evoTractionBattery

Table of contents

1 About this content

Below is important information about the content.

1.1 Validity

The content is valid for the following products:

- eTB48-50-025 F
- eTB48-100-05 F
- eTB48-200-10 F
- eTB48-300-15 F
- eTB96-50-05 F
- eTB96-100-10 F
- eTB96-150-15 F

1.2 Target group

Depending on the target group, there are different activities that may be performed.

Target audience	Prerequisite	Product knowledge
Operator	• End user of a system in which the product is installed (e.g. vehicle driver, equipment operator, etc.) • No special knowledge required	• Technical data and intended use of the product • Sources of danger and safety devices of the product • Correct behavior in the event of malfunctions
Qualified personnel	• see "Operator • Electrotechnical training/further training • General knowledge of electronics and battery circuitry	• see "Operator • In-depth knowledge of the user interface and its functions (parameterization) • Knowledge of the application areas and processing options
Specialized personnel	• see "Operators" and "Qualified personnel • Electrotechnical education/further training • In-depth knowledge of battery wiring • For systems from 60 V DC: High voltage course • English language skills (written and spoken)	• see "Operators "and "Qualified personnel • Reading and interpreting electrical diagrams, I/O list and BMS parameters • In-depth knowledge of PC hardware, operating system (Windows), peripherals and applications of the product. • In-depth knowledge of applications • Systematic procedure for troubleshooting and fault diagnosis • Training for fire-fighting in the case of Li-ion batteries

1.3 Content and purpose

This information is limited to the assembly, installation, setup and basic operation of the product.

1.4 Additional information

In the download area under eco-volta Download additional information can be found such as:

- Quick Guide (QG)
- Warranty Terms and Conditions (WT)
- Consumer Notes (CN)

How do you find the information?

1. Open link.
2. Select language.
3. Select the desired category (product name).
4. If necessary select document type.

✓ The requested documents will be displayed and can be downloaded

1.5   Warnings and categories

Warnings must be observed and are therefore specially marked. They contain information on potential damage or injuries so that accidents and damage can be prevented.

⚠ DANGER
Indicates an immediate threat which could lead to serious injuries or death.

⚠ WARNING
Indicates a potentially dangerous situation which could lead to serious injuries or death.

⚠ CAUTION
Indicates a potentially dangerous situation which could lead to minor injuries.

Safety instruction
This warning concerns the proper way to handle the product. If ignored, it could lead to damage or loss.

INFORMATION
Contains additional information on the product to help users better understand and operate the product.

2 Basic safety information and warnings

This section contains important basic safety information and warnings that must be observed when handling the product.

2.1 Safety first!

Before working on or with the product: read this operating manual through completely. If not observed, there is the risk of property damage as well as injury and risk to life.

2.2 Proper use

This product is intended exclusively for the use specified in Kapitel "Gerät kennenlernen" is described. Any use beyond this is considered improper, and for any damage resulting from this, the ecovolta AG not. The user/operator bears sole responsibility for all the risks associated with improper use.

2.3 Generally valid safety information

Ensuring employee qualification
Make sure that anyone working on or with the battery has the required personnel qualifications for their job, see "Target group" page 1.

Safety instructions for handling the battery
The following personal protective equipment must be worn when using the product:

Eye protection

Hand protection

Foot protection

Before working with the battery: Ensure that the battery is in perfect condition and has no worrying characteristics. Worrying characteristics include:

- Cracks or breaks in the battery housing
- Mechanical damage to the battery housing
- Malfunction
- Other anomalies

If the battery has any characteristics of concern, do not install or use it.

⚠ DANGER
Electric shock Contact with live parts results in severe bodily injury or death. • The batteries >60 V DC may only be sold to and the systems commissioned by trained specialized personnel. • The trained specialized personnel are responsible for safe installation of the system. • The system in which the batteries are installed must contain insulation monitoring as a safety component (already installed at the factory depending on the configuration). • Work on live parts may only be carried out by specialized personnel. • Work on the evoTractionBattery may only be performed when it is switched off. • The user must not make any technical modifications to the evoTractionBattery. • The evoTractionBattery must not be opened, disassembled or repaired by the user.

> ⚠️ **WARNING**
>
> **Live parts**
> Contact with live parts can result in serious bodily injury or death.
> - It must be ensured that no voltage is present before working on the electrical system.
> - Work on the electrical system must only be carried out by qualified personnel.
> - All connectors to the evoTractionBattery must be disconnected before starting work on the electrical system.

> ⚠️ **WARNING**
>
> **Electric shock due to improper wiring**
> Contact with live parts can result in serious bodily injury or death.
> - The wiring of evoTractionBattery may only be performed by specialized personnel.

> ⚠️ **WARNING**
>
> **Humidity**
> Electric shock
> - The evoTractionBattery must be protected against water ingress.
> - The installation location must be protected from direct water contact.

> ⚠️ **WARNING**
>
> **Lithium-ion batteries can explode or burst explosively and toxic gases can escape.**
> Improper handling of lithium-ion batteries can lead to fires and explosions.
> - The lithium-ion batteries in the evoTractionBattery must be protected from fire and/or high temperatures.
> - Do not open or damage the lithium-ion batteries in the evoTractionBattery.
> - Do not short-circuit the lithium-ion batteries in the evoTractionBattery.

> ⚠️ **CAUTION**
>
> **Lithium-ion batteries can explode or burst explosively and toxic gases can escape.**
> Improper handling of lithium-ion batteries can lead to fires and explosions.
> - Call fire department.
> - Protect airways.
> - If possible, remove evoTractionBattery from the source of the fire.
> - Use suitable extinguishing agent.

> ⚠️ **CAUTION**
>
> **Heavy battery over 25 kg.**
> Risk of physical injury during lifting.
> - Only lift the battery in pairs.

> ⚠️ **CAUTION**
>
> **Triggering of the bursting membrane.**
> Danger of hearing damage due to noise when equalizing pressure.
> When the bursting membrane is triggered, put on hearing protection.

> ⚠️ **CAUTION**
>
> **Electric shock due to connected devices**
> Contact with live parts can lead to minor physical injuries.
> - The safety of the electrical system must be taken into account and ensured during the planning stage.

Safety instruction

- The evoTractionBattery and its components must not be exposed directly to flames.
- The housing of the evoTractionBattery must not come into contact with acetone.

Safety instruction

The evoTractionBattery must be transported in accordance with ADR/RID. It is transported tied to pallets, in a sturdy wooden box and with labelling in accordance with UN3480.

Insofar as applicable, the UN 38.3 test report has been handed over to the carrier.

Safety instruction

Battery housing that is vulnerable to impact.

Risk of damage in case of improper handling.

- Leave the battery in its original packaging until use.
- Transport the battery with care.
- Protect the battery from shocks.
- Do not pull or push the battery across the floor.
- Avoid mechanical stress, e.g. by stepping on the battery.
- Check the battery for damage after unpacking.
- Do not put a damaged battery into operation.

Safety instruction

The evoTractionBattery must not be used in the following areas of application:
- Nuclear Technology
- Medical Technology
- Aviation
- Submarine application
- Ex zone areas
- Critical infrastructures

Safety instruction

- The evoTractionBattery may only be charged within the temperature range described in the technical data.
- The evoTractionBattery must not be used at an altitude above 3500 meters above sea level.
- The evoTractionBattery may only be charged with CAN bus-capable lithium-ion battery chargers in CCCV mode (Constant Current - Constant Voltage).

Safety instruction

- Opening the evoTractionBattery is strictly prohibited.
- Opening the evoTractionBattery will void the warranty.

Safety instruction

- The HV network must be implemented potential-free.
- A galvanically isolated charger is required to charge the evoTractionBattery.
- Commissioning and maintenance of electrical systems may only be carried out by qualified personnel.

Safety instruction

The user must provide a secondary protection mechanism for the evoTractionBattery.

Safety instruction
evoTractionBattery is stored and switched off   Possible damage to the evoTractionBattery due to deep discharge   - The storage of the evoTractionBattery under -10 °C and above 45 °C (max. 3 months) or above 24 °C can lead to damage to the cell chemistry.   - The humidity during storage must be within 5-95 %.   - The evoTractionBattery must be protected against mechanical influences.   - All connections not occupied with connectors must be sealed using dummy plugs in order to maintain the IP protection class.   - Before storing the evoTractionBattery, a complete charging cycle has to be run through at least 90 % of the initial battery capacity. Discharge to 30 % before storage.   - If the storage period exceeds 6 months, a complete charging cycle must be run every 6 months, at least until 90 % of the initial battery capacity. Discharge to 30 % before storage again.

Safety instruction
Damage to the evoTractionBattery due to water ingress   Water ingress will damage the evoTractionBattery.   - The evoTractionBattery must be installed so that it is protected from water and humidity.   - The evoTractionBattery must not be cleaned with a high-pressure cleaner.

Safety instruction
- The product must only be assembled and installed by a specialist see "Ensuring employee qualification" see "Ensuring employee qualification".   - The installation may only be carried out in locations that meet the requirements of ecovolta AG meet the specified climatic and technical conditions.   - The evoTractionBattery is preferably installed and operated horizontally on the stand.   - If the battery is to be installed lying on one side or standing on one end face: suitable devices should prevent the battery housing from being damaged due to specific areas of pressure.   - The battery must not be installed upside down.   - ecovolta AG is not liable for damage caused by improper handling or faulty installation.

Safety instruction
The warranty is voided if the evoTractionBattery is opened.

INFORMATION
In case of technical problems, please contact the regional contact point of ecovolta AG.

INFORMATION
The electromagnetic compatibility of the entire system must be checked.

INFORMATION
This Technical Manual must be kept in the vicinity of the evoTractionBattery.

2.4 Fire protection measures

⚠ WARNING
Organic cell contents are flammable above 125 °C. In the event of overheating or fire, harmful gases will escape and the battery may explode. Harmful gases: • Hydrogen fluoride • Carbon monoxide • Carbon dioxide Avoid causes of overheating: • External heat exposure • Exceeding the maximum permissible load • Overload • Short circuit • Mechanical damage

Preventive measures
- Observe the storage instructions for Li-ion batteries.
- Inform the fire department about the storage locations of the Li-ion batteries and about parking locations of the vehicles or machines.
- Mark escape and rescue routes.
- Have suitable extinguishing agent ready on site:
  - Water
  - Water with extinguishing additives
  - Gel Extinguishing Agent

Safety instruction
The following extinguishing agents are not suitable and must not be used: • ABC or BC powder • Metal burning powder • Carbon dioxide

Fire fighting measures
- If possible, remove the batteries from hazardous areas.
- Exit the vehicle.
- Alert the fire department with the indication of a burning Li-Ion battery.
- Do not expose yourself to the personal risk of endangering yourself.
- Only take your own measures if you are sufficiently practiced in doing so.
- Wear the appropriate personal protective equipment when fighting fires:
  - Self-contained breathing apparatus according to NIOSH/MSHA
  - Protective clothing
  - Hand protection
- Keep people away from the hazardous area who are unprotected and not required for hazard prevention.
- Fight the fire with suitable extinguishing agent. See: "Preventive measures".
- Observe the following minimum distances when deleting:
  - With portable and mobile fire extinguishers with spray jet:
    At least 1 meter
  - For wall hydrants with spray jet (Euro nozzle):
    At least 3 meters
  - For wall hydrants with full jet:
    At least 5 meters

- In case of clear smoke development or gas release:
  - Leave the room or the hazardous area immediately.
  - Ensure that there is adequate ventilation.

Fire watch

Safety instruction
Batteries can reignite even after a long time.
Store the batteries under water after extinguishing them:
• in a sufficiently large water basin
• in a general average container

When the extinguished battery must be moved to another location for fire watch:

- Contact the manufacturer for information on transport regulations.
- Obtain a transport permit from the appropriate authority.
- Have the battery transported by a specialized company.

2.5 Environmental protection

The products of the ecovolta AG are designed with eco-design in mind to minimize their impact on the environment. The following features are considered standard in the design of the products:

- The products of the ecovolta AG are made of high quality materials to maximize the life of their.
- The product design allows the separation of the different materials for reprocessing and efficient recycling.
- The ecovolta AG is always working to further develop its products and continuously reduce their environmental impact.

The products of the ecovolta AG serve to use energy more efficiently and thereby reduce everyday environmental pollution. The ecovolta AG tries to keep the impact on people and the environment low throughout the product cycle and to return as much as possible to the material cycle. It is important that the user handles all products with care and uses them efficiently.

For information on return and disposal of the products see "Disposal and recycling".

3 Product description

This section contains information on the product.

3.1 Overview

In which vehicles may the evoTractionBattery be installed?
The evoTractionBattery is intended for installation in the vehicles listed below.

	NOTE
i	For some applications, additional safety equipment and a respective assessment may be necessary.

- Class L vehicles (two-, three- and light four-wheeled motor vehicles)
  according to Directive 2002/24/EC and EU Regulation No. 168/2013
- Vehicles in categories M1 and M1G (at least four-wheeled vehicles for passenger transport with a maximum of eight seats plus the driver's seat)
  according to Directive 2007/46/EC, Annex II
- Vehicles of categories N1 and N1G (at least four-wheeled vehicles for the carriage of goods and special purpose vehicles up to 3.5 t)
  according to Directive 2007/46/EC, Annex II
- Class T vehicles (wheeled agricultural or forestry tractors)
  according to Directive 2003/37/EC, Annex II
- Prototypes of vehicles for operation on the road (for the purpose of conducting a test program).
  according to Directive 2007/46/EC, Article 2, Section 4, letter b
- Construction site vehicles and self-propelled machinery (for use principally on construction sites, in quarries or at airports, and vehicles used for work other than the carriage of passengers or goods) in accordance with Directive 2007/46/EC, Article 2, Section 3, letters a and c
- Class C vehicles (tractors on tracks or a combination of wheels and tracks).
  according to Regulation (EU) No. 167/2013
- Watercraft (recreational boats and personal watercraft)
  according to Directive 2013/53/EU

Can the evoTractionBattery also be used for other applications?
The evoTractionBattery may expressly be used for other applications only after written approval by the manufacturer.
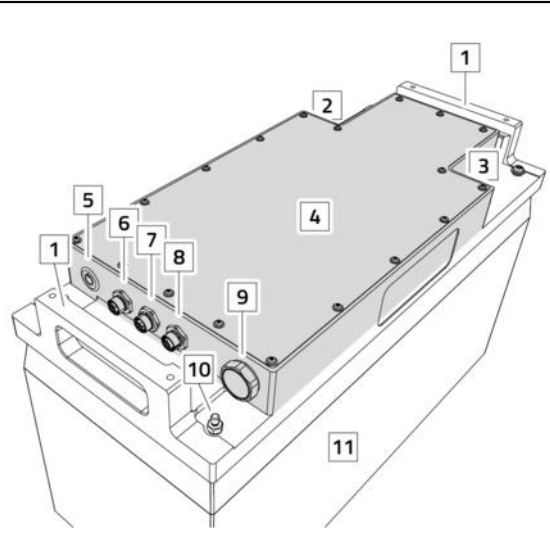
Which use is contrary to the intended use?
The battery is considered to be used contrary to its intended purpose:

- The use of the battery for purposes other than those specified.
- Any action that deviates from the instructions given.
- The use of the battery in disregard of the technical data.
- Any technical modification to the battery.

How is the evoTractionBattery constructed?

The evoTractionBattery is structured as follows:

Figure	No.	Meaning
	1	Carrying handles
	2	Battery pol (+)
	3	Battery pol (–)
	4	Battery Management System (BMS)
	5	Battery button (on/off)
	6	CAN OUT connection
	7	Connection EXT. SIGN.
	8	CAN IN connection
	9	Berst membrane
	10	Ground cable connection (potential equalization)
	11	Lithium-ion battery cells

How does the evoTractionBattery work?

The evoTractionBattery is equipped with lithium-ion battery cells that are charged and discharged via the built-in Battery Management System (BMS).

The Battery Management System (BMS) is delivered from the factory with a standard configuration. Special configurations must be specified when ordering.

