

INSTRUCTIONS FOR

PERFEKTUM LITHIUM BATTERY



INSTRUCTIONS FOR USE

Dear Customer,

Thank you for purchasing Perfektium Battery. We invite you to read very carefully the following instructions presented in order to prevent and avoid possible damage when using the battery. Any damage that may be caused by disregard of the instructions and advice for use will not be covered by our warranty and we decline any responsibility.



General information

In order to ensure proper and safe use of the lithium battery, please read this instruction on the lithium battery. This instruction contains all information necessary to install, use, and maintenance. All specified safety instructions and directives are prerequisites for safe work and must be observed. The illustrations in this instruction are provided for basic understanding and may differ from the actual version.

CATALOG

1. Introduction	04
1.1 Product description	04
1.2 Product characteristics	04
1.3 Terminology	05
1.4 Identification	05
2. Warning	05
2.1 Anthropogenic factors	05
2.2 External factors	06
2.3 Improperly use factors	06
3. Technical information	06
3.1 Environmental conditions	06
3.2 Maximum battery wiring recommendation	07
3.3 Heating film technology	07
3.4 Reset button	08
3.5 Power indicator	08
4. Safety instructions and safety precautions during installation	09
4.1 General information	09
4.2 Correct behavior in emergency situations	10
4.3 Correct behavior in the event of a fire	10
4.3.1 Extinguishing	10
4.3.2 Fire fighting instructions	10
4.3.3 Effective handling of accidents	10

5. Installation ----- 11

5.1 General information----- 11

5.2 Preparing the lithium-ion battery for use ----- 12

5.3 Connection cable ----- 12

5.4 Disconnecting the lithium-ion battery ----- 12

6. Using battery ----- 13

6.1 General information----- 13

6.2 Charging the battery ----- 13

6.3 Bluetooth data connection ----- 14

7. Inspection, cleaning, and maintenance ----- 14

7.1 General information ----- 14

7.2 Inspection ----- 14

7.3 Cleaning ----- 15

7.4 Maintenance ----- 15

8. Storage ----- 15

9. More information ----- 15

1. Introduction







1.1 Product description

Lithium batteries are certainly the best alternative to lead batteries because they have a stable voltage supply even under heavy load. In addition to its extremely high weight advantage, it also offers a huge reserve of energy. In the first place, the lithium battery is designed as power supply battery, e.g. for Motorhomes and caravans, Photovoltaics, Solar systems and renewable energies, High performance traction, Fishing, electric boat engines and depth sounders Emergency power supply and Uninterruptible power supply (UPS) Mobile homes and leisure.

The battery must not be used for any applications other than those described in this user manual. Any other use of the lithium battery constitutes improper use resulting in invalidation of product warranty. Perfektium assumes no liability for damages caused by improper use, wrong application or careless handling of the lithium battery. Please read this user manual carefully and completely prior to unpacking and using the product.

A technical data sheet and a material safety data sheet are available from Perfektium as additional documents. The provisions specified in both these data sheets must be strictly observed at all times.

1.2 Product characteristics

-  **High performance traction**
Especially for mobile or stationary use with the highest requirements.
-  **Safest lithium (LiFePO4) technology**
Lithium-iron-phosphate, no gas, no danger of explosion or fire.No need maintenance.
-  **Long service life**
Maximum service life with more than 4000 cycles, even with regular deep dis-charge.
-  **High discharge current**
High discharge performance without voltage drop for large consumers such as coffee machines and air conditioning systems.
-  **Light weight**
Up to 70% weight savings compared to lead-acid batteries.
-  **Low automatic discharge**
Stored / unused, only about 3% per month.

1.3 Terminology

Service Life Expected battery lifespan if all provisions specified in this user manual are observed.

SoC State of Charge [%].

BMS Battery Management System.

**The internal Battery Management System is sophisticated and provides extra safety features. It is not recommended to wire the batteries in series and parallel. It will harm the batteries over time. Note the max drain on batteries per battery specifications.*

1.4 Identification

	Warning. Follow the instructions.
	Follow the instructions for safe use. Follow the instructions on the battery and in the user manual.
	Fire, open light and smoking prohibited! Avoid sparks when handling cables and short circuits.
	Not waterproof
	Note the temperature
	Conformity mark
	Product safety performance testing and certification from Underwriter Laboratories Inc.

