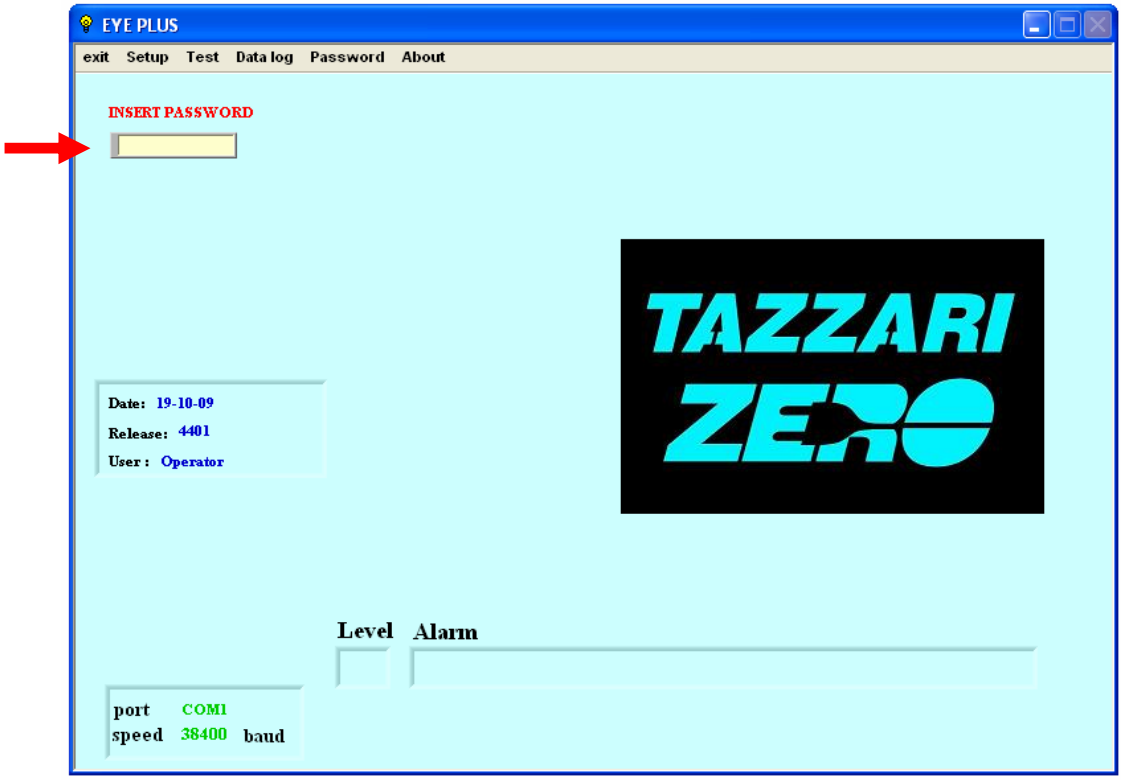


Fig. 3.9 – EyePlus screen - Password menu -.

- By entering the correct password, access to additional menus will be obtained. These menus allow certain parameters to be modified which – if wrongly set – can cause vehicle malfunctioning and above all, damages to persons and property.
- Only modify these parameters if expressly authorized by Tazzari GL technical staff.

After correctly entering your password (********), access to the **Supervisor** operating mode will be obtained**.**

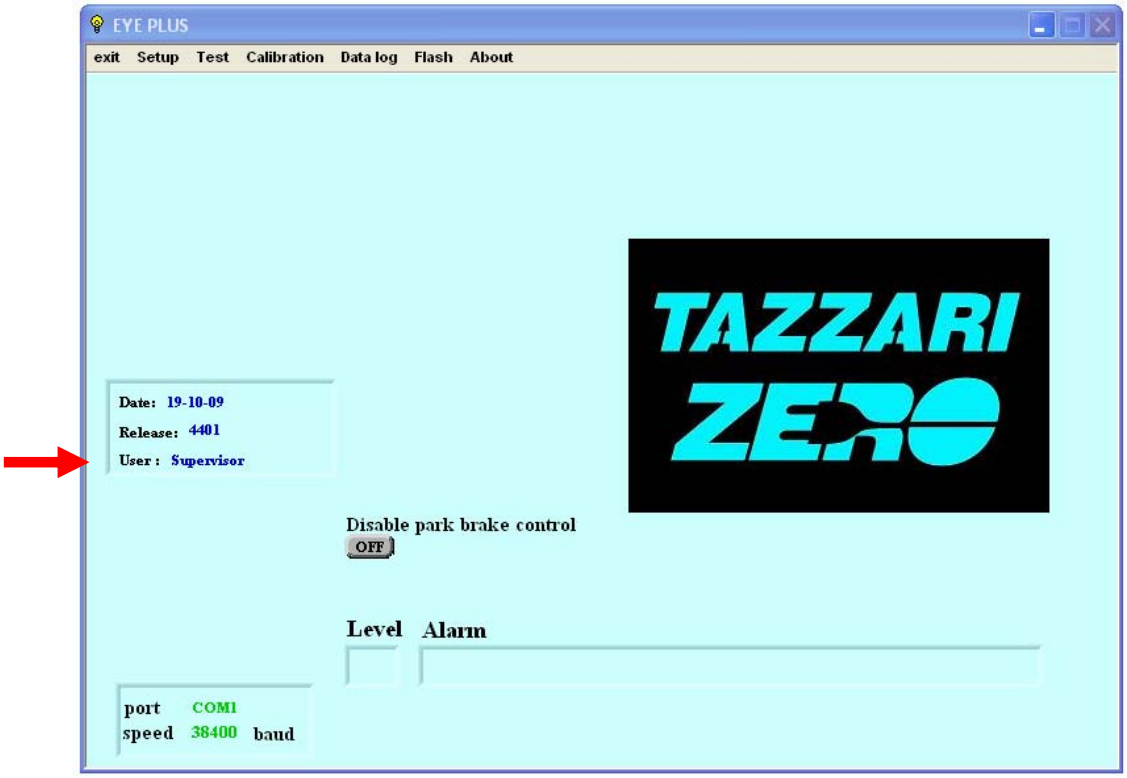


Fig. 3.10 – EyePlus screen – connection to Supervisor mode established -.

From the **Supervisor** mode, the following additional menus can be accessed:

- Parameter setting : "**Calibration**"
- Controller upgrading software: "**Flash**"

CALIBRATION

For safety reasons, access to the these menus is only possible from the **Supervisor** mode and the **handbrake must be pulled up**.
If you choose to quit this menu without saving any modifications, you will be prompted to confirm.
Values outside of the limit range may not be entered; if this were attempted, a warning message ("**Out of limit**") would however be displayed.
The Calibration pop-up menu includes several items, but only those for which Tazzari GL support for parameter editing is not specifically requested will be described:

- "**Load eeprom default**": restores the EEPROM memory default parameters
- "**Parameters image**": exports and imports parameter image files
- "**Pedal**": accelerator pedal calibration

CALIBRATION > **LOAD EEPROM DEFAULT**
This sub-menu has two main functions:

1. If an EEPROM alarm is active, the EEPROM total resetting procedure must be controlled.
2. If the controller software has changed, and you wish to start from a default configuration of the EEPROM parameters, an EEPROM total resetting procedure

must be controlled. If you wish to keep the values set during the calibration phase, though, an EEPROM partial resetting procedure can be controlled.

Neither resetting procedure, however, will alter the timer's or the alarm log's values.

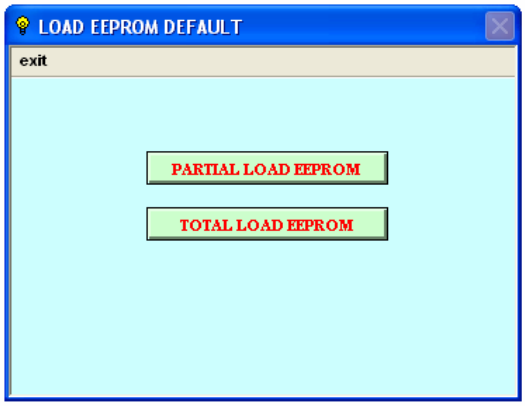


Fig. 3.11 –EyePlus screen – Load eeprom default menu -.

To control partial Eeprom resetting it is necessary to:

- Press the PARTIAL LOAD EEPROM key
- Confirm that you wish to load default values

To control total Eeprom resetting it is necessary to:

- Press the TOTAL LOAD EEPROM key
- Confirm that you wish to load default values
- Confirm again in the dialogue box that will open

- Complete Eeprom resetting will imply the **loss** of any previous setting values

CALIBRATION > **PEDAL**

This sub-menu allows the accelerator travel parameters to be set

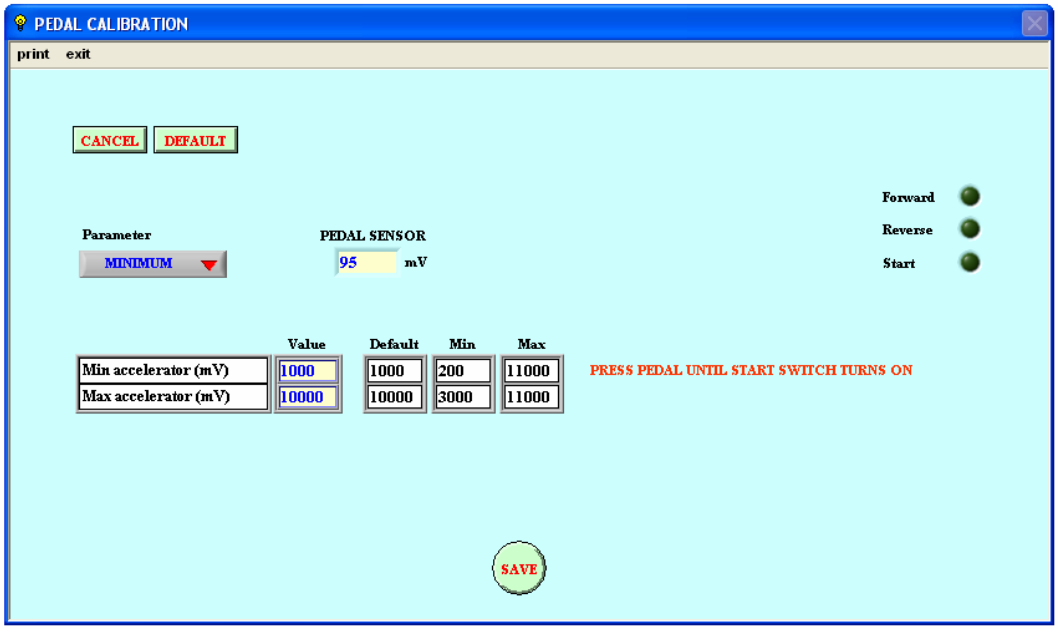


Fig. 3.14– EyePlus screen – Pedal menu - .

To modify the accelerator pedal travel adjustment parameters, it is necessary to:

1. Select the **MIN ACCELERATOR** parameter
2. Slowly depress the accelerator pedal, until the **START** switch is activated and the corresponding green LED lights up
3. Press the accelerator pedal once again to make it cover a few more rotation degrees
4. Press the **SAVE** key to confirm
5. Select the **MAX ACCELERATOR** parameter (next figure)
6. Press the accelerator pedal all the way down
7. Cause the accelerator pedal to go back by a few rotation degrees
8. Press the **SAVE** key to confirm

Press the CANCEL key; the VALUE fields will be updated with the values existing at the time of access to the menu.
If the entered parameter is outside the permitted value range, and calibration is therefore not possible, the device operation should be checked. In this screen page the status of the travelling selection switches can also be checked in real time.

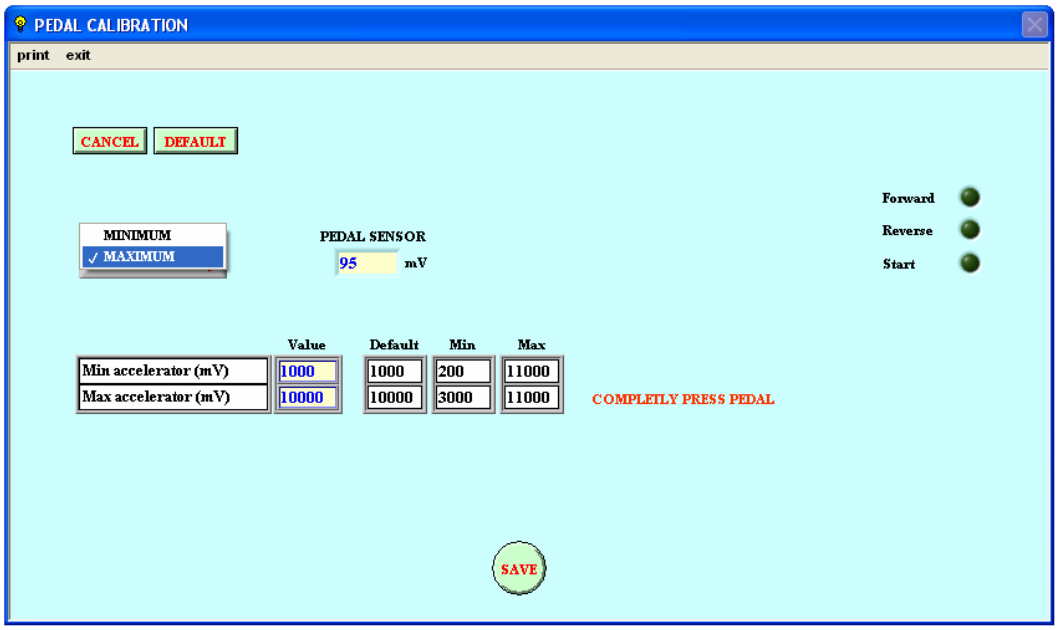


Fig. 3.15– EyePlus screen – Pedal > MINIMUM menu- .

FLASH

From this menu, the controller software can be upgraded in the following steps:

a. Disable controller controls including: direction selection, pedal brake etc…
b. Pull the hand brake
c. Save the file containing the upgraded software version to the following directory: C:\Source_SME\Source_SNG_FILE\TAZZARI\84V
d. Select the FLASH item in the menu bar. This will display the following screen page

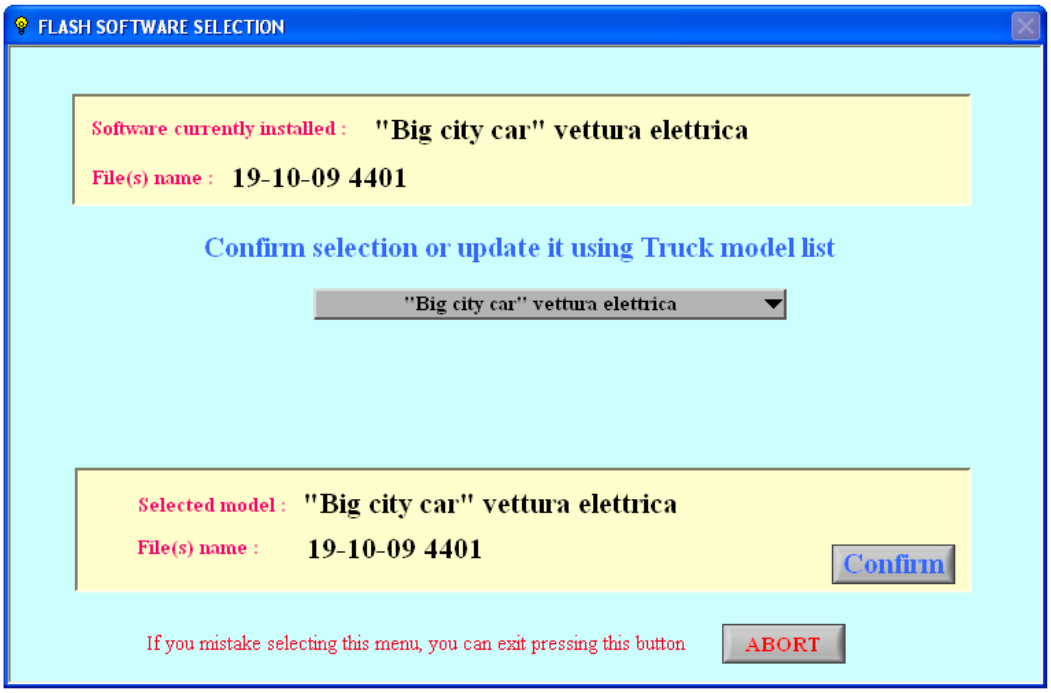


Fig. 3.16– EyePlus screen –Flash menu -.

e. Make sure that in the "**File(s) name**" box at the bottom of screen the name of the upgraded software can be read, then press "**Confirm**"

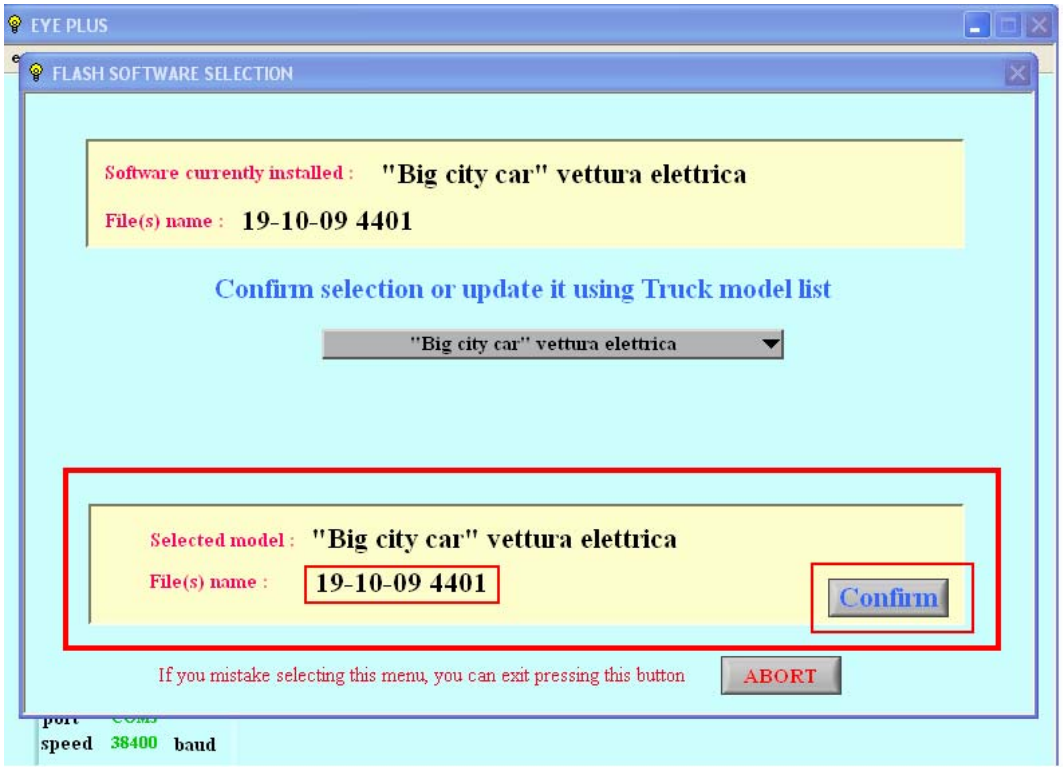


Fig. 3.17– EyePlus screen – Flash menu -.

f. Press "**YES**" in response to the confirm prompt to start Flash programming; the process will begin and a progress bar will be displayed

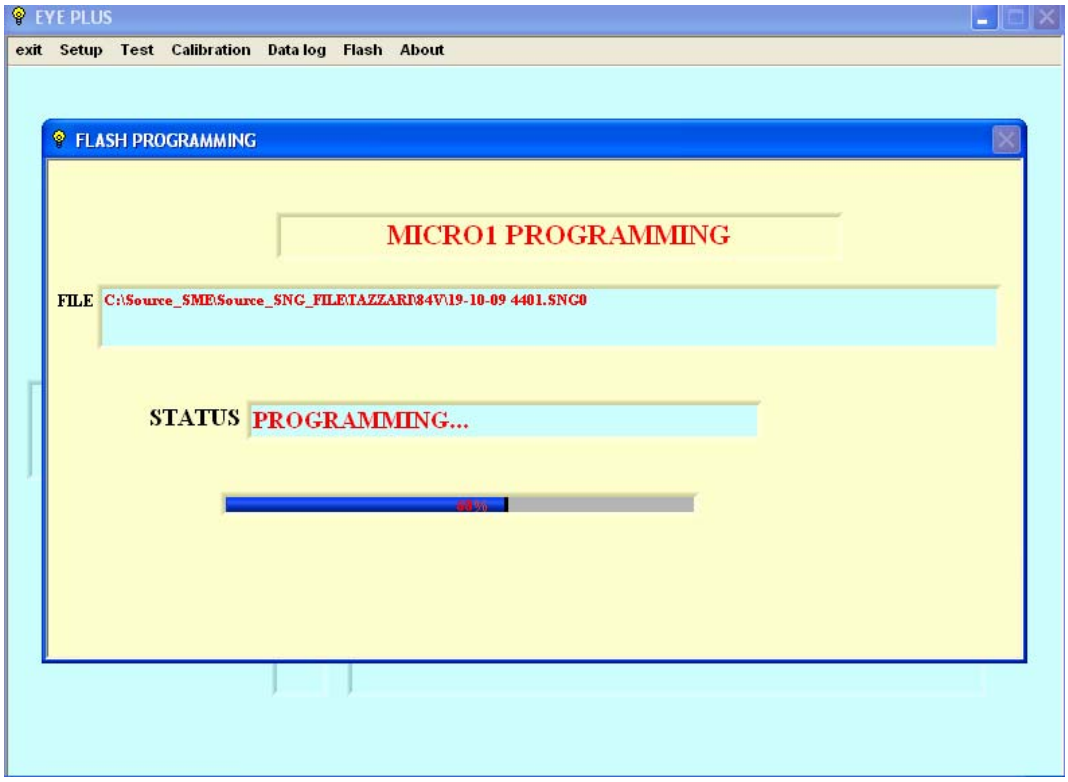


Fig. 3.18– EyePlus screen – Flash menu -.

g. If writing errors have occurred in the EEPROM memory or, in any case, software has been upgraded which did not include CRC control on the EEPROM, a CRC alarm message will be displayed. By pressing the special button it will be possible to restore the EEPROM status; until this is done, all calibration functions will be inhibited.