About the function of the bursting membrane
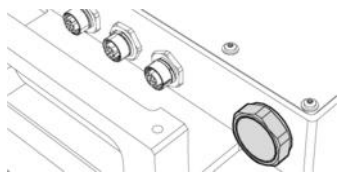
The bursting membrane monitors the internal pressure of the battery and opens in the event of overpressure to prevent the battery housing from bursting.
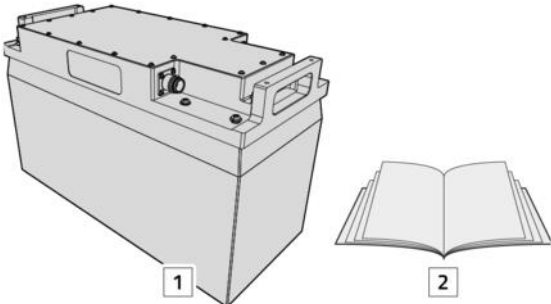
Overpressure can be caused by the following events, for example:
- Extreme air pressure differences in the environment
- Heat development due to permanent overload

3.2 Scope of delivery

Standard scope of delivery

The scope of delivery consists of:

|	
1	evoTractionBattery
2	Original operating instructions

	NOTE
ℹ	This operating manual is an integral part of the product and is inseparable from the product
	If the product is passed onto other owners, then the operating manual also has to be passed on.
	The operating instructions can also be downloaded online. Use the QR code on the type label for this purpose.

Optional scope of delivery

The delivery contains additional separately packed components depending on the order:
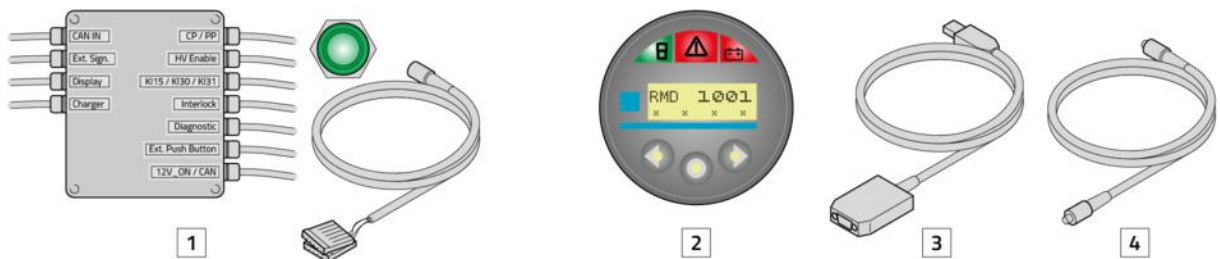
1	Distributor box incl. CAN cable and battery button
2	Display
3	PCAN-Cable
4	Cable with Amphenol connector

Additionally required components

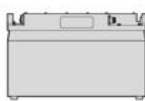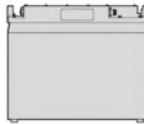| INFORMATION |
| --- |
| Depending on regional legal regulation, it may be necessary to install additional suitable protective devices. Examples:

• Emergency stop for redundant protection of the high-voltage relay (highest priority)
• Additional external safeguarding on both poles
• High current distributor
• Housing circuit breaker (GSS)
• Interlock circle
• High-voltage relay

It is the customer's responsibility to adhere to local regulations. |

3.3 Technical data

3.3.1 Battery type overview

There are the following types of batteries:

eTB48-50-025 F	eTB48-100-05 F	eTB48-200-10 F	eTB48-300-15 F
48 V 2.5 kWh	48 V 5.0 kWh	48 V 10.0 kWh	48 V 15.0 kWh
For general technical data, see: "General technical data" For product-specific technical data, see:			
"Battery type: eTB48-50-025 F"	"Battery type: eTB48-100-05 F"	"Battery type: eTB48-200-10 F"	"Battery type: eTB48-300-15 F"

eTB96-50-05 F	eTB96-100-10 F	eTB96-150-15 F
96 V 5.0 kWh	96 V 10.0 kWh	96 V 15.0 kWh
For general technical data, see: "General technical data" For product-specific technical data, see:		
"Battery type: eTB96-50-05 F"	"Battery type: eTB96-100-10 F"	"Battery type: eTB96-150-15 F"

3.3.2 General technical data

The following technical data apply equally to all battery types:

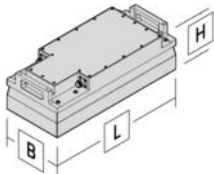| Environmental conditions	
Ambient temperature during charging *)	-10 °C...+50 °C
Ambient temperature during dis-charge	-25 °C...+60 °C
Ambient temperature during storage	Up to 3 months: -10 °C...+45 °C From 3 months: -10...+24 °C
Relative humidity	max. 95 %
Pollution level	PD2

*) Charging below -10 °C is not possible; at -10...0 °C only with 0.1 C.

Control	
Communication	CAN bus
CAN bus connection	CAN-In: SACC-DSI-M12FS- 12CON-M16 SH Phoenix Contact Article no: 1441956 Signals: CAN_extern, CAN_intern, 12V Enable, Interlock, HV Enable
	CAN-Out: SACC-DSI-M12FS- 12CON-M16 SH Phoenix Contact Article no: 1441956 Signals: CAN_extern, CAN_intern, 12V Enable, Interlock, HV Enable
	External Signals: SACC-DSI-M12FS- 12CON-M16 SH Phoenix Contact Article no: 1441956 Signals: Display, LED, On Switch external, IEC 62196 charge modes CC/CP, Charge Plug Actuator Control, Vehicle Unlock Button
CAN properties	SOC (State of Charge) Cell voltage Battery voltage Battery temperature Battery power General status etc.
Baud rate	500 kbit/s

Security	
Battery Management System (BMS)	SIL2-Level
Balancing	passive
Interlock	HV connector monitoring EMERGENCY OFF
Safety functions	All pole disconnection Over and under temperature shutdown Over- and undervoltage shutdown Overcurrent shutdown

Security	
	Patented overcurrent protection per cell Equipotential bonding at the battery housing
Certifications	UN38.3, ECE-R 100, ECE-R 10, others in validation: ISO/LVD
Conformity	RoHS, in validation: CE

3.3.3 Battery type: eTB48-50-025 F

Mechanical data		
	Dimensions (L x W x H)	522 x 223 x 156 mm
	Total weight	23 kg
	Color	Housing: Yellow Lid: Anthracite (RAL 7011)
	Mounting type	Upright on the stand or lying on a long side or end face
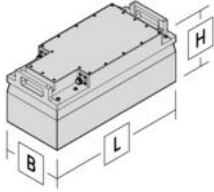
Electrical data	
Nominal voltage	51,8 V
Max. Voltage	56 V
Min. Voltage	39,2 V
Capacity	2409 Wh
Gross capacity	46.5 Ah
Net capacity	34.5 Ah
Energy density	96 Wh/kg
Gross energy	2409 Wh
Net energy (project-specific)	1787 Wh
Battery configuration	14s15p
Number of cells	210 piece
Capacity per cell (on charge and discharge 0.2 C at +25 °C)	Net: 2.3 Ah Gross: 3.1 Ah
Cell technology	Lithium-ion NMC (nickel-manganese-cobalt oxides)
Max. Discharge power (10 s) at SoC 50 % *)	4973 W
Max. Discharge power (1 s) at SoC 50 % *)	7459 W
Discharge power (continuous) at SoC 50 % *)	2486 W
Discharge voltage (recommended)	44,8 V
Fuse	100 A
Loading method	CC/CV (constant current/constant voltage)
Charging end voltage	56 V
Charge cut-off (recommended)	0,015C: Current < 0.75 A

Electrical data	
Pre-charging	Up to nominal voltage
Charging power (continuous) at SoC 50 % *)	1191 W
Energy consumption offline/standby Per cell	0.015 µA
Discharge depth DoD (project-specific)	72 %
Life expectancy at 70% remaining capacity (72% DoD or 3.2 V...4.0 V at +25°C)	Up to 2000 cycles
Insulation voltage	>600 V
Insulation resistance	>1 MOhm
Overvoltage category	OV2
Recommended cable cross section	50 mm^2
Battery terminal connections	Amphenol SURLOK PLUS 8.0 mm
Mating cycles	100
Operation	Battery button (on/off)
Protection class	IP 64 (IP 65 in validation)

*) Depending on the ambient conditions

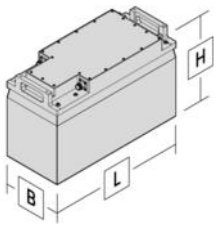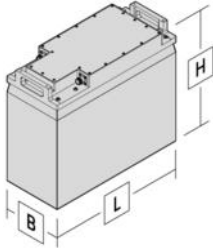| **Integration**	
Interconnection	8 serial, up to 15 parallel (project specific)
Loading communication	CAN or IEC 62196 type 2 / IEC 61851-1
Vehicle categories	C, L, M1, M1G, N1, N1G, T, watercraft according to Directive 2013/53/EU, construction site vehicles and independent working machines according to 2007/46/EC and prototype vehicles
Chargers (DC Charger)	TC-Charger, Xepics, ZIVAN SG3 & NG3, charge control also via CAN bus (third-party chargers possible)

3.3.4 Battery type: eTB48-100-05 F

Mechanical data		
	Dimensions (L x W x H)	522 x 223 x 213 mm
	Total weight	35 kg
	Color	Housing: Yellow Lid: Anthracite (RAL 7011)
	Mounting type	Upright on the stand or lying on a long side or end face

Electrical data	
Nominal voltage	51,8 V
Max. Voltage	56 V
Min. Voltage	39,2 V
Capacity	4817 Wh
Gross capacity	93 Ah
Net capacity	69 Ah
Energy density	134 Wh/kg
Gross energy	4817 Wh
Net energy (project-specific)	3574 Wh
Battery configuration	14s30p
Number of cells	420 piece
Capacity per cell (on charge and discharge 0.2 C at +25 °C)	Net: 2.3 Ah Gross: 3.1 Ah
Cell technology	Lithium-ion NMC (nickel-manganese-cobalt oxides)
Max. Discharge power (10 s) at SoC 50 % *)	9946 W
Max. Discharge power (1 s) at SoC 50 % *)	14918 W
Discharge power (continuous) at SoC 50 % *)	4972 W
Discharge voltage (recommended)	44,8 V
Fuse	200 A
Loading method	CC/CV (constant current/constant voltage)
Charging end voltage	56 V
Charge cut-off (recommended)	0,015C: Current < 1.5 A
Pre-charging	Up to nominal voltage
Charging power (continuous) at SoC 50 % *)	2383 W
Energy consumption offline/standby Per cell	0.015 µA
Discharge depth DoD (project-specific)	72 %

Electrical data	
Life expectancy at 70% remaining capacity (72% DoD or 3.2 V...4.0 V at +25°C)	Up to 2000 cycles
Insulation voltage	>600 V
Insulation resistance	>1 MOhm
Overvoltage category	OV2
Recommended cable cross section	50 mm^2
Battery terminal connections	Amphenol SURLOK PLUS 8.0 mm
Mating cycles	100
Operation	Battery button (on/off)
Protection class	IP 64 (IP 65 in validation)

*) Depending on the ambient conditions

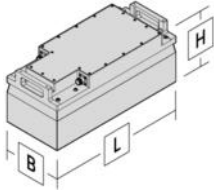| **Integration**	
Interconnection	8 serial, up to 15 parallel (project specific)
Loading communication	CAN or IEC 62196 type 2 / IEC 61851-1
Vehicle categories	C, L, M1, M1G, N1, N1G, T, watercraft according to Directive 2013/53/EU, construction site vehicles and independent working machines according to 2007/46/EC and prototype vehicles
Chargers (DC Charger)	TC-Charger, Xepics, ZIVAN SG3 & NG3, charge control also via CAN bus (third-party chargers possible)

3.3.5 Battery type: eTB48-200-10 F

Mechanical data		
	Dimensions (L x W x H)	522 x 223 x 322 mm
	Total weight	59 kg
	Color	Housing: Yellow Lid: Anthracite (RAL 7011)
	Mounting type	Upright on the stand or lying on a long side or end face

Electrical data	
Nominal voltage	51,8 V
Max. Voltage	56 V
Min. Voltage	39,2 V
Capacity	9635 Wh
Gross capacity	186 Ah
Net capacity	138 Ah
Energy density	163 Wh/kg
Gross energy	9635 Wh
Net energy (project-specific)	7148 Wh
Battery configuration	14s60p
Number of cells	840 piece
Capacity per cell (on charge and discharge 0.2 C at +25 °C)	Net: 2.3 Ah Gross: 3.1 Ah
Cell technology	Lithium-ion NMC (nickel-manganese-cobalt oxides)
Max. Discharge power (10 s) at SoC 50 % *)	14918 W
Max. Discharge power (1 s) at SoC 50 % *)	22377 W
Discharge power (continuous) at SoC 50 % *)	7459 W
Discharge voltage (recommended)	44,8 V
Fuse	300 A
Loading method	CC/CV (constant current/constant voltage)
Charging end voltage	56 V
Charge cut-off (recommended)	0,015C: Current < 3 A
Pre-charging	Up to nominal voltage
Charging power (continuous) at SoC 50 % *)	4766 W
Energy consumption offline/standby Per cell	0.015 µA
Discharge depth DoD (project-specific)	72 %

Electrical data	
Life expectancy at 70% remaining capacity (72% DoD or 3.2 V...4.0 V at +25°C)	Up to 2000 cycles
Insulation voltage	>600 V
Insulation resistance	>1 MOhm
Overvoltage category	OV2
Recommended cable cross section	50 mm^2
Battery terminal connections	Amphenol SURLOK PLUS 8.0 mm
Mating cycles	100
Operation	Battery button (on/off)
Protection class	IP 64 (IP 65 in validation)

*) Depending on the ambient conditions

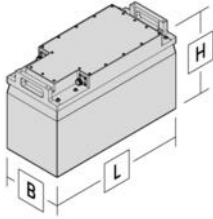| **Integration**	
Interconnection	8 serial, up to 15 parallel (project specific)
Loading communication	CAN or IEC 62196 type 2 / IEC 61851-1
Vehicle categories	C, L, M1, M1G, N1, N1G, T, watercraft according to Directive 2013/53/EU, construction site vehicles and independent working machines according to 2007/46/EC and prototype vehicles
Chargers (DC Charger)	TC-Charger, Xepics, ZIVAN SG3 & NG3, charge control also via CAN bus (third-party chargers possible)

3.3.6 Battery type: eTB48-300-15 F

Mechanical data		
	Dimensions (L x W x H)	522 x 223 x 437 mm
	Total weight	84 kg
	Color	Housing: Yellow Lid: Anthracite (RAL 7011)
	Mounting type	Upright on the stand or lying on a long side or end face

Electrical data	
Nominal voltage	51,8 V
Max. Voltage	56 V
Min. Voltage	39,2 V
Capacity	14452 Wh
Gross capacity	279 Ah
Net capacity	207 Ah
Energy density	172 Wh/kg
Gross energy	14452 Wh
Net energy (project-specific)	10723 Wh
Battery configuration	14s90p
Number of cells	1260 piece
Capacity per cell (on charge and discharge 0.2 C at +25 °C)	Net: 2.3 Ah Gross: 3.1 Ah
Cell technology	Lithium-ion NMC (nickel-manganese-cobalt oxides)
Max. Discharge power (10 s) at SoC 50 % *)	14918 W
Max. Discharge power (1 s) at SoC 50 % *)	22377 W
Discharge power (continuous) at SoC 50 % *)	7459 W
Discharge voltage (recommended)	44,8 V
Fuse	300 A
Loading method	CC/CV (constant current/constant voltage)
Charging end voltage	56 V
Charge cut-off (recommended)	0,015C: Current < 4.5 A
Pre-charging	Up to nominal voltage
Charging power (continuous) at SoC 50 % *)	7200 W
Energy consumption offline/standby Per cell	0.015 µA
Discharge depth DoD (project-specific)	72 %