	Batteries marked with the recycling symbol must be returned to recognized recycling centers.
	This product or parts of this product may be recycled
	Product has Bluetooth function
	Transport Safety Certified
	Restriction of Hazardous Substances
	Quality Management System Certification
	Material Safety Data Sheet

2. Warning

! Lithium-ion cells and battery packs may get hot, explode or ignite and cause serious injury if exposed to extreme conditions. Be sure to follow the safety warnings listed below:

2.1 Anthropogenic factors

- Do not put metal objects near the battery
- Do not smoke around the battery
- Do not allow minors to approach the battery

2.2 External factors

- Do not place heavy objects on the surface of the battery
- Do not pierce the battery with a nail, hit the battery with a hammer, step on the battery or otherwise subject the battery to strong impact
- Do not expose the battery to moisture or rain or water
- Do not put the battery in a high-temperature environment
- Do not place the battery in a high-voltage environment


2.3 Improperly use factors

- Do not disassemble or modify the battery
- Do not connect to an alternator or non-smart charging system, only use an approved LiFePO4 battery charger
- Do not use any metal objects (such as wires) to connect the positive and negative poles of the battery to each other
- Do not use LiFePO4 batteries with any other types of batteries
- Do not continue to use the battery when the battery emits peculiar smell, heat, discoloration or deformation, or other abnormalities

3. Technical information

Battery Management System.

3.1 Environmental conditions

 **Warning!** The lithium battery may only be used under the conditions specified in this instruction. Using the lithium battery under conditions outside the limits specified in this user manual may result in personal injuries and damage to the battery.

The lithium battery must always be kept in a well ventilated, dry, clean and dust-free environment. Never expose the battery to fire, water or solvents.

Operating temperature range during charging	0°C ~ 45°C
Operating temperature range during discharging	-35°C ~ 60°C
Storage temperature range	- 35°C ~ 60°C(≤1 month) 5%-75%RH - 10°C ~ 45°C(≥3 month) 5%-75%RH 15°C ~ 25°C (Recommend Temperature) 5%-75%RH
Recommended relative humidity during storage	5%-75%RH

Vibration and impact resistance:

Tested according to UN38.3

- ★ At very low temperatures, battery capacity / performance may be reduced.
- ★ Long-term storage outside recommended temperature range may reduce the battery service life.

3.2 Maximum Battery Wiring Recommendation

- ★ PB Series: 4 Parallel & 4 Series Connection
- ★ PF Series: 4 Parallel / 4 Series Connection
- ★ PL Series: 4 Parallel Connection Only

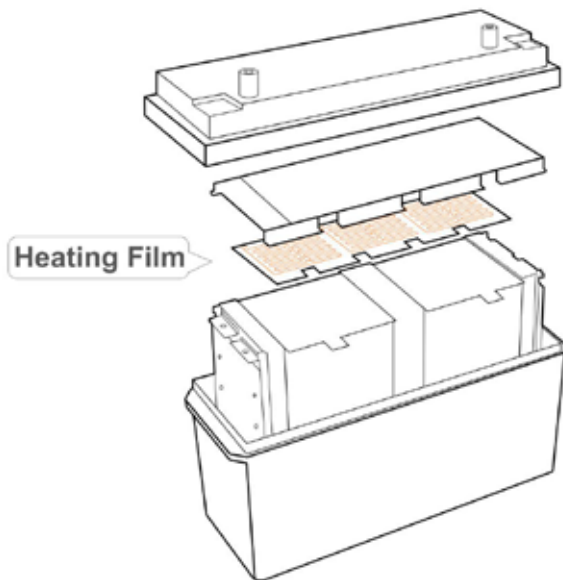
3.3 Heating film technology (PF Series)

The Perfektium lithium battery PF series has a heating film and is suitable for extreme environments, event at -35°C.

! PB and PL series without heating film technology.

- ★ The heating film is made of IP material, the material is thin, and it is attached to the surface of the cell for uniform heating. Make sure that the batteries are heated synchronously to reach thermal equilibrium.
- ★ The BMS has a heating control function, the heating and electricity is obtained from the charger to ensure that the battery itself is not consumed.