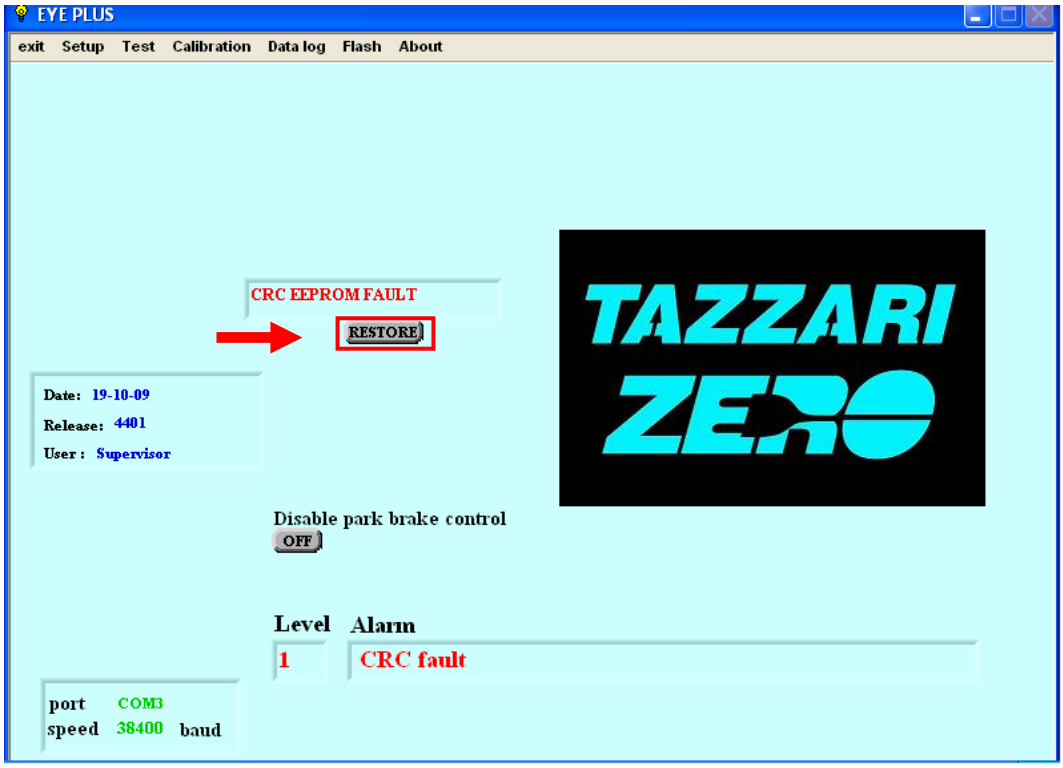


Fig. 3.19– EyePlus screen – CRC restoring -.

h. Carry out the EEPROM memory total resetting from the **Calibration > Load Eeprom Default** menu. Select "**Total Load EEPROM**" then confirm with "**Yes**" from the Warning menu.

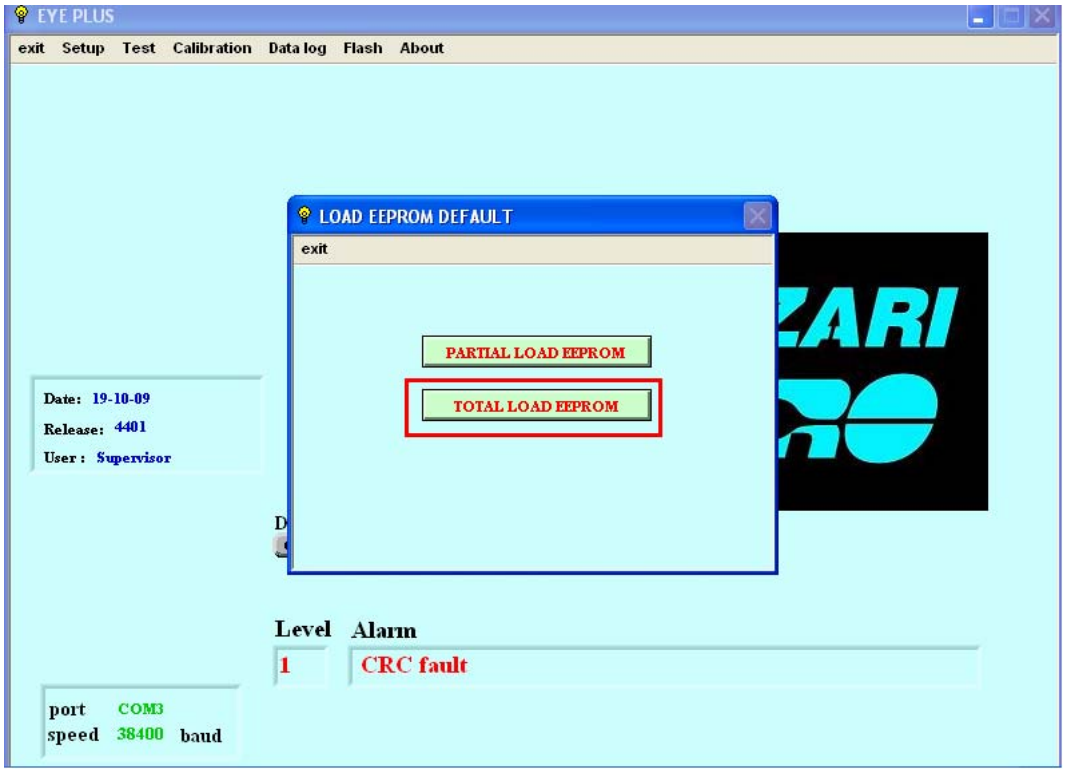


Fig. 3.20– EyePlus screen – default parameter programming -.

i. Ensure that there are no error messages in the main screen page

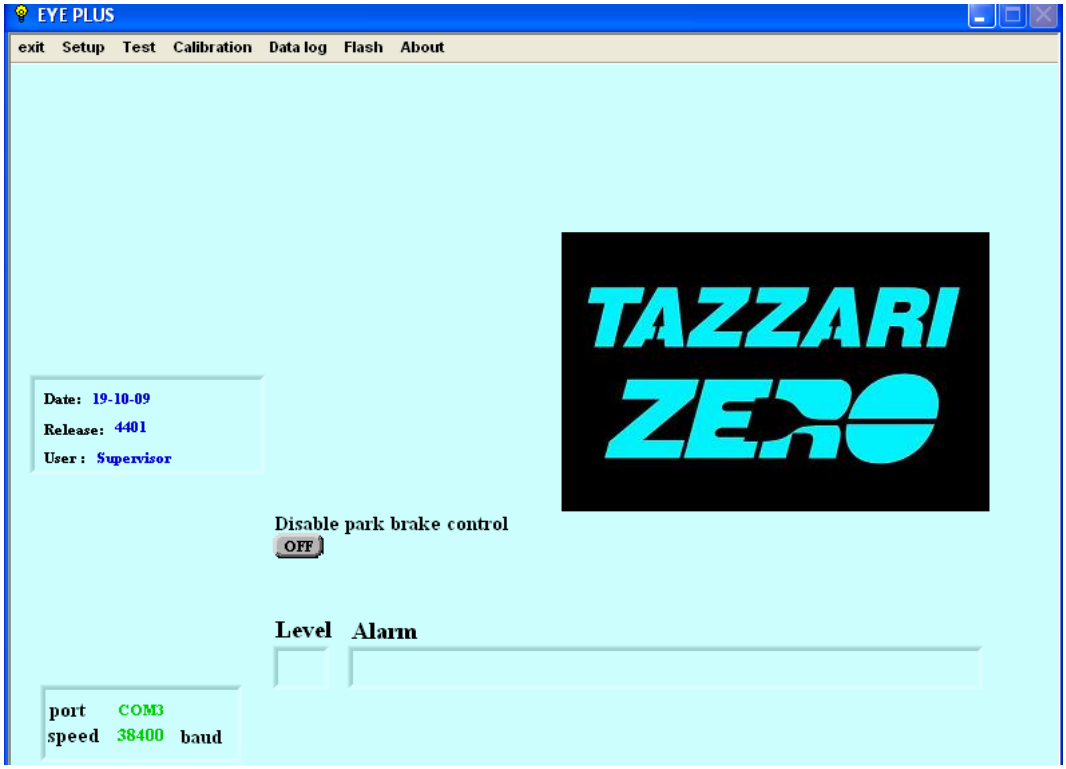


Fig. 3.21– EyePlus screen – main page -.

4. BMS console

BMS console function

The BMS console allows the operating condition of the batteries and BMS system included in the Zero vehicle equipment to be monitored.

Fig. 4.1 –BMS Console.

The BMS is equipped with a backlit LCD and 4 buttons:

- **+ set**: used to scroll the current menu or increase a parameter
- **- set**: used to scroll the current menu or decrease a parameter
- **Enter**: used to access the displayed menu
- **Save**: used to save your parameter setting

- This peripheral device can be used to modify certain parameters able to cause BMS system malfunctions and consequently, damages to persons or property.
- Only modify these parameters if expressly authorized by Tazzari GL and under the supervision of a Tazzari GL technician.

How to connect the peripheral device

This peripheral device must be plugged via its 6-way connector into the BMS testing socket located below the dashboard on the passenger's side, as shown in the photo.

Fig. 4.2 – BMS Console connection to Zero.

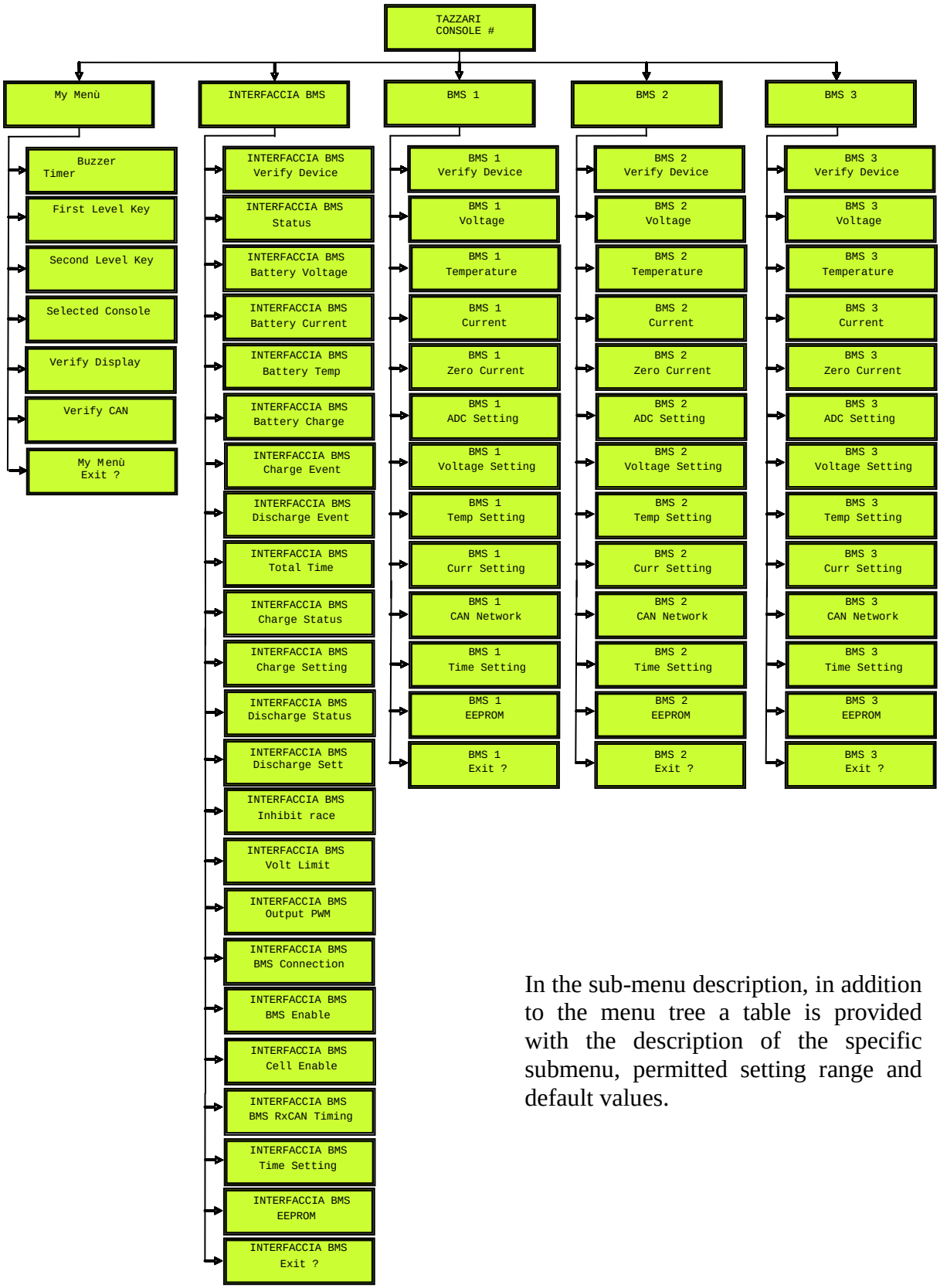
The BMS console is switched on every time that the vehicle starter key is turned to ON and the BMS system is on (e.g. during the vehicle recharging phase).

BMS console menus

3 main menus can be found on the Console:

- **My menu**: allows BMS Console settings management
- **BMS interface**
  - Allows battery pack status monitoring
  - Allows the log of events occurred in the battery pack to be viewed
  - Allows references to the controller and battery charger to be viewed
  - Allows any system error to be detected
  - Allows the BMS Console management software parameters to be modified
- **BMS 1-3**
  - Allows individual cell voltage to be checked
  - Allows battery pack temperature to be checked
  - Allows battery pack current to be checked

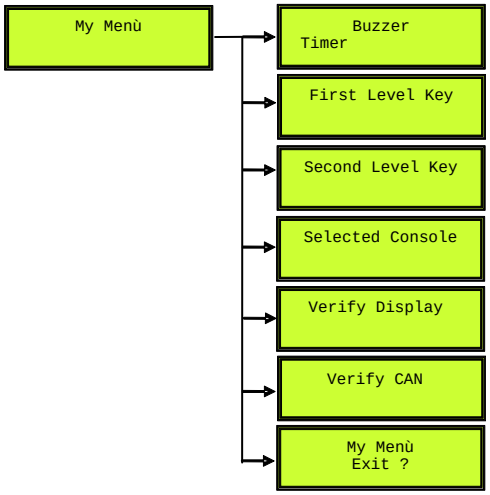
A tree chart of the main menus implemented on the BMS Console is provided here below.



In the sub-menu description, in addition to the menu tree a table is provided with the description of the specific submenu, permitted setting range and default values.

Fig. 4.3 – Main menus tree.