Electrical data	
Life expectancy at 70% remaining capacity (72% DoD or 3.2 V…4.0 V at +25°C)	Up to 2000 cycles
Insulation voltage	>600 V
Insulation resistance	>1 MOhm
Overvoltage category	OV2
Recommended cable cross section	50 mm²
Battery terminal connections	Amphenol SURLOK PLUS 8.0 mm
Mating cycles	100
Operation	Battery button (on/off)
Protection class	IP 64 (IP 65 in validation)

*) Depending on the ambient conditions

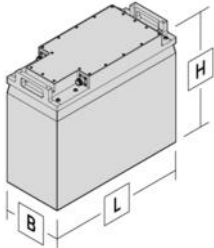| **Integration**	
Interconnection	8 serial, up to 15 parallel (project specific)
Loading communication	CAN or IEC 62196 type 2 / IEC 61851-1
Vehicle categories	C, L, M1, M1G, N1, N1G, T, watercraft according to Directive 2013/53/EU, construction site vehicles and independent working machines according to 2007/46/EC and prototype vehicles
Chargers (DC Charger)	TC-Charger, Xepics, ZIVAN SG3 & NG3, charge control also via CAN bus (third-party chargers possible)

3.3.7 Battery type: eTB96-50-05 F

Mechanical data		
	Dimensions (L x W x H)	522 x 223 x 213 mm
	Total weight	36 kg
	Color	Housing: Yellow Lid: Anthracite (RAL 7011)
	Mounting type	Upright on the stand or lying on a long side or end face

Electrical data	
Nominal voltage	103,6 V
Max. Voltage	112 V
Min. Voltage	78,4 V
Capacity	4817 Wh
Gross capacity	46.5 Ah
Net capacity	34.5 Ah
Energy density	134 Wh/kg
Gross energy	4817 Wh
Net energy (project-specific)	3574 Wh
Battery configuration	28s15p
Number of cells	420 piece
Capacity per cell (on charge and discharge 0.2 C at +25 °C)	Net: 2.3 Ah Gross: 3.1 Ah
Cell technology	Lithium-ion NMC (nickel-manganese-cobalt oxides)
Max. Discharge power (10 s) at SoC 50 % *)	9946 W
Max. Discharge power (1 s) at SoC 50 % *)	14918 W
Discharge power (continuous) at SoC 50 % *)	4973 W
Discharge voltage (recommended)	89,6 V
Fuse	100 A
Loading method	CC/CV (constant current/constant voltage)
Charging end voltage	112 V
Charge cut-off (recommended)	0,015C: Current < 0.75 A
Pre-charging	Up to nominal voltage
Charging power (continuous) at SoC 50 % *)	2383 W
Energy consumption offline/standby Per cell	0.015 µA
Discharge depth DoD (project-specific)	72 %

Electrical data	
Life expectancy at 70% remaining capacity (72% DoD or 3.2 V...4.0 V at +25°C)	Up to 2000 cycles
Insulation voltage	>600 V
Insulation resistance	>1 MOhm
Overvoltage category	OV2
Recommended cable cross section	50 mm^2
Battery terminal connections	Amphenol SURLOK PLUS 8.0 mm
Mating cycles	100
Operation	Battery button (on/off)
Protection class	IP 64 (IP 65 in validation)

*) Depending on the ambient conditions

Integration	
Interconnection	4 serial, up to 15 parallel (project specific)
Loading communication	CAN or IEC 62196 type 2 / IEC 61851-1
Vehicle categories	C, L, M1, M1G, N1, N1G, T, watercraft according to Directive 2013/53/EU, construction site vehicles and independent working machines according to 2007/46/EC and prototype vehicles
Chargers (DC Charger)	TC-Charger, Xepics, ZIVAN SG3 & NG3, charge control also via CAN bus (third-party chargers possible)

3.3.8 Battery type: eTB96-100-10 F

Mechanical data		
	Dimensions (L x W x H)	522 x 223 x 322 mm
	Total weight	60 kg
	Color	Housing: Yellow Lid: Anthracite (RAL 7011)
	Mounting type	Upright on the stand or lying on a long side or end face

Electrical data	
Nominal voltage	103,6 V
Max. Voltage	112 V
Min. Voltage	78,4 V
Capacity	9635 Wh
Gross capacity	93 Ah
Net capacity	69 Ah
Energy density	163 Wh/kg
Gross energy	9635 Wh
Net energy (project-specific)	7149 Wh
Battery configuration	28s30p
Number of cells	840 piece
Capacity per cell (on charge and discharge 0.2 C at +25 °C)	Net: 2.3 Ah Gross: 3.1 Ah
Cell technology	Lithium-ion NMC (nickel-manganese-cobalt oxides)
Max. Discharge power (10 s) at SoC 50 % *)	19891 W
Max. Discharge power (1 s) at SoC 50 % *)	29837 W
Discharge power (continuous) at SoC 50 % *)	9945 W
Discharge voltage (recommended)	89,6 V
Fuse	200 A
Loading method	CC/CV (constant current/constant voltage)
Charging end voltage	112 V
Charge cut-off (recommended)	0,015C: Current < 1.5 A
Pre-charging	Up to nominal voltage
Charging power (continuous) at SoC 50 % *)	4869 W
Energy consumption offline/standby Per cell	0.015 µA
Discharge depth DoD (project-specific)	72 %

| Electrical data	
Life expectancy at 70% remaining capacity (72% DoD or 3.2 V...4.0 V at +25°C)	Up to 2000 cycles
Insulation voltage	>600 V
Insulation resistance	>1 MOhm
Overvoltage category	OV2
Recommended cable cross section	50 mm^2
Battery terminal connections	Amphenol SURLOK PLUS 8.0 mm
Mating cycles	100
Operation	Battery button (on/off)
Protection class	IP 64 (IP 65 in validation)

*) Depending on the ambient conditions

Integration	
Interconnection	4 serial, up to 15 parallel (project specific)
Loading communication	CAN or IEC 62196 type 2 / IEC 61851-1
Vehicle categories	C, L, M1, M1G, N1, N1G, T, watercraft according to Directive 2013/53/EU, construction site vehicles and independent working machines according to 2007/46/EC and prototype vehicles
Chargers (DC Charger)	TC-Charger, Xepics, ZIVAN SG3 & NG3, charge control also via CAN bus (third-party chargers possible)

3.3.9 Battery type: eTB96-150-15 F

Mechanical data		
	Dimensions (L x W x H)	522 x 223 x 437 mm
	Total weight	84 kg
	Color	Housing: Yellow Lid: Anthracite (RAL 7011)
	Mounting type	Upright on the stand or lying on a long side or end face

Electrical data	
Nominal voltage	103,6 V
Max. Voltage	112 V
Min. Voltage	78,4 V
Capacity	14452 Wh
Gross capacity	139.5 Ah
Net capacity	103.5 Ah
Energy density	172 Wh/kg
Gross energy	14452 Wh
Net energy (project-specific)	10723 Wh
Battery configuration	28s45p
Number of cells	1260 piece
Capacity per cell (on charge and discharge 0.2 C at +25 °C)	Net: 2.3 Ah Gross: 3.1 Ah
Cell technology	Lithium-ion NMC (nickel-manganese-cobalt oxides)
Max. Discharge power (10 s) at SoC 50 % *)	26936 W
Max. Discharge power (1 s) at SoC 50 % *)	40404 W
Discharge power (continuous) at SoC 50 % *)	13426 W
Discharge voltage (recommended)	89,6 V
Fuse	250 A
Loading method	CC/CV (constant current/constant voltage)
Charging end voltage	112 V
Charge cut-off (recommended)	0,015C: Current < 2.25 A
Pre-charging	Up to nominal voltage
Charging power (continuous) at SoC 50 % *)	7148 W
Energy consumption offline/standby Per cell	0.015 μA

Electrical data	
Discharge depth DoD (project-specific)	72 %
Life expectancy at 70% remaining capacity (72% DoD or 3.2 V...4.0 V at +25°C)	Up to 2000 cycles
Insulation voltage	>600 V
Insulation resistance	>1 MOhm
Overvoltage category	OV2
Recommended cable cross section	50 mm^2
Battery terminal connections	Amphenol SURLOK PLUS 8.0 mm
Mating cycles	100
Operation	Battery button (on/off)
Protection class	IP 64 (IP 65 in validation)

*) Depending on the ambient conditions

Integration	
Interconnection	4 serial, up to 15 parallel (project specific)
Loading communication	CAN or IEC 62196 type 2 / IEC 61851-1
Vehicle categories	C, L, M1, M1G, N1, N1G, T, watercraft according to Directive 2013/53/EU, construction site vehicles and independent working machines according to 2007/46/EC and prototype vehicles
Chargers (DC Charger)	TC-Charger, Xepics, ZIVAN SG3 & NG3, charge control also via CAN bus (third-party chargers possible)

3.3.10 Derating curve diagrams

Curve diagrams of the behavior of the batteries can be found below. In each case during charging, discharging and recuperation as a function of cell voltage and temperature.

Battery type: 48 V; 2.5 kWh

Charge Current Derating [A] vs. Temperature [°C]
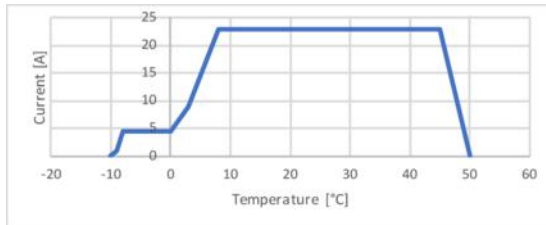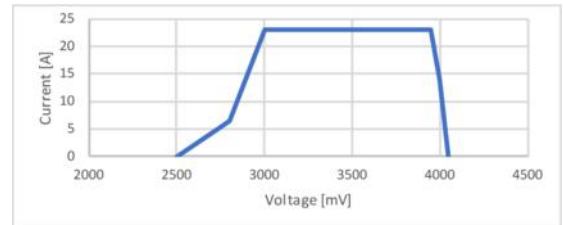
Charge Current Derating [A] vs. Voltage [mV]

Discharge Current Derating [A] vs. Temperature [°C]
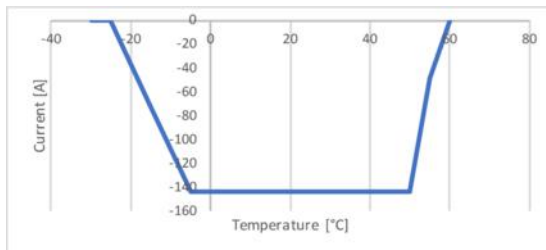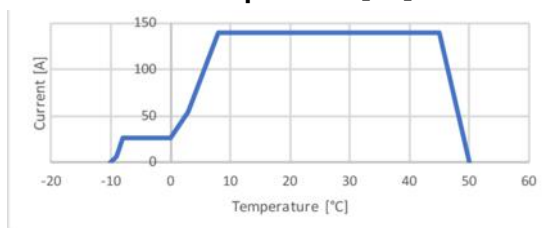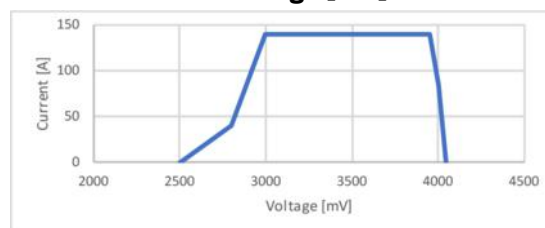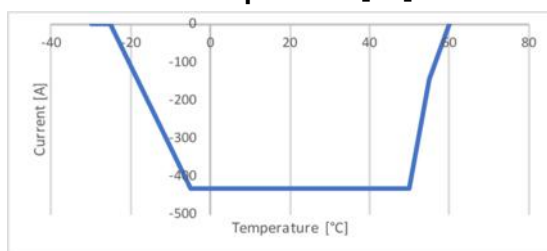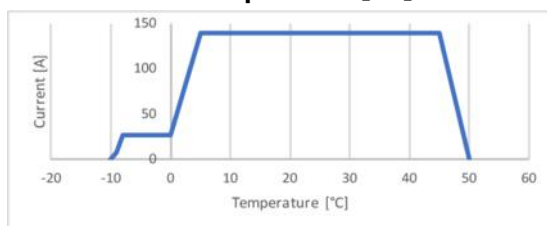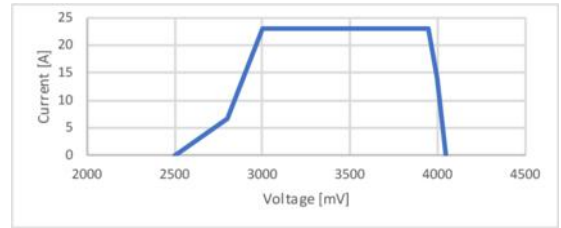

Discharge Current Derating [A] vs. Voltage [mV]
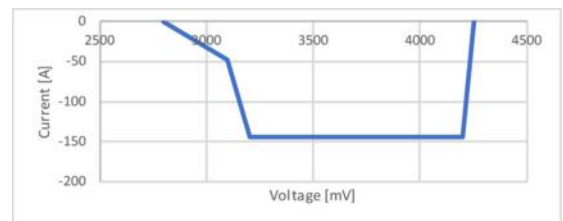
Recuperation Current Derating [A] vs. Temperature [°C]
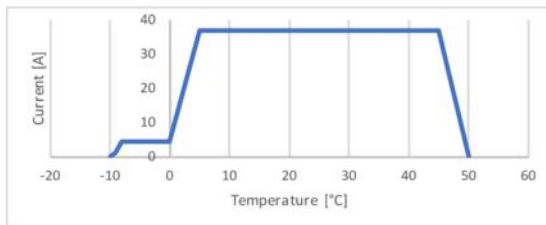
Recuperation Current Derating [A] vs. Voltage [mV]
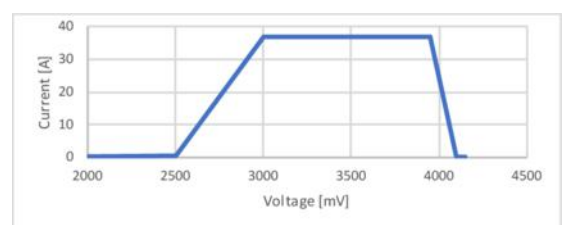
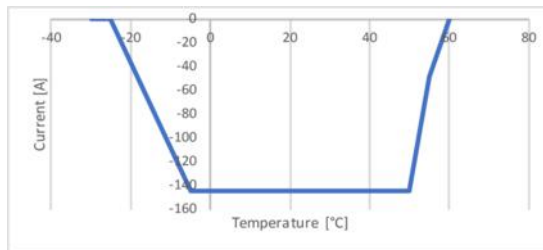**Battery type: 48 V; 5.0 kWh**

**Charge Current Derating [A]
vs. Temperature [°C]**
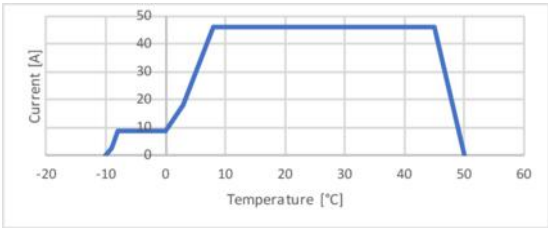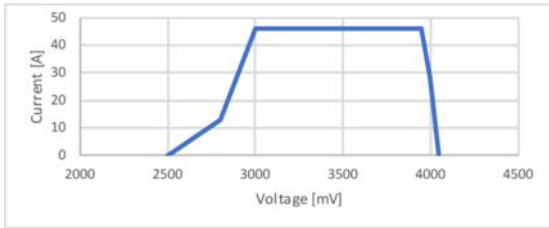
**Charge Current Derating [A]
vs. Voltage [mV]**