- ★ For the ambient temperature, $-10^{\circ}\text{C} \leq T \leq 0^{\circ}\text{C}$,
When the charger output current $I < 0.07c$, do not charge, do not heat.
When the charger output current $I > 0.07c$, turn on heating to 5°C to charge.
- ★ $T > 0^{\circ}\text{C}$,
No heating, direct charging. The last but not least, the heating film is equipped with a temperature control switch of 65°C .
When thermal runaway occurs, the heating current can be cut off to improve safety.



3.4 Reset button

When the battery is over-used, BMS protects the battery from short-circuit, and the reset button helps to turn off the protection state.

3.5 Power indicator

Display the remaining battery capacity, 4 Power indicator, each indicator represents 25% power.

4. Safety instructions and safety precautions during installation

4.1 General information

For reasons of safety, any installer or user must become familiar with following safety instructions and safety precautions before using the lithium battery:

- ★ Over voltage, wrong wiring, reverse polarity of the terminals or short circuits between the terminals may damage the lithium battery which can be extremely dangerous.
- ★ The lithium battery must not be installed on flammable material or flammable ground as well as in places where flammable materials are stored or in other environments that are liable to catch fire.
- ★ Before starting to work on the lithium battery or make measurements, the vehicle ignition must be turned off. The connecting terminals of the vehicle must be disconnected from any electric load.
- ★ The safety instructions specified in the user manual must be observed.
- ★ Lithium batteries must not be exposed to heat or fire. During storage, lithium batteries must be protected from direct sunlight.
- ★ In case of exceptional heat development during operation, the lithium battery must be disconnected and removed from the vehicle. Inform your dealer immediately.
- ★ The lithium battery must never be short-circuited. If several lithium batteries are stored in a compartment, it must be ensured that the batteries cannot short-circuit each other. It must also be ensured that the batteries cannot be short-circuited by any other electro-conductive objects.
- ★ Lithium batteries must be protected from mechanical impacts.
- ★ The lithium battery is usually charged by the electrical system of the vehicle. If the battery is charged outside of the vehicle, only those chargers can be used that are recommended by the battery distributor. Alternatively, the battery can be charged by specially skilled personnel on battery terminals and connection.
- ★ Lithium batteries of different brands, capacity, size or type must not be connected with each other.
- ★ As a matter of principle, solely the lithium battery type recommended by the vehicle manufacturer must be installed.
- ★ Lithium batteries must always be kept dry and clean.
- ★ Dirty battery terminals must be cleaned with a dry and clean cloth.
- ★ Corroded battery terminals must never be used.
- ★ The original product documents (such as this user manual) must be kept until the lithium battery is disposed of properly.
- ★ The lithium battery must be used for the designated application only.
- ★ During longer periods of non-use, the lithium-ion battery should be removed from the vehicle to reduce self-discharge. In doing so, the provisions of the vehicle manufacturer must be observed. It must also be noted that the terminals of the lithium battery have to be covered with protective caps or with any other appropriate insulating material (e.g. insulating tape) in order to prevent short circuits.
- ★ At the end of its service life, the lithium-ion battery must be disposed of according to legal provisions.

4.2 Correct behaviour in emergency situations

- ★ For correct behaviour in emergency situations, the information in the separately provided safety data sheet must be observed.
- ★ In the event that a user comes into contact with substances from inside the battery, the following measures are recommended and please consult a doctor in time:
Inhalation: Leave the contaminated area;
Eye contamination: Rinse affected eye for 15 minutes with clean water;
Skin contact: Clean the affected area with water and soap;
Swallowing.

4.3 Correct behaviour in case of fire

4.3.1 Fire extinguishing

In case of a burning lithium-ion battery any type of extinguisher can be used, preferably an ABC powder extinguisher. This type of extinguisher can be used to extinguish other burning materials involved in the fire as well. In addition, the fire can also be extinguished with plenty of water (cooling effect).

4.3.2 Fire fighting instructions

In case of fire, the vehicle ignition must be turned off if possible without risk for the user. Lithium-ion batteries must be removed from the fire area if possible without risk. Water is useful to cool down the lithium-ion batteries and the fire area. In case of a burning lithium-ion battery, the fire department must be alerted in any case, even if the fire could be successfully extinguished since a renewed flare-up of the fire cannot be excluded. If possible, the extinguished lithium-ion battery should be observed until the fire department arrives.

