Thank you for purchasing one of our Offgrid Power Solutions (OPS) batteries. We hope you get many hours and many cycles out of it and that it gives you stress free power for your adventures!

Table of Contents:

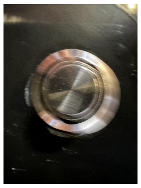
What do you get as Standard?

- An advanced and highly configurable battery management system (BMS)
- Bluetooth connectivity to a free mobile app
- Active 2A Balancer keeps all four cells closely matched
- Cold cell temperature protection
- High cell temperature protection
- MOSFET high temperature protection
- Over current protection
- Dead short protection
- Over-charge protection
- Over-discharge protection
- “Standard” battery size compared to Lead Acid but with loads more storage (the OPS300 is the equivalent of four or five 100ah lead acid batteries)

- Plus much more…

It really is a cool battery!

Switching the Battery ON



When you first get the battery it will be switched off.
The switch, shown to the left, will have no light on.
Simply press the switch (short press, don't hold)
The battery should then switch on and the switch has a red light (see below)

To switch the battery off you press the switch and hold it down for about five seconds and release. You should see the red light around the switch turn off.

Mobile App

If you want to see the details of your battery then please download this free app

The app is called "JK BMS"
When you first open the app, you will see a button called "Scan". Press that and a list of available JK BMS will be displayed, the name of your BMS will look something like: "OPS300-000". Click on that. Don't try to pair with your Bluetooth facility first - do it in the app

Important Specifications

	OPS100	OPS280	OPS300
Weight	18kg	23kg	23kg
Dimensions	260mm X 180mm X 260mm	375mm X 270mm X 190mm	375mm X 270mm X 190mm
Terminal size	M8 bolt	M8 bolt	M8 bolt
Voltage	14.2 bulk, 13.6 resting	14.2 bulk, 13.6 resting	14.2 bulk, 13.6 resting
Charge current	100A max, 50A recommended	200A max, 100A recommended	200A max, 100A recommended
Discharge current	100A max continuous	200A max continuous	200A max continuous

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Capacity Ah	100ah	280ah	300ah
Capacity KWh	1300KWh at 13v	3640KWh at 13v	3800KWh at 13v
Charger Profile	LifePO4	LifePO4	LifePO4
Charger Bulk/Absorption	14.2v	14.2v	14.2v
Charger float voltage	13.5	13.5	13.5
Min charge temperature	3°C	3°C	3°C

Here are some instructions and general tips.

How to connect the battery to your system.

This is pretty basic but just in case.
The red (+) terminal attaches to your positive cable. We strongly suggest you install an isolating switch and a fuse on the (+) red cable close-ish to the battery. If your battery is an OPS280 or OPS300 the recommended maximum fuse is 200A. For the OPS100 the fuse should be a maximum of 100A.
Your negative (usually black) cable should be attached to the negative blue terminal. Usually this will go directly to a shunt (smart shunt) and from there to a busbar or directly to the chassis.
If you have more than one battery in parallel then adjust your fuse size accordingly.

How thick should your cables be?

In high current situations (200A) you will want at least 35mm cables running from the battery to your current draw (inverter?).
For our OPS100 a 16mm cable would suffice.
Of course, this depends on cable length, quality of cable, heat rating of cable and the ability of the cable to dissipate heat buildup.
The ABYC app is really helpful for sizing your cables.

Charging voltage

The OPS batteries are set to a high voltage disconnect (HVD) of 3.55v per cell meaning a total voltage of 14.2v for the battery as a whole. This corresponds with the default voltage of Victron

chargers, particularly the bulk/absorption phase.
This means that when the first cell reaches 3.55v while charging the battery BMS will stop further charging until the voltage drops down to 3.5v
Your charger should be set to a bulk/absorption voltage of 14.2v and a float voltage of 13.5v. In fact, you don't really need a float phase but virtually all chargers allow you to set this.
So why not 3.45v HVD and set charger to 13.8v? Although you will still get loads of use out of your battery the charging time could be extended considerably and you don't want that (caveat: this depends on your charger). We suggest that Victron's default of 14.2v (3.55v per cell) is the most suitable.

Getting to 100% State of Charge (SOC)

This next bit is important to get to 100% state of charge.
This is one of our most common support queries. Mismatches between the chargers and BMS often prevent the battery from reaching full 100% SOC.
It's really important that your charger and battery are set to the same parameters. If your charger is set to less than the BMS cutoff (high voltage disconnect) then in theory you will never complete the bulk/absorption phase and your BMS will never report a full SOC even if your shunt does. This is because the BMS never reaches the point where the highest cell voltage reaches the HVD and so it never stops the charging process. Your charger may switch from bulk to float but the BMS doesn't know that and assumes you never reached 100% SOC.