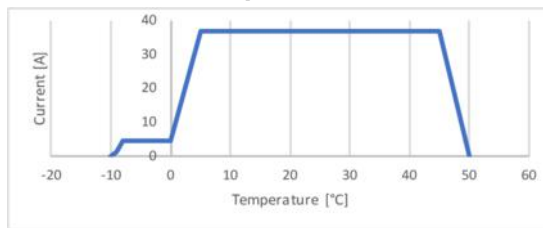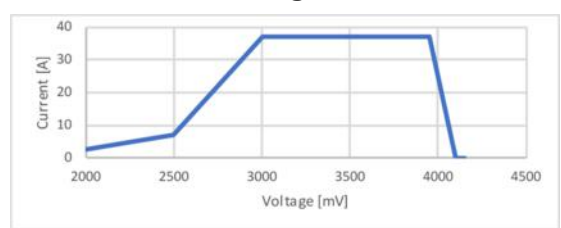**Discharge Current Derating [A]
vs. Temperature [°C]**
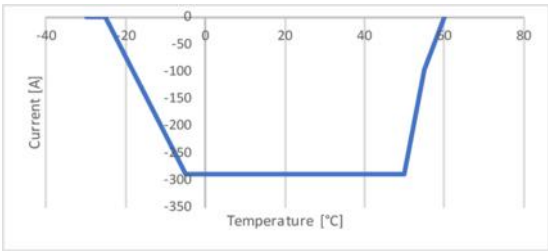
**Discharge Current Derating [A]
vs. Voltage [mV]**
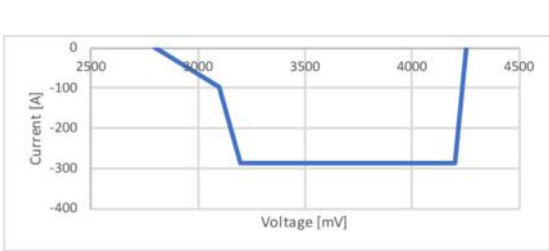
**Recuperation Current Derating [A]
vs. Temperature [°C]**
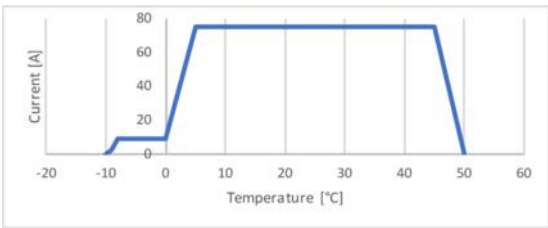
**Recuperation Current Derating [A]
vs. Voltage [mV]**
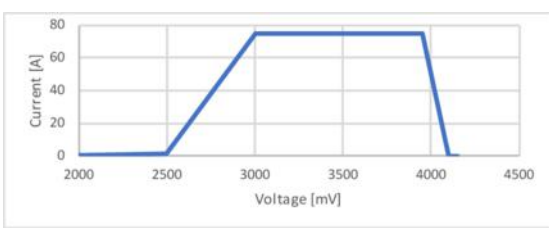
Battery type: 48 V; 10.0 kWh

Charge Current Derating [A] vs. Temperature [°C]
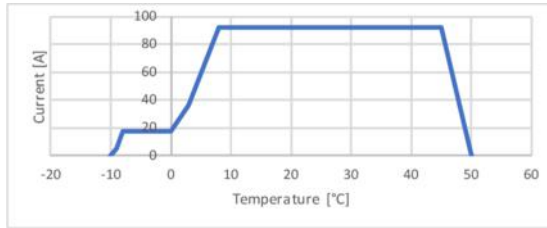
Charge Current Derating [A] vs. Voltage [mV]
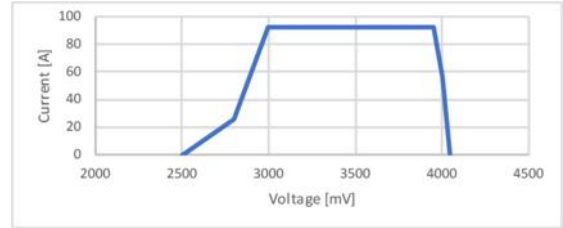
Discharge Current Derating [A] vs. Temperature [°C]
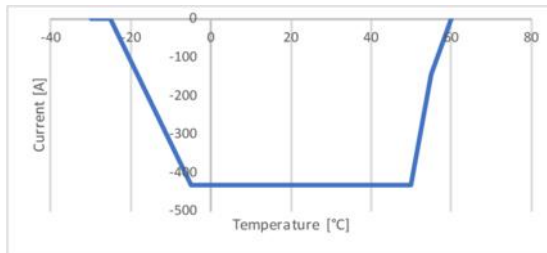
Discharge Current Derating [A] vs. Voltage [mV]
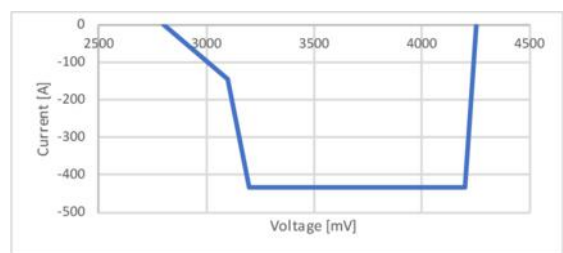
Recuperation Current Derating [A] vs. Temperature [°C]
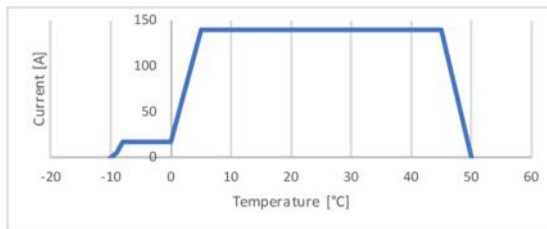
Recuperation Current Derating [A] vs. Voltage [mV]
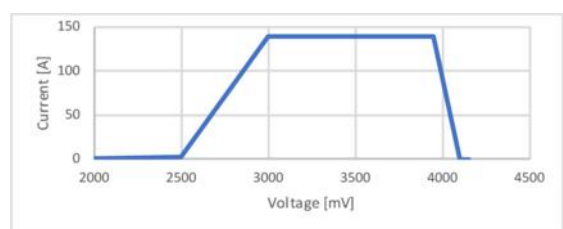
Battery type: 48 V; 15.0 kWh

**Charge Current Derating [A]
vs. Temperature [°C]**

**Charge Current Derating [A]
vs. Voltage [mV]**

**Discharge Current Derating [A]
vs. Temperature [°C]**

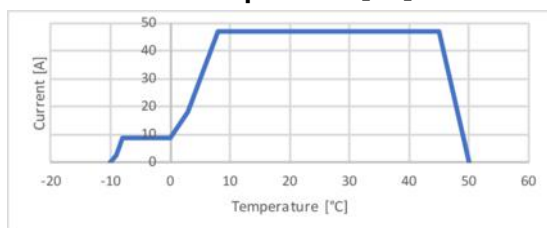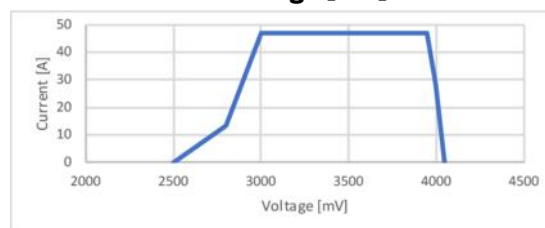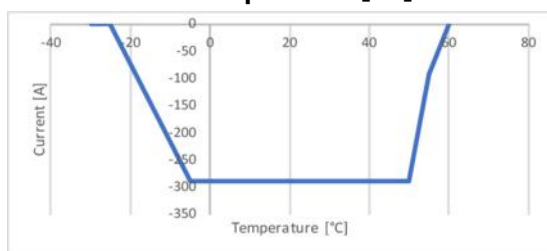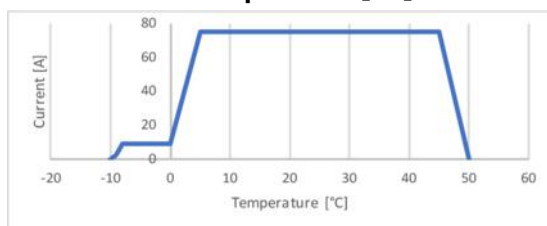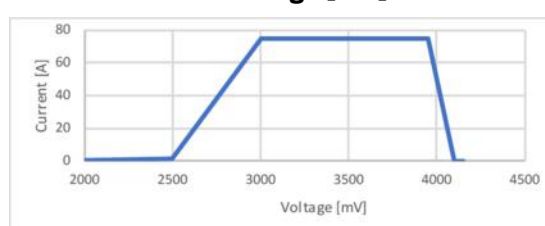**Discharge Current Derating [A]
vs. Voltage [mV]**
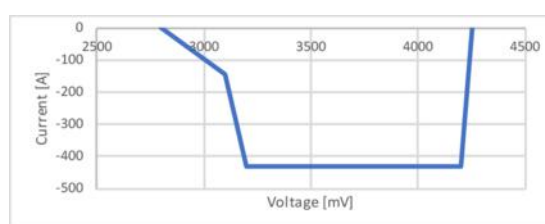
**Recuperation Current Derating [A]
vs. Temperature [°C]**

**Recuperation Current Derating [A]
vs. Voltage [mV]**
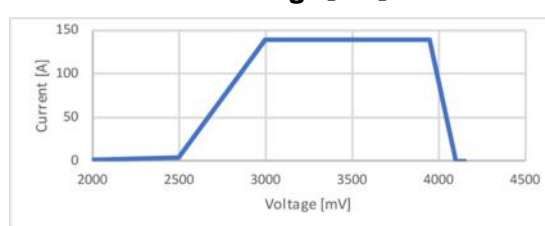
Battery type: 96 V; 5.0 kWh

Charge Current Derating [A] vs. Temperature [°C]
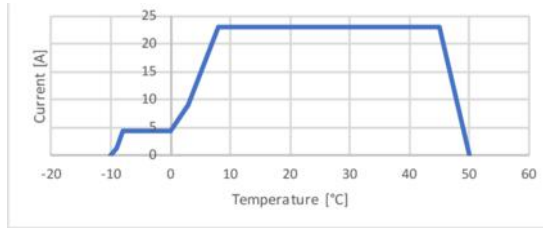
Charge Current Derating [A] vs. Voltage [mV]

Discharge Current Derating [A] vs. Temperature [°C]

Discharge Current Derating [A] vs. Voltage [mV]

Recuperation Current Derating [A] vs. Temperature [°C]
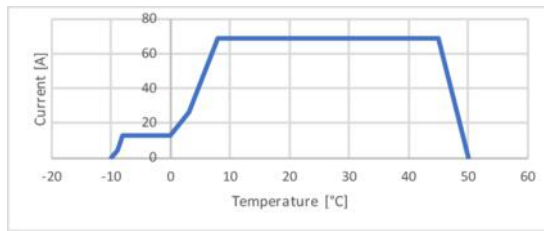

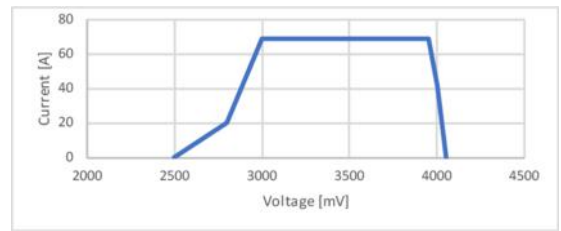### Recuperation Current Derating [A] vs. Voltage [mV]
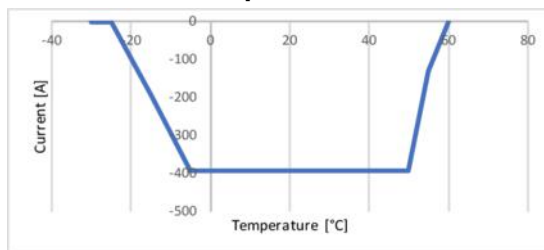
Battery type: 96 V; 10.0 kWh

**Charge Current Derating [A]
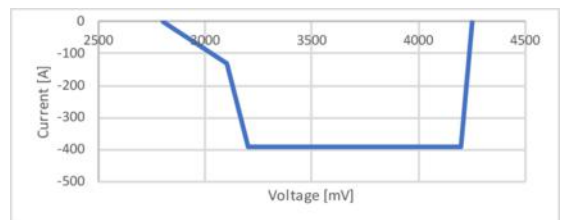vs. Temperature [°C]**

**Charge Current Derating [A]
vs. Voltage [mV]**

**Discharge Current Derating [A]
vs. Temperature [°C]**

**Discharge Current Derating [A]
vs. Voltage [mV]**

**Recuperation Current Derating [A]
vs. Temperature [°C]**

**Recuperation Current Derating [A]
vs. Voltage [mV]**

Battery type: 96 V; 15.0 kWh

Charge Current Derating [A] vs. Temperature [°C]

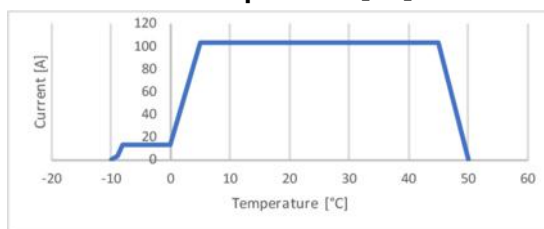### Charge Current Derating [A] vs. Voltage [mV]
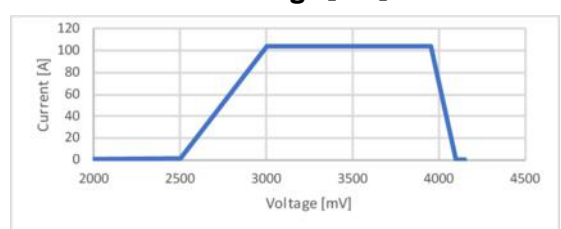

Discharge Current Derating [A] vs. Temperature [°C]

Discharge Current Derating [A] vs. Voltage [mV]

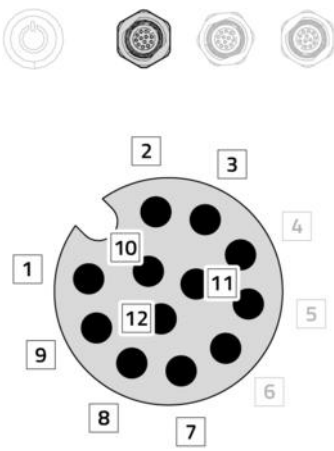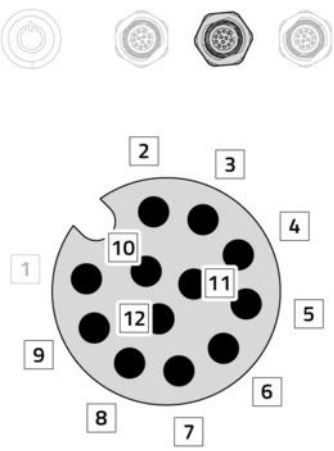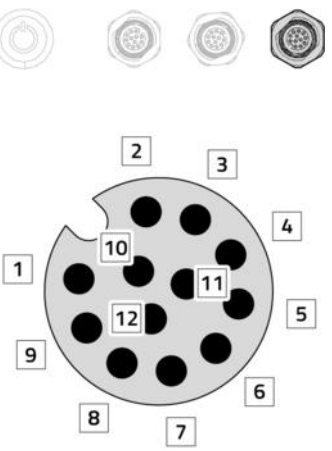### Recuperation Current Derating [A] vs. Temperature [°C]

Recuperation Current Derating [A] vs. Voltage [mV]

3.3.11 PIN assignment of the CAN connections

The pin assignment of the CAN connectors is as follows:

		CAN OUT	External Signals	CAN IN
1	bn	12 V-ON (KL 15)	(not used)	12 V-ON (KL 15)
2	bl	GND	Unlocl Relais Common	GND
3	we	HV-Enable	V_{out} Display (max. 150 mA!)	HV-Enable
4	gn	(not used)	LED + (red)	CAN1_H
5	rs	(not used)	Unlocl Relais NC	CAN1_GND
6	ge	(not used)	LED - (green)	CAN1_L
7	sw	CAN2_H (CAN internal)	Button -	CAN2_H (CAN internal)
8	gr	CAN2_L (CAN internal)	Unlock relay NO	CAN2_L (CAN internal)
9	rt	ID loop back (internal)	CP / Control Pilot	ID loop back (internal)
10	vt	ID-OUT (internal)	Button +	ID-IN (internal)
11	gr/rs	Interlock Bridge	PP / Charge enable	PLT / Interlock -
12	rt/bl	Interlock Bridge	Vehicle unlock	PLT+ / Interlock +

The illustrations show the sockets with a view of the outside.

