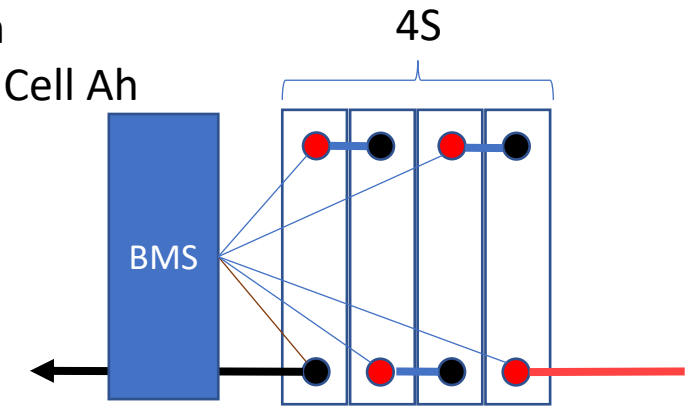
LiFePO4 Cell Configurations 12V, 24V & 48V

This deck shows the most common configurations for using LiFePO4 Cells to build 12V, 24V and 48V batteries.

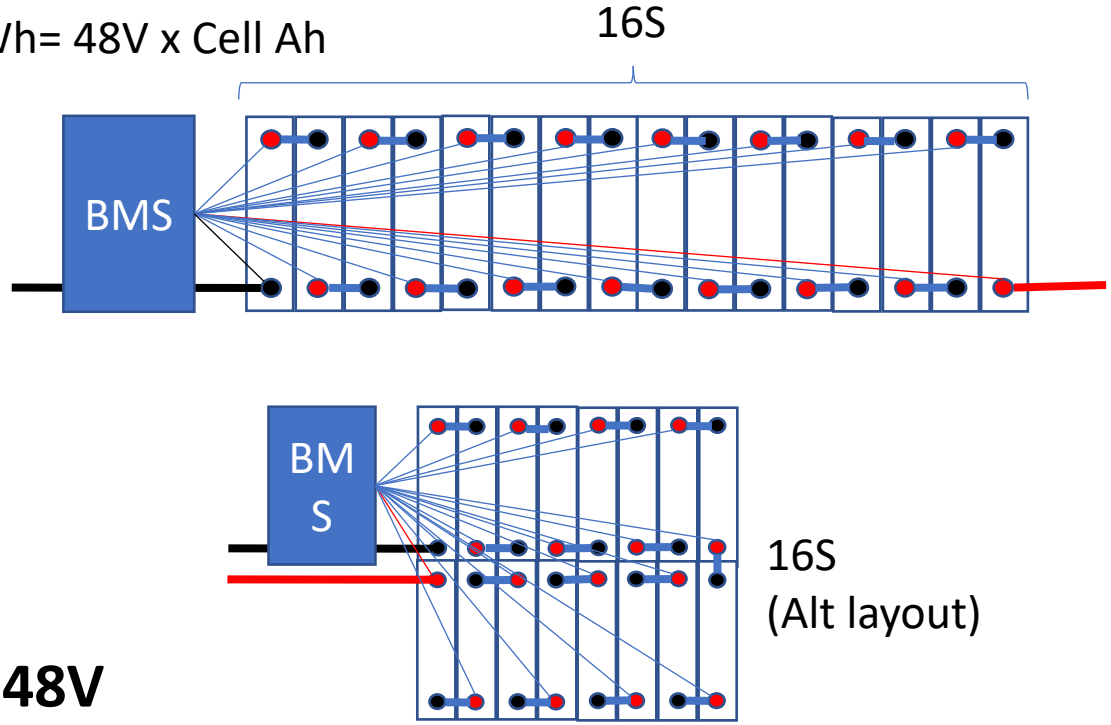
Series-Only (1P) Configurations 12V, 24V & 48V

