

USER MANUAL

<https://www.kon-tec.eu/batteries/>

Lithium iron phosphate LiFePO4 battery

12,8 V



50Ah



75Ah



100Ah



150Ah



200Ah

1. SAFETY NOTES

1.1. GENERAL RULES

	Read this manual before use.		Wear protective eye-glasses and clothing during using the li-ion battery.
	Explosion or fire hazard. Lithium-ion battery terminals are always live. Therefore, it is forbidden to place items or tools directly on the li-ion battery.		Any uncovered battery parts or material such as electrolyte or powder on skin, or eyes must be flushed with plenty of clean water immediately. Then consult with a doctor. Spillages on clothing should be flushed with water
	Too deep discharge is very dangerous and may damage the battery. Therefore, it is obligated to use internal safety relay.		In case of overcharge, over discharge or any damage to the battery there may be released dangerous gas compounds.
	It is forbidden to open or disassemble li-ion battery. The battery contains electrolyte that is very corrosive. In normal operating conditions contact with electrolyte is impossible. If the battery case is damaged, it is forbidden to touch exposed electrolyte due to corrosive effects.		The battery is heavy. In case of damage or an accident it can become explosive. During montage or transport ensure proper protection and use suitable equipment. Li-ion battery is sensitive to shock. Handle with care
	Never short circuit positive (+) and negative (-) pole of the battery!		

CAUTION!
NON-COMPLIANCE WITH MANUAL, REPAIRS MADE WITH OTHER THAN ORIGINAL PARTS OR UNAUTHORISED REPAIRS RENDER THE WARRANTY VOID.

1.2. TRANSPORTATION

CAUTION!

The li-ion battery must be transported in its original case in upright position.
If the battery is transported in packs on pallets and the use of straps is required, use soft straps to support the load to avoid damage.
It is forbidden to stand below the battery when it is hoisted.

Always handle the battery with handles, never the terminals!

2.2. GENERAL INFORMATION

Lithium-iron-phosphate (LiFePO4 or LFP) batteries have no memory effect and provide the highest energy density. The self-discharge effect is negligible and they have long lifetime. The li-ion battery with iron and phosphate admixtures has the safest cells available on the market. The nominal voltage of cell is 3,2 V. Therefore the 12,8 V Li-ion battery consists of 4 cells connected in series.

The nominal capacity of the battery is:

• 50 Ah • 75 Ah • 100 Ah • 150 Ah • 200 Ah

2.1. EFFICIENCY

The energy efficiency of the entire cycle of a lithium-ion battery (discharge from 100% to 0% and recharge from 0% to 100%) is 92%. By comparison, in a lead-acid battery, the energy efficiency is only 80%. The LiFePO4 battery can be charged and discharged at high current levels without loss of capacity and has a very high durability (the number of complete charge-discharge cycles while maintaining up to 80% of nominal capacity is up to 2000).

The energy density of the battery reaches over 120 Wh/kg, which is very desirable and energy efficient.

1.3. UTILIZATION OF LI-ION BATTERIES

Batteries marked with the recycling symbol must be disposed via recognized recycling agency. Batteries may be returned to the manufacturer by agreement. Used batteries must not be mixed with domestic or industrial waste.



2.2. DIMENSIONS AND WEIGHT

Capacity [Ah]	Weight [kg]	Dimensions [mm]
50	5,8	196x165,5x175
75	9,5	260x168x213
100	12,5	308x169x211
150	19,6	483,5x170x241
200	26	483,5x170x241

2.3. APPLICATION

- Electric vehicles (EV),
- Outboard motors,
- Power source for inverters 12 V~/230 V~,
- Toys.

Kon-TEC Kraczkowa 1647 37-124 Kraczkowa, Poland
Tel.: +48 695 904 655 email: info@kon-tec.eu
www.kon-tec.eu



3. INSTALLATION

Caution!

The batteries must always be mounted vertically.

In the case of any type of connection, the batteries must be protected by a fuse placed in the circuit.

When connecting batteries, remember to use the correct cross-section and the same cable length, to avoid unnecessary energy loss.

Do not charge individual batteries in a circuit.