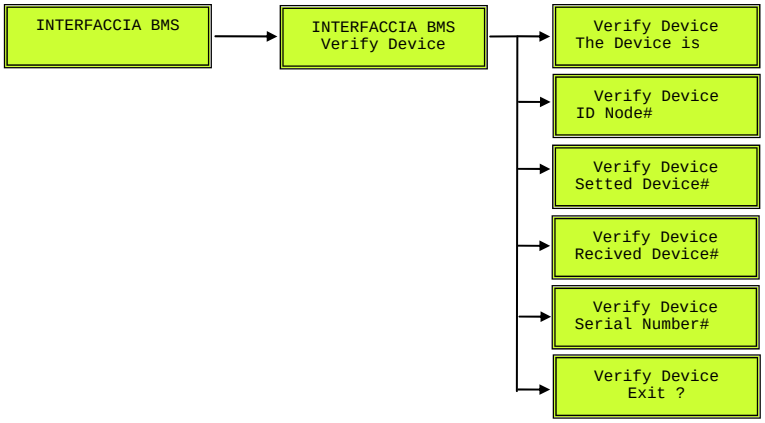
My Menu



Code	Type	Range	Description	Default
Buzzer Timer	Parameter	0 ÷ 250 [ms]	Sets Buzzer time	0
First Level Key	Parameter	number	Sets entry-level menu password	000
Second Level Key	Parameter	number	Sets second-level menu password	000
Selected Console	Parameter	CONSOLE 1 ÷ 4	Selects the name of the Console in use *N.B: the Consoles connected to the same CAN bus must have different names.*	CONSOLE 1
Verify Display	Parameter		Checks LCD crystal operation	
Verify CAN	Parameter		Checks E BMS peripheral device CAN efficiency	

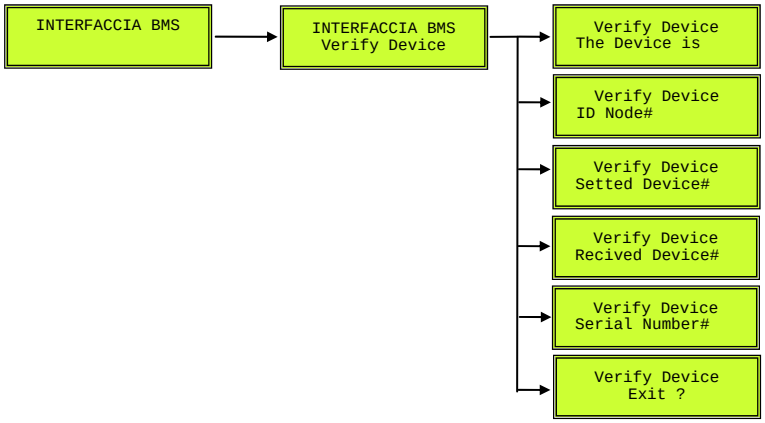
Protection type	***P 0***

BMS INTERFACE



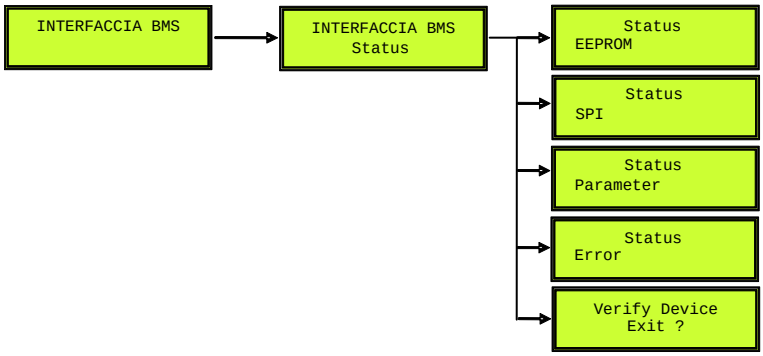
Sigla	Tipo	Range	Descrizione	Default
The Device is	Stato	Connected Not Connected	Indica se il dispositivo è connesso al bus CAN	-
ID Node#	Valore	numero	Numero del nodo	-
Setted Device#	Valore	numero	Numero della periferica	-
Recived Device#	Valore	numero	Conferma il numero settato nella voce precedente	-
Serial Number#	Valore	numero	Numero di serie della periferica	-

Tipo di protezione	***P 0***



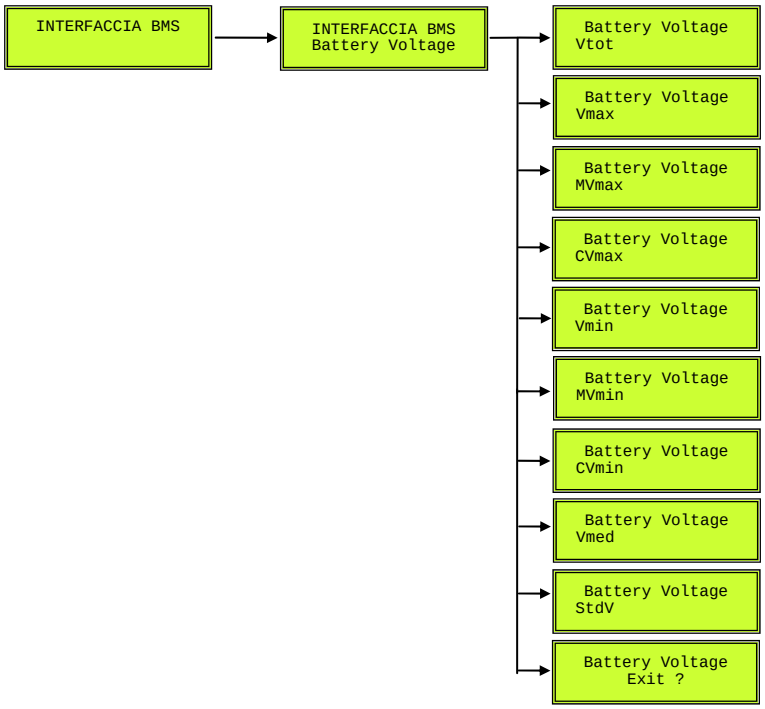
Code	Type	Range	Description	Default
The Device is	Status	Connected Not Connected	Indicates if device is connected to CAN bus	-
ID Node#	Value	number	Node number	-
Set Device#	Value	number	Peripheral device number	-
Received Device#	Value	number	Confirms number set in previous item	-
Serial Number#	Value	number	Peripheral device serial number	-

Protection type	***P 0***



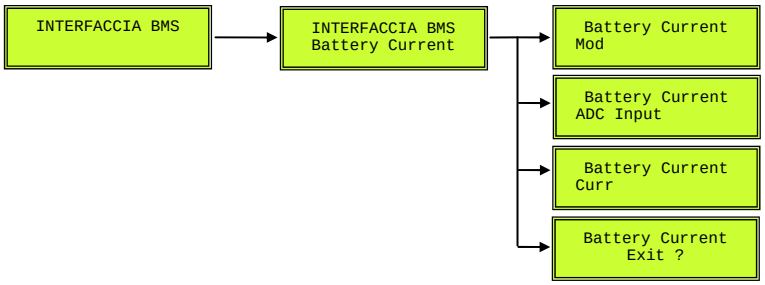
Code	Type	Range	Description	Default
EEPROM	Status	OK Error	Indicates correct EEPROM memory operation	-
SPI	Status	OK Error	Indicates correct SPI communication system operation	-
Parameter	Status	OK Error	Indicates correct parameter setting in BMS	-
Error	Status	OK Error	Indicates if BMS has detected an error	-

Protection type	***P 0***



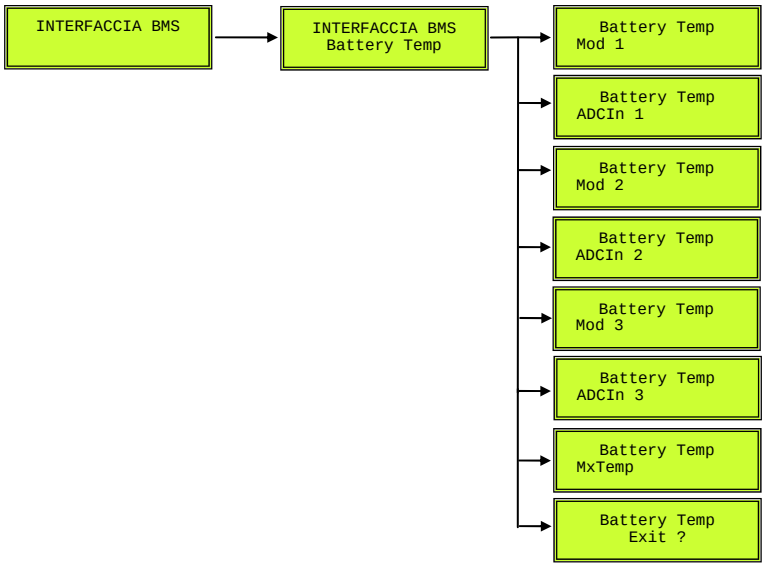
Code	Type	Range	Description	Default
Vtot	Value	number [V]	Battery Pack total voltage	-
Vmax	Value	number [V]	Max cell voltage	-
MVmax	Value	number	Number of module which measured max cell voltage	-
CVmax	Value	number	Number of cell which showed max cell voltage	-
Vmin	Value	number [V]	Min cell voltage	-
MVmin	Value	number	Number of module which measured minimum cell voltage	-
CVmin	Value	number	Number of cell which showed minimum cell voltage	-
Vmed	Value	number [V]	Average cell voltage	-
StdV	Value	number [V]	Standard deviation of voltage values acquired by BMS	-

Protection type	***P 0***



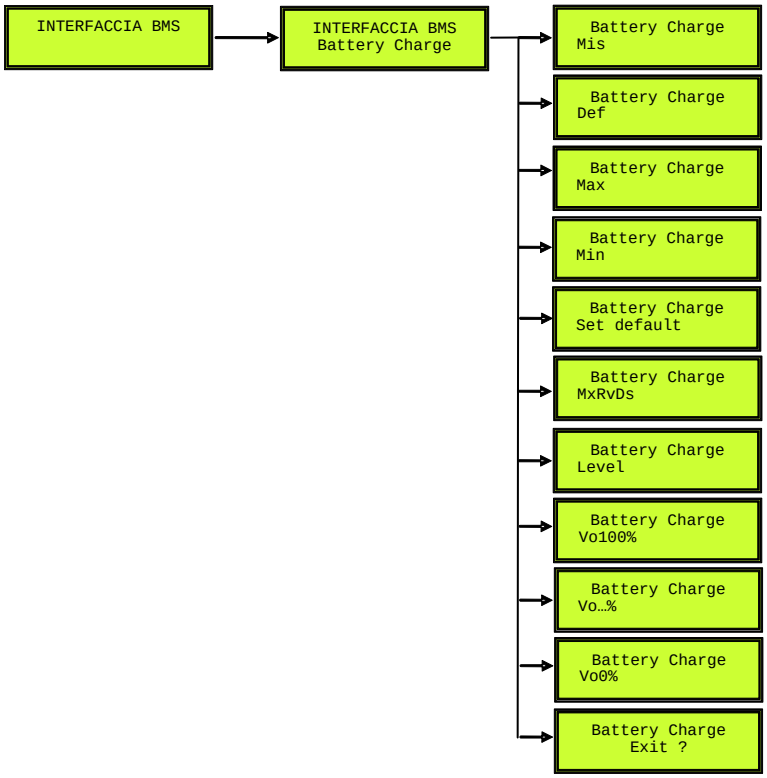
Code	Type	Range	Description	Default
Mod	Parameter	1 ÷ 16	Sets the module from which to acquire current	3
ADC Input	Parameter	1 ÷ 8	Sets the module input from which to acquire current	3
Curr	Value	number [A]	Instantaneous value of the Battery Pack current (positive during discharging, negative during charging)	-

Protection type	***P 0***



Code	Type	Range	Description	Default
Mod 1	Parameter	1 ÷ 16	Sets a module to be module number 1	1
ADC Input 1	Parameter	1 ÷ 8	Sets the input of module number 1 from which to acquire battery pack temperature	6
Mod 2	Parameter	1 ÷ 16	Sets a module to be module number 2	2
ADC Input 2	Parameter	1 ÷ 8	Sets the input of module number 2 from which to acquire battery pack temperature	6
Mod 3	Parameter	1 ÷ 16	Sets a module to be module number 3	3
ADC Input 3	Parameter	1 ÷ 8	Sets the input of module number 3 from which to acquire battery pack temperature	6
MxTemp	Value	number [°C]	Max temperature among all the acquired values	-

Protection type	***P 0***

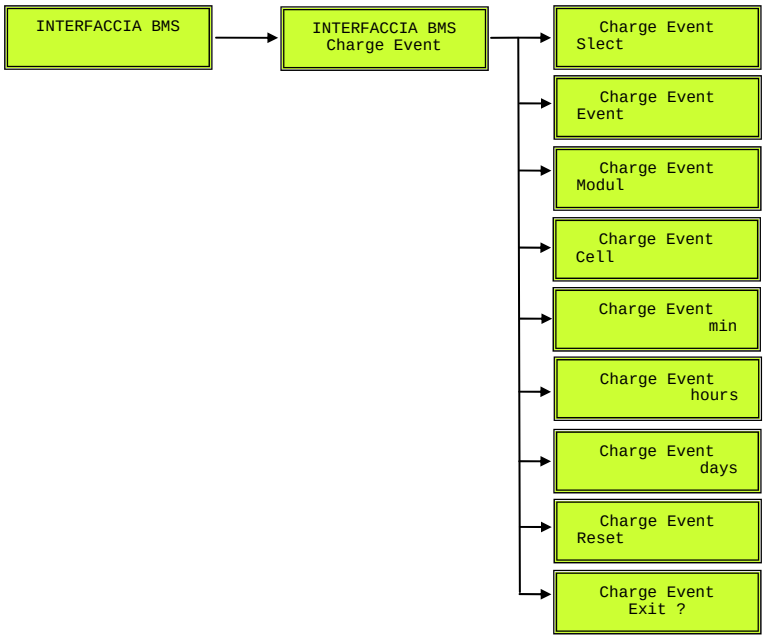


Code	Type	Range	Description	Default
Mis	Value	number [Ah]	Charge stored by the Battery Pack (pure amperometric method)	-
MisR	Value	number [Ah]	Charge stored by the Battery Pack (amperometric and volt-metric method)	-
MxRvDs	Parameter	number [A]	Max regeneration current coming from the motor to use	0,0
VoC	Parameter	number [A]	Current threshold beyond which the system will switch from the volt-metric to the amperometric method	5,2
VoT	Parameter	number [min]	Time threshold beyond which the system will switch from the volt-metric to the amperometric method	3,0
LevVo	Value	number [%]	Storage battery state of charge on the basis of battery pack voltage	-

LevAh	Value	number [%]	Storage battery state of charge measured according to amperometric method	-
LevAhR	Value	number [%]	Storage battery state of charge measured according to amperometric and volt-metric methods	-
Set Default	Parameter	Off On	Sets the measured capacity at rated value	Off
Def	Parameter	number [Ah]	Battery Pack rated capacity	160
Vo100%	Parameter	number [V]	Associates the 100% value at charge indicator output with the parameterized voltage representing VminCell x 24	81.0
Vo90%	Parameter	number [V]	Associates the 90% value at charge indicator output with the parameterized voltage representing VminCell x 24	80.5
Vo80%	Parameter	number [V]	Associates the 80% value at charge indicator output with the parameterized voltage representing VminCell x 24	79.8
Vo70%	Parameter	number [V]	Associates the 70% value at charge indicator output with the parameterized voltage representing VminCell x 24	79.4
Vo60%	Parameter	number [V]	Associates the 60% value at charge indicator output with the parameterized voltage representing VminCell x 24	79.1
Vo50%	Parameter	number [V]	Associates the 50% value at charge indicator output with the parameterized voltage representing VminCell x 24	78.8
Vo40%	Parameter	number [V]	Associates the 40% value at charge indicator output with the parameterized voltage representing VminCell x 24	78.2
Vo30%	Parameter	number [V]	Associates the 30% value at charge indicator output with	77.8

			the parameterized voltage representing VminCell x 24	
Vo20%	Parameter	number [V]	Associates the 20% value at charge indicator output with the parameterized voltage representing VminCell x 24	77.4
Vo10%	Parameter	number [V]	Associates the 10% value at charge indicator output with the parameterized voltage representing VminCell x 24	76.8
Vo0%	Parameter	number [V]	Associates the 0% value at charge indicator output with the parameterized voltage representing VminCell x 24	76.4

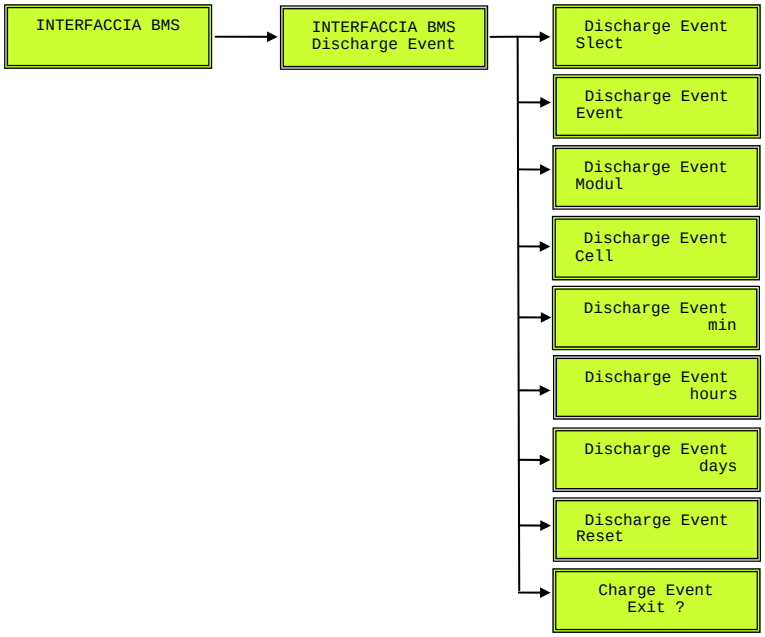
Protection type	***Non-modifiable parameters P0***



Code	Type	Range	Description	Default
Select	Parameter	0 ÷ -30	Selects the event to test (from the most recent to the oldest)	-
Event	Value	Event coding	Indicates the type of event	**Init Cycle:** start cycle (no fault) **MinVtEr:** the cell has exceeded the allowable minimum voltage **MaxVtEr**: the cell has exceeded the allowable maximum voltage **MaxMinVtEr:** the cell has exceeded in a very short period of time both maxi mum and the minimum voltage allowed **CanEr:** error in CAN communication system **StdVEr:** The voltages of the cell have a not correct distribution (equalization not corrected)
Module	Value	0 ÷ 16	Indicates the module concerned by the event	-

Cell	Value	0 ÷ 8	Indicates the module cell concerned by the event	-
Min	Value	number [min]	Operation minute during which the event occurred	*not available*
Hours	Value	number [hrs]	Operation hour during which the event occurred	*not available*
Days	Value	number [days]	Operation day during which the event occurred	*not available*
Reset	Parameter	Off On	Resets all events in charge status	Off

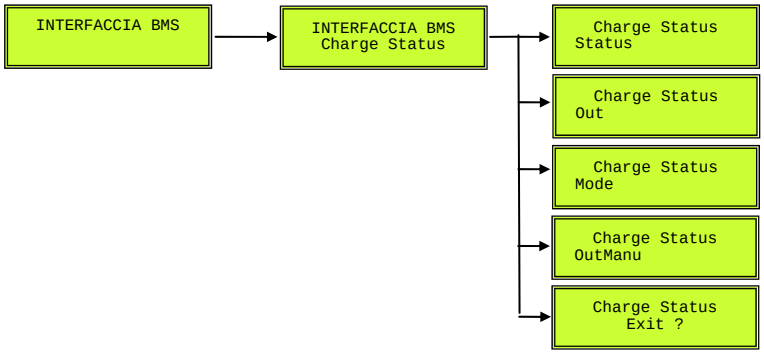
Protection type	***P 0***



Code	Type	Range	Description	Default
Select	Parameter	0 ÷ -30	Selects the event to test (from the most recent to the oldest)	-
Event	Value	Event coding	Indicates the type of event	**Init Cycle:** start cycle (no fault) **MinVtEr:** the cell has exceeded the allowable minimum voltage **MaxVtEr**: the cell has exceeded the allowable maximum voltage **MaxMinVtEr: t**the cell has exceeded in a very short period of time both maximum and the minimum voltage allowed **CanEr:** error in CAN communication system **StdVEr:** The voltages of the cell have a not correct distribution (equalization not corrected)
Module	Value	0 ÷ 16	Indicates the module concerned by the event	-

Cell	Value	0 ÷ 8	Indicates the module cell concerned by the event	-
min	Value	number [min]	Operation minute during which the event occurred	*not available*
hours	Value	number [hours]	Operation hour during which the event occurred	*not available*
days	Value	number [days]	Operation day during which the event occurred	*not available*
Reset	Parameter	Off On	Resets all events in discharge status	Off

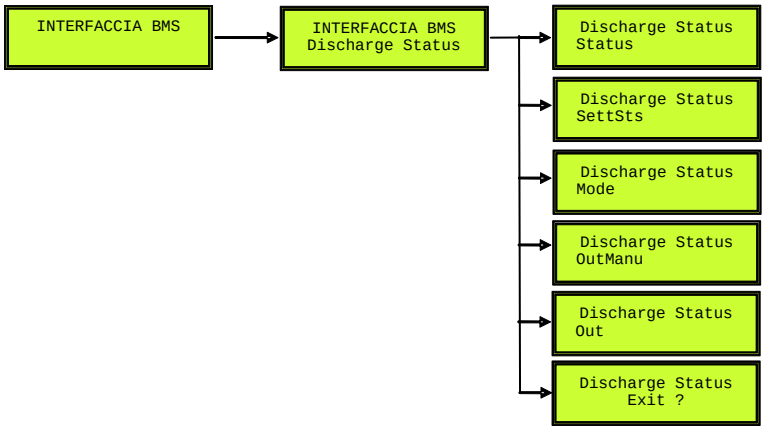
Protection type	***P 0***



Code	Type	Range	Description	Default
Status	Status	reset	Not in battery recharging phase	-
		SUV	Status below recharging thresholds	
		SV1	First charging threshold exceeded	
		SV2	Second charging threshold exceeded	
		SV3	Third charging threshold exceeded	
		SOV	Charging stop	
		OvTp	OvTp temperature value exceeded and battery charger reference forced to Omi	
		HiOvTp	HiOvTp temperature value exceeded and battery charger reference forced to Ost	
Out	Value	0% ÷ 100%	Battery charge reference value	-
Mode	Parameter	auto	Out value set automatically	Auto
		man	**Out value set manually through the Parameter OutManu. !! BSM control no longer applied to charging phase!!**	
OutManu	**Parameter**	**0% ÷ 100%**	**Sets reference to battery charger manually**	0%

Protection type	***P 0***

- If the Parameter Mode is set to man the BMS system will no longer perform any charging phase control. This operation, if incorrectly performed, may damage the system and cause harm to persons or property.

