

# Charging Batteries in Series

If you want to get the most life out of your battery pack it is important to maintain them properly. Having the right charger for your pack is only part of the solution.

When you charge batteries in series, you are charging the entire group of them all at the same time. The charger will stop charging when the entire group reaches a certain voltage. If the batteries are not each at the same voltage, this means that one battery is charging higher than the rest, and one is not charging as high as the rest. This will not give you the most usable capacity out of the pack, and will likely lead to one or more of the batteries reaching the end of their usable life sooner than necessary.

## How to balance your pack

To make sure that all of your batteries are at the same voltage, the easiest way is to put them all in parallel and charge them all at the same time at the individual battery voltage. For instance, if you plan on using a 48v pack that is comprised of (4) 12v batteries, you will initially charge them all at 12v to make sure they are all completely full. Even better is to put them all into parallel while balance charging making one big 12v battery. Make sure that your 12v charger is rated for the type of batteries you're using, like sealed vs. flooded. \*Note that a "12v" battery will charge to approx. 14.7v total, and then float around 13.5v.

After your 4 12v batteries are all topped off, take them out of parallel and wire them in series. This means you have a fully charged 48v battery pack with each battery at the same state of charge.

## Maintenance

Over time it is good to check your individual batteries with a voltmeter. It's best to check at the very end of a charge cycle as this will show the biggest difference in voltage, if there is one. The easiest way to fix a voltage difference is to charge the pack fully, then bring up the lowest battery with a 12v charger placed on just the lowest battery. You do not need to disconnect the series connections to do this as long as you can access just the lowest battery.

Next time you charge, you should see the batteries are then closer in voltage at the end of the charge cycle.

For a plethora of information including important safety information see [batteryuniversity.com](http://batteryuniversity.com)