When connecting batteries, make sure that their charge level is similar and that the battery type is the same.

Otherwise when connecting batteries very high equalizing currents may flow, which may result in

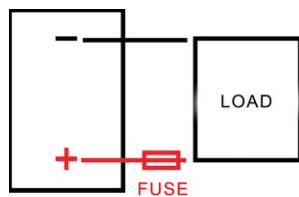
damage to the connected batteries or incorrect system operation. To make sure that the batteries are at the same charge level it is necessary to:

1. charge each of them separately to full charge,
2. connect the batteries in parallel and charge them again until they are fully charged,
3. leave the batteries for 12 to 24 hours.

After this proces you can combine the prepared accumulators in one of the systems described below:

3.1. SINGLE BATTERY INSTALLATION

Picture 1 shows wiring diagram for one battery with load.

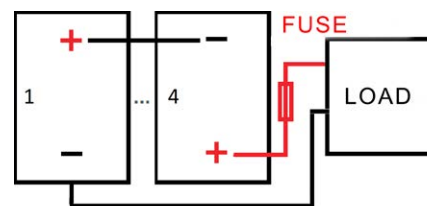


Picture 1. Single battery

3.2. SERIES CONNECTION

Batteries can be connected in series (output voltage increase) in a maximum number of 4 batteries.

Picture 2 shows wiring diagram for series connection batteries with load.

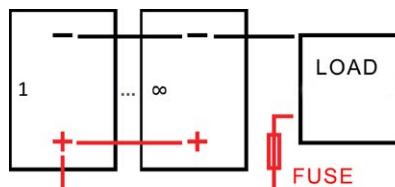


Picture 2. Series connection

3.3. PARALLEL CONNECTION

Batteries can be connected in parallel (capacity increase) and in this case there is no limit in number of batteries.

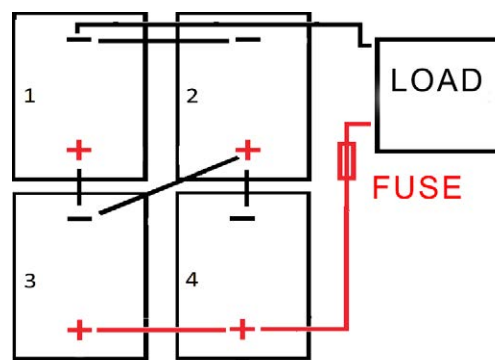
Pay attention the outgoing wires from positive and negative pole are not derived from the last battery. From the first battery should be wired positive (+) and the last battery should be wired negative (-). It is proper connection the battery that takes into account compensation of wire resistance and the batteries operate evenly loaded. Therefore, their lifetime is longer. Picture 3 shows parallel connection.



Picture 3. Parallel connection

3.4. SERIES-PARALLEL CONNECTION

Batteries can be connected in series-parallel (the sum of 2 each voltage and the sum of 2 each capacity). Picture 4 shows wiring diagram for series-parallel connection.



Picture 4. Series-parallel connection

4. OPERATION

4.1. CHARGING

Caution!

For charging process use only dedicated charger by manufacturer. Non-compliance with user manual may cause damage to the battery or danger to health or life.

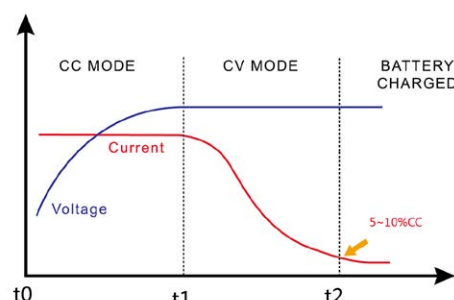
Charging process needs to be carried out under direct supervision. It is not recommended to leave the battery charging without user's supervision. It is not allowed to charge the battery at temperatures below 0 C.

4.2. FIRST CHARGING

For safety reasons during shipping, the batteries are approximately charged at 50%. Therefore, it is recommended to fully charge the battery before use.

4.3. CHARGING PROCESS – GENERAL INFORMATION

The li-ion battery charging process can be divided into 3 cycles:



Picture 5. Charging cycles

t0 – constant current CC;
t1- constant voltage CV;
t2- battery charged.