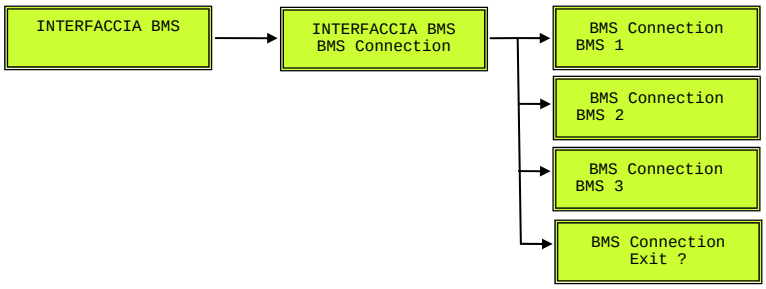


Code	Type	Range	Description	Default
Status	Status	reset	Not in battery discharging phase	-
		SOV	Status above discharging thresholds	
		SV3	First discharging threshold exceeded	
		SV2	Second discharging threshold exceeded	
		SV1	Third discharging threshold exceeded	
		SUV	Discharging stop	
		OvTp	OvTp temperature value exceeded and controller reference forced to Oot	
SettSts	Status	Race	Race mode selected by user	
		Standard	Standard mode selected by user	
		Economy	Economy mode selected by user	
		Rain	Rain mode selected by user	
Mode	Parameter	auto	Out value set automatically	Auto
		man	**Out value set manually through the Parameter OutManu. !! BSM control no longer applied to discharging phase!!**	
OutManu	**Parameter**	**0% ÷ 100%**	**Sets reference to controller manually**	**0**

Out	Value	0% ÷ 100%	Controller reference value	-

Protection type	***P 0***

- If the Parameter Mode is set to man the BMS system will no longer perform any discharging phase control. This operation, if incorrectly performed, may damage the system and cause harm to persons or property.

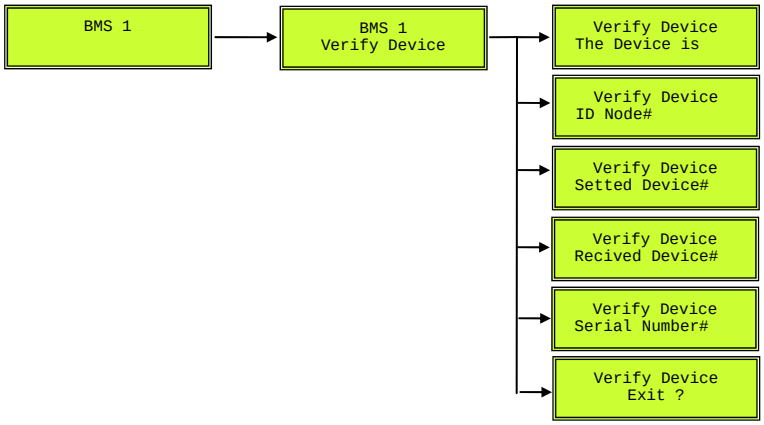


Code	Type	Range	Description	Default
BMS 1	Status	On	BMS 1 connected	-
		Off	BMS 1 not connected	
BMS 2	Status	On	BMS 2 connected	-
		Off	BMS 2 not connected	
BMS 3	Status	On	BMS 3 connected	-
		Off	BMS 3 not connected	

Protection type	***P 0***

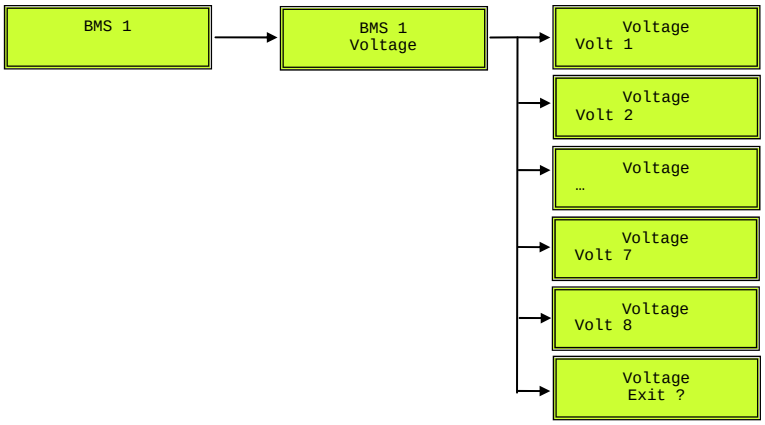
BMS 1, BMS 2 and BMS 3

The submenus that we are going to analyze here below specifically deal with the configuration and management of BMS system Modules/Equalizers. In this specific application, there are three modules. To avoid providing an excessively long description, we are only going to present the first module Menu - the others obviously being the same.



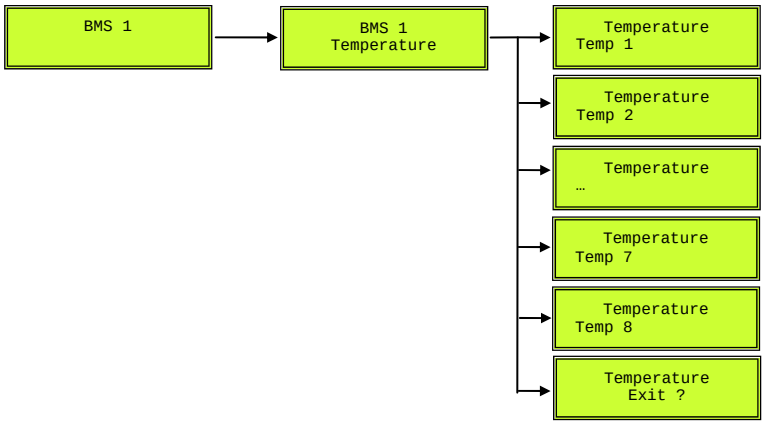
Code	Type	Range	Description
The Device is	Status	Connected	Indicates whether device is connected to CAN bus
		Not Connected	
ID Node#	Value	number	Node number
Set Device#	Value	number	Peripheral device number
Received Device#	Value	number	Confirms number set in previous item
Serial Number#	Value	number	Peripheral device serial number

Protection type	***P 0***



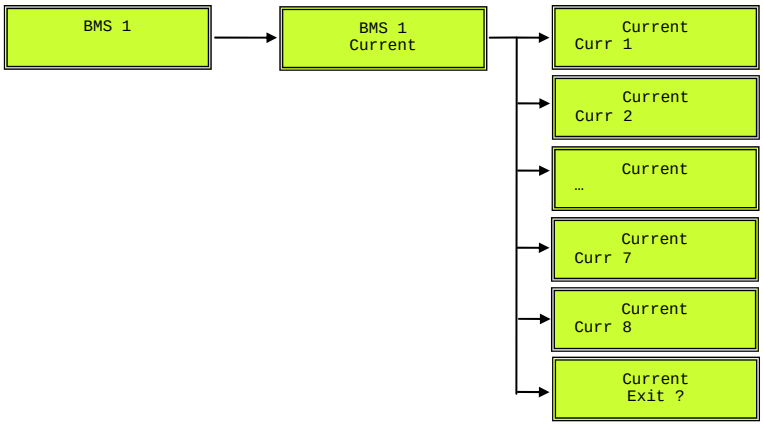
Code	Type	Range	Description
Volt 1	Value	number [V]	Cell 1 voltage
…	Value	number [V]	Cell …voltage
Volt 8	Value	number [V]	Cell 8 voltage

Protection type	***P 0***



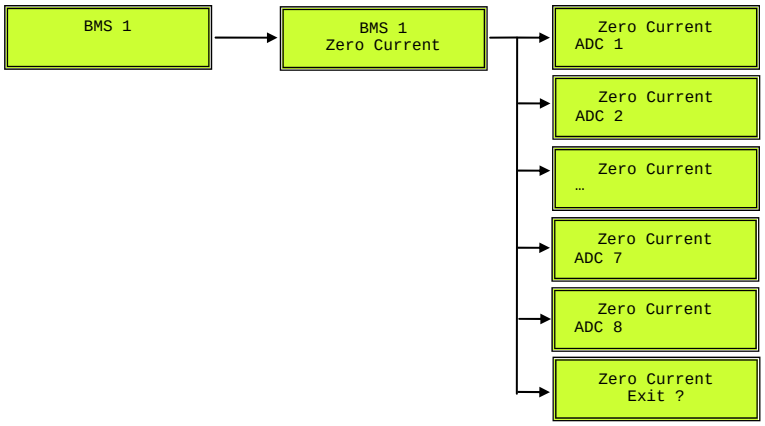
Code	Type	Range	Description
Temp 1	Value	number [°C]	Temperature 1
…	Value	number [°C]	Temperature …
Temp 8	Value	number [°C]	Temperature 8

Protection type	***P 0***



Code	Type	Range	Description
Curr 1	Value	number [A]	Current 1
…	Value	number [A]	Current …
Curr 8	Value	number [A]	Current 8

Protection type	***P 0***



Code	Type	Range	Description
ADC 1	Status	On	Current zero correctly set
		Off	Current zero not correctly set (and set to 0 by default)
…	Status	On	Current zero correctly set
		Off	Current zero not correctly set (and set to 0 by default)
ADC 8	Status	On	Current zero correctly set
		Off	Current zero not correctly set (and set to 0 by default)

Protection type	***P 0***

5. B.M.S. Manager

B.M.S. Manager function

The BMS Manager software allows for simultaneous monitoring of most of the main battery pack quantities.
This software is particularly useful to carry out an in-depth analysis of the battery pack operating status.

How to connect peripheral devices

- Do not install any software not supplied by Tazzari GL.
- When the software used requires plugging a peripheral device into a service PC USB port, exclusively use the port indicated by the arrow in this photo or the PC USB port indicate by the label "← USE THIS USB"

- Never connect two USB devices to the PC at the same time. Failure to observe this recommendation may cause the failure of your PC.

The first thing to do is switching on your service PC; plug the CAN to USB adapter into the USB port.

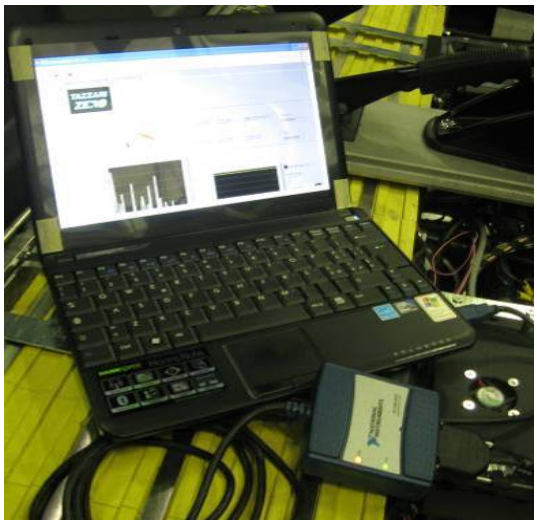


Fig. 5.1 – Service PC connected to CAN to USB Adapter.

It will then be necessary to plug the supplied CAN to USB Adapter cable into the BMS testing socket provided on the vehicle.
The BMS testing socket is located below the dashboard on the passenger's side as shown in this photo:

Fig. 5.2 – Service PC connected to the CAN to USB Adapter and to the BMS test socket

Two LEDs are provided on the CAN to USB adapter: the top one lights up when the peripheral device is connected to the service PC through the USB port, while the bottom one lights up when the peripheral device either transmits or receives a CAN message.
When all the above-described connections have been carried out, turn the vehicle starter key to its ON position and double-click to launch the BMS manager software BMS manager.

BMS manager software

After launching the software, the following window will be displayed:

*N.B.: For improved software displaying, press **CTRL** / to maximize the window size.*

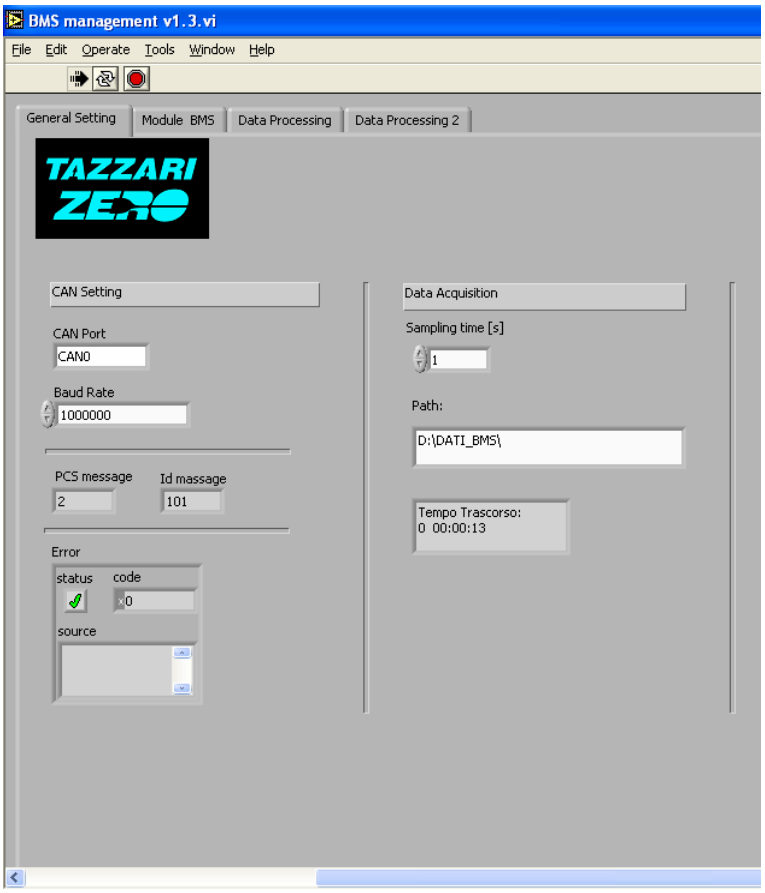


Fig. 5.3 – BMS manager screen - General Setting menu - .

At this point, the software will be automatically started, saving all the data to a text file (extension: .txt) named after the data acquisition start date and time.

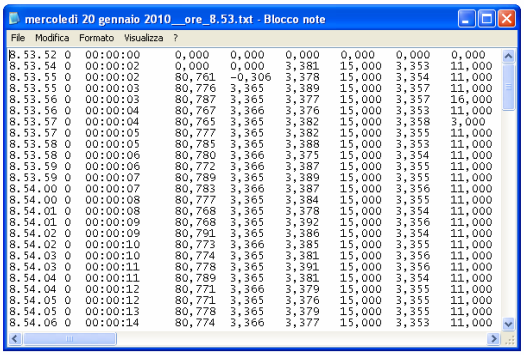


Fig. 5.4 – Text file with saved data .

The data files can be downloaded to the **DATI_BMS directory** on the USB memory stick by using the "**Save DATA on key USB**" software.

The data contained in the.txt file are arranged in columns. Check the meaning of each column here below:

Time of acquisition	Time spent	Battery Voltage	Mean Cell Voltage	MAX Voltage Cell	Cell MAX	MINVoltage Cell	Cell MIN	Temperature Pack1	Temperature Pack2	Temperature Pack3	Maximum voltage differenzial	Variance	Battery current	SoCi %	SoCv %	Energy	SoCe %
8.53.55	0 00:00:03	80,776	3,365	3,389	15	3,357	11	17,09	17,09	17,09	0,032	0,04	-14,4	100	90	-0,319	100
8.53.56	0 00:00:03	80,787	3,365	3,377	15	3,357	16	17,08	17,08	17,08	0,02	0,025	-14	100	90	-0,642	100
8.53.56	0 00:00:04	80,767	3,366	3,376	15	3,353	11	17,08	17,08	17,08	0,023	0,029	-14,2	100	90	-0,956	100
8.53.57	0 00:00:04	80,765	3,365	3,382	15	3,358	3	17,12	17,12	17,12	0,024	0,03	-15	100	90	-1,274	100
8.53.57	0 00:00:05	80,777	3,365	3,382	15	3,355	11	17,11	17,11	17,11	0,027	0,028	-14,4	100	90	-1,611	100
8.53.58	0 00:00:05	80,785	3,365	3,388	15	3,353	11	17,11	17,11	17,11	0,035	0,043	-14,6	100	90	-1,934	100
8.53.58	0 00:00:06	80,78	3,366	3,375	15	3,354	11	17,11	17,11	17,11	0,021	0,024	-14,4	100	90	-2,262	100
8.53.59	0 00:00:06	80,772	3,366	3,387	15	3,355	11	17,15	17,15	17,15	0,032	0,039	-14,4	100	90	-2,585	100
8.53.59	0 00:00:07	80,789	3,365	3,389	15	3,355	11	17,13	17,13	17,13	0,034	0,044	-15,1	100	90	-2,908	100
8.54.00	0 00:00:07	80,783	3,366	3,387	15	3,356	11	17,15	17,15	17,15	0,031	0,038	-14,2	100	90	-3,247	100
8.54.00	0 00:00:08	80,777	3,365	3,384	15	3,355	11	17,18	17,18	17,18	0,029	0,032	-13,9	100	90	-3,565	100
8.54.01	0 00:00:08	80,768	3,365	3,378	15	3,354	11	17,16	17,16	17,16	0,024	0,026	-14	100	90	-3,877	100
8.54.01	0 00:00:09	80,768	3,365	3,392	15	3,356	11	17,12	17,12	17,12	0,036	0,049	-13,7	100	90	-4,191	100
8.54.02	0 00:00:09	80,791	3,365	3,386	15	3,354	11	17,13	17,13	17,13	0,032	0,039	-14,3	100	90	-4,499	100
8.54.02	0 00:00:10	80,773	3,366	3,385	15	3,355	11	17,11	17,11	17,11	0,03	0,038	-14,6	100	90	-4,82	100
8.54.03	0 00:00:10	80,774	3,365	3,381	15	3,356	11	17,1	17,1	17,1	0,025	0,029	-14,2	100	90	-5,147	100