Ah= Cell Ah
Wh= 12V x Cell Ah



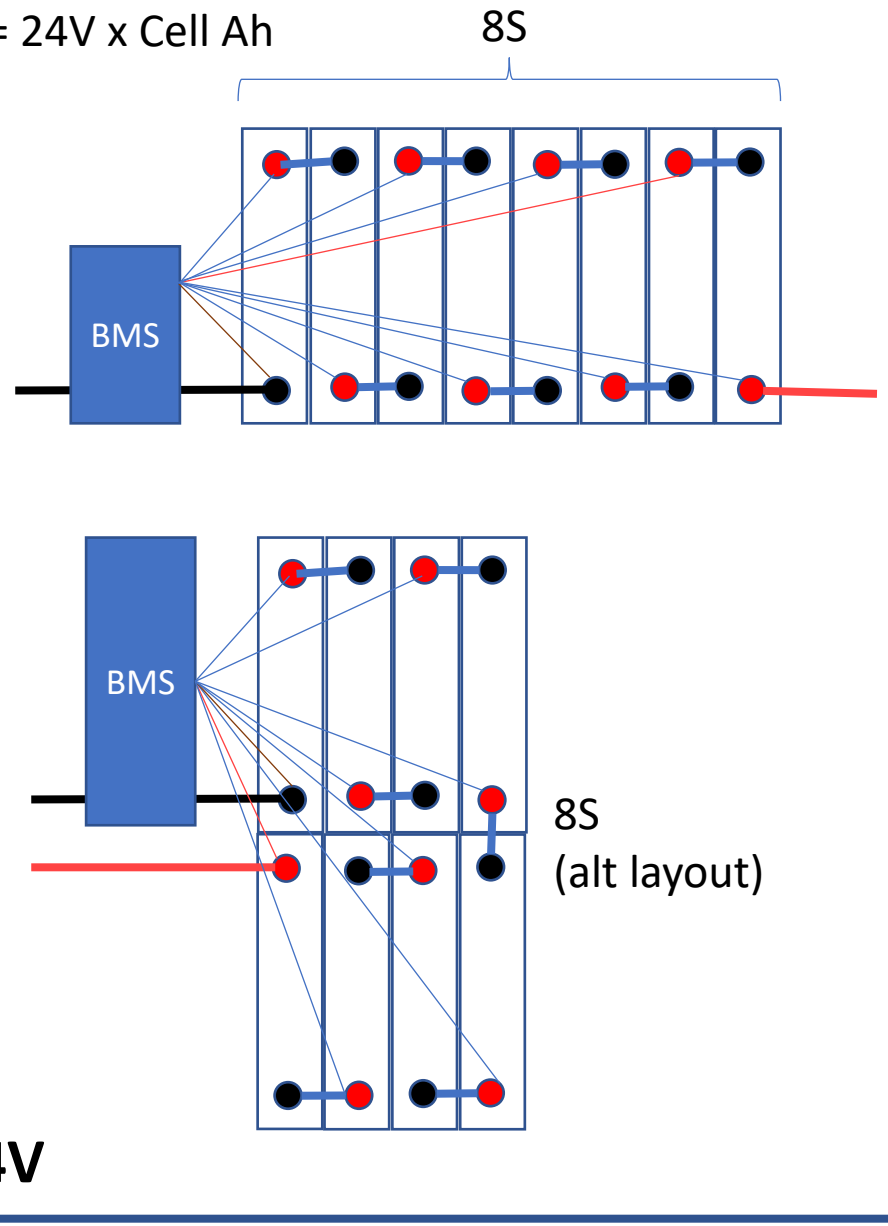
12V

Ah= Cell Ah
Wh= 48V x Cell Ah



48V

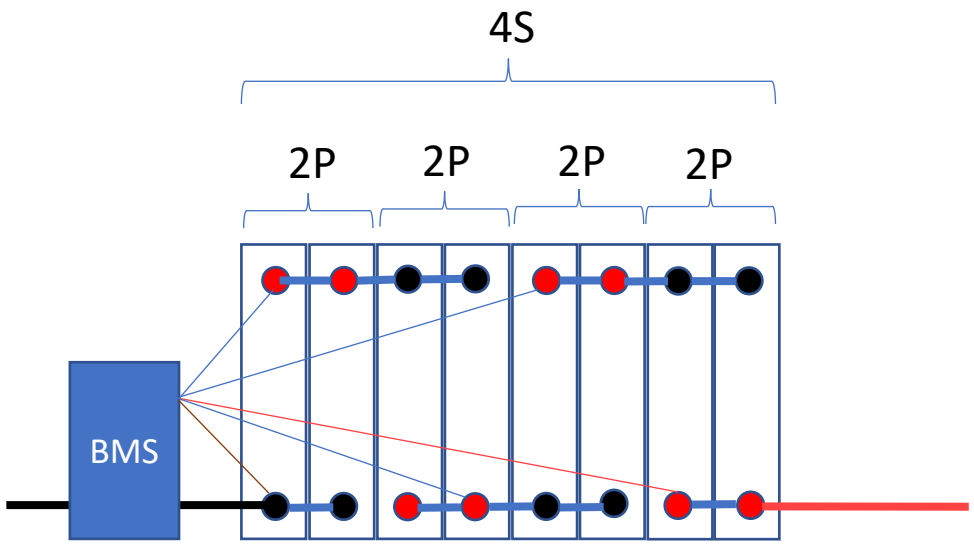
Ah= Cell Ah
Wh= 24V x Cell Ah



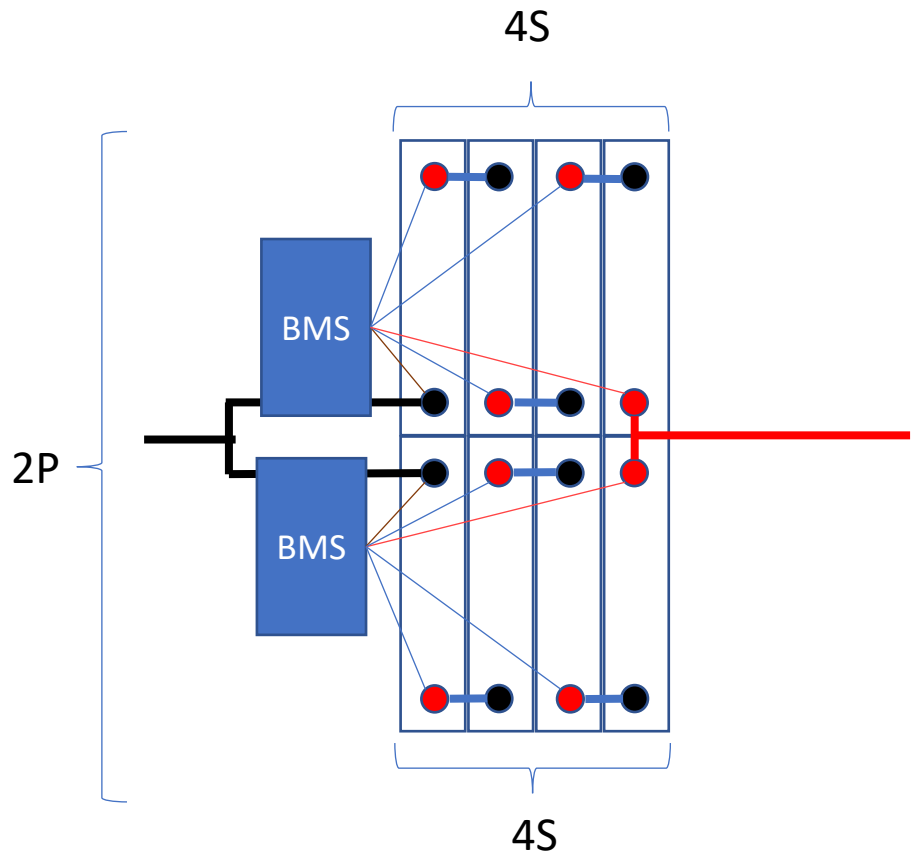
24V

2P Wiring for 12V batteries

Voltage = 4 times cell voltage = Nominal 12V for LiFePO4
Ah= 2X Cell Ah (assuming balanced Cells)
Wh= Voltage X Battery Ah = 12V x (2 x Cell Ah) = 24 x Cell Ah



2P4S
(Parallel-First)