3.3.12 Lithium Ion Battery

INFORMATION
The following information is an excerpt and translation from LG's English product specifications. If you need more information please contact support@eco-volta.com.

Nominal specification

| Type	Specification
Rated voltage	Average: 3,7 V
Standard charge	• Constant current: 0,5 C • Final current (shutdown): 0.05 C
Max. Charging current	1.0 C
Standard discharge	• Constant current: max. 1,0 C
Operating temperature during charging	• -10...0 °C: 0.1C (310 mA) • 0...+50 °C
Operating temperature during discharge	• -30...+60 °C
Storage temperature (30 % SOC)	• Up to 1 month: -30...+60 °C • Up to 3 months: -30...+45 °C • Up to 1 year: -30...+24 °C

3.3.13 Materials

The components of the evoTractionBattery are made of the following materials:

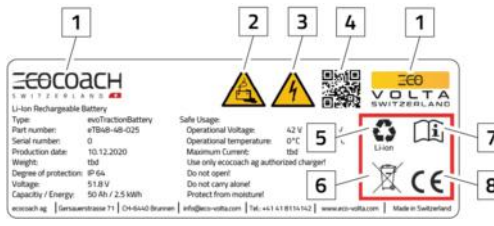| Component	Material
Spacer	Spring steel
	Polyacetat
	Polyamide / PA 6.6
	Polystyrene
Fasteners	Spring steel
	Steel
	Galvanized steel
	INOX
Sheet metal components	INOX, Aluminium
Bolt	
Cover	Hart-PVC
Seals	EPDM / EPDM25, kSil V-0 Soft
Flat gaskets	Rubber, steel
Milled parts	PVDF
Threaded rod	GFK
Insulation material	Insulating board OA 1200 blue
Voltage taps	Nickel plated steel
Busbar	Copper ETP
Cell holder	PC 88 FRD 1

3.4   Marking

Type plate
Identify your battery by the type label:
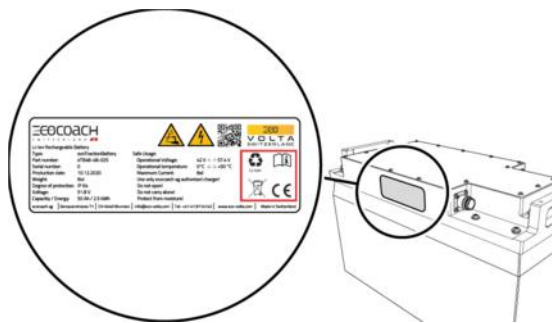
The type plate is located on the side of the battery housing.

Interpret the pictograms on the type label:

Type plate	No.	Meaning
	1	Manufacturer logo
	2	Warning of dangers due to battery leakage
	3	Warning of electrical voltage (>60 V DC)
	4	QR code (link to operating instructions)
	5	Recycling symbol for lithium-ion battery
	6	Recycling marking according to WEEE Directive 2012/19/EU (Do not dispose of battery in household waste)
	7	Observe operating instructions
	8	CE mark in validation (conformity with the European requirements for safety, health and environmental protection).

Interpret the text information on the type label:
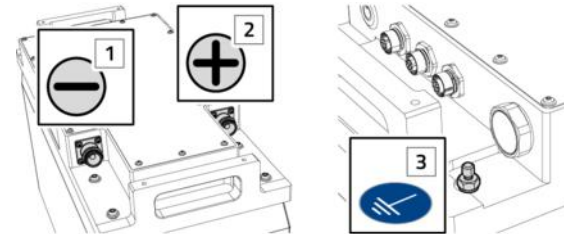
Type plate	Text	Meaning
	Li-Ion Rechargeable Battery	Classification
	Type	Type designation
	Part number	Part number
	Serial number	Serial number
	Production date	Date of manufacture
	Weight	Weight
	Degree of protection	Protection class
	Voltage	Rated voltage
	Capacity/Energy	Nominal capacity/Electr. Energy

Type plate	Text	Meaning
	Safe Usage	Notes on safe use
	Operational Voltage	Operating voltage
	Operational temperature	Operating temperature
	Maximum Current	Maximum output current
	Use only ecovolta authorized charger !	Only use chargers approved by ecovolta!
	Do not open !	Do not open the battery!
	Do not carry alone !	Do not carry battery alone!
	Protect from moisture !	Protect the battery from contamination!

Type plate	Manufacturer details
	Company name
	Street
	Country, zip code and city
	E-mail address
	Phone number
	Internet address
	Country of origin

Connection markings
Interpret the terminal markings on the battery case:

Position	No.	Meaning
	1	Battery negative terminal
	2	Battery positive terminal
	3	Ground connection for equipotential bonding conductors

4 Planning

Before installing an evoTractionBattery, the technical design of the system must be planned.

Safety instruction
This activity may be performed exclusively by specialized personnel (definition see Kapitel 1.2 "Target group").

Safety instruction
The evoTractionBattery is preferably installed and operated horizontally on the stand.
If the battery is to be installed lying on one side or standing on one end face: suitable devices should prevent the battery housing from being damaged due to specific areas of pressure.
The evoTractionBattery must not be installed upside down.

ℹ️ **NOTE**
Several batteries may be placed butt to butt next to each other.

Safety instruction
Do not stack multiple batteries on top of each other.

4.1 Notes on system integration

Observe the following instructions for integrating the battery into a system:

- CAN communication: For additional protection of active control software, the heartbeat signal of the battery management system (BMS) can be read out in order to switch off the battery in the event of a fault, e.g. via an external relay.
- The EMERGENCY STOP or EMERGENCY OFF function must be superordinate to all other control and operating functions.
- The conductor cross-section HV & LV must be designed according to the current load.
- Accident protection measures must be taken by the integrator.
- The safe state of the application is the responsibility of the system integrator.
- The electrical safety of the application is the responsibility of the system integrator.

4.2 Connection options

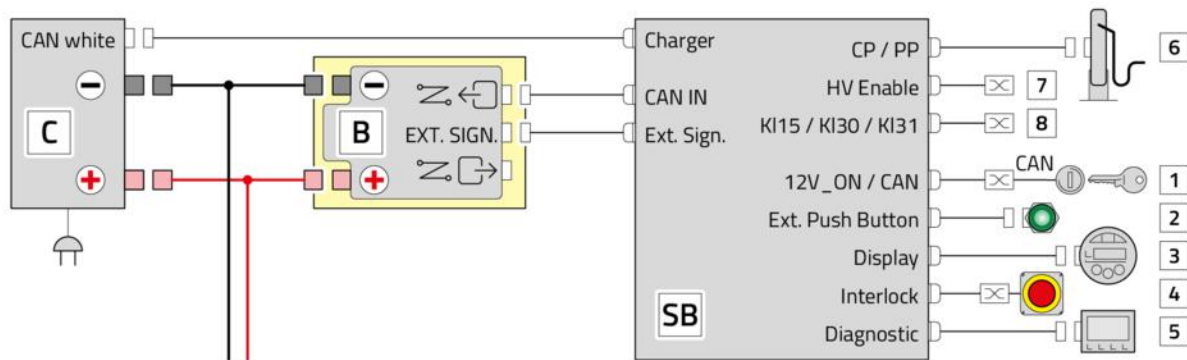There are several ways to connect the evoTractionBattery.

Depending on the application, the evoTractionBattery can be connected in parallel and/or in series. Communication takes place via the CAN connection of the master battery, which automatically controls the slave batteries.

Safety instruction
The connection option of the evoTractionBattery depends on the order and can also only be used for this option!

4.2.1 Standalone battery

This example shows the connection possibilities of a standalone battery:

No.	Meaning
C	Charger
B	Battery
SB	Signal distributor box
	External components:
1	Ignition lock
2	External battery button
3	Display
4	EMERGENCY STOP button
5	Diagnostic device
6	Communication charging station
7	HV Enable
8	Terminal connections (Kl. 15, Kl. 30, Kl. 31)

Pictogram	Meaning
	Fixed connection (cable bushing)
	Pre-assembled plug connection
	Individual connection (single wires)

4.2.2 Batteries in series connection

This example shows the connection possibilities of several batteries in series connection:

| No.	Meaning
C	Charger
M	Master battery
S1	Slave battery 1
Sx	Slave battery x
SB	Signal distributor box
	External components:
1	Ignition lock
2	External battery button
3	Display
4	EMERGENCY STOP button
5	Diagnostic device
6	Communication charging station
7	HV Enable
8	Terminal connections (Kl. 15, Kl. 30, Kl. 31)

Pictogram	Meaning
	Fixed connection (cable bushing)
	Pre-assembled plug connection
	Individual connection (single wires)

4.2.3 Batteries in parallel connection

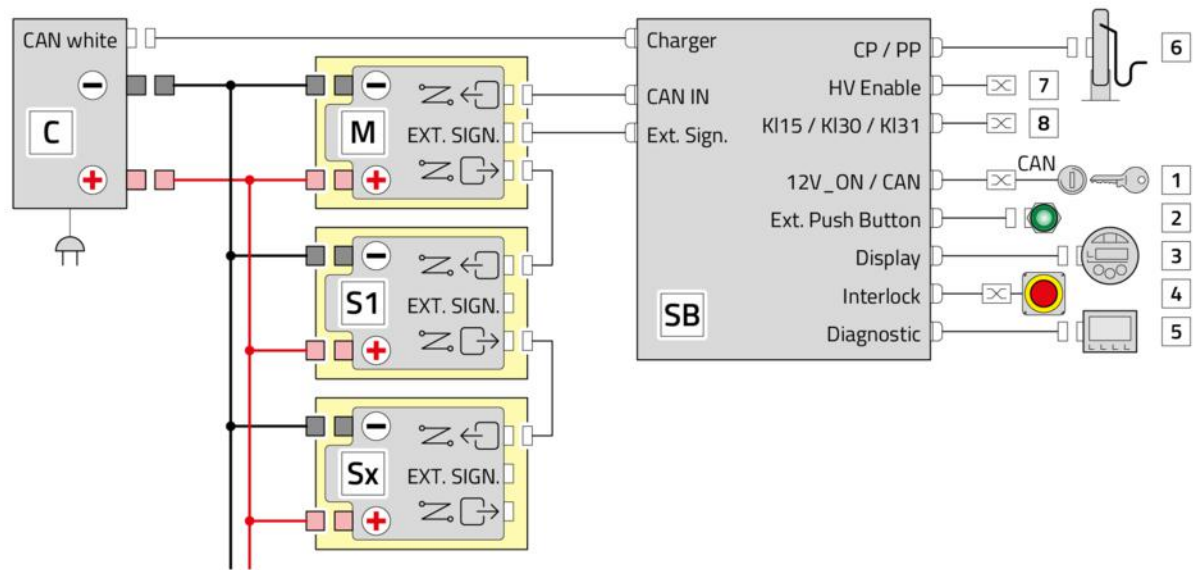This example shows the connection possibilities of several batteries in parallel connection:

No.	Meaning
C	Charger
M	Master battery
S1	Slave battery 1
Sx	Slave battery x
SB	Signal distributor box
	External components:
1	Ignition lock
2	External battery button
3	Display
4	EMERGENCY STOP button
5	Diagnostic device
6	Communication charging station
7	HV Enable
8	Terminal connections (Kl. 15, Kl. 30, Kl. 31)

Pictogram	Meaning
	Fixed connection (cable bushing)
	Pre-assembled plug connection
	Individual connection (single wires)

5 Installation and commissioning

The following is information on installing and commissioning the product.

5.1 Check installation requirements

The following are the requirements that are placed on the installation of the battery.

5.1.1 Requirements for stability

Make sure that the following requirements are met:

- The standing surface for the battery is level and sufficiently load-bearing.
- The installation location has a sufficiently resilient mounting option for the battery (e.g. straps or retaining brackets). The battery must be stable under all operating conditions, even in extreme situations (e.g. impact or rollover of the vehicle).
- With multiple batteries: The footprint is large enough for arranging all batteries in rows on one level. Do not stack the batteries on top of each other.
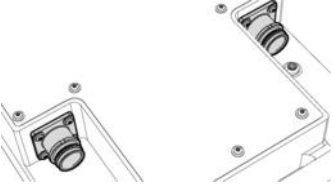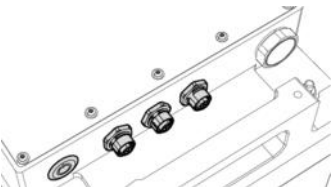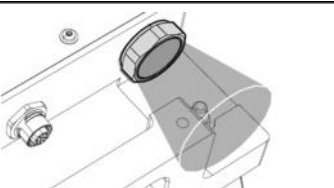
5.1.2 Requirements for protection against damage

Make sure that the following requirements are met:

- The battery and the wiring are protected by design measures against damage by moving or moving parts.
- For the cabling, sufficient space is available for safe installation without mechanical stress (observe bending radii).
- The battery is protected by design measures from being stepped on by persons or used as a climbing aid. The battery is not designed for mechanical load.

5.1.3 Requirements for ease of operation and maintenance

Make sure that the following requirements are met:

View	Request
	There is sufficient clearance around the battery terminals to allow the battery to be connected and disconnected without difficulty.
	Sufficient clearance is provided for access to the connections and operating elements.
	There is sufficient space around the bursting membrane for testing the membrane cap and bursting the membrane.

5.2   Install evoTractionBattery

Safety instruction
This activity may be performed exclusively by qualified and specialized personnel (definition see Kapitel 1.2 "Target group").

Requirements

⇨   The plan for the installation of the batteries is available.

⇨   Depending on the weight of the battery, you may need two people, a crane or similar.

⇨   Wear personal protective equipment during assembly and installation.

⇨   The environment is clean and dry.

Procedure

1.   Line the standing surface for the battery with a non-slip surface.

2.   Lift the battery into the vehicle by the carrying handles and place it on the stand feet.

Safety instruction
The evoTractionBattery is preferably installed and operated horizontally on the stand.
If the battery is to be installed lying on one side or standing on one end face: suitable devices should prevent the battery housing from being damaged due to specific areas of pressure.
The evoTractionBattery must not be installed upside down.

3.   Place additional batteries if necessary.

i	**NOTE**
	Several batteries may be placed butt to butt next to each other.

Safety instruction
Do not stack multiple batteries on top of each other.

4.   Secure the battery, e.g. with tension straps or retaining brackets.

✓   The battery is installed.

5.3 Connecting the evoTractionBattery

Safety instruction
• This activity may be performed exclusively by specialized personnel (definition see Kapitel 1.2 "Target group").
• Do not use multimeters for measurements. Use only measuring instruments explicitly provided by the legislator:
° Voltage test instrument
° Insulation test instrument

5.3.1 Connect battery terminals and equipotential bonding

Connect battery terminals
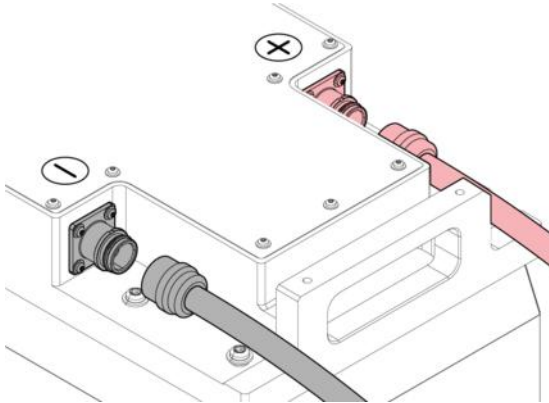
Connect the battery terminals.
Safety Instruction: The plugs must be inserted as far as they will go and then locked.