Voltage cell n°1	Voltage cell n°2	Voltage cell n°3	Voltage cell n°4	Voltage cell n°5	Voltage cell n°6	Voltage cell n°7	Voltage cell n°8	Voltage cell n°9	Voltage cell n°10	Voltage cell n°11	Voltage cell n°12	Voltage cell n°13	Voltage cell n°14	Voltage cell n°15	Voltage cell n°16	Voltage cell n°17	Voltage cell n°18	Voltage cell n°19	Voltage cell n°20	Voltage cell n°21	Voltage cell n°22	Voltage cell n°23	Voltage cell n°24	Capacity
3,363	3,364	3,359	3,369	3,369	3,368	3,363	3,369	3,36	3,368	3,357	3,362	3,364	3,369	3,389	3,36	3,366	3,363	3,373	3,372	3,366	3,365	3,366	3,363	-0,004
3,364	3,362	3,358	3,37	3,37	3,368	3,363	3,367	3,358	3,367	3,358	3,363	3,364	3,369	3,377	3,357	3,362	3,365	3,373	3,372	3,366	3,365	3,366	3,363	-0,008
3,366	3,363	3,36	3,37	3,37	3,367	3,363	3,369	3,361	3,365	3,353	3,364	3,363	3,37	3,376	3,354	3,366	3,364	3,374	3,372	3,365	3,363	3,364	3,363	-0,012
3,363	3,361	3,358	3,37	3,368	3,369	3,363	3,368	3,36	3,369	3,358	3,364	3,363	3,369	3,382	3,36	3,365	3,365	3,374	3,372	3,365	3,364	3,365	3,362	-0,016
3,363	3,365	3,36	3,371	3,369	3,368	3,363	3,368	3,363	3,366	3,355	3,363	3,365	3,369	3,382	3,361	3,365	3,364	3,373	3,373	3,365	3,365	3,366	3,363	-0,02
3,364	3,362	3,358	3,37	3,372	3,368	3,364	3,365	3,363	3,364	3,353	3,362	3,365	3,369	3,388	3,359	3,363	3,364	3,372	3,372	3,367	3,366	3,367	3,363	-0,024
3,362	3,362	3,358	3,37	3,369	3,367	3,363	3,368	3,364	3,362	3,354	3,365	3,363	3,372	3,375	3,362	3,366	3,364	3,373	3,373	3,366	3,364	3,366	3,364	-0,028
3,362	3,362	3,36	3,369	3,369	3,368	3,363	3,371	3,363	3,364	3,355	3,366	3,364	3,371	3,387	3,359	3,363	3,366	3,374	3,373	3,365	3,365	3,366	3,364	-0,032
3,361	3,365	3,359	3,371	3,371	3,368	3,364	3,367	3,36	3,364	3,355	3,366	3,365	3,37	3,389	3,358	3,363	3,365	3,372	3,372	3,366	3,364	3,365	3,363	-0,036
3,364	3,364	3,359	3,371	3,368	3,366	3,362	3,366	3,362	3,365	3,356	3,364	3,364	3,371	3,387	3,357	3,365	3,363	3,372	3,372	3,366	3,365	3,365	3,363	-0,04
3,364	3,362	3,358	3,371	3,368	3,366	3,363	3,365	3,362	3,365	3,355	3,363	3,366	3,369	3,384	3,359	3,365	3,363	3,371	3,372	3,365	3,364	3,366	3,362	-0,044
3,362	3,362	3,358	3,372	3,368	3,367	3,363	3,367	3,362	3,365	3,354	3,362	3,363	3,37	3,378	3,362	3,364	3,364	3,373	3,372	3,366	3,365	3,366	3,363	-0,048
3,364	3,362	3,358	3,372	3,369	3,368	3,363	3,369	3,361	3,366	3,356	3,363	3,365	3,371	3,392	3,359	3,364	3,363	3,372	3,372	3,367	3,365	3,367	3,363	-0,052
3,363	3,362	3,357	3,373	3,368	3,367	3,364	3,368	3,362	3,364	3,354	3,362	3,364	3,372	3,386	3,36	3,364	3,363	3,372	3,371	3,365	3,364	3,365	3,363	-0,056
3,364	3,364	3,359	3,373	3,367	3,368	3,363	3,364	3,361	3,364	3,355	3,364	3,363	3,37	3,385	3,355	3,365	3,364	3,372	3,372	3,367	3,365	3,366	3,364	-0,06
3,364	3,362	3,357	3,373	3,368	3,368	3,363	3,367	3,363	3,365	3,356	3,366	3,363	3,37	3,381	3,358	3,365	3,364	3,372	3,372	3,366	3,365	3,366	3,364	-0,064

The BMS manager software is divided into 4 menus:

- **General settings**: enables to set the main program functions
- **BMS Module**: displays all the information available on the CAN bus coming from the BMS modules
- **Data processing**: processes the information to obtain key quantities for the battery and important statistical data
- **Data processing 2**: processes the information to obtain key quantities for the battery and important statistical data

GENERAL SETTING

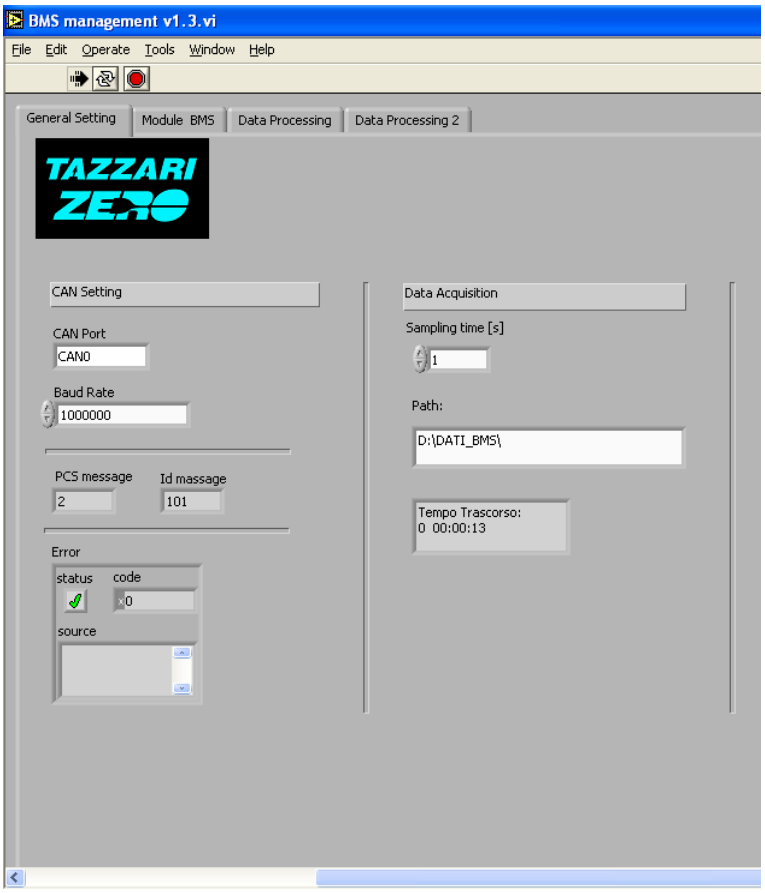


Fig. 5.5 – BMS manager screen - General Setting menu- .

From this menu, the main software functions can be programmed.

Data Acquisition
Sampling time: allows to choose every how many seconds the acquired data must be saved
Path: data file saving path
Elapsed Time: total data acquisition duration

BMS MODULE

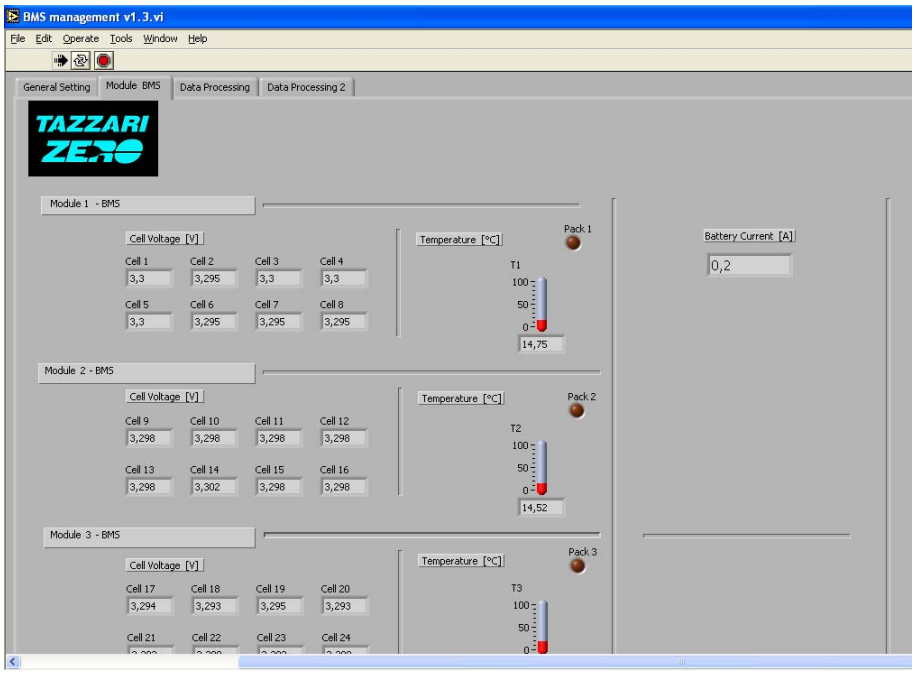


Fig. 5.6 – BMS manager screen - Module BMS menu - .

From this menu, it is possible to view all the information submitted by the three modules.
It is therefore possible to view all 24 the cell voltage values, each sub-pack temperature value and the battery current at the same time.

DATA PROCESSING

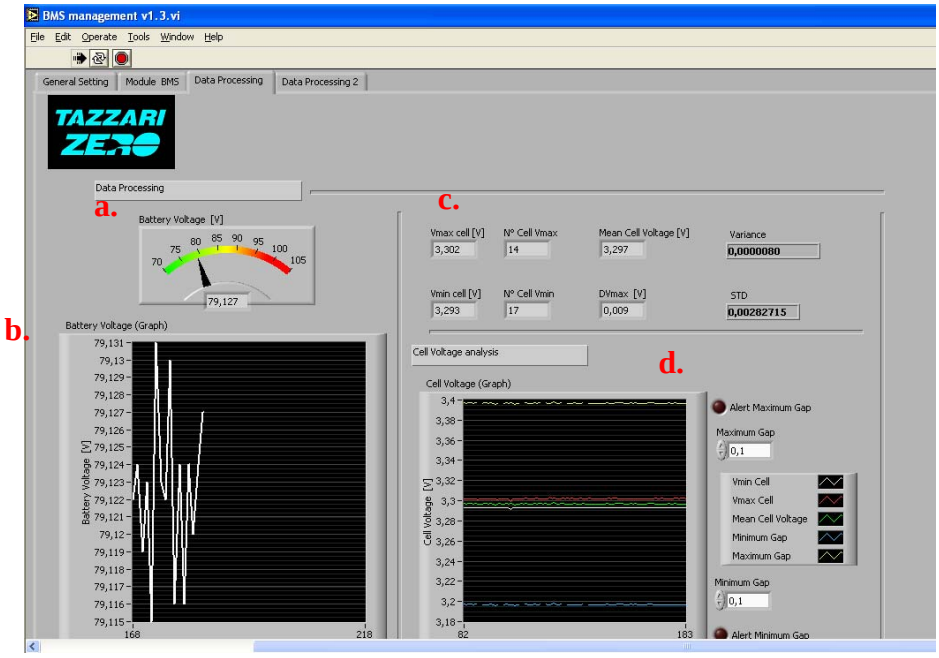


Fig. 5.7 – BMS manager screen - Data Processing menu - .

In the Data processing menu, the battery voltage can be viewed as both an Instantaneous value (a.) and a trend in time (b.).

The box (c.) specifies which cell has the maximum voltage rating and its Value, and additionally, which cell has the minimum voltage rating and its Value.
The same box (c.) also specifies the maximum difference between cell voltage values (**DVmax**), and the average voltage calculated on the basis of all cell voltage values (**Mean Cell Voltage**).
Finally, the bottom box (d.) shows the maximum voltage trend, the minimum voltage trend and the mean voltage trend over time. It is possible to set two thresholds for the deviation from mean voltage (**Maximum Gap** and **Minimum Gap**): when these thresholds are exceeded, an alarm is activated.

DATA PROCESSING 2

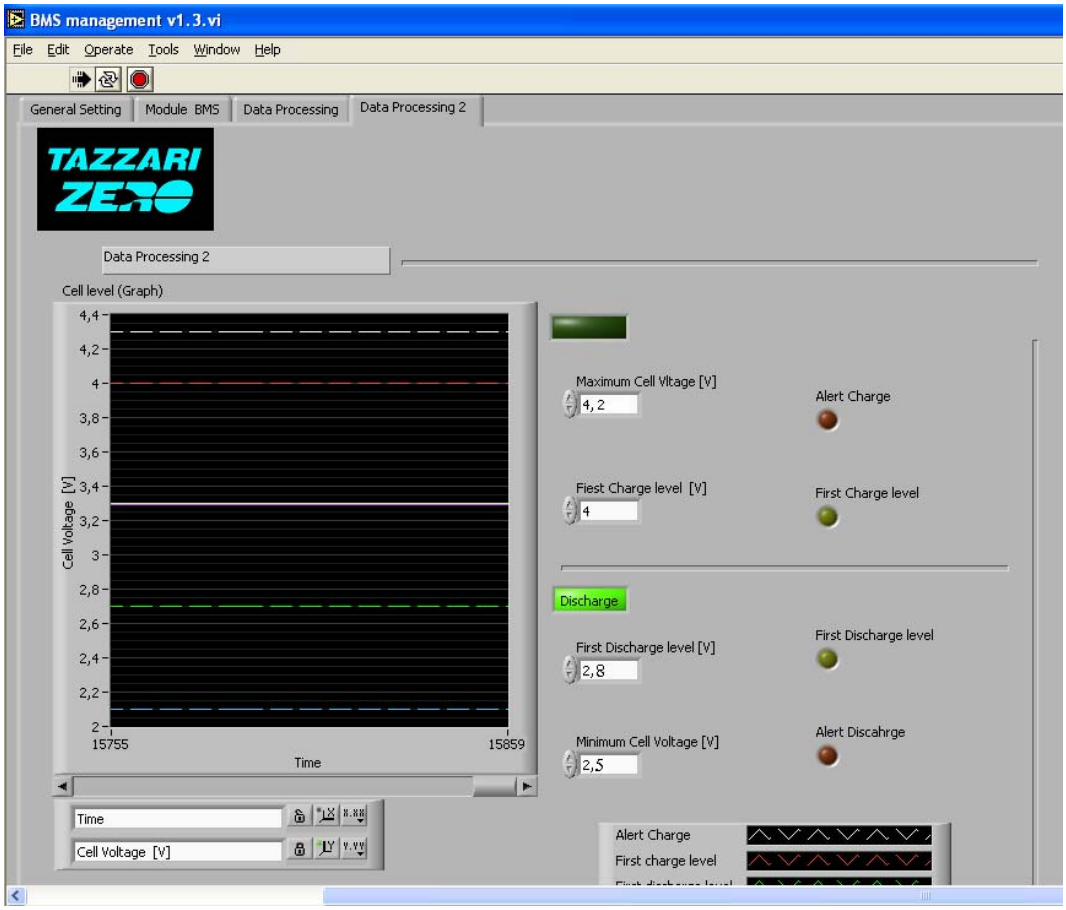


Fig. 5.8 – BMS manager screen - Data Processing 2 menu - .

In the Data Processing 2 menu, the minimum cell voltage and maximum cell voltage trends are shown. 4 alarm thresholds can be set, beyond which an alarm message is activated.
The four thresholds can be set to suit user requirements.

To quit the BMS manager software, just press the red button key on the instrument bar in the top left corner.

6. PICkit 2

PICkit 2 software function

This software allows the BMS system software to be upgraded every time that a new version is released by Tazzari GL.
To upgrade the BMS system software, access must be obtained to the type RJ12 programming connectors of the BMS Electronic Control Unit and of the three BMS modules (circled in the figure):

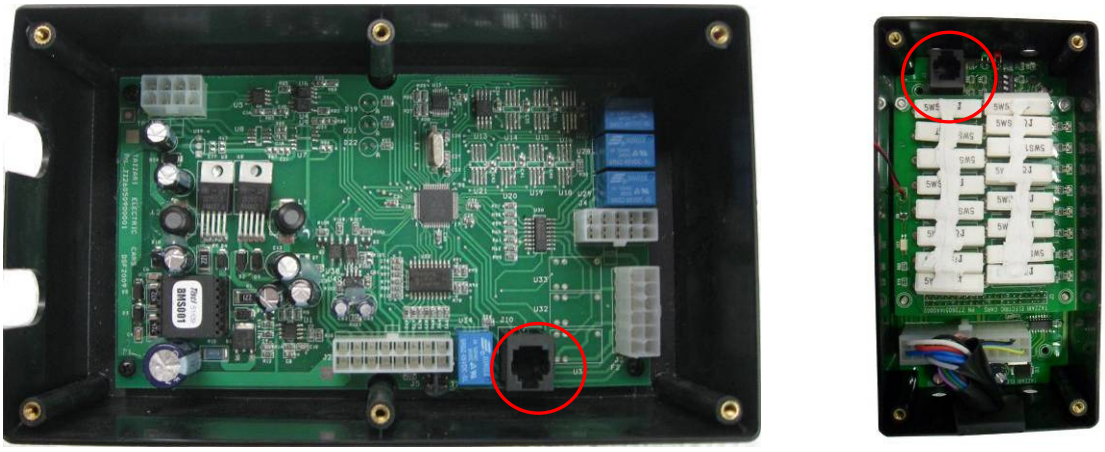


Fig. 6.1 – BMS Electronic Control Unit and BMS Modules programming connectors.

How to connect peripheral devices

- Do not install any software not supplied by Tazzari GL.
- When the software used requires plugging a peripheral device into a service PC USB port, exclusively use the port indicated by the arrow in this photo or the PC USB port indicate by the label "← USE THIS USB"

- Never connect two USB devices to the PC at the same. Failure to observe this recommendation may cause failure of your PC.

The first thing to do is switching on your service PC; plug the PICkit 2 programmer into the USB port.

Fig. 6.2 – PICkit 2 programmer.

Before connecting the programmer to the BMS peripheral devices (Control Unit and/or Modules), the vehicle key must be turned to the OFF position and the F1 and F2 fuses must be removed.
Connect the PICkit2 programmer to the BMS peripheral device to be programmed and launch the PICkit2 software .

N.B.: BMS peripheral devices can be programmed without having to remove them from the machine: just open the plastic casings to expose the RJ12 programming connectors.

Fig. 6.3 – PICkit 2 programmer plugged in the service PC and in the peripheral device to program (in this photo, the BMS electronic control unit).

PICkit 2 software

After launching the software, check that the *Power*, *Target* and *Busy* LEDs are all lit at the same time and that the following screen page is displayed:

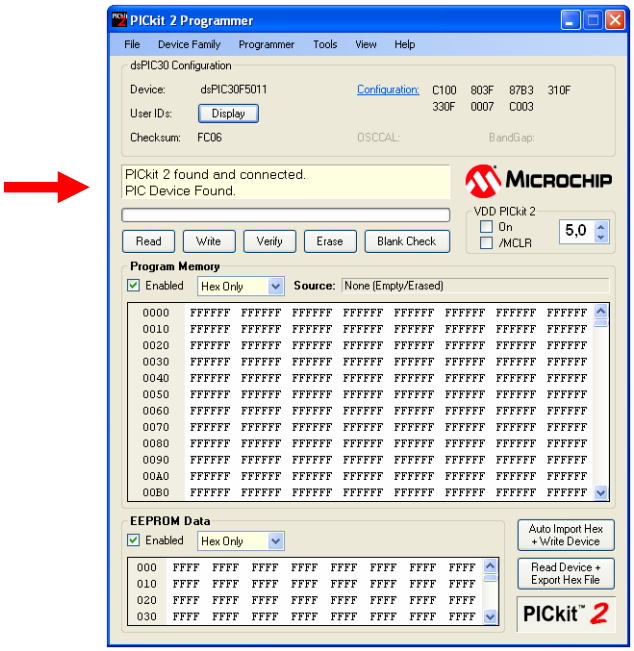


Fig. 6.4 – PICkit 2 programming software.

Press the key corresponding to the **Import Hex** item in the **File** menu and, in the Import Hex File search window, select the file with the .hex extension containing the latest software version released by Tazzari GL.

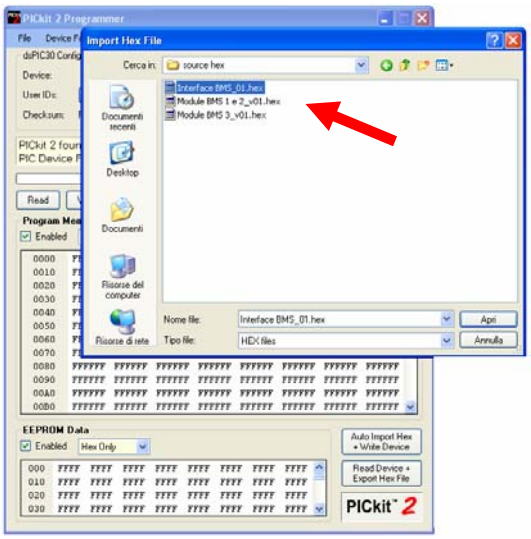


Fig. 6.5 – PICkit 2 programming software – hex. file loading

After selecting the suitable software for the peripheral device which is being programmed, the following screen page will be displayed.