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Connecting Multiple Batteries in Parallel

You can connect our OPS batteries in parallel.
This means your voltage will be “12v” (actually 13v-ish), so the voltage stays the same but your storage (amp hours or kilowatt hours) increases. Also, the maximum amperage draw increases too.
For example, if you connect two OPS300’s in parallel you get 600ah of storage and can draw 400A of current (200A from each battery).

There are some things to remember though. If you are using your storage heavily and the first battery kicks in LVD (Low Voltage Disconnect) then the system drawing the current will still attempt to draw all the current from the remaining battery. This may overload the battery and the BMS will stop discharge in order to protect itself and the battery as a whole.

You should ideally use batteries of similar capacities, the age of the batteries is not a major concern except that the older battery could have reduced capacity. This is only a problem where the two batteries have dissimilar voltages as the first one reaches 100% SOC (stage of charge).

Please note: this topic is hotly debated on many forums with varying opinions.

This is really important: don’t put two (or more) batteries in parallel when one of the battery BMS uses regular relays instead of MOSFETs. Our OPS batteries use MOSFETs

Connecting Multiple Batteries in Series

Sorry - this is a NO.

Cold temperatures

Cold temperatures of below freezing (0°C) will cause damage to your cells if they are charged when in this cold state. You can safely discharge the battery down to -40°C, but NOT charge them.
We set our highly configurable BMS to stop accepting charge when the battery temperature drops to 3°C. Once this threshold has been reached the temperature must rise to 5°C for the BMS to allow charging again.
Why not 0°C? And why set the reset value to 5°C?

> Imagine it’s really cold and your pack gets down to -20°C.
> You get to your vehicle/boat/cottage and switch the heating on.
> Eventually the outside of the cells reach …. Say 1°C
> The inside of your cells are still frozen - you should NOT allow charging.
> So our setting of 5°C reset value is just a safety margin to allow the inside of your cells time to warm up.

Hot temperatures

Both charge and discharge Over Temperature Protect are set to 70°C, and the reset value is 10°C less than that at 60°C.
We've stress tested the batteries to determine how much heat buildup can be expected in cases of heavy and extended current draw. Our findings are that by the time the cells are depleted running at 160A the temperature is close to the cutoff (at a starting temperature of 21C).

Humidity

Please ensure the battery is not in an excessively humid environment. Although the cases are generally well sealed they are not airtight and as the components heat and cool air will be expelled and drawn back in.

… corrosion on terminals

Excessively humid environments will cause rusting on the terminals. In the first place, you should not have a battery in such conditions but if you have no choice please apply some dielectric paste to the terminals to reduce/prevent oxidation.

Versions of the Truth

This is to help you hold onto your sanity.
If you happen to connect your battery to other monitoring tools such as a SmartShunt or Cerbo GX you will notice that the BMS does not always agree with your other devices. Our suggestion is to decide on one device (probably your smartshunt) and use that as your version of the truth. Don't try to figure out the differences. For one thing, your BMS is there to measure your cells, and it will have it's own shunt that will drop the outgoing voltage slightly. In addition to this, MOSFETs can also have an affect on voltage. So use the BMS for what it's good at (managing and protecting the cells) and use a smartshunt for what it's good at (monitoring and reporting SOC accurately).

State of Charge (SOC) when you first get the battery

Initially the BMS will report an inaccurate state of charge. The reason for this is that while we perform a short stress test on every battery we don't fully charge them. The BMS simply doesn't know the true SOC until the first full charge has completed. From then on the BMS should maintain a reasonable accurate measurement of the SOC.
Remember to charge at 14.2v so the cells reach a value of 3.55v and then the BMS assumes 100% SOC (and correctly so).

Float Charging

As you might know your charging system allows you to set two voltages:

1. Bulk/Absorption

2. Float

In actual fact, LifePO4 doesn't really need float. But seeing as you can't always switch it off we suggest going with Victron defaults of 13.5

Battery Management System (BMS) Settings.

Please note, when we say "Highest Cell" we mean the cell with the highest voltage, and "Lowest Cell" means the cell with lowest voltage.
When we say "Release value for above" what we mean is that when the protection parameter defined in the parameter directly above this one kicks in, this is the value that will Release the condition. It should make sense as you read on.

