Why lithium-iron-phosphate?

Lithium-iron-phosphate (LiFePO₄ or LFP) is the safest of the mainstream li-ion battery types. The nominal voltage of a LFP cell is 3,2V (lead-acid: 2V / cell). A 12,8V LFP battery therefore consists of 4 cells connected in series; and a 25,6 V battery consists of 8 cells connected in series.

Why a Battery Management System (BMS) is needed:
1. A LFP cell will be damaged if the voltage over the cell falls to less than 2,5V.
2. A LFP cell will be damaged if the voltage over the cell increases to more than 4,2V.
3. The cells of a LFP battery do not auto-balance at the end of the charge cycle.

A LFP battery therefore must be protected by a BMS that actively balances the individual cells and prevents under- and over-voltage.

Rugged

A lead-acid battery will fail prematurely due to sulfation:
• If it operates in deficit mode during long periods of time (the battery is rarely, or never at all, fully charged).
• If it is left partially charged or worse, fully discharged (yacht or mobile home during winter time).

A LFP battery does not need to be fully charged. Service life even slightly improves in case of partial charge instead of a full charge. This is a major advantage of LFP compared to lead-acid.

Other advantages are the wide operating temperature range, excellent cycling performance, low internal resistance and high efficiency (see below).

LFP is therefore the chemistry of choice for very demanding applications.

Efficient

In several applications (especially off-grid solar and/or wind), energy efficiency can be of crucial importance. The round trip energy efficiency (discharge from 100% to 0% and back to 100% charged) of the average lead-acid battery is 80%.

The round trip energy efficiency of a LFP battery is 92%.

The charge process of lead-acid batteries becomes particularly inefficient when the 80% state of charge has been reached, resulting in efficiencies of 50% or even less in solar systems where several days of reserve energy is required (battery operating in 70% to 100% charged state). In contrast, a LFP battery will still achieve 90% efficiency under shallow discharge conditions.

Size and weight

Saves up to 70% in space
Saves up to 70% in weight

Expensive?

LFP batteries are expensive when compared to lead-acid. But in demanding applications, the high initial cost will be more than compensated by longer service life, superior reliability and excellent efficiency.

Endless flexibility

LFP batteries are easier to charge than lead-acid batteries. The charge voltage may vary from 14V to 16V (as long as no cell is subjected to more than 4,2V), and they do not need to be fully charged. Several batteries can be connected in parallel and no damage will occur if some batteries are less charged than others.

Our 12V BMS will support up to 10 batteries in parallel (BTVs are simply daisy-chained).
A 12V BMS that protects the alternator (and wiring), and supplies up to 200A in any DC load (including inverters and inverter/chargers)

Alternator/battery charger input (Power Port AB)
1. The first function of Power Port AB is to prevent the load connected to the LFP battery from discharging the starter battery. This function is similar to that of a Cyrix Battery Combiner or Argo FET Battery Isolator. Current can flow to the LFP battery only if the input voltage (= voltage on the starter battery) exceeds 13V.
2. Current cannot flow back from the LFP battery to the starter battery, thus preventing eventual damage to the LFP battery due to excessive discharge.
3. Excessive input voltage and transients are regulated down to a safe level.
4. Charge current is reduced to a safe level in case of cell unbalance or over temperature.
5. The input current is electronically limited to approximately 80% of the AB fuse rating. A 50A fuse, for example, will therefore limit the input current to 40A.
   Choosing the right fuse will therefore:
   a. Protect the LFP battery against excessive charge current (important in case of a low capacity LFP battery).
   b. Protect the alternator against overload in case of a high capacity LFP battery bank (most 12V alternators will overheat and fail if running at maximum output during more than 15 minutes).
   c. Limit charge current in order not to exceed the current handling capability of the wiring.
   The maximum fuse rating is 100A (limiting charge current to approximately 80A).

Load/battery charger output/input (Power Port LB)
1. Maximum current in both directions: 200A continuous.
2. Peak discharge current electronically limited to 400A.
3. Battery discharge cut-off whenever the weakest cell falls below 3V.
4. Charge current is reduced to a safe level in case of cell unbalance or over temperature.

### BMS 12/200 specification

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum number of 12,8V batteries</td>
<td>10</td>
</tr>
<tr>
<td>Maximum charge current, Power Port AB</td>
<td>80A @ 40°C</td>
</tr>
<tr>
<td>Maximum charge current, Power Port LB</td>
<td>200A @ 40°C</td>
</tr>
<tr>
<td>Maximum continuous discharge current, LB</td>
<td>200A @ 40°C</td>
</tr>
<tr>
<td>Peak discharge current, LB (short circuit proof)</td>
<td>400A</td>
</tr>
<tr>
<td>Approximate cut-off voltage</td>
<td>11V</td>
</tr>
<tr>
<td>No load current when operating</td>
<td>10mA</td>
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<tr>
<td>Current consumption when switched off</td>
<td>7mA</td>
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<tr>
<td>Current consumption after battery discharge cut-off due to low cell voltage</td>
<td>3mA</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>-40 to +60°C</td>
</tr>
<tr>
<td>Humidity, maximum</td>
<td>90%</td>
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<tr>
<td>Humidity, average</td>
<td>95%</td>
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<tr>
<td>Protection, electronics</td>
<td>IP65</td>
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<tr>
<td>DC connection AB, LB and battery minus</td>
<td>M8</td>
</tr>
<tr>
<td>DC connection battery plus</td>
<td>Faston female 6.3mm</td>
</tr>
</tbody>
</table>

### LEDs
- Battery being charged through Power Port AB: green
- Battery being charged through Power Port LB: green
- Power port LB active: green
- Over temperature: red

### ENCLOSURE
- Weight (kg): 1.8
- Dimensions (h x w x d in mm): 65 x 120 x 260

### STANDARDS
- Emission: EN 50081-1
- Immunity: EN 50082-1
- Automotive Directive: 2004/104/EC