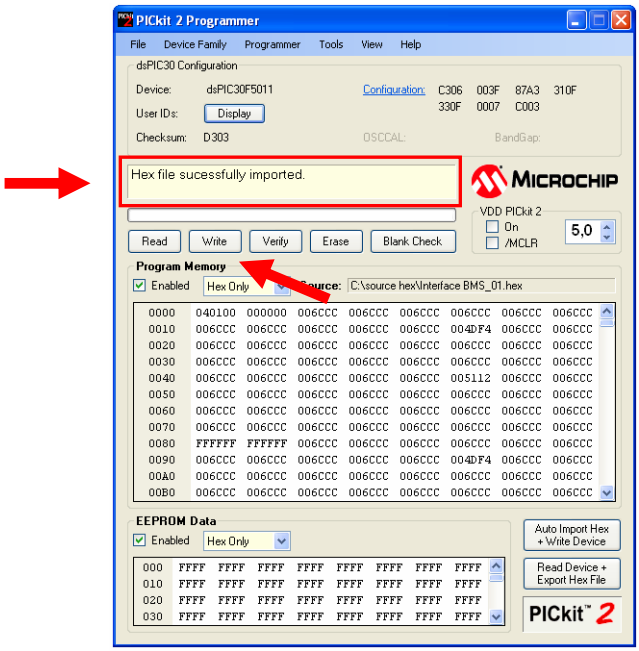


Fig. 6.6 – PICkit 2 programming software – hex. file loaded.

Now press the **Write** key to complete programming; at the end of the programming phase, the following screen page will be displayed.

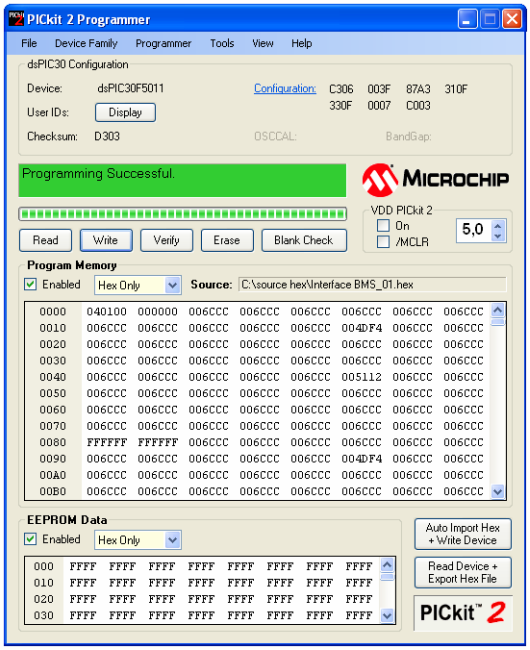


Fig. 6.7 – PICkit 2 programming software – hex. file programmed.

Unplug the PICkit 2 programmer from the now programmed peripheral device; the peripheral device is now ready to be used.

7. Connect to LOGGER

Connect to LOGGER software function

This application enables to display and save information on the battery voltage trend with respect to an absolute time reference.

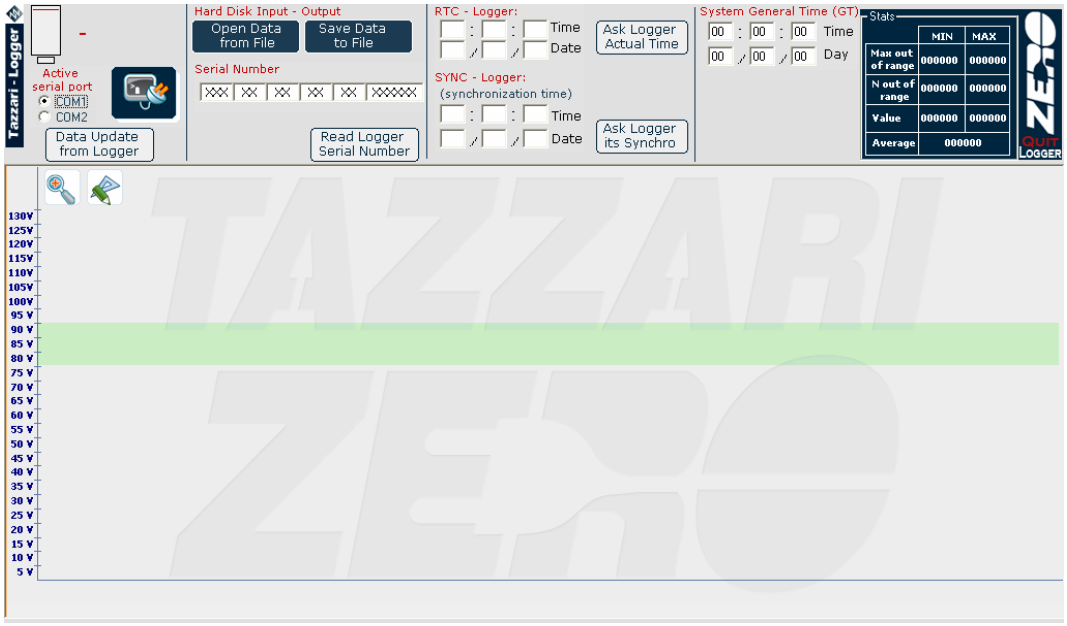


Fig. 7.1 – Connect to LOGGER software screen .

How to connect peripheral devices

The first thing to do is switching on your service PC; plug the USB/serial adapter cable into the USB port. Now connect the USB/serial adapter cable to the 232/TPL Data-logger Converter device.
Finally, connect the 232/TPL Data-logger Converter to the Battery Data-logger installed on the vehicle.

Fig. 7.2 – Peripheral device connecting procedure.

It is now possible to launch the Connect to logger software .

Once launched, the software will read "**Capture… Data from Logger**" in the top right corner. A few minutes' wait will be necessary before being able to view the battery voltage trend over time.

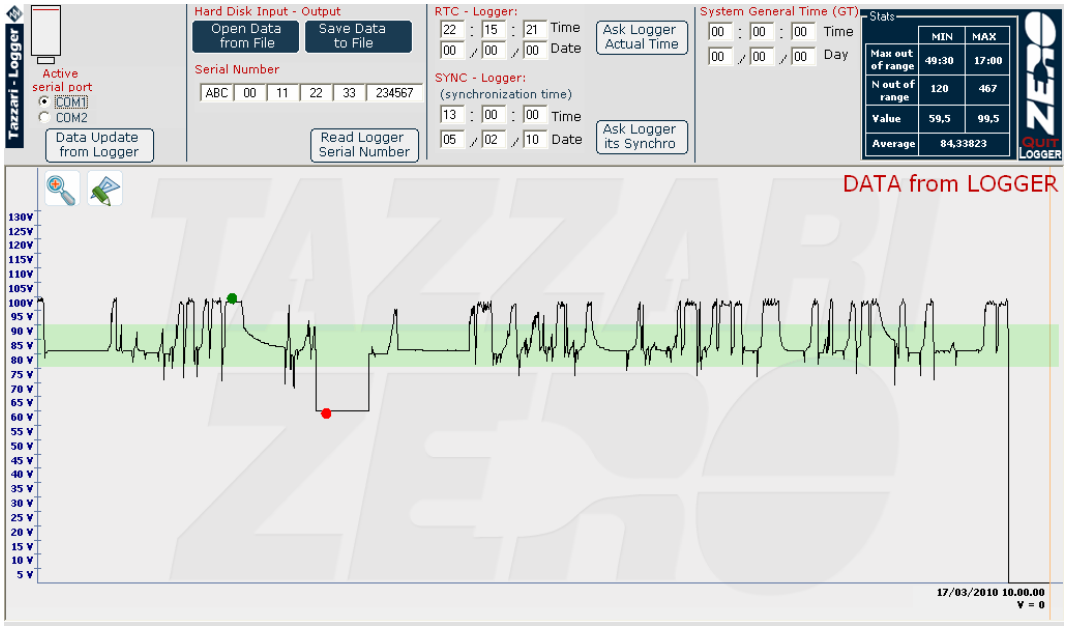


Fig. 7.3 –Connect to LOGGER software screen – Displayed battery voltage -.

The features available on the software instrument bar are described here below:

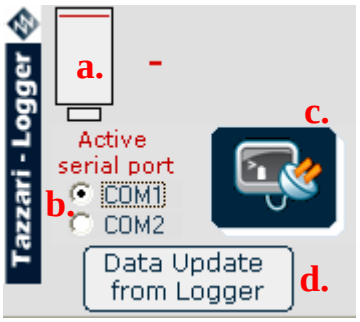


Fig. 7.4 – Connect to LOGGER software screen – instrument bar 1/4 -.

The first section of the instrument bar shows:

a. The battery voltage that is being acquired by the Data-logger
b. The communication port options to select (the default setting is COM1)
c. An icon showing that a connection with the battery Data-logger has been established (after connection this icon will no longer be visible)
d. The **Data Update from Logger** button allowing Data-logger data content to be updated in the software

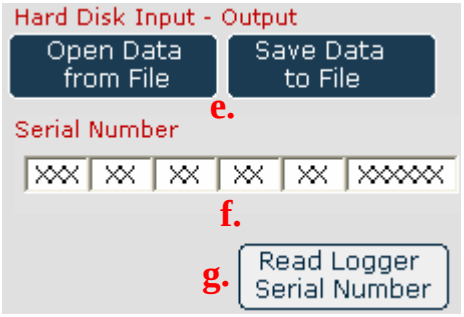


Fig. 7.5 – Connect to LOGGER software screen – instrument bar 2/4 -.

The second section of the instrument bar shows:

e. The buttons to use to save a chart to the disk (**Save Data to File**) and to view a chart previously stored to the disk (**Open Data to File**)
f. The serial number of the Data-logger (17 alphanumeric characters) matching the VIN of the vehicle on which the device is installed
g. A button in which to read the Data-logger serial number (**Read Logger Serial Number**)

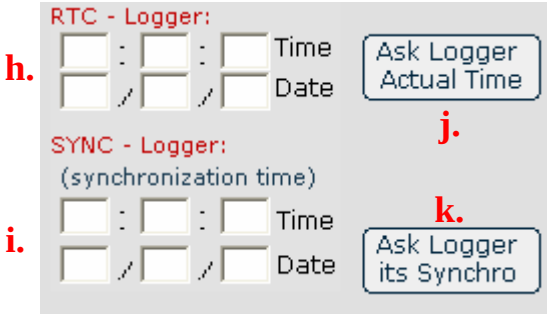


Fig. 7.6 – Connect to LOGGER software screen – instrument bar 3/4 -.

The third section of the instrument bar shows:

h. **RTC – Logger** (*Real Time clock*): it shows the absolute time used by the Data-logger for battery voltage data acquisition
i. **SYNC – Logger** (*Synchronization Time*): it shows the absolute time on which the Data-logger was started
j. Button to read the RTC from the Data-logger
k. Button to read the SYNC from the Data-logger

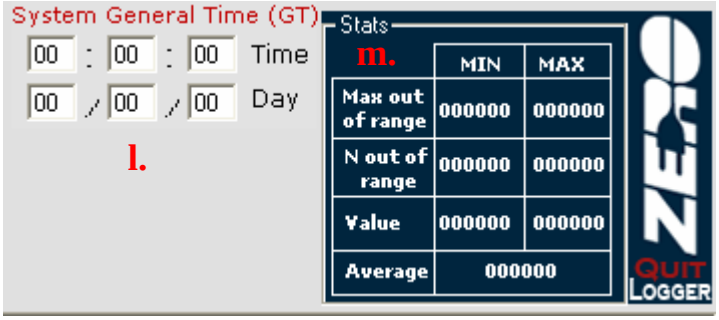


Fig. 7.7 – Connect to LOGGER software screen – instrument bar 4/4 -.

The fourth section of the instrument bar shows:

l. **System General Time**: shows the service PC absolute time
m. **Stats**: shows certain statistical quantities that are critically important to establish whether the battery pack is being correctly used.
n. The **Quit Logger** key can be used to quit this software.

	MIN	MAX
Max out of range	Shows the longest time during which battery voltage has gone below 75V	Shows the longest time during which battery voltage has gone over 90V
N out of range	Shows how many times the battery voltage has gone below the 75V value	Shows how many times the battery voltage has gone over the 90V value
Value	Shows the minimum voltage value reached by the battery	Shows the maximum voltage value reached by the battery
Average	Battery voltage average value calculated on the basis of all the acquired values	

The chart also shows the points at which battery voltage has reached its maximum (green circle) and minimum (red circle) values.

With the  key, two chart points can be selected where to zoom in by pressing the  key.

Press the  key to return to the previous screen.

- Tampering with the files generated by the “Connect to LOGGER” software will imply the loss of all battery pack guarantee rights.

8. Data saving

Data saving function

The software supplied with the service PC allows in many cases files to be generated containing information on the vehicle status and operation – which must then be transmitted to the Tazzari GL technicians.
With this software it is possible to copy data to the supplied USB key to then transfer the data to other PCs equipped with an Internet connection.

How to connect the peripheral device

A USB memory stick has been supplied. Whenever data have be copied from the service PC, the memory stick must be inserted in its slot.

Fig. 8.1 – USB key plugged into service PC.

- Only and exclusively use the USB port indicated by the arrow in the photo or the PC USB port indicate by the label "← USE THIS USB"

After inserting the USB key, launch the Save DATA on USB key software by double-clicking on the special desktop icon 

.
All the files will then be automatically saved to the USB key.

The following folders will be saved to the key:

- **DATI_BMS**: folder in which the files created with the BMS Manager software are contained
- **LOGGER_DATA**: folder in which the files created with the Connect to LOGGER software are contained
- **IMAGES**: folder in which the files created with the **print** feature of the EyePlus software are contained
- **OUT**: folder in which the files created with the **Data Log** menu of the EyePlus software are contained

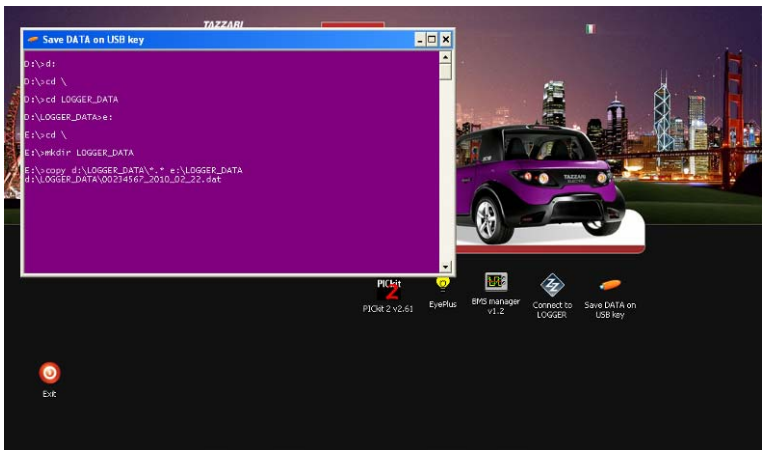


Fig. 8.2 – Saving data to USB key.

A PC with an Internet connection can then be used to send these files to the Tazzari GL after-sales service.

- After copying the files to another PC, it is advisable to delete all the USB content before more files are copied from the service PC.
- It is advisable to ensure that the used PCs are virus-free and without any application software which might damage the service PC if transferred on the USB key.
- Do not attempt to connect your service PC to the Internet.

9. Movement control device

Movement control device function

The movement control device must be only and exclusively used when, due to malfunctioning or break down, the vehicle will not move even after correctly performing the starting procedure.

Fig. 9.1 – Movement control device.

How to connect the movement control device

The movement control device must be connected to the interface board via the B17 connector.

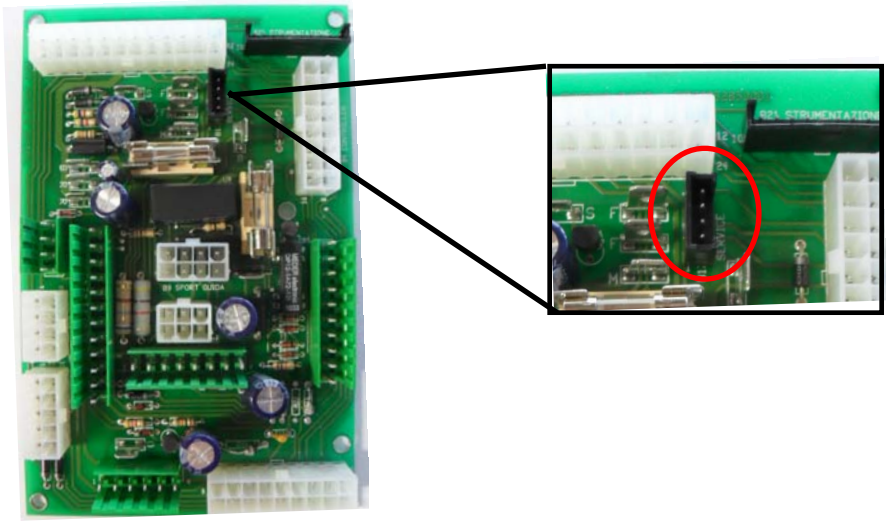


Fig. 9.2 – B17 connector on the interface board.

To obtain access to the interface board SE/EVO, exposing the B17 connector, Touch control board must be removed (see photo).

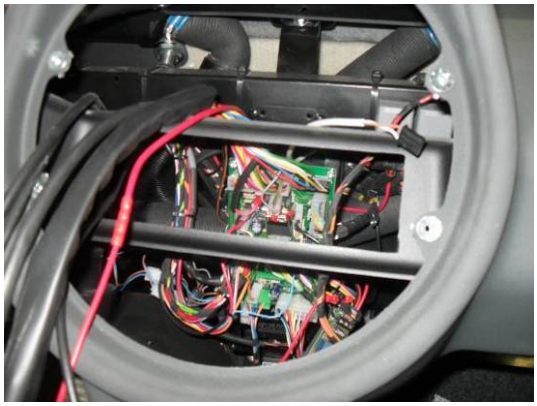


Fig. 9.3 – Tazzari Touch system removed.

Movement control device operation

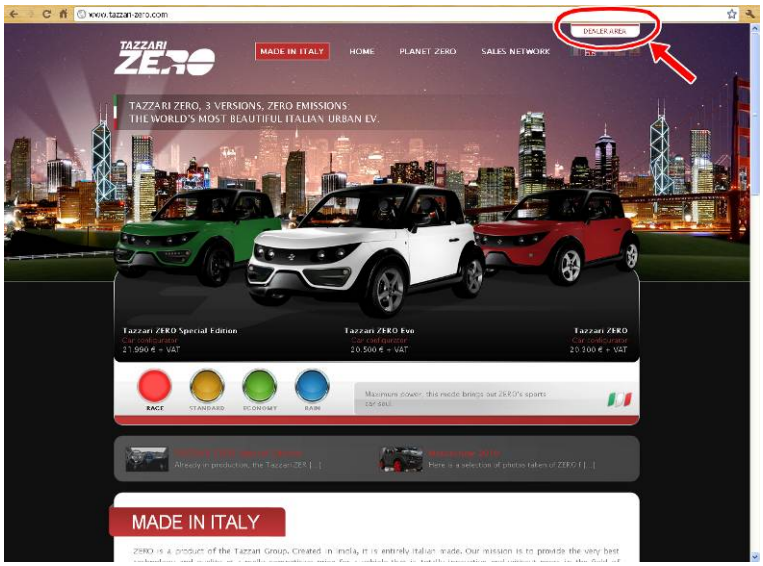
The movement control device is equipped with a 3-position switch.
Setting the selector to its central position will put the car in neutral; setting the selector to the position 2 will select forward travelling; setting the selector to the position 1 will select reverse travelling.
The meaning of each position is explained on the device.

Fig. 9.4 – Movement control device – positions explained.

