Series and parallel wiring

Combine batteries for more voltage or more capacity, and what to watch for in a battery bank.

Batteries are combined in **parallel** for more capacity (amp-hours) at the same voltage, or in **series** for a higher voltage. Each battery has its own BMS, so a bank needs a little care to keep every battery in step. What follows is general guidance for LiFePO4 batteries.

> **Only what your battery allows**
> How many batteries of your type can take in series and in parallel is on its data sheet. A connection it doesn't allow isn't covered by the warranty.

The rules for any bank

- **Same type, capacity and age.** Never mix types, capacities, ages or makes in one bank, and never mix lithium with lead-acid.
- **Match them first.** Charge each battery fully on its own before connecting them, so they start at the same state of charge.
- **Equal cables.** Use cables of the same length and cross-section for every battery, and connect the bank's positive and negative at opposite ends (diagonally), so every battery carries the same share.
- **Fuses.** Put a fuse on each battery's positive in a parallel bank, and one on the bank's main positive, sized for the cables and the current.
- **Register each battery** of the bank separately in Battery Monitor.

Parallel

Parallel batteries share the load. The voltage stays that of one battery; the capacity adds up: two 12.8 V 100 Ah batteries make 12.8 V 200 Ah.

If one battery's BMS stops charging or discharging to protect it, the others carry on and take its share. Keep the total current within what the remaining batteries can deliver.

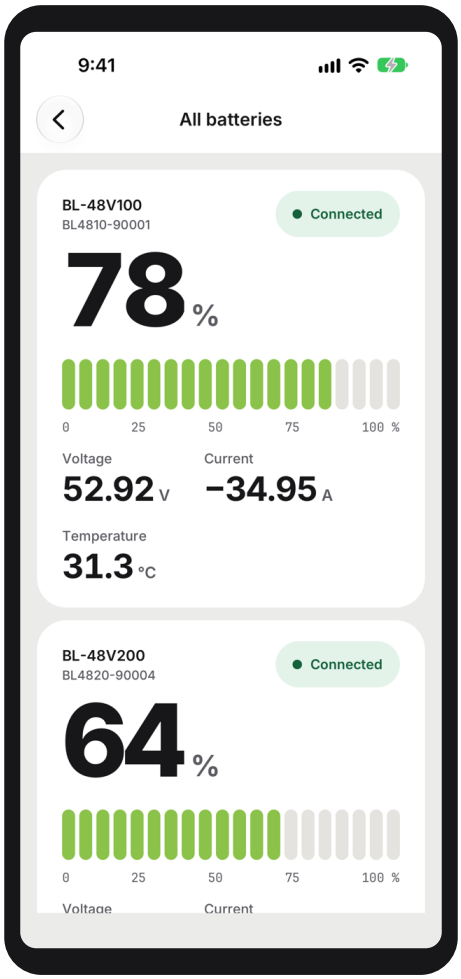
Series

Series batteries add their voltages; the capacity stays that of one battery: two 12.8 V 100 Ah batteries make 25.6 V 100 Ah.

In series, a battery that falls behind limits the whole bank, and each battery's BMS balances only its own cells, not the batteries against each other. Charge each battery fully on its own from time to time, or use a battery balancer, to keep them in step.

Watching a bank in Battery Monitor

Battery Monitor connects to several batteries at once: connect to each and use **View all** to see them side by side. Batteries that drift apart in voltage or state of charge are a reason to recharge them individually or to open a support case.



All batteries