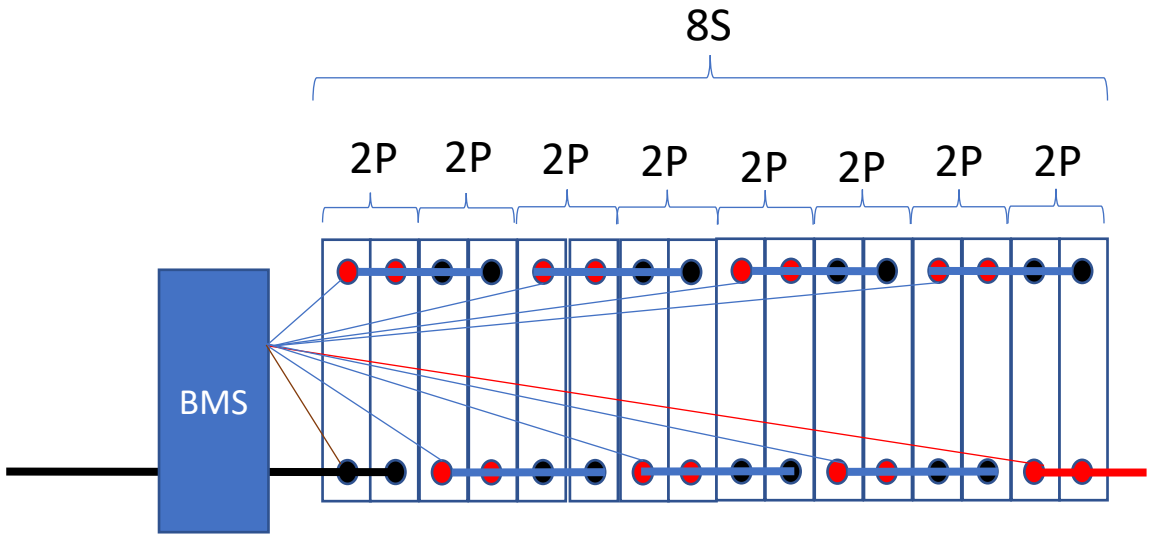


4S2P
(Series-First)

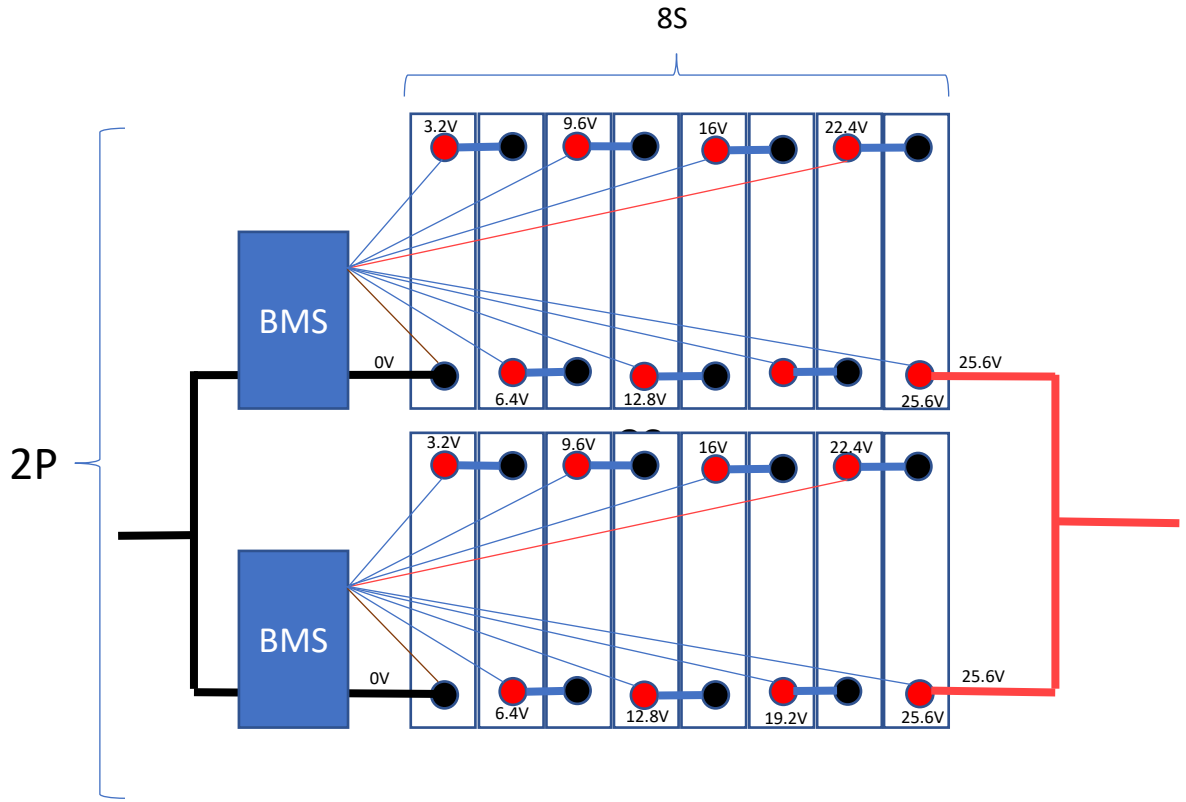
Note: As shown on the Series only (1P) layouts, this can have Alternate physical layouts that could optimize the footprint to the needs.