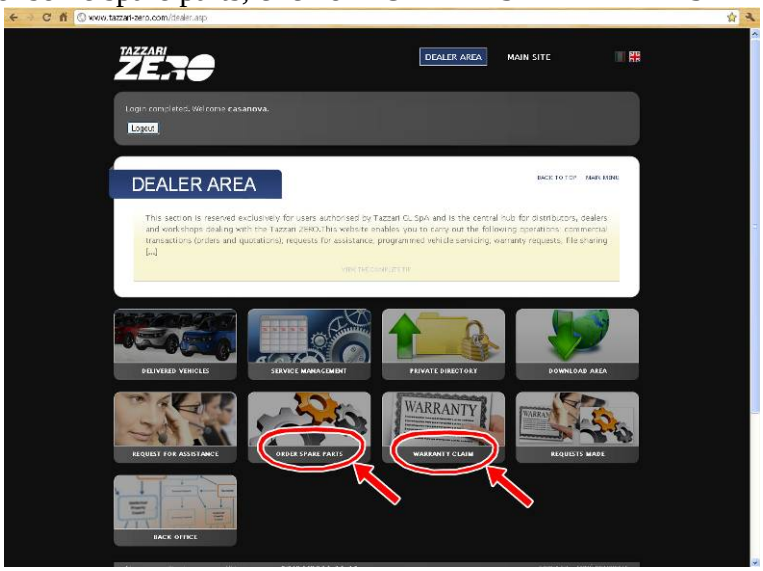
10. Procedure for spare parts orders/warranty claims

1. Enter the webiste: http://www.tazzari-zero.com

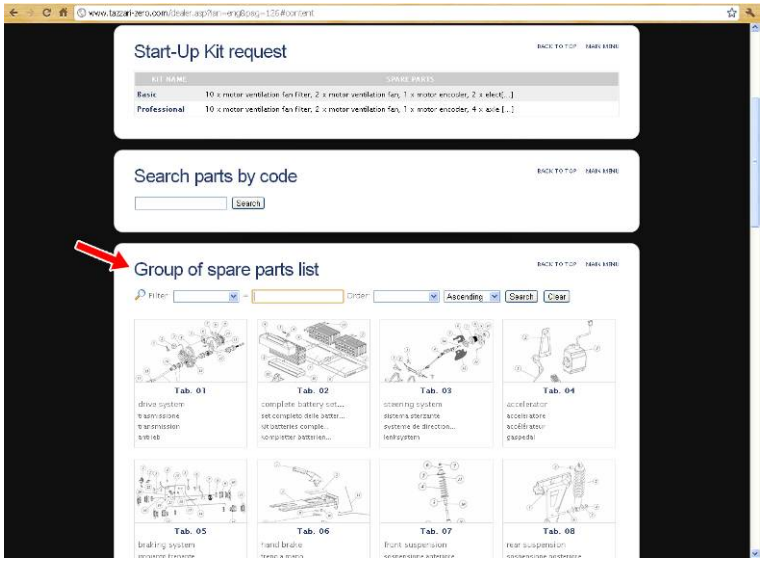
2. Click on the “DEALER AREA” link.



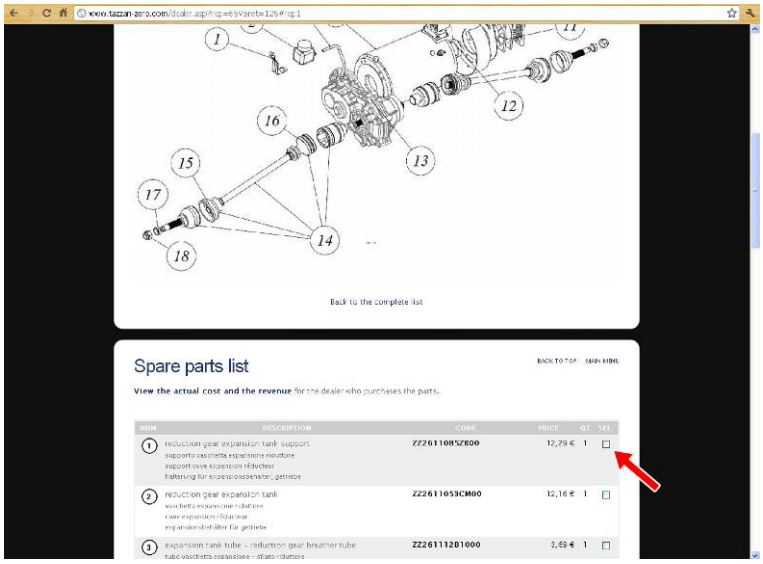
3. If you want to request parts under warranty, click on “WARRANTY CLAIM”, if you want to order some spare parts, click on “ORDER SPARE PARTS”



4. On the Table's list, please click on the ones that contain the parts you want.

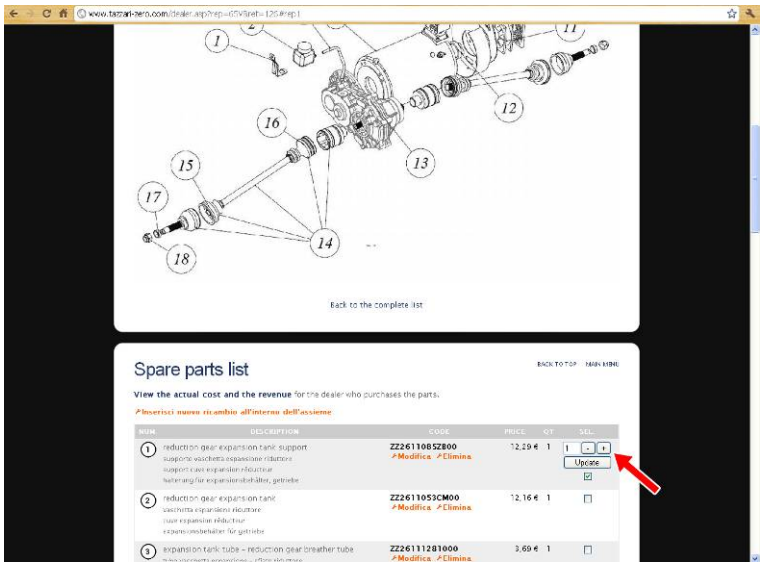


5. Identify the part and select it by clicking on the square box on the right of the description.



6. Using the "+" and "-" buttons, select the desired quantity (next to the selected quantity, you can see how many parts of that kind are present on the car). WARNING: the price is referred to 1 (ONE) part.

7. Click on "UPDATE" to save your choice on the order's list.

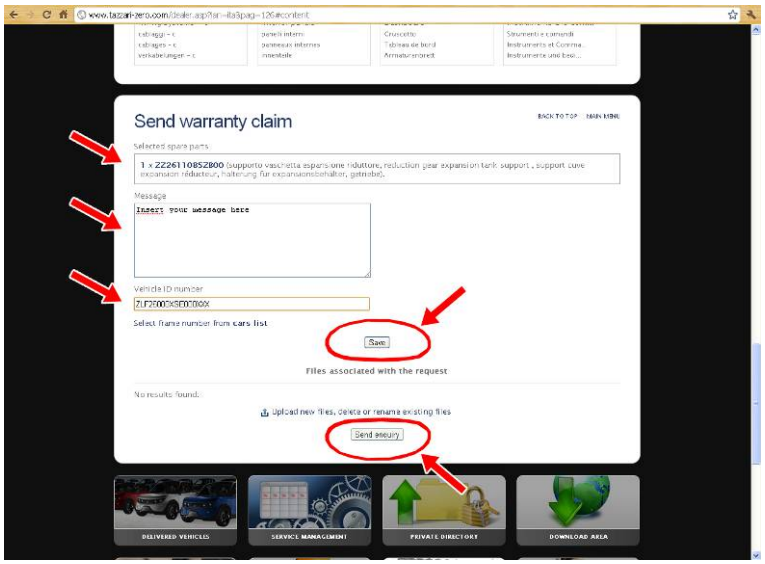


8. Repeat this operation for every part you want. At the end return to the main page of the “DEALER AREA”.

9. Check the order’s list, insert the <u>COMPLETE</u> VIN number and a detailed explanation of the problem. It’s recommended to upload photos and videoclips with the function “Upload new files, delete or rename existing files”.

<u>VIN Number Example:</u>
ZLF260001SE00XXXX (Classic)
ZLF260002SE00XXXX (Classic Right Hand Drive)
ZLF260003SE00XXXX (Special Edition)

10. Click on “SAVE” (only for the Warranty Claims) and on “SEND ENQUIRY”, then follow the instructions.



11. The enquiry will be send to the Service Team that will examine it and will forward the order. To obtain the warranty, you have to send back to Tazzari GL the defected parts within 30 days from the receipt of the spare part.

The shipping must have the following documents:

- Warranty code;
- Description of the part;
- Tazzari code.

After the verifications made by Tazzari GL, the warranty and the labour time will be grant.

RECOMMENDATIONS BEFORE BEGINNING TO WORK:

- Turn the vehicle key to its OFF position.
- Remove the fuses F1 (15A) and F2 (10A). Some sparking can be observed when removing or inserting the fuses F1 and F2: it is caused by the on-board electronic circuit capacitors and should not be regarded as a fault.
- Press the main emergency control.

- Do not carry out any adjustments or servicing while the vehicle is on. Moving parts such as the drive system or motor cooling fan can cause severe injuries.
- The motor fan can still work when the instrument panel is off and the main safety control has been released, because it is automatically operated when the motor reaches a temperature of 70°C. Only carry out any required maintenance after the motor has cooled off.

REQUIRED TOOLS

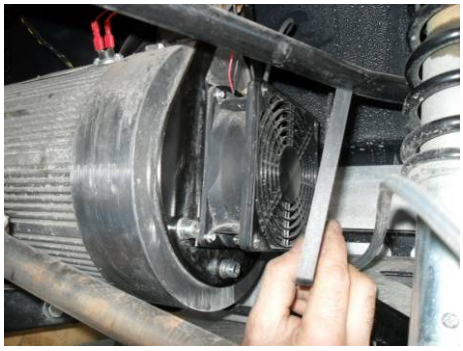
- 5.5mm double open end wrench
- 5mm Allen key
- MEDIUM-strength thread locker

Sequence 1

Raise the vehicle on the lift to allow access to the drive motor, after having pulled the parking brake.

Sequence 2

Remove the filter located on the motor cooling fan. The filter is snap-fitted on the cooling fan.



Sequence 3

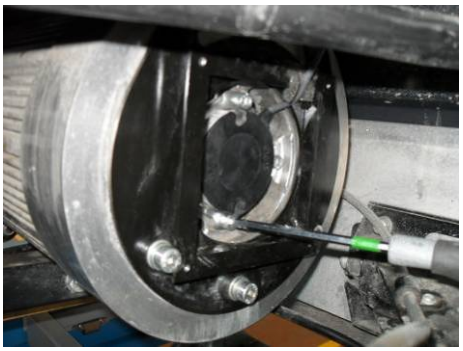
Remove the cooling fan by unscrewing the four hex head self-tapping screws. Use the supplied 5.5mm open end wrench to do this.

Sequence 4

Be careful not to cut the fan electric input lines and move the fan to expose the rear part of the motor where the encoder is located.

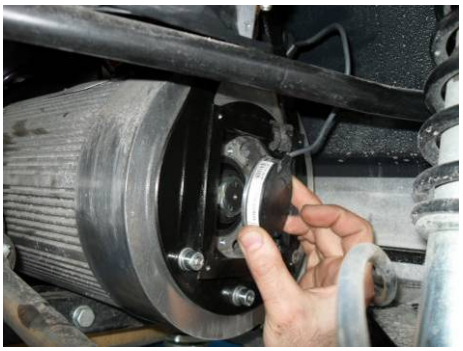
Sequence 5

The encoder is now accessible; to remove the encoder, its 4 Allen screws and two fixing flanges must be removed.



Sequence 6

After unscrewing the fixing screws, the encoder can be extracted.



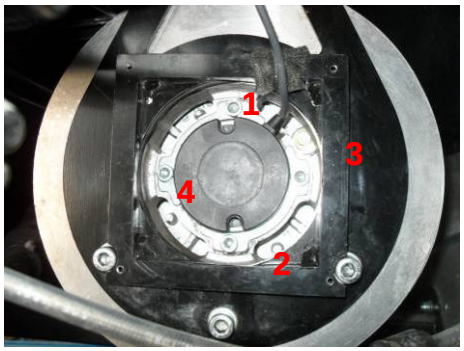
Sequence 7

After releasing the 4-way plastic connector, the encoder can be removed.

Sequence 8

Now connect the new encoder and place it in its seat.
Position the anchoring flanges and screw down the 4 Allen screws without tightening hard.

- Coat the 4 Allen screws with some MEDIUM-strength thread locker.
- Tighten the Allen screws in a crossed pattern as shown in the photo to prevent incorrect encoder installation or its accidental movement out of its seat.



Sequence 9

Mount the cooling fan on its metal support and fix it with its 4 hex head self-tapping screws.

Sequence 10

Install the filter on the cooling fan.

Battery Pack Replacement

RECOMMENDATIONS BEFORE BEGINNING TO WORK:

- The drive batteries contain flammable substances and irritants. Do not tamper with the batteries in any way and do not force open or break the plastic casing containing the active cells.
- A spent battery disposed freely to the environment poses an ecological hazard because of its contained cells. After replacing the battery, return the old one to your nearest waste collection point.
- Do not use the vehicle unless the battery is fully efficient.

- Turn the vehicle key to its OFF position.
- Press the main emergency control.
- Remove the fuses F1 (15A) and F2 (10A). Some sparking can be observed when removing or inserting the fuses F1 and F2: it is caused by the on-board electronic circuit capacitors and should not be regarded as a fault.

- The measured voltage at battery leads is comprised between 65 and 90 Volts, according to charge levels. This is a potentially dangerous voltage. Do not touch the battery terminals.
- Your vehicle batteries can release current up to a few thousand Amperes if short-circuited. Do not work near the battery terminals with metal tools.
- Before servicing the batteries, operators must remove any potential conductors of electric current such as metal watches, bracelets, rings, chains etc.

Spent batteries must be returned to Tazzari GL so that the contained active cells can be recycled, optimizing the energy cycle necessary to produce new batteries and actively contributing to environmental protection.
Handle batteries with care after removing them from the vehicle as they can still deliver potentially dangerous current. Protect the battery leads with insulating material or store the batteries in wooden or plastic crates whenever this is possible. Do not expose the batteries to direct sources of heat or direct sunlight. Batteries must be returned to Tazzari GL exclusively through an authorized after-sale center, which will suitably protect and package the batteries for transport so as to prevent any harm to persons or property.

- The lithium contained in the batteries is flammable. Never short-circuit the battery leads, never expose the batteries to sources of direct heat, always protect the batteries from exposure to naked flames or sparks.

REQUIRED TOOLS

- Phillips screwdriver
- Small-size Phillips screwdriver
- Flat-tip screwdriver
- Pliers
- 13mm insulated open end wrench
- 4mm Allen key
- 10mm open end wrench

BATTERY PACK REMOVAL

Sequence 1

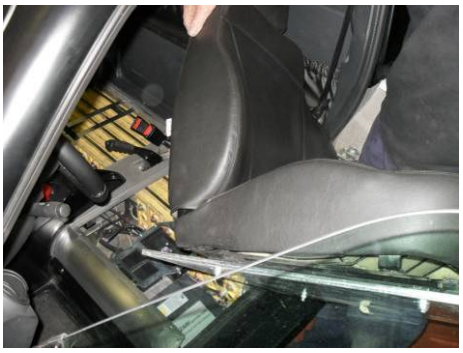
Before replacing a battery pack, turn the vehicle key to its OFF position, press the emergency switch and disconnect the fuses F1 (15A) and F2 (10A).

Sequence 2

To expose the rear battery packs, remove the driver's and passenger's seats from the vehicle by unscrewing the four Phillips screws located on the two aluminum plates.

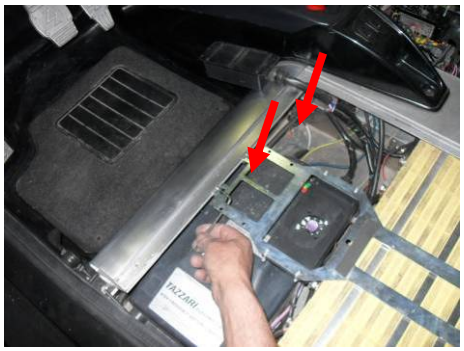
Remove the plastic covers from the driver's and passenger's seat supports by gently working the door seal.

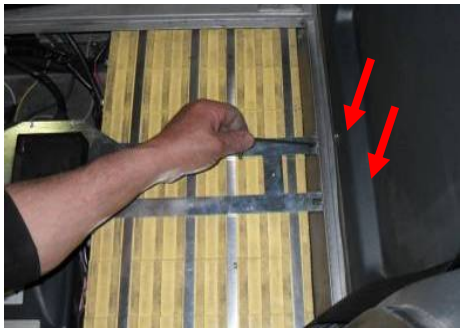
It is now possible to remove the two seats, by lifting them at the front and pulling forward.



Sequence 3

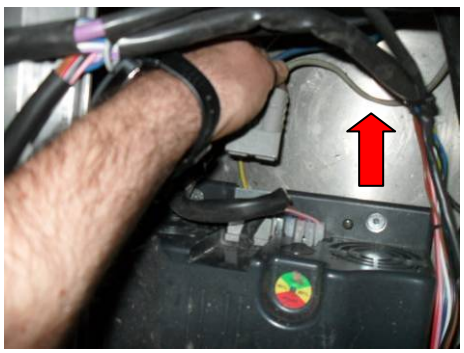
By using a 4mm Allen key, remove the two BMS Module box and Equalizer supports.
To do this, you must first cut the plastic clips securing the BMS Module to its metal support; you will then be able to unscrew the socket head screws.





Sequence 4

Before disconnecting the battery pack electric connections, remove the grey power inlet provided on the battery charger.



Sequence 5

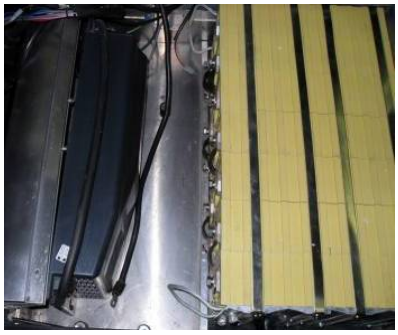
It is now possible to disconnect the electric connections provided on the battery i.e.:

- Power wires;
- Signal wires connected to the batteries through Faston connectors;
- Temperature sensors.

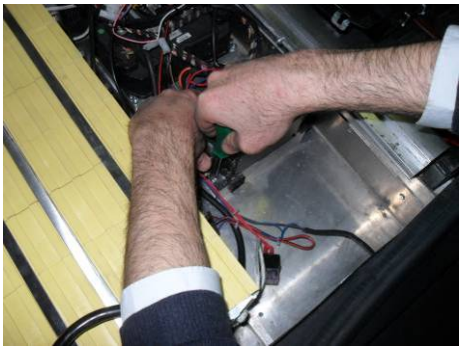
- To perform these operations use suitably insulated tools.

Sequence 6

By using a 4mm Allen key, remove the 4 screws fixing the battery charger to the vehicle on the driver's side and position it as shown in the photo (plastic cover facing the batteries).



On the passenger's side, use a 4mm Allen key and a Phillips screwdriver to remove the 4 screws fixing the converter aluminum support to the vehicle and to remove the converter from its support.