The CC - cycle charges the battery with a constant current, while the output voltage of the charger is higher than the nominal battery charging voltage. That condition is necessary, because there is a need for such a difference in potential to pass the charging current. While the battery reaches its maximum safe voltage, the CC cycle ends and the CV cycle begins.

The CV - cycle charges the battery with a constant voltage until the current drops to close to 0. Then the balancing of the battery cells takes place. During balancing, the cells that have reached too high voltage are discharged through a special resistor.

There are two reasons for this:

- first, not to overcharge the cells;
- second, remaining cells with too low voltage have time to charge.

When the voltage difference of balanced cells is small enough for charger and BMS, the cycle CV ends and passes to the charged battery cycle.

The charged battery cycle begins immediately after balancing and ends the charging process. During this cycle the charger is disconnected from the battery by opening the charging contactor.

4.4. BATTERY MANAGEMENT SYSTEM (BMS)

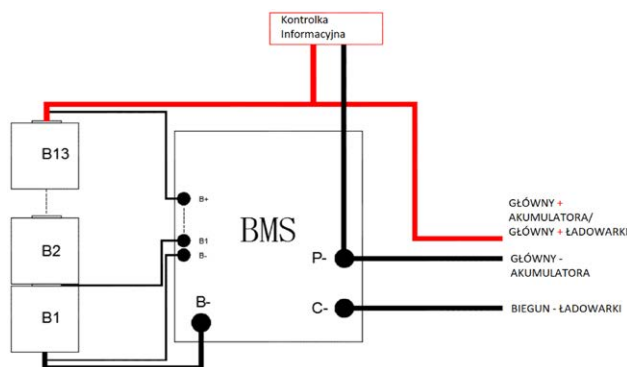
The cells in a lithium ion battery are not completely identical and may charge and discharge at different rates and discharge differently. Each lithium ion cell is very sensitive to overcharging and over-discharge. For this reason, it is essential that each battery pack has protection against these hazards.

The Battery Management System (BMS) performs specific tasks by measuring and controlling battery parameters:

- protecting the battery cells from exceeding the minimum safe voltage (for LiFePO4 cells it is 2.5V),
 - protects the battery cells from exceeding the maximum safe voltage (for LiFePO4 cells it is 3.65V/cell),
 - during charging, balances and equalizes voltages on all cells, which extends battery life and reliability.
- In addition, the BMS protects against short-circuits and battery overloads.

Caution!

In the BMS system, despite safeguards applied, it is possible to damage the battery through incorrect use. Examples are leaving a discharged battery for more than 72 hours (permanent damage to the battery) and leaving a charged battery for more than 3 months (partial loss of capacity).



Rys. 6. Schemat ogólny systemu BMS zamontowanego w akumulatorze

4.5. BUILT IN DISPLAY (IF ACCOMPANIED)

The battery has a built-in display that shows voltage and percentage of charge level.

To read the values press the button:

- 1 time - battery voltage in volts,
- Twice - indication of the percentage of charge,
- 3 times - display off.

However, due to the non-linear nature of LiFePO4 battery discharge, the display does not show actual values.

In order for the user to determinate the state of discharge, these values were measured.

The table below shows the battery voltage and displayed percentage of discharge and corresponding actual battery's remaining capacity.

Display	Actual data	
	U[V]	State of charge [%]
14 - 13,2	100 - 96	100 - 78
13,1	99 - 96	78 - 57
13	95 - 93	57 - 35
12,9	92 - 88	35 - 25
12,8	87 - 85	25 - 21
12,7	84 - 80	21 - 12
12,6	78	11
12,5	76	9
12,4	70	7
12,1	58	5
11,6	41	3
10,9	11	2
<10,9	<10	~0

Tab.1. Pomiar napięcia i pojemności akumulatora



During discharge, the LiFePO4 battery maintains its voltage constant for a long time. During further discharge these values decrease.

Due to the non-linear nature of the battery discharge, the voltage ranges differ slightly or maintain a constant value with lower percentages of charge and capacity.