2P Wiring for 24V Batteries

Voltage = 8 times cell voltage = Nominal 24V for LiFePO4
Ah= 2X Cell Ah (assuming balanced Cells)
Wh= 24V x (2 x Cell Ah) = 48 x Cell Ah



2P8S
(Parallel-First)

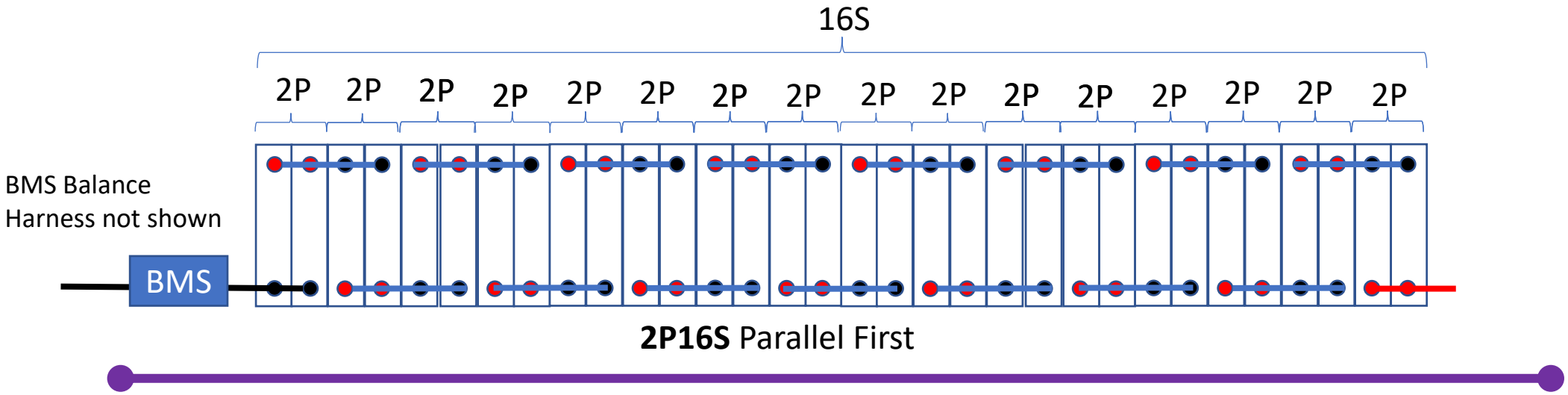


8S2P
(Series-First)