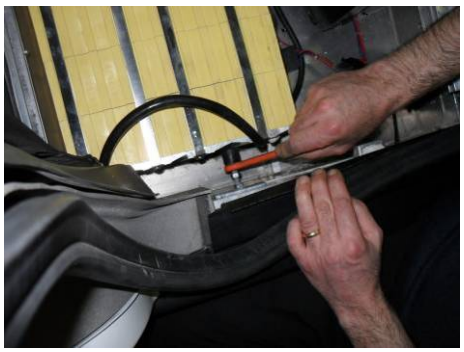


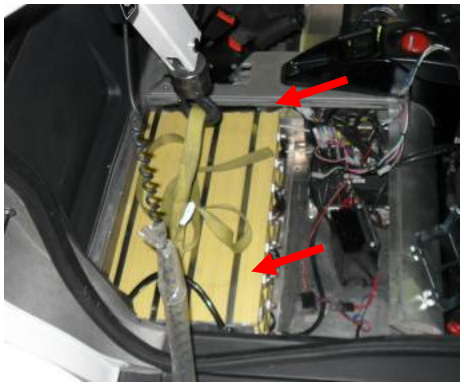
Remove the fuse and relay located on the converter and on the converter aluminum support.

- Be very careful not to allow any contact between any components' metal parts and the battery terminals.

Sequence 7

Remove the two stops located on the batteries and pictured here below. Remove the two battery packs using an electro-mechanical lift. Lift by the special handles provided on the battery packs.





Sequence 8

To obtain access to the front battery pack, open the front hood and use an additional support to keep it open as pictured.

By using a Phillips screwdriver, screw out the 6 screws fixing the vehicle front hood to the vehicle frame.

Battery Pack Replacement

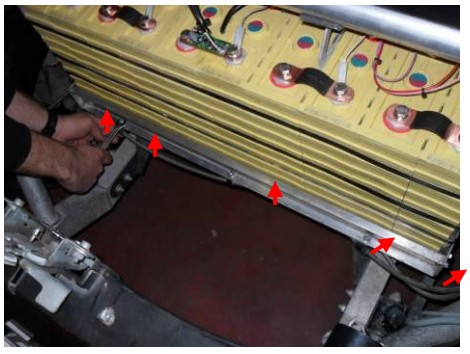
If the vehicle is pre-set for Superfast and/or Multifast fitting, remove the following components:

- Headlamp access plug (Use a flat-tip screwdriver as shown in the photo);
- Power inlet for Superfast pre-setting;
- Signal inlet for Superfast pre-setting;
- Optional Multifast selector.

The front hood can now be removed.

Sequence 9

Remove the 5 hex head screws and nuts securing the battery fixing support as shown in the photo.



Remove the 4 hex head screws located laterally.

Sequence 10

It is now possible to disconnect the electric connections provided on the battery i.e.:

- Power wire;
- Signal wires connected to the batteries through Faston connectors;
- Temperature sensor.
- Current sensor (remove the current sensor by unscrewing the two self-tapping steel screws).

- To perform these operations use suitably insulated tools.

Sequence 11

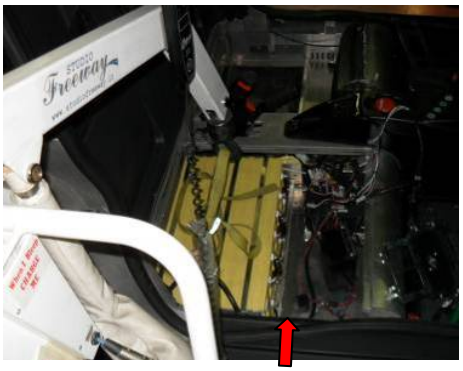
Remove the battery pack by using an electro-mechanical lift. Lift by the special handles provided on the battery pack.

- Be very careful not to allow any contact between any metal parts and the battery terminals.

BATTERY PACK INSTALLATION

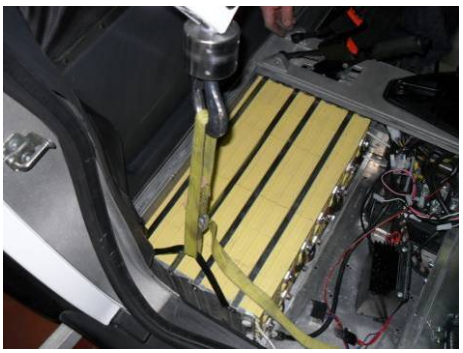
Sequence 12

Position the rear battery packs with the help of an electro-mechanical lift.

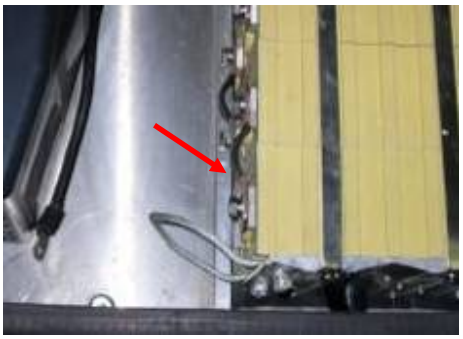


Tidy away the handles under the aluminum plate as shown in the photo.

Push the battery pack all the way in towards the aluminum plate.

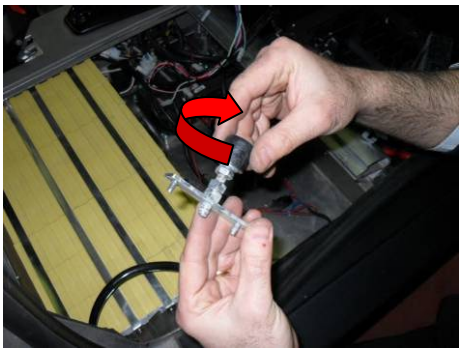


Make sure that the rear battery packs are correctly positioned with the bottom surface in contact with the aluminum stop (as pictured).

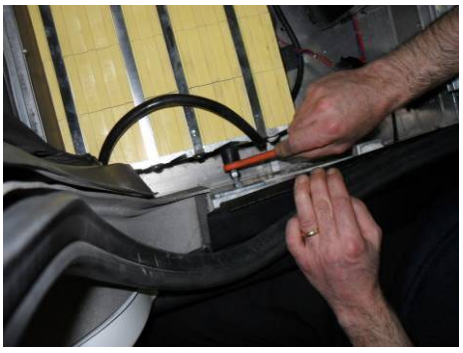


Sequence 13

Insert the battery fixing pads, after checking that the pad has been tightened as shown in the photo.



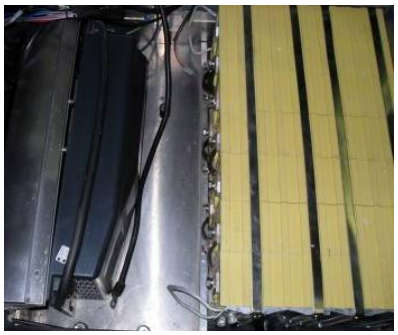
After correctly positioning the pad, screw it out until it compresses the battery pack.



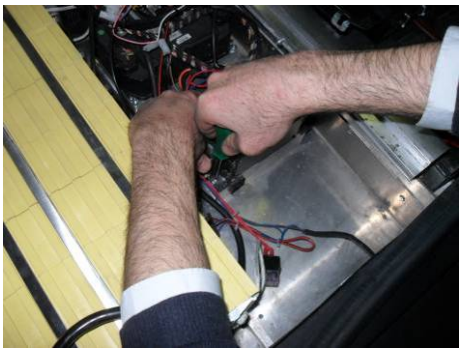
Screw in the lock nut to lock the battery pad.

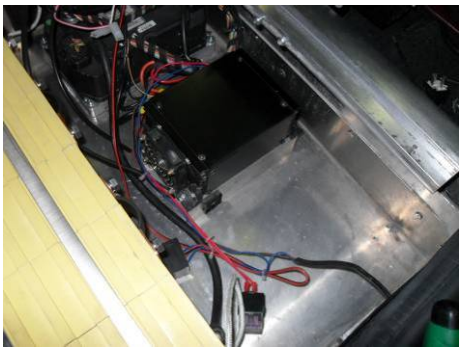
Sequence 14

By using a 4mm Allen key, fix the 4 screws securing the battery charger to the vehicle on the driver's side. Be very careful not to allow any contact between the metal parts and the battery terminals.

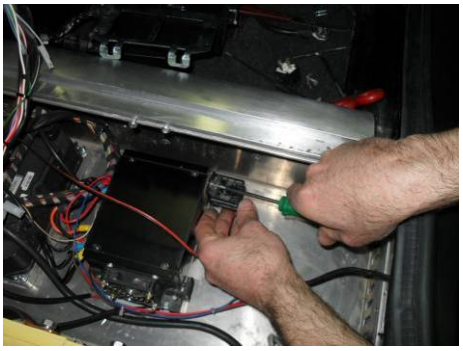


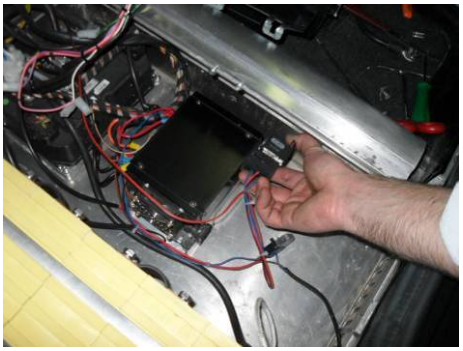
On the passenger's side, use a 4mm Allen key and a Phillips screwdriver to fix the 4 screws fixing the converter aluminum support to the vehicle and the converter to its support.

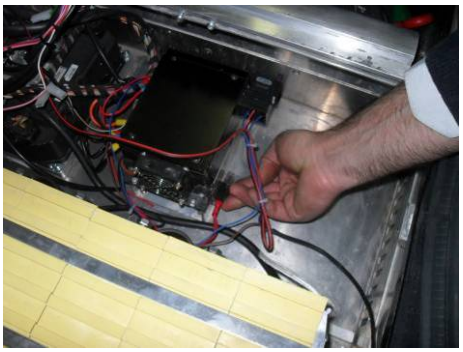




Fix the relay and fuse as shown in the photo.





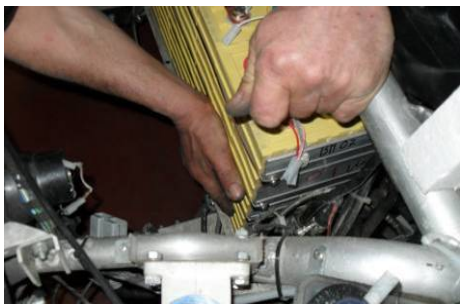


- Be very careful not to allow any contact between any components' metal parts and the battery terminals.

Sequence 15

Position the front battery pack with the help of an electro-mechanical lift.

- Be very careful not to allow any contact between metal parts and the battery terminals.



Sequence 16

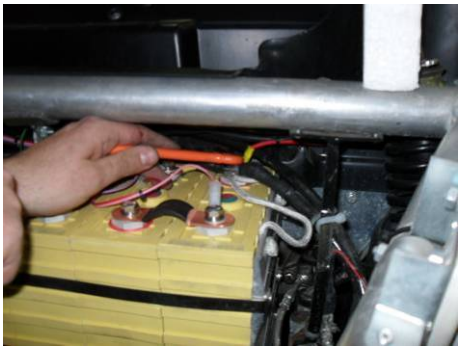
Install the 5 hex head screws and nuts fixing the battery anchoring support as shown in the photo.
Check that the brake hoses are securely fixed to the battery pack support with the special plastic clips.

Re-tighten the 4 lateral hex head screws.

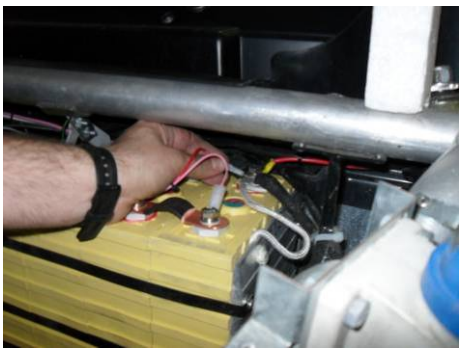
Sequence 17

It is now possible to carry out the required electrical connections on the front battery pack i.e.:

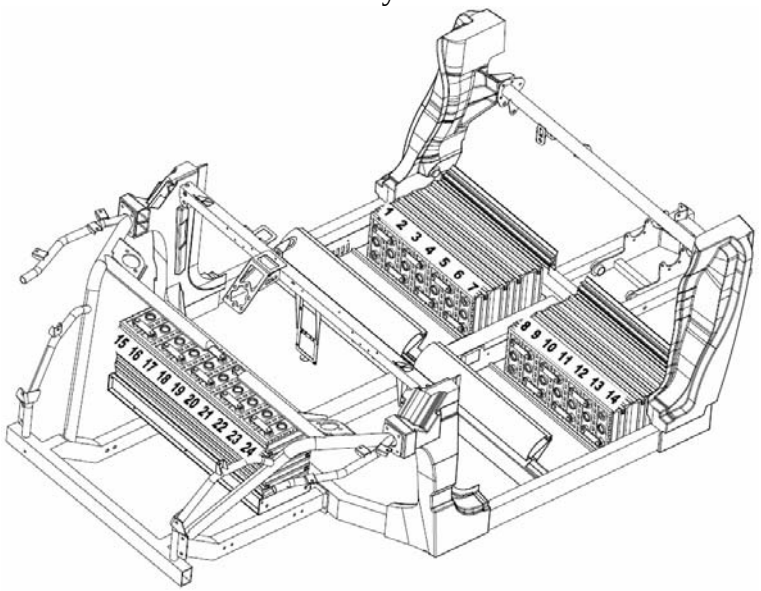
- Power wires;



- Signal wires connected to the batteries through Faston connectors;

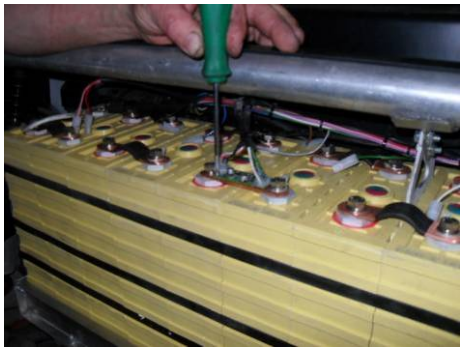


Each signal wire is marked with a number near the Faston connector, showing the connecting point for that Faston on the battery.
The corresponding numbers on the battery are shown in the figure here below. The battery '+' is circled in red on the battery terminals.



- Temperature sensor;

- Current sensor (install the current sensor by tightening the two small-sized self-tapping steel screws).



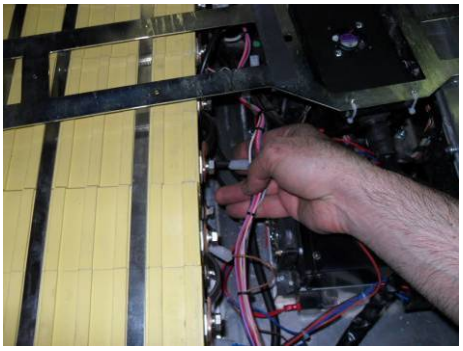
- Carry out these operations by using suitably insulated tools.

Sequence 18

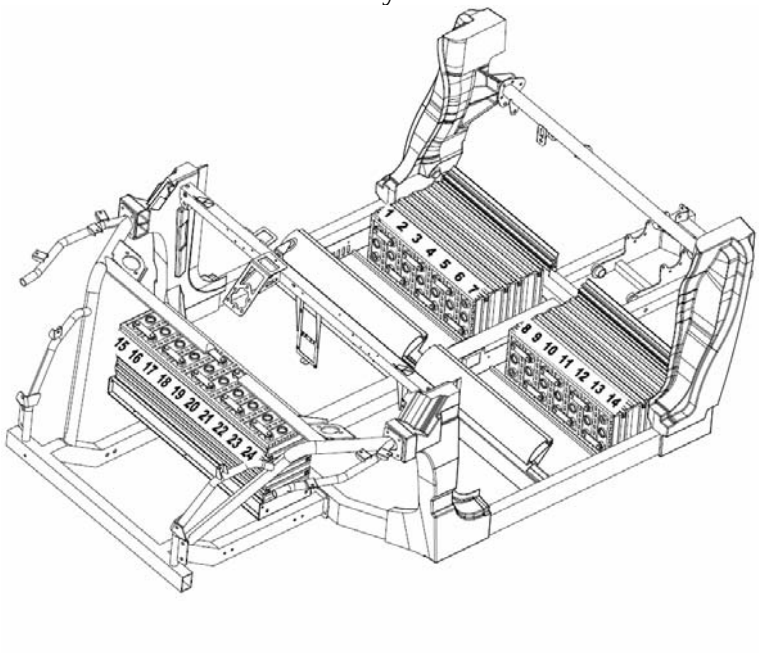
It is now possible to carry out the electrical connections on the rear battery packs i.e.:

- Power wires;

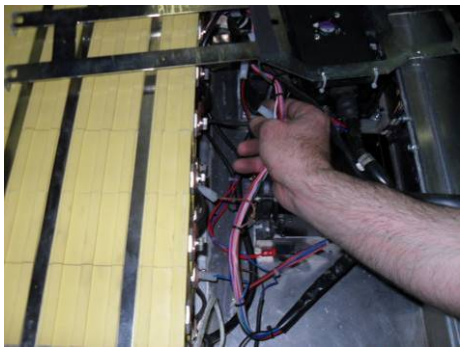
- Signal wires connected to the batteries through Faston connectors;



Each signal cable is marked with a number near the Faston connector, showing the connecting point for that Faston on the battery.
The corresponding numbers on the battery are shown in the figure here below. The battery '+' is circled in red on the battery terminals.



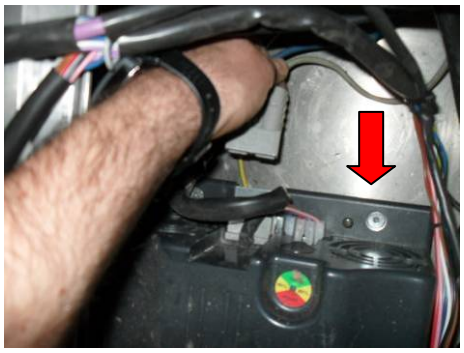
- Temperature sensors;



- Carry out these operations by using suitably insulated tools.

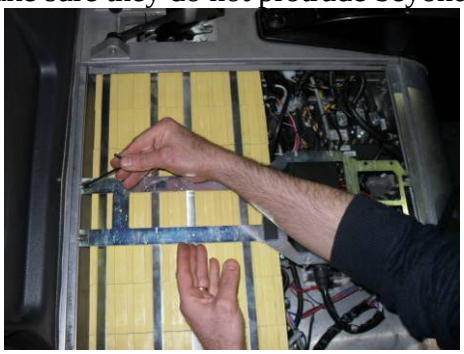
Sequence 19

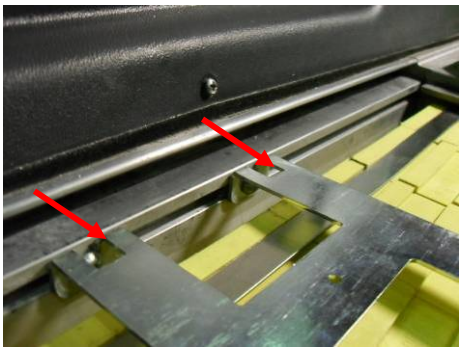
Reconnect the grey power inlet on the battery charger.



Sequence 20

By using a 4mm Allen key, fix the two BMS Module box and Equalizer supports.
After fixing both supports, install the BMS Modules that had previously been removed by securing them with plastic clips.
When fixing the supports, make sure they do not protrude beyond the seat supporting plates.





Sequence 21

It is now possible to install the seat support plates (on both the driver's and the passenger's sides) fixing them with the 4 self-tapping screws.
Then, the plastic covers must be re-placed and the door seals fitted around the door profiles.

Sequence 22

Install the front hood by reversing the order of the disassembly operations.

Sequence 23

Connect the fuses F1 (15A) and F2 (10A).

Some sparking can be observed when inserting the fuses F1 and F2: it is caused by the on-board electronic circuit capacitors and should not be regarded as a fault

Sequence 24

When the vehicle starter key is turned, the BMS fault light must be off or it must indicate a reserve condition if the installed battery pack is not charged.
If the BMS fault light is flashing, check that the signal wires have been correctly connected to the battery pack.