Connect equipotential bonding
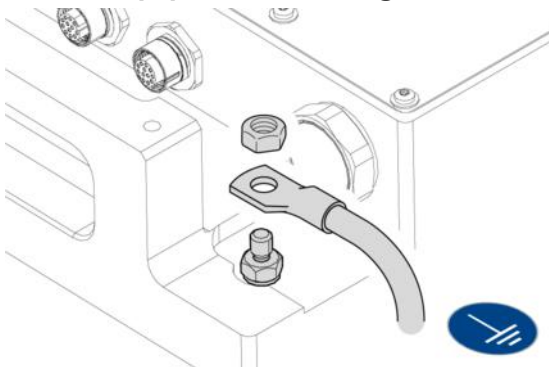
Connect the ground connection of the battery (POTENTIAL EQUALIZATION) per equipotential bonding conductor to the reference potential of the vehicle. Counter the ground connection of the battery with an open-end wrench.

Wire multiple batteries in parallel   **Wire multiple batteries serially**
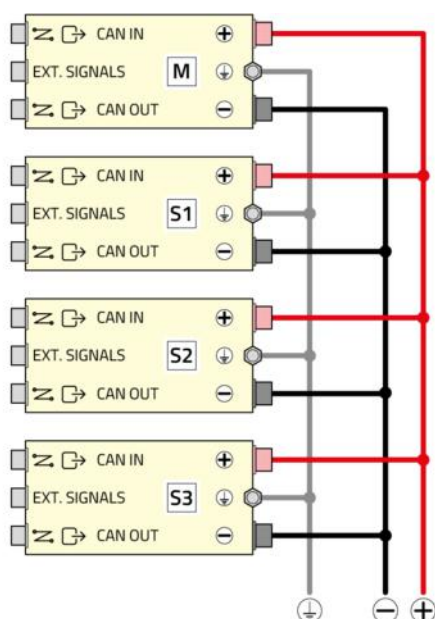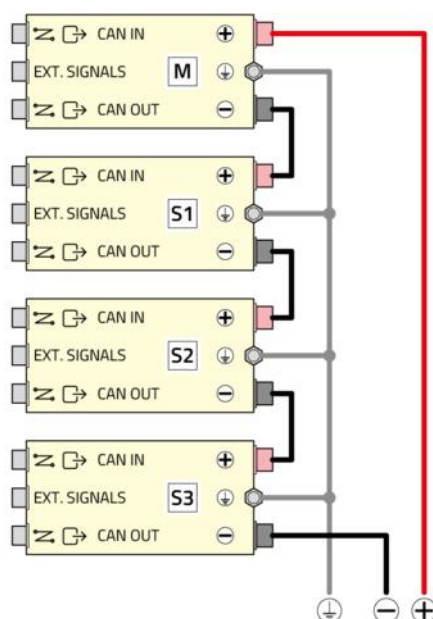
Wire the batteries in parallel or series.
See: "Connection options"

5.3.2 Connect charger

To a standalone battery   **To a built-in battery**
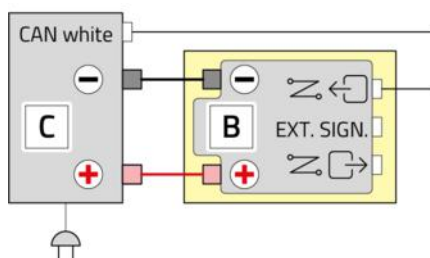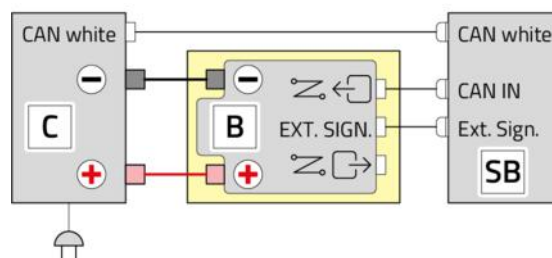
No.	Meaning
C	Charger
B	Battery
SB	Signal distributor box

5.3.3 Connect external components

All external components are connected via CAN bus to the signal distribution box, which is connected to the battery and to the charger.

A project-specific signal distributor box is supplied for each application.

The pictograms used in the following figures have the following meaning:

Pictogram	Meaning
	Fixed connection (cable bushing)
	Pre-assembled plug connection
	Individual connection (single wires)

Connect the signal distributor box to the battery and to the charger

Connect the signal distributor box to the battery and to the charger.	
C	Charger
B	Battery
SB	Signal distributor box
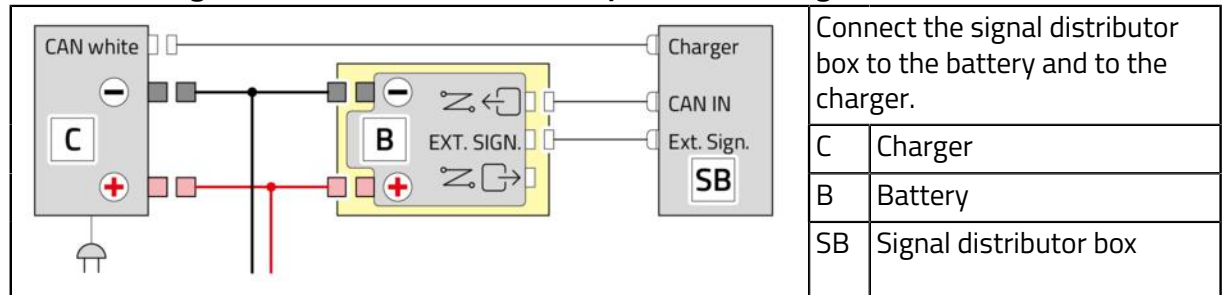
Connect ignition lock

Connect the ignition lock:		
1	green	12V_ON (Kl. 15)
2	white	CAN_H
3	brown	GND (cl. 31)
4	blue	CAN_L
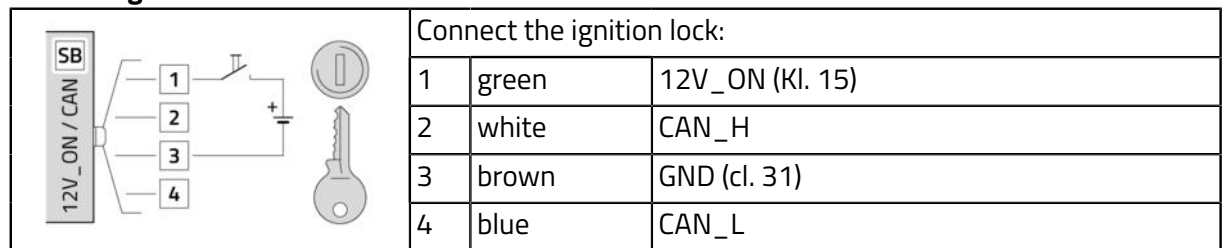
Connect external battery button

Connect the external battery button.
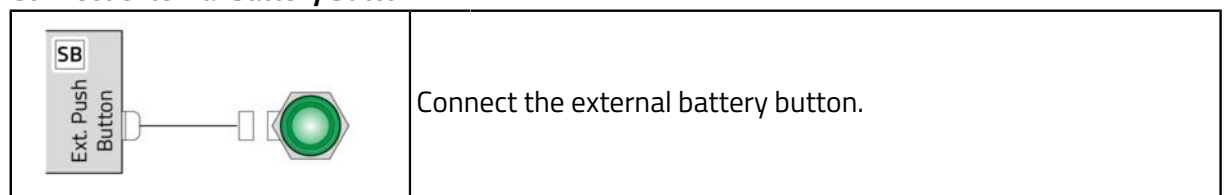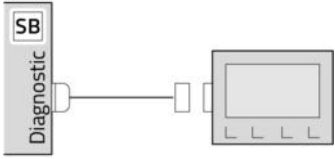
Connect display

Connect the display.
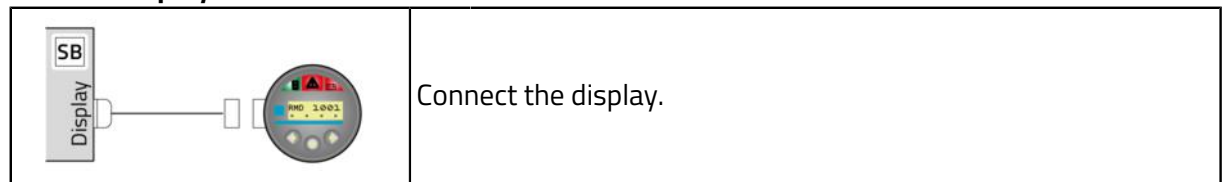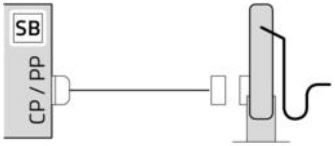
Connecting the EMERGENCY STOP button

Use a latching normally closed (NC) contact as the EMERGENCY STOP button. Connect the EMERGENCY STOP button:		
2	brown	Interlock (+)
4	green	Interlock (-)
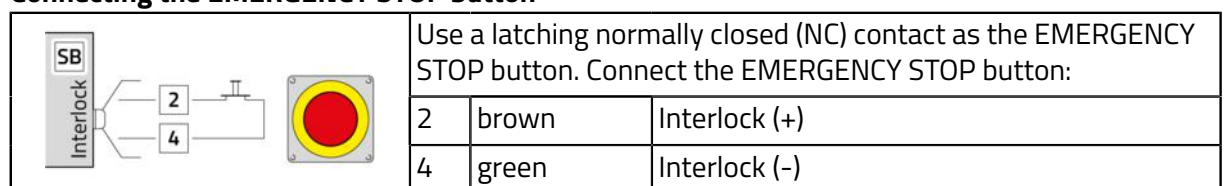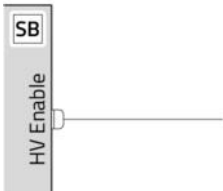
Connect diagnostic device

		Connect the diagnostic device.	
	1	(not occupied)	
	2	white	CAN_H
	3	brown	CAN_GND
	4	green	CAN_L
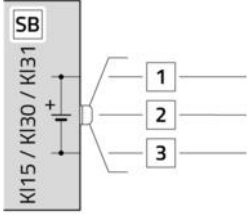
Connect communication line to charging station (optional)

		Connect the communication line to the charging station.	
	1	yellow	PP
	2	green	CP

Connect HV_Enable (optional)

		Connect the HV_Enable signal:	
	1	white	HV_Enable (low active)
	2	brown	Potential to GND line (non-floating)

Use terminals 15, 30 and 31 (optional)

		These connections can be used for customer applications.	
	1	green	+12 V (Kl. 30)
	2	white	Switching contact +12 V (Kl. 15)
	3	brown	GND (cl. 31)

5.3.4 Wire system for charging the vehicle battery at a charging station

The Battery Management System (BMS) supports PP/CP communication between the battery and the charging socket via the signal distribution box. This makes it possible to charge the battery at a charging station via a charging plug according to IEC 62196-2 (type 2).

For this, additional components must be provided by the customer:

VUB	Vehicle unlock button	Button to wake up the battery for charging and to stop the charging process
VUC	Vehicle unlock control	Circuit for controlling the electromechanical charging plug interlock
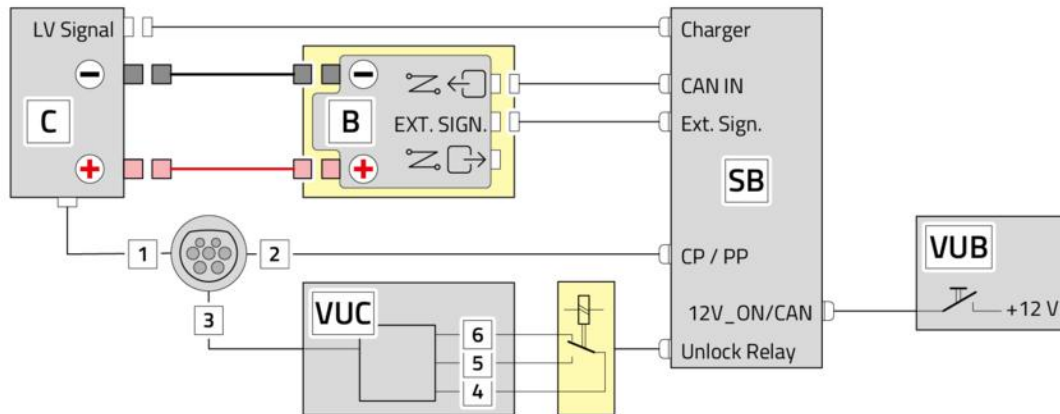
No.	Meaning
C	Charger
B	Battery
SB	Signal distributor box
VUB	Vehicle unlock button
VUC	Vehicle unlock control

No.	Meaning		
	Charging socket:		Vehicle unlock control (VUC):
1	Mains voltage	4	Common +12 V
2	CP/PP	5	NO = +12 V => Close interlocking
3	Charging plug interlock	6	NC = +12 V => Open interlock

About the function of the Vehicle unlock button (VUB)

With this button (normally open contact/NO) a +12 V pulse is given to 12V_ON to wake up the battery for charging or to end the charging process.

About the function of vehicle unlock control (VUC)

This circuit uses the relay switching contacts in the Battery Management System (BMS). It must be designed to detect the switching state of the relay and control the interlocking of the charging plug accordingly.

Safety instruction
The relay switching contacts may only be used to detect the relay switching state. They are not suitable for direct control of the charging plug interlock.

5.4 Switch on and switch off the battery

Depending on the firmware version of the battery, there are several ways to switch the battery on and off:

- On the battery pushbutton or on an external pushbutton
- Per 12V_ON signal
- Per CAN_ENABLE signal

Only one version can be active at a time.

For the pushbutton and 12 V version, the switch-on behavior can be supplemented in combination with a "low active" HV enable signal. More information on this in the following chapters.

5.4.1 Battery button displays

Regardless of the firmware version, the battery pushbutton always indicates the current operating status.
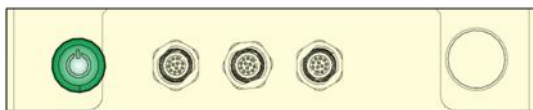
LED of the battery button		Meaning
🟢	Lights green	The battery is switched on and ready for operation.
🟢	Flashes green	The battery is in charging mode.
🔴	Flashes red	An error has occurred.

5.4.2 Precondition for continuous operation

In continuous battery operation, a short operating pause must be taken at least every 72 hours for technical reasons.

To do this, proceed as follows:

After a maximum of 72 hours: Interrupt continuous operation

1. Disable all ENABLE signals.
✓ The switch-off process of the battery management system (BMS) begins.
2. Wait at least 5 minutes.
✓ The battery management system (BMS) is completely switched off.

After the break in operation: Resume continuous operation

1. Enable all ENABLE signals.
✓ The battery management system (BMS) switches on again.
✓ The battery is ready for operation again for the next 72-hour cycle.

5.4.3 Switching the battery on and off at the battery button or at an external button

In this version, the battery is switched on and off either at the built-in battery button or at an externally connected button.

Switching operation
Switch on battery:
1. Press the button.
✓ The battery is woken up.
✓ The BMS is in IDLE mode.
✓ The LED is not yet lit.
✓ The battery voltage is not yet enabled.
2. Press the button again.
✓ The battery turns on.
✓ The BMS is in DRIVE mode.
✓ The LED of the battery button lights up green.
✓ The battery voltage is enabled.

In this state, the battery can be charged or discharged.

Switch off battery:
1. Press the button.
✓ The battery switches off.
✓ The BMS is in IDLE mode.
✓ The LED of the battery button goes out.
✓ The battery voltage is disconnected.
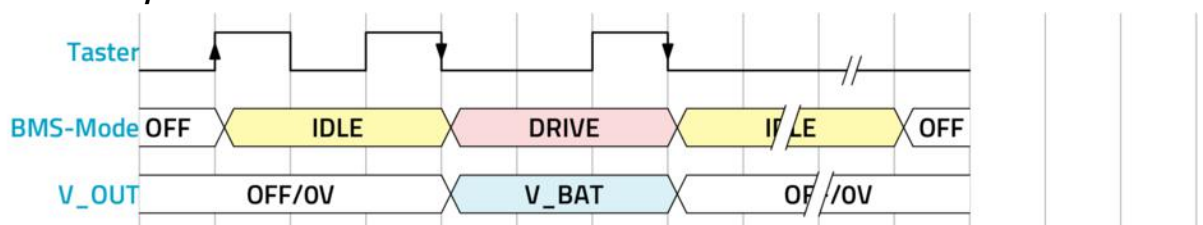
Functionality

In this version, the "low-active" HV-ENABLE signal has the following functionalities:
- If the battery is in IDLE mode (BMS is running, but battery voltage is not enabled), the HV-ENABLE signal can be used to switch the battery on and off.
- If the battery is in DRIVE mode (battery voltage enabled), the button can be blocked via the applied HV-ENABLE signal. This means that as long as the HV-ENABLE signal is active, the battery cannot be switched off. Only when the HV-ENABLE signal has been removed can the battery be switched off again via the pushbutton.