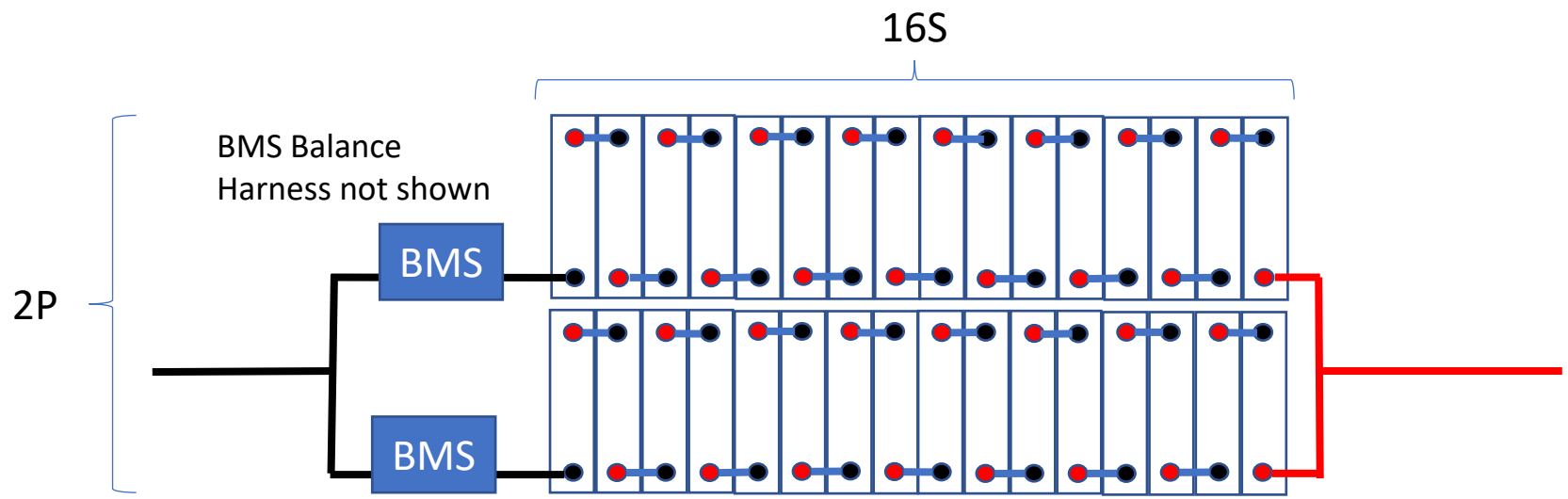
Note: As shown on the Series only (1P) layouts, each of these can have Alternate physical layouts that could optimize the footprint to the needs.

2P Wiring for 48V Batteries

Voltage = 16 times cell voltage = Nominal 48V for LiFePO4
Ah= 2X Cell Ah (assuming balanced Cells)
Wh = 48 X (2 x Cell Ah) = 96 x Cell Ah



2P16S Parallel First



16S2P Series First

Note: As shown on the Series only (1P) layouts, each of these can have Alternate physical layouts that could optimize the footprint to the needs.

Series first vs parallel first

There is a lot of debate about whether series-first or parallel-first is best. The fact is, both of them are used successfully by many people. The 'correct' choice comes down to the particular situation and the designer's preference.

Parallel-First

Pro

- Simplicity of a single BMS (Fewer corner cases, less electronics that can go bad)
- (possibly) Lower Price of the single BMS
- The BMS balances everything

Con

- Must use higher current BMS
- Only 'groups' of cells are managed and monitored
- With only one bank there is no fall back redundancy

Series-First

Pro

- Each cell is monitored and managed separately.
- If one bank goes out, you still have the other bank
- You can use lower current BMSs to build up a High current solution.

Con

- Complexity of two BMS and making sure the corner cases are covered.
- Doubling the BMSs can increase cost
- Doubling the BMSs doubles the circuitry that can go bad.
- The multiple BMSs don't balance between the two banks

Note About Weight

LiFePO4 cells are considerably lighter than any form of Lead-Acid, but as the cell count goes up the battery can still get very heavy.

Example. the EVE 280AH cells weight in at 5.2 Kg (11.5 LBS) each cell

8 cells = 41.2Kg (93 Lbs)

16 cells = 82.4Kg (184 LBS)

Add the weight of Box and bits it becomes unwieldy quickly.

Series first vs parallel first – Personal Preference

Warning: The following is the authors personal preference. There is no right or wrong

I do builds both ways, but I prefer Parallel first.

- **I believe that if you start out with good matched cells, the likelihood of one cell drifting way out from the others is very low so I don't feel a need for monitoring individual cells.**
- **I am a strong believer in simplicity**
- **In most of my builds, having half capacity does not help much.**

When I do series first it is usually because the BMS available will not handle the current for a parallel-first configuration.

Other folks on the forum *strongly* believe Serial-First is the only way to go.

Each designer must decide based on their situation and priorities

Document Revision History

Revision 1 - Original
Revision 2 - Added comments about alternate physical layouts
Revision 3 - Added note about weight of large configurations.
Revision 4 - Added Wh (Watt Hour) Calculations.

Bonus: Possible 12V 4P4S Fortune Cell Layouts

Oversized Bus-bar
Factory Bus-bar