In this section we're detailing all of the settings we've implemented in our OPS batteries. All our batteries are protected by a JK BMS which is very effective and highly configurable.

Basic Settings:

- Cell Count (4). This is simply the number of cells in your pack. A 12v LifePO4 battery (which is actually between 13v and 14v) has four prismatic cells with a nominal voltage of 3.2v each.
- Battery Capacity (AH) (100, 280 or 300). This is simply the capacity of your cells. The BMS needs this to calculate SOC.
- Balance Trig. Volt. (V) (0.01). The Balance Trigger Voltage Difference is a parameter that controls balance. When the balance switch is on, when the delta between highest cell and lowest cell voltage exceeds this value, the balance starts, and the balance ends when the difference voltage is lower than this value. For example, the balance trigger voltage difference is set to 0.01V. When the battery pack voltage difference is greater than 0.01V, balance is started, and when the battery pack voltage difference is lower than 0.01V, the balance is ended.
- Calibrating Volt. (V). The voltage calibration function can be used to correct the voltage that the BMS reads from the cells. We usually leave this alone.
- Calibrating Curr. (A) (0). If the current displayed by the BMS is incorrect it can be corrected here. Again, we leave this alone. For one thing, we'd rather rely on a smartshunt.

Advanced Settings:

- Cell OVP(V) (3.55). Cell Over Voltage Protection. Basically High Voltage Disconnect when charging. We base the 3.55v on the default of 14.2v used by Victron for LifePO4 (3.55x4=14.2).
- Cell OVPR(V) (3.50). Release value for above.
- Cell UVP(V) (2.65). Cell Under Voltage Protection. Basically Low Volt Disconnect when discharging.
- Cell UVPR(V) (2.60). Release value for above.

- Power Off Vol.(V) (2.5). When any one of the cells reaches this value the BMS will turn itself off.
- Start Balance Volt.(V) (3.0). Balancing can only occur when all cells are at or above this voltage. We like to leave a fairly big window for balancing.
- Max Balance Cur.(A) (2.0). The maximum balancing current. 2A is the max. It means that charge will be transferred from highest cell to lowest cell at a maximum of this amperage.
- Charge Over Current Protection parameters
    - Continued Charge Curr.(A) (100A for OPS100, 200A for OPS280 and OPS300). What maximum amperage do you charge the battery at? When your charging system exceeds this parameter the Charge MOS will disconnect. Take note of this parameter - it catches many people out! This parameter must be set in conjunction with the Charge OCP Delay (below)
    - Charge OCP Delay(S) (30). Charge Over Current Protection Delay. When the charging current exceeds the maximum set above for the number of seconds defined in this parameter the charge MOS will be switched off.
    - Charge OCPR Time(S) (60). Number of seconds before Charge OCP Releases, so if there was Over-Charging and the charge MOS has been turned off the system waits this number of seconds before turning the charge MOS back on.
- Discharge Over Current Protection parameters
    - Continued Discharge Curr.(A) (100A for OPS100, 200A for OPS280 and OPS300). Maximum Discharge Current Allowed. When the discharge current exceeds this value for the number of seconds specified below the discharge MOS is turned off.
    - Discharge OCP Delay(S) (300). See above
    - Discharge OCPR Time(S) (60). Number of seconds before Discharge OCP Releases, so if there was Over-Discharging and the discharge MOS has been turned off the system waits this number of seconds before turning the discharge MOS back on.
- SCP Delay(us) (1500). Short Circuit Protection.
- SCPR Time(S) (60). Release Short Circuit Protection
- Charge OTP(°C) (70). Charge Over Temperature Protection. When the temperature measured at the probes exceeds this value the system will switch the charge MOS off.
- Charge OTPR(°C) (60). Release value for above.
- Discharge OTP(°C) (70). Discharge Over Temperature Protection. When the temperature measured at the probes exceeds this value the system will switch the discharge MOS off.
- Discharge OTPR(°C) (60). Release value for above.
- Charge UTP(°C) (3°C). Charge Under Temperature Protection. When the temperature measured at the probes is less than this value the system will switch the charge MOS off.

- Charge UTPR(°C) (5°C). Release value for above.
- MOS OTP(°C) (100). MOS Over Temperature Protection. When the MOS temperature reaches this value the BMS will stop both charging and discharging.
- MOS OTPR(°C) (80). Release value for above.
- User Private Data. Ignore this.
- Wire Resistances. If you know the true resistance, you can set it here. This is the resistance of the balance leads. We leave these values - they are handy for debugging problems.