Mode of operation with HV_ENABLE signal and external pushbutton
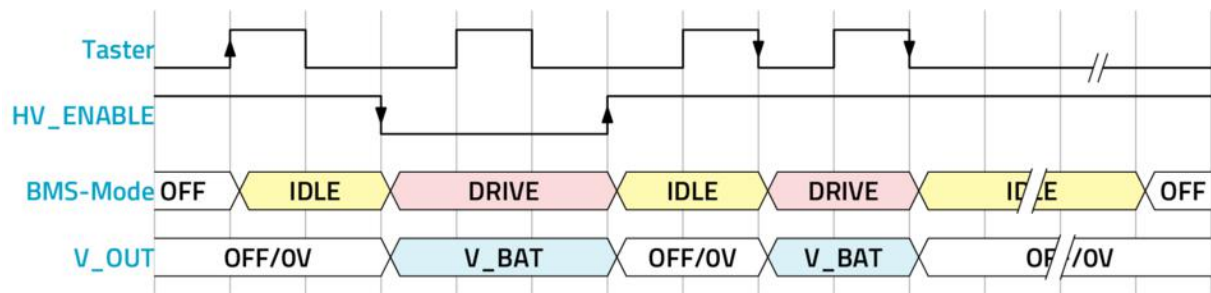
In order for the battery to change to CHARGE mode, the battery must be in DRIVE mode and recognize the communication of one of the supported chargers via CAN.

Alternatively, the battery can be set to CHARGE mode via the CAN bus. To do this, send the CAN message 0x100 with HV-ENABLE = 1 and CH-ENABLE = 1 to the battery while it is in DRIVE mode.

Safety instruction
If the battery is completely discharged, it is imperative that the 12V ON and HV ENABLE signals are removed from the battery immediately and that the battery is promptly set to min. 30% SOC to be charged.
If the 12V-ON or HV-ENABLE signal is not removed or the battery is not charged, there is a high probability of deep discharge.

Automatically switch off the battery

If the battery is in IDLE mode (BMS is running, but battery voltage is not enabled), the internal electronics will switch off completely after five minutes.

If the battery is in DRIVE mode (battery voltage enabled, but no power is drawn [current draw <=2A]), it will turn itself off after one hour.

5.4.4 Switch battery on and off via 12V_ON signal

In this version the battery is switched on and off by 12V_ON signal. This 12 V signal can come from the onboard 12 V starter battery via the ignition lock, for example.

Switching operation
Switch on battery:
1. Apply the 12V_ON signal to the battery.
✓ The battery turns on.
✓ The battery is in DRIVE mode.
✓ The battery voltage is enabled.
✓ The LEDs of the battery pushbuttons light up green.

In this state, the battery can be charged or discharged.

Switch off battery:
1. Remove the 12_ON signal from the battery.
✓ The battery switches off.
✓ The BMS is in IDLE mode.
✓ The LEDs of the battery pushbuttons go out.
✓ The battery voltage is disconnected.

Functionality

Safety instruction
If the battery is completely discharged, it is imperative that the 12V ON and HV ENABLE signals are removed from the battery immediately and that the battery is promptly set to min. 30% SOC to be charged.
If the 12V-ON or HV-ENABLE signal is not removed or the battery is not charged, there is a high probability of deep discharge.

If the battery is in IDLE mode (BMS is running, but battery voltage is not enabled), the internal electronics will switch off completely after five minutes.
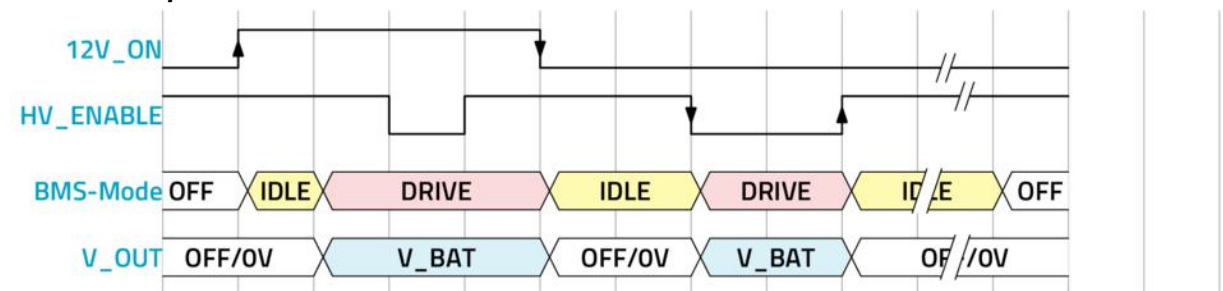
In this version, the "low-active" HV-ENABLE signal has the following functionality:

• If the battery is in IDLE mode (BMS is running, but battery voltage is not enabled), the HV_ENABLE signal can be used to switch the battery on and off. This means that the battery can be woken up by a short 12V_ON pulse (1…2 s) or by pressing the battery button and then set to DRIVE mode with the HV_ENABLE signal.

For the battery to enter CHARGE mode, the battery must be in DRIVE mode and detect communication from a supported charger via CAN. Alternatively, the battery can be set to CHARGE mode via the CAN bus. The CAN message 0x100 with HV_ENABLE = 1 and CH_ENABLE = 1 is sent to the battery while it is in DRIVE mode.

5.4.5 Switch battery on and off via CAN-ENABLE signal

In this version the battery is switched on with a combination of 12V_ON signal and CAN message. The 12V_ON signal wakes up the battery and the CAN message is used to enable the battery voltage.

It is important that the BMS receives the CAN message with the ID 0x100 at least once per second in this version, so that it does not fall into an ERROR state. If the battery is in ERROR state, the 12V_ON signal must be removed for a reset.

How the CAN messages are structured can be found in chapter "Structure of CAN messages"

Switching operation
Switch on battery:
1. Send on the CAN1 at least once per second a CAN message 0x100 with HV_ENABLE = 0 and CH_ENABLE = 0.
2. Apply the 12V_ON signal to the battery.
✓ The battery is in IDLE mode.
✓ The BMS is running.
✓ The battery voltage is not enabled.
✓ The LED of the battery button does not light up.
3. Send on the CAN1 at least once per second a CAN message 0x100 with HV_ENABLE = 1 and CH_ENABLE = 0.
✓ The battery turns on.
✓ The battery is in DRIVE mode.
✓ The battery voltage is enabled.
✓ The LED of the battery button lights up green.
   In this state, the battery can be discharged.
4. Send on the CAN1 at least once per second a CAN message 0x100 with HV_ENABLE = 1 and CH_ENABLE = 1.
✓ The battery changes to CHARGE mode.
✓ The battery voltage is enabled.
✓ The LED of the battery button flashes green.
   In this state, the battery can be charged.

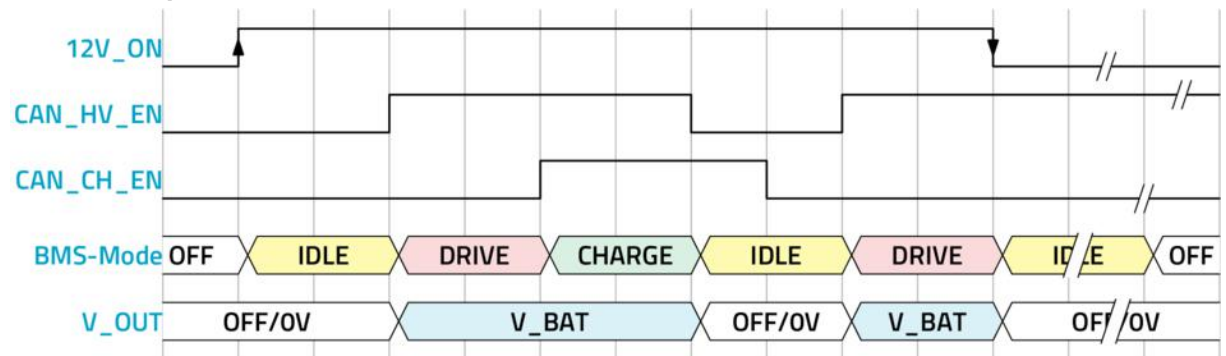**Switch off battery:**
1. Send on the CAN1 at least once per second a CAN message 0x100 with HV_ENABLE = 0 and CH_ENABLE = 0.
✓ The battery switches to IDLE mode.
✓ The BMS is running.
✓ The battery voltage is not enabled.
✓ The LED of the battery button goes out.
2. Remove the 12V_ON signal from the battery.

Functionality

Safety instruction
If the battery is completely discharged, it is imperative that the 12V ON and HV ENABLE signals are removed from the battery immediately and that the battery is promptly set to min. 30% SOC to be charged.
If the 12V-ON or HV-ENABLE signal is not removed or the battery is not charged, there is a high probability of deep discharge.

5.4.6 Structure of CAN messages

The battery has two CAN buses:

- CAN1: External bus for communication with the battery (baud rate = 500kbit/s)
- CAN2: Internal bus for communication between batteries

The following CAN messages are available on CAN1:

CAN ID	RX/TX	Name	Description
0x100	RX	SCU_BMS_batEnable	BMS Control message
0x101	TX	BMS_SCU_batStatus1	BMS status message (BMS_State, Interlock, Balancing, number of initialized masters)
0x102	TX	BMS_SCU_batStatus2	BMS status message (warnings, alarms and error messages)
0x103	TX	BMS_SCU_batLim	BMS Limit message (max. Discharge current, max. Charge/regeneration current)
0x104	TX	BMS_SCU_batVal1	BMS value message (battery voltage, battery current, highest and lowest cell temperature)
0x105	TX	BMS_SCU_batVal2	BMS value message (SOH, SOC, min./max. cell voltages)
0x106	TX	BMS_SCU_batVal3	BMS value message (drawn energy, used capacity)
0x107	TX	BMS_SCU_batStatus3	BMS status message (which battery pack has a fault?)
0x108	TX	BMS_SCU_batVal4	BMS value message (HV measurements)
0x109	TX	BMS_SCU_batVal5	BMS value message (current measurements, status of relay auxiliary contacts)
0x10A	RX	SCU_BMS_UDSin	UDS Service message
0x10B	TX	UDS_Out	UDS Service message
0x1806e5f4	TX	TC_Charger ping	Message is needed for charger recognition.
0x0A0	TX	Xepics BMS Limit	Message is needed for Xepics charger.
0x0A1	TX	Xepics BMS Request	Message is needed for Xepics charger.
0x6A1	TX	Zivan Charge Request	Message is needed for Zivan charger.
0x6C1	TX	Zivan Charge Request	Message is needed for Zivan charger.
0x776	TX	Zivan Charge Request	Message is needed for Zivan charger.

In the following the most important CAN messages are described in more detail, which are necessary for the operation of the battery.

For a detailed description of all CAN messages please refer to the CAN database file (dbc), which will be provided on request.

CAN message 0x100 SCU_BMS_batEnable (RX)
Length: 8 Byte
Timing: <1000 ms

Key Signals

Name	Byte	Start bit	Length [bit]	Comments
BMS_batHvEnable	0	0	1	HV enable Signal, 0 = Idle, 1 = Drive-Mode
BMS_batChEnable	0	1	1	Charge enable, 0 = idle, 1 = charge mode, with active charge derating curves

To ensure that the battery with the CAN firmware version works correctly and does not go into an ERROR state, the message with the CAN ID 0x100 must be sent on the CAN1 at least once per second.

After the battery has been switched on with the 12V_ON signal, the battery output can be controlled via the CAN message 0x100.

If the battery is to switch on, the bit "BMS_batHvEnable" is set to High (0x1). This turns on the battery and starts the pre-charge process. The battery is now in DRIVE mode and the battery voltage is enabled.

To switch off the battery again, the bit "BMS_batHvEnable" is set to Low (0x0). This will cause the battery to turn off. The battery is now in IDLE mode and the BMS is running, but the battery voltage is not enabled.

If both bits "BMS_batHvEnable" and "BMS_batChEnable" are set to high (0x11), the battery goes into CHARGE mode, in which the derating values specific to charging are active.

Safety instruction
If the battery is completely discharged, it is imperative that the 12V ON and HV ENABLE signals are removed from the battery immediately and that the battery is promptly set to min. 30% SOC to be charged.
If the 12V-ON or HV-ENABLE signal is not removed or the battery is not charged, there is a high probability of deep discharge.

CAN message 0x100 SCU_BMS_batEnable (RX)
Length: 8 Byte

Key Signals

Name	Byte	Start bit	Length [bit]	Comments,
batStatus1State *)	0	0	8	Indicates in which mode the battery is (Idle, Drive, Charge, Error...).
batStatus1InitMasters	1	0	8	Indicates how many active batteries have been detected.
batStatus1Hvi	2	2	1	Condition HV interlock: 0 = Interlock closed 1 = Interlock not closed
batStatus1Balancing	2	4	1	Indicates whether balancing is active: 0 = inactive 1 = active

*) This message announces information about the general operating condition of the battery.

Values of the signal batStatus1State:

Value	State
0x8	IDLE mode: The battery is ready to be switched on.
0x10	DRIVE mode: The battery voltage is enabled for discharging.
0x4F	CHARGE mode: The battery voltage is enabled for charging (charging derating curves active).
0x5A	ERROR mode: The battery is in error mode after an error. Reset required.

CAN message 0x103 BMS_SCU_batLim (TX)
Length: 8 Byte

Key Signals

Name	Byte	Start bit	Length [bit]	Comments,
batLimCurrentDchaMax	0	0	12	Maximum allowed discharge current
batLimCurrentRgnMax	1	4	12	Maximum permitted charge/recovery current
batLimVoltageMin	3	0	10	Absolute minimum battery voltage
batLimVoltageMax	4	2	10	Absolute maximum battery voltage

In order to operate the battery optimally, the maximum current limits must be read out via the CAN bus and adhered to. If cell voltages or cell temperatures are too low or too high, current limits are reduced to protect the battery. This means, for example, that the current is reduced at high cell temperatures to counteract further strong heating of the battery. Or, when the cell voltage is low, the current is reduced to prevent the cell voltages from dropping too much so that the entire remaining capacity of the battery can be accessed.

If the limits are not observed or exceeded, the battery switches off automatically.

The absolute maximum and minimum battery voltages must never be reached during normal operation. At these values, the BMS no longer connects the battery.
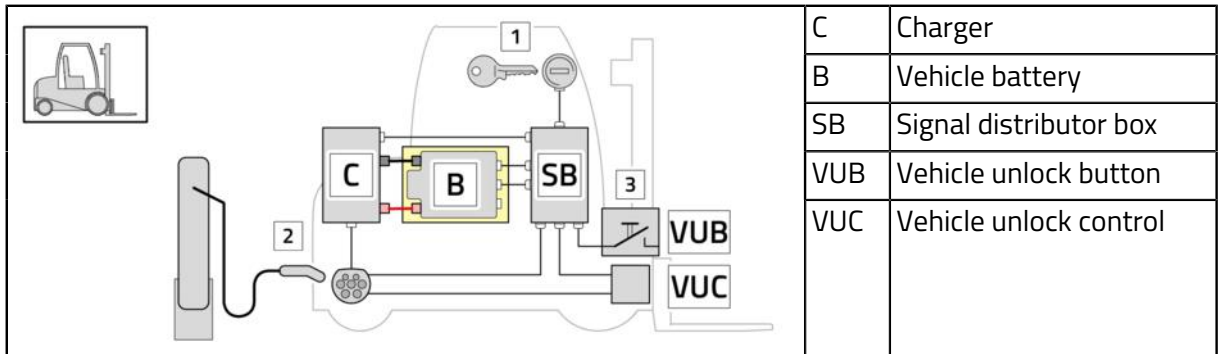
5.5 evoTractionBattery charging

Safety instruction
Only use chargers that use CAN communication to the BMS to charge the battery.