Attention must be paid to the fact that new substances are created in the event of a fire and therefore the fire residues must be inspected by a specialist and disposed of accordingly. Only carry out fire fighting measures if there is no danger to life and limb. Otherwise leave the danger zone immediately and inform the fire department.

4.3.3 Effective handling of an accident


Persons must be taken out of the danger zone immediately. In any case the fire department / police must be alerted. First responders and emergency services must be informed of the presence of a lithium-ion battery in the vehicle.

If the lithium-ion battery has been flooded or immersed in water, the following measures are recommended: In case of flooding, first switch off the power supply to the lithium-ion battery. The flooded lithium-ion battery must not be reused and must be disposed of in accordance with legal requirements.

5. Installation

5.1 General information

- Do not reverse the polarity! The battery has safety protections but damage may occur. Voids warranty.
- Check battery voltage before use. Make sure the battery voltage matches that of the battery charger and load. Properly size your battery cables for your application.
- Battery cables must be crimped or soldered. Soldered connections alone are not acceptable. High quality, UL-listed battery cables are recommended.
- Battery terminal must be clean to reduce the resistance between the DC terminal and cable connection.
- Do not connect the positive terminal and negative terminal of the battery to each other with any metal object (such as wire).
- Install in an environment with minimal heat. Warranty voided for terminal burnout due to excess heat and improper maintenance.
- Install in any orientation.
- Battery is usable inside or outside.
- Use proper fusing.

 **Warning!** Under no circumstances may the lithium battery be opened or mechanically damaged.

 **Warning!** A damaged lithium battery must never be installed or used.

Before each connection of several batteries, check in the technical data sheet of the battery variant whether and how many batteries may be connected in series or parallel. If several lithium batteries are connected in parallel or serially, only lithium batteries of the same manufacturer, battery type, capacity, state of charge and age may be used. Check after unpacking immediately, check the lithium battery for damage. If the lithium battery is damaged, please contact your dealer. Never install or use a damaged lithium battery.

5.2 Preparing the lithium battery for use

The Perfektium lithium battery with a Bluetooth connection are shipped in sleep-mode by default. To activate the battery a charge voltage has to be applied by the internal charge controller (e.g. in the vehicle) or by an external charger.

Before using the lithium battery, ensure that it is secured in the designated area in the vehicle so that it cannot move. The fixing devices available in the vehicle must be used for installation.

5.3 Connection cable

The connection cables available in the vehicle must be used. If these do not fit the terminals of the lithium battery, adapters are available for connection after consultation with the vehicle manufacturer.

5.4 Disconnecting the lithium battery

If the lithium battery is suspected to be damaged or if you do not use the lithium battery for a longer period, please disconnect it as described below:

1. First disconnect the negative connection cable from the negative terminal of the lithium battery. Either put a protective cap on the negative terminal or tape the negative terminal with a suitable, non-electroconductive material (e.g. insulating tape) to protect the lithium battery against short circuits.
2. Then disconnect the positive connection cable from the positive terminal of the lithium battery. Either put a protective cap on the positive terminal or tape the positive terminal with a suitable, non-electroconductive material (e.g. insulating tape) to protect the lithium battery against short circuits.

6. Using the battery

6.1 General information

- Warning! External charging of the lithium battery may only be carried out using the chargers recommended by the battery manufacturer.
- Warning! The lithium battery must never be short-circuited.
- Warning! When using the lithium battery, the parameters for the use of lithium batteries stated on the corresponding data sheet must always be observed.
- Warning! The safety regulations and safety precautions from chapter 4 must be followed.
- Caution! In the event of shutdown due to under voltage, the lithium battery must be recharged as quickly as possible.

6.2 Charging the battery

- Warning! A lithium battery must never be overcharged, as this will permanently damage the lithium battery. Only chargers with an automatic charge stop function may be used.
- Warning! If the lithium battery becomes too hot during charging, the charging process must be interrupted.
- Warning! The charging current must not be higher than the maximum charging current specified in the technical data sheet.

Warning! The lithium battery must be charged before use.

- Caution! When the charger is no longer in use, disconnect the lithium battery from the charger.
- Warning! To ensure safety and a long service life of the lithium battery, a charger must be used on which the parameters specified in the technical data sheet can be set. Other-charging devices may only be used if it is ensured that the charging voltage does not exceed the charging voltage limits of the lithium battery in any charging phase.