The data presented is given so that the user can determinate the actual state of charge of the battery.

4.5. BATTERY DAMAGE OR FIRE PROCEDURE

Caution!

Incorrectly used or damaged battery can be unstable and very dangerous for the user. If noticed any irregularities, the load should be immediately disconnected from the battery and put in a safe place. Then immediately contact the manufacturer / supplier.

The procedure for lithium-ion battery fire is:

1. Alert people in the danger zone immediately and then leave it.
2. Call the fire brigade.
3. Ventilate the room if possible.
4. If possible, use a D category fire extinguisher.
5. If possible, cool the burning battery with a continuous stream of water until the fire brigade arrives.

Additional information:

- get a gas mask;
- if possible, disconnect the load from the battery,
- continuous cooling of the battery reduces the risk of ignition of emitted gases.

General precautions:

- Do not expose the battery to sunlight,
- Do not immerse the battery in water,
- Do not leave the battery near heat sources,
- Charge the battery only under supervision,
- Do not short circuit the + and the - poles with any conductive elements,
- Do not connect the battery directly to electrical sockets,
- Do not put the battery into a fire,
- Do not transport the battery with other metal objects,
- Do not hit, throw or step on the battery,
- Do not pierce the battery with any objects,
- Do not disassemble / open the battery,
- Do not store the battery if it has not been used for a long time,
- Do not leave the battery in high temperature conditions,
- Do not use the battery in a strong electrostatic or magnetic field,
- If the battery emits a strange smell, is noticeably hot, changes colour, deforms or in any other way deviates from standards when using, immediately disconnect it from the load and store it in a safe place. Then contact the supplier / manufacturer,
- If the battery terminals are dirty, clean them with a dry cloth, otherwise connection may be faulty,
- Read the charger manual carefully,
- Store the battery with secured terminals,
- Keep the battery away from children and animals,
- Do not wear metal objects when handling and using the battery,
- Charging time should be no longer than specified in the manual,
- Do not sold anything to the battery,
- Do not expose the battery to microwaves and high pressure,
- Do not use any form of pressure on the battery.

4.6 STORAGE

The battery should be stored in conditions as:

- Dry, ventilated places, avoiding directly sunlight,
- In case of long-time storage, the battery should be stored in low humidity places and temperature range -20° C do + 30° C,
- Store the battery in the state of 50 % charge (longer lifetime),
- If the battery is stored more than 6 months, it is recommended to perform charge cycle to avoid damage to cells through self-discharge.

5. TERMS OF WARRANTY

The above 12.8V LFP battery is warranted to be free from defects in materials and workmanship for a period of 24 months from the date of purchase in Poland. If, during the warranty period, symptoms arise which may indicate that the product is defective, please contact technical support who will advise you on further action to be taken.

Under this guarantee, the defective product will be restored to a usable condition, or replaced if the defect makes repair impossible. The warranty will be processed within a maximum of 30 working days from receipt of the complaint.

Caution!

Replacement of the device includes the delivery of a new product free from defects of the same product or in case it is withdrawn NOTE - Replacement of the device includes delivery of a new defect-free product of the same or, in case it is withdrawn from production, similar parameters, excluding dimensions that may change. Traces of service operations may remain on the outer packaging of the battery.

This warranty does not apply:

- when the product has been modified, opened, altered or damaged due to improper use,
- if the instructions for use are not observed,
- If the product is sold at public auction,
- if the equipment is damaged in an accident or natural disaster,
- damaged connection terminals,
- if the appliance is incorrectly connected, used or charged,
- if the equipment is damaged by fire, freezing or high temperatures,
- when flooded/crushed by pressure,
- If the user interferes with the unit,
- damage to the housing.

Caution!

The number of cycles depends on the depth and current of discharge of the device. Their number is not less than 2000, with a discharge depth of 100% DoD and a current of 0.3C. After reaching 2000 cycles the device is operational but its capacity does not exceed 80% of the rated capacity. Discharging and charging the battery with high current and improper use (e.g. improper storage) will also reduce capacity. For more information on harmful factors please refer to the above mentioned operating instructions. Battery service life is estimated at more than 12 years.