ℹ	**NOTE**
	No outgassing or other emissions are produced during charging.

5.5.1 Charging the vehicle battery at the charging station

	C	Charger
	B	Vehicle battery
	SB	Signal distributor box
	VUB	Vehicle unlock button
	VUC	Vehicle unlock control

Loading
1. Switch off the vehicle.
2. Connect the vehicle to the charging station.
3. Briefly press the Vehicle unlock button to wake up the battery.
✓ The vehicle battery is charged.
✓ The battery button flashes green.

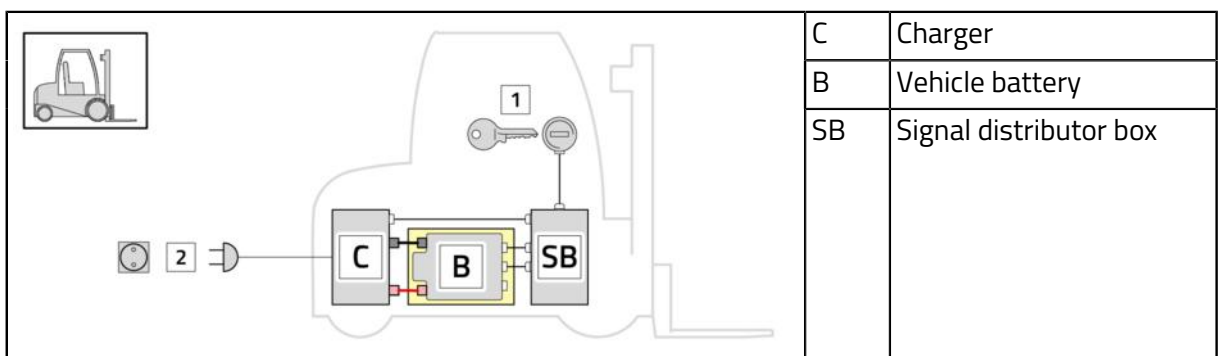| Safety instruction |
| --- |
| Do not disconnect the vehicle from the charging station during the charging process. |

Cancel charging process prematurely
1. Briefly press the Vehicle unlock button to release the charging plug lock.
2. Disconnect the vehicle from the charging station.

After loading
✓ As soon as the battery button lights up green, the vehicle battery is charged and ready for operation.
1. Briefly press the Vehicle unlock button to unlock the charging plug.
2. Disconnect the vehicle from the charging station.

5.5.2 Charging the vehicle battery on a built-in charger

	C	Charger
	B	Vehicle battery
	SB	Signal distributor box

Loading

1. Switch off the vehicle.

2. Connect the charger's power cord to the power outlet.

✓ The vehicle battery is charged.
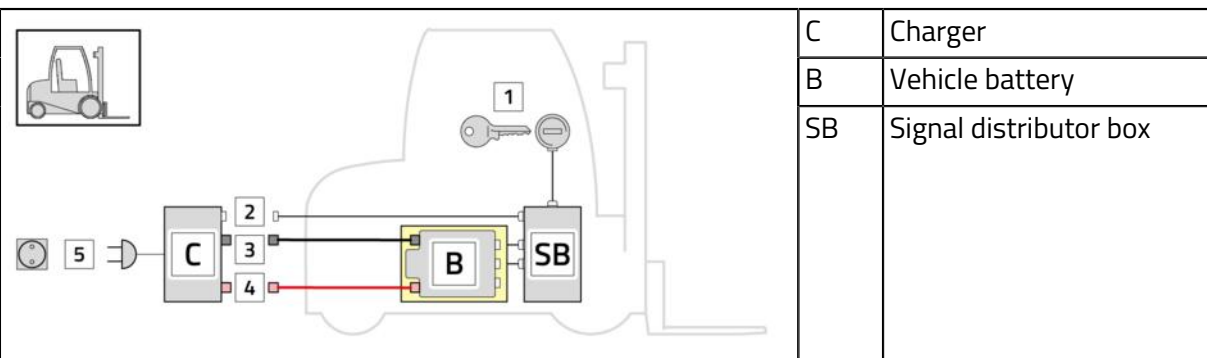
✓ The battery button flashes green.

Safety instruction
Do not disconnect the vehicle battery from the charger during the charging process.

After loading

✓ As soon as the battery button lights up green, the vehicle battery is charged and ready for operation.

1. Disconnect the charger from the power outlet.

5.5.3 Charging the vehicle battery on an external charger

Safety instruction
This activity may be performed exclusively by qualified and specialized personnel (definition see Kapitel 1.2 "Target group").

C	Charger
B	Vehicle battery
SB	Signal distributor box

Procedure

1. Switch off the vehicle.

2. Connect the "Charger" cable of the signal distributor box to the signal connector of the charger.

3. Connect the negative terminal of the vehicle battery to the negative terminal of the charger.

4. Connect the positive terminal of the vehicle battery to the positive terminal of the charger.

5. Connect the charger's power cord to the power outlet.

✓ The vehicle battery is charged.

✓ The battery button flashes green.

Safety instruction
Do not disconnect any cable connections during the charging process.

After loading

✓ As soon as the battery button lights up green, the vehicle battery is charged and ready for operation.

1. Disconnect all cable connections in reverse order.

5.5.4 Loading times

The most efficient charging time can be expected at 0% to 80% residual capacity of the evoTractionBattery. A deeply discharged evoTractionBattery must not be charged because the

cell chemistry would be damaged. Therefore, the BMS blocks the charging function if the evoTractionBattery is deeply discharged.

1 C Charging current corresponds to the charging current of the battery capacity. Example: A 50 Ah evoTractionBattery, which is equipped with 0,5 C is charged, charges with a charging current of 25 A.

5.6   Putting the vehicle into operation

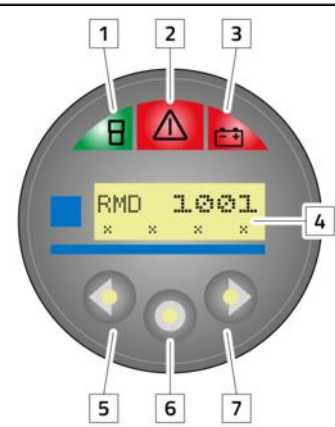| INFORMATION |
| --- |
| Vehicle and customer-specific information can be found in your vehicle documentation. |

6 Check system status and troubleshoot

The following is information on checking system health and troubleshooting.

The prerequisite is a connected display.

6.1 Controls and displays

The display has the following controls and indicators:

Figure	No.	Meaning
	1	LED (green): Load status
	2	LED (red): Warning
	3	LED (red): Discharge status
	4	Display for error messages
	5	Left arrow key: Scroll back to the last display
	6	Key: Display state of charge
	7	Right arrow key: Scroll to next ad

6.2 Read out system values

To scroll through the system values: Tap the "forward" and "back" arrow keys.

To display the charge status: Tap the middle button.

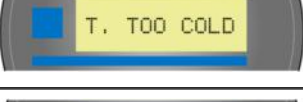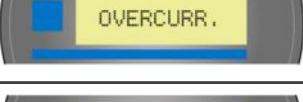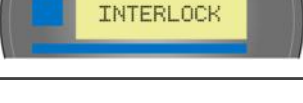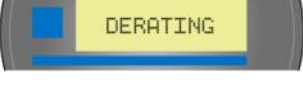| Figure	Display	Meaning
	SoC	State of charge [%].
	B.STATUS	Battery status: • Idle Mode • Drive Mode • Charge Mode • Error (error condition)
	BATTERY CHARGING/DISCHARGING	Battery current during charge/discharge [A].
	BATTERY HIGHEST TEMP.	Highest battery temperature [°C]
	CELL HIGHEST VOLTAGE	Highest cell voltage [V]
	CELL LOWEST VOLTAGE	Lowest cell voltage [V]
	BATTERY VOLTAGE	Total voltage of the battery [V]
	MAIN MENU	Main menu

6.3 LED indicators interpret
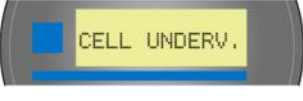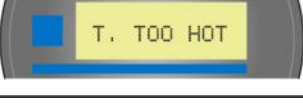
The LED indicators have the following meaning:
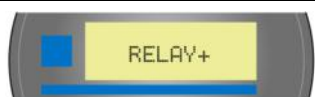
Figure	LED	Meaning
	lights	The battery is fully charged (SoC = 100 %).
	flashes	The battery is charged.
	lights + beep	At least 1 error has occurred.
	lights	The battery charge is low. SoC < 20 %
	flashes	The battery is empty. SoC < 10 %.

6.4 Detect and fix errors

Display	Meaning
	If the red LED lights up and a signal tone sounds, then there is at least one error.

The display shows the cause of the error. Proceed as follows to troubleshoot the problem:

Display	Error cause	Troubleshooting
CELL OVERV.	The cell voltage is too high.	• Discharge the battery.
CELL UNDERV.	The cell voltage is too low.	• Wait a few minutes. • Charge the battery.
T. TOO HOT	The battery temperature is too high.	• Reduce the ambient temperature. • Allow the battery to cool down.
T. TOO COLD	The battery temperature is too low.	• Ensure that the ambient temperature is sufficient.
OVERCURR.	An excessive discharge current has occurred.	• Reduce the discharge current.
INTERLOCK	Faulty plug connection	• Check and correct all plug connections. • Start the battery.
DERATING	The battery was operated outside the battery parameters.	• Check and correct the ambient temperature. • Reduce the charge or discharge current.

Display	Error cause	Troubleshooting
		• When the battery is discharged: After waiting a few minutes, charge the battery. • When the battery is fully charged: Discharge the battery.
RELAY+	Error in HV relay (+)	• Switch off the battery. • After waiting for 1 minute, start the battery.
RELAY-	Error in HV relay (-)	• Switch off the battery. • After waiting for 1 minute, start the battery . If the error is still present after a reset, the HV relay is defective. • Have the defective HV relay replaced.
RELAYS	Error in both HV relays (+ and -)	• Switch off the battery. • After waiting for 1 minute, start the battery.
CAN ERROR	CAN communication is interrupted.	• Check and correct the CAN cables and connectors.
PRECHARGE	Erroneous pre-charging	• Check if there is a connection between + and - or if there is a load there. This may prevent the pre-charging.. • If the pre-charge is only successful after several attempts, the capacity of the system is too large (> 15mF) and must be reduced.

7 Maintenance

The following is information on the maintenance of the product.

7.1 Maintain and service

Maintenance plan

Adhere to the following maintenance schedule:

Maintenance interval	Activity
As needed	see "Clean battery housing and installation location"
At each cleaning, at least monthly	see "Check battery housing"
	see "Check battery mounting"
	see "Check electrical connections for tight fit"
	see "Check cable"
	see "Check safety markings and type plate"
	see "Check safety label"
	see "Check optical display"

Clean battery housing and installation location
- Clean the battery housing with a dry or damp cloth.
  Do not use aggressive or abrasive cleaning agents.
- Clean the installation site of the battery with dry aids.

Check battery housing
- Inspect the battery case for external abnormalities such as. B.:
  - Material abrasion on the surface
  - Cracks in battery case
  - Thickening of the battery case

- If the battery case shows any external abnormalities:
  - Put the battery out of service.
  - Secure the battery against start-up with a warning label.
  - Arrange for professional replacement of the battery.
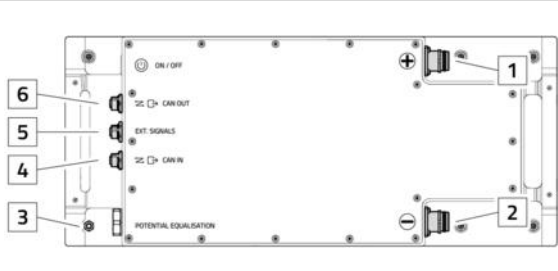
Check bursting membrane
- Check the bursting membrane for proper condition.
  In case of abnormalities: Contact the manufacturer support.

Check battery mounting
- Check the battery mounting for secure, tight fit.
- If the battery fastening is loose:
  - Tighten the screw connections again.

- If the fittings cannot be tightened because they are overtightened or worn:
  - Replace the screw fittings with new ones.

Check electrical connections for tight fit
- Check all electrical connections for tightness according to the table.
- Tighten any loose connections.
- If connections cannot be tightened:
  Arrange for professional replacement of the connections.

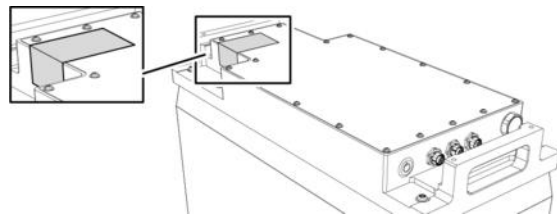| 1	Positive pole, red
2	Minus pole, black
3	Equipotential bonding conductor
4	CAN input
5	Ext. Signals
6	CAN output

Check cable
- Check the cables for external anomalies such as. B.:
  - Pinch points
  - Broken or damaged insulation
  - Kinks in the cable routing
- If a cable has any external abnormalities:
  - Set the system out of operation.
  - Secure the system with a warning against setup.
  - Arrange for professional replacement of the wiring.

Check safety markings and type plate
- Check the safety markings and type label on the battery case.
  The safety markings must be complete and clearly visible. To the safety markings see "Marking" page 41.

Check safety label

Position	Activity
	Check the safety label on the battery. The safety label must be undamaged.

If the safety label is damaged, then the battery may have been opened and needs to be checked.
  - Set the system out of operation.
  - Secure the system with a warning against setup.
  - Arrange for the battery to be professionally checked.

Check optical display
- Check the illumination of the battery button for function.

7.2   Replace evoTractionBattery

INFORMATION
• The replacement battery must be configured according to the battery to be replaced. • Master/slave setting, node ID and baud rate of the replacement battery must match the battery to be replaced. • The voltage of the replacement battery must correspond to the voltage of the battery to be replaced (max. +/– 2 V difference).

Requirements
⇨ Wear personal protective equipment during assembly and installation.
⇨ The environment is clean and dry.

Procedure
1. Switch off the battery group.

Safety instruction
The main relay of the battery must be open for this operation, there must be no voltage at the power connector of the battery.

2. Disconnect and remove the power cable of the battery to be replaced.
3. Disconnect and remove the signal cable of the battery to be replaced.
4. Remove the ground connection on the housing.
5. Remove the battery to be replaced.
6. Install replacement battery.
7. Reattach the ground connection to the housing.
8. Plug the signal cable into the spare battery.
9. Plug the power cable into the spare battery.
10. Battery compound can now be switched on and used.

Safety instruction
If there is a voltage difference between the spare battery and the remaining batteries, this will result in a limitation of the capacity until the balancing process of the battery is completed.

7.3 Power/signal cable replacement

INFORMATION
• The replacement cables must meet the requirements.

Requirements

⇨ Wear personal protective equipment during assembly and installation.

⇨ The environment is clean and dry.

Procedure

1. Switch off the battery group.

Safety instruction
The main relay of the battery must be open for this operation, there must be no voltage at the power connector of the battery.

2. Loosen and remove defective power cable and/or signal cable.

3. Connect new power cable and/or signal cable to the battery pack.

4. Switch on the battery network.

✓ The cables are replaced and the battery compound can be used again.

7.4 Accessories and spare parts

Accessories and spare parts are obtained from:

ecovolta AG
Gersauerstrasse 71   +41 41 811 41 42
6440 Brunnen   info@eco-volta.com
Switzerland   eco-volta.com

7.5 Service, maintenance and support

Service, maintenance and support are provided by ecovolta AG and their partners.

8   Disposal and recycling

Do not dispose of the battery in household waste or other unsorted waste.
Take the battery to the local recycling system for used batteries.
If you have any questions about the materials and ingredients used, contact the manufacturer.

The packaging materials are recyclable. Please do not throw the packaging into the household waste, but reuse it or return it separately according to the local recycling system.