In order to guarantee the longevity of the battery, only a reduced charging current is accepted at very high and very low temperatures or the charging process is even completely stopped. The temperature limits for the charge currents can be found on the technical data sheet.

6.3 Bluetooth data connection

The Lithium battery features a Bluetooth connection to display various battery parameters (e.g. Current, Voltage, and Temperature) on a suitable device.

For this an app is available for android and iOS devices, which can be downloaded on the Perfektium homepage or the respective app stores. The Perfektium-bluetooth-app is available in German or in English. The language can be selected via the main menu of the app by selecting the flag symbol in the upper right corner (a restart of the app might be necessary).


★ Type dependent

After successfully establishing a connection, the current status of the battery is displayed automatically (Voltage, Current, Temperature Cycle life). By swiping to the left or right and scrolling up/down, the different Status windows can be selected.

If the battery is not being used for a longer period of time, it is recommended to put the battery into sleep-mode. To decrease the self-discharge the Bluetooth-connection is disabled in sleep-mode and a discharge of the battery is not possible. The sleep-mode can be activated via the "Off-button" (top right) and by confirming the info-message. By applying a charge voltage the battery can be reactivated.

7. Inspection, cleaning, and maintenance

7.1 General information

 **Warning!** Never try to open or disassemble the lithium battery! There are no parts inside the battery case that require maintenance.

1. The lithium battery must be disconnected from all electrical consumers and chargers before cleaning activities.
2. To avoid touching the battery terminals, please put protective caps on the terminals or cover them with a non-conductive material.

7.2 Inspection

The lithium battery must be inspected regularly for poorly attached and damaged wiring and connections, as well as cracks and deformation of the case, leaks or other damage. For this purpose, the specifications of the vehicle manufacturer regarding the maintenance intervals must be observed. As soon as damage is detected, contact the specialist workshop to replace the lithium battery. A damaged lithium battery must never be used.

The general condition and state of charge (SoC) of the lithium battery must be checked regularly. Lithium batteries are partially self-discharged if they are stored or not used for a longer period of time.

7.3 Cleaning

The surface of a lithium-ion battery should be cleaned with a soft, dry cloth made of non-electroconductive material. Under no circumstances should liquids, cleaning agents or solvents be used to clean a lithium-ion battery.

7.4 Maintenance

- ★ Battery should be inspected often.
- ★ Ensure cables and terminals are kept clean and free from corrosion, dirt or build-up of any kind. Use dry cloth to clean.
- ★ When possible keep batteries at a moderate temperature. Dispose of batteries properly.
- ★ Must be recycled.
- ★ Store battery at 50% SoC.
- ★ Charge and discharge according to battery specifications.
- ★ If you don't use the battery frequently, you should fully charge the battery at least once every three months, and don't until the battery is completely used up before recharging.

With proper maintenance and normal use, the battery life will be longer.

8. Storage

In order to achieve the longest possible service life, all the following instructions for storing the lithium battery must be followed. If these instructions are not followed, the battery may be damaged. If no voltage can be measured when checking the lithium battery, the battery is probably in sleep mode and can be activated by reset button. If this is not possible, it must be assumed that the battery is damaged. In this case, do not attempt to recharge and use the lithium battery. The battery must then be replaced with a new lithium battery.

- ★ During storage of the lithium battery, the battery terminals must be covered with suitable, non-electroconductive material (e.g. insulating tape).
- ★ Storage temperatures listed in section 3.1.
- ★ For storage, the minimum and maximum must be observed.
- ★ The lithium battery may only be stored in a clean, dry, well ventilated place on level ground.
- ★ The lithium battery must be stored on non-flammable materials or non-flammable surfaces and under no circumstances in areas where flammable materials are present or in any other flammable environment.
- ★ The lithium battery must be stored at least 5 cm away from the wall or other objects. The lithium battery must be out of reach of children and animals.
- ★ Storage in direct sunlight must be avoided by all means.
- ★ Lithium battery will not be used for a long time, please remove the battery from the load and store it separately and maintain and charge regularly.

9. Further information

The following additional documents must be observed:

Technical data sheets, general terms and conditions.