

Setting up your Battery BMS

I will highlight this at the top of this article, as it is highly important, especially to novices who have not built batteries previously – **busbar nuts should NOT BE OVER-TIGHTENED!** Check the datasheets below for the maximum torque permitted, but as a general rule we would advise tightening to **4Nm torque** and no more! Do not expect your standard automotive torque wrench to measure this accurately – it is way too low on its range. You will need to either calculate and apply the correct torque using a spring balance and a known length of spanner/wrench OR use a digital low-torque gauge, such as the ones we have for sale. They are not expensive, and well worth it to avoid. We can also hire you one for the duration of your build and you can send it back once the job has been completed.

Choosing your BMS

Most battery builders will use JK, Seplos or Daly. We recommend the JK BMS. This is a good quality BMS with plenty of features and is also available with built-in active balancer of either 1Amp or 2Amp. Balancing the cells is important, but with new cells, you will find the active balancer is only active for very short periods of time. In this respect, the 1Amp version, which is slightly cheaper, is more than sufficient. For old cells or cells that have been treated harshly, you may find a bigger capacity difference has built-up over time, in which case a 2A active-balancer may be an advantage. To be honest, many customers will opt for the 2A version, but in our view, the 1A version should achieve the objective just as effectively. You can buy the BMS in different variations – eg there is a 4S-8S version (which is suitable for 4-8cells) and there is a 16S version suitable for up to 16 cells.

Current rating

The JK BMS is available in 100A, 150A, 200A and 300A ratings. Most customers chose the 200A rating, even though this may be vastly over-rated for the inverter they plan to use. For example, 200A on a 48V battery system will be equivalent to approximately 10kW. If you have a 3kW inverter, it may not exceed 70Amps. Although some inverters can be over-driven for short periods of time – so check your inverter manual before deciding on which BMS to choose.

Setting up your BMS:

There are some useful videos on Youtube to help you understand the settings in your BMS – Check out this website - <https://off-grid-garage.com/my-settings/> which also has videos on various BMS systems.

For the JK BMS, the easiest way to check/change the settings is by downloading the JK BMS app from your app store, and use that to connect to the BMS using BLE (Low-energy Bluetooth). Note that you need to be fairly close to the BMS for this – partly because the signal strength is low and partly because the BMS is shielded to a greater extent by the battery casing.

We've summarised the settings we use when building systems below, but check out what each setting means, refer to the datasheet and decide what suits your application best.

JK BMS Advanced Settings

Cell Count	16	This is the number of cells in the battery
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Capacity	314	The cell capacity in Ah
Calibration Voltage	xx.x V	This is the measured voltage of the battery. If it is incorrect, it can be adjusted, but this is not recommended unless you have a calibrated meter with which to check it
Calibration Current	xx.x A	This is the measured current
Advanced Settings		
Start Voltage	3.40V	The voltage at which cell balancing may start.
Max Balance Current	2.0A	The maximum current permitted in active-balancing
Cell OVP	3.65V	The maximum voltage value for ANY cell, which causes the BMS to shut-down charging
Vol Cell RCV	3.45V	This is the target voltage recommended by the BMS to the charging device (eg inverter) via CANBUS
SOC 100%	3.449V	This setting defines when 100% SOC has been reached
cell OVPR	3.42V	The voltage at which normal charging will resume, after the voltage has exceeded the Cell OVP setting
cell UVPR	2.9V	After a low-voltage cutout, the cell voltage needs to exceed this level before the BMS will allow discharging to resume
SOC 0%	2.65V	Defining the cell voltage which will be considered 0% state of charge
cell UVP	2.6V	The cell voltage at which the BMS will disconnect the load to prevent over-discharging the battery
Power Off V	2.5V	The voltage at which the BMS will completely power-down (including Bluetooth) to prevent deep discharge damage
Vol Cell RFV	3.35V	The 'requested float voltage' setting sent to the inverter/charger via CANBUS
Vol SmartSleep	3.5V	To prevent battery from being self-discharged by BMS during long periods of inactivity it will shut down if zero current is detected for a period defined in the setting below
Time SmartSleep	24	In conjunction with the setting above, the number of hours at zero current that triggers the BMS shutting down.
Cont Charge Cur	100	Maximum continuous charging current. Usually set to 0.2 – 0.5 x the Ah capacity rating of the cells. Check datasheet of cell for manufacturer recommendation.
Delay	3	How long Cont Charge Cur can be exceeded before triggering shutdown
Charge OCPtime	60	Defines how long the BMS waits before reconnecting load after a shutdown due to Charge OCP
Cont Discharge Cur	150A	Maximum continuous discharge current permitted
Delay		How long Cont Discharge Cur can be exceeded before triggering shutdown
Discharge OCPtime	60	Defines how long the BMS waits before reconnecting load after a shutdown due to Discharge OCP
Charge OTP	50	If during charging, this battery temperature is exceeded,

		operation is paused until it cools
Charge OTPR	45	Following the above, this temperature allows normal operation to resume
Discharge OTP	55	If during discharging, this battery temperature is exceeded, operation is paused until it cools
Discharge OTPR	50	Following the above, this temperature allows normal operation to resume
Charge UTPR	4	Cell temperature at which normal operation resumes, after being halted due to falling below 'Charge UTP' temperature.
Charge UTP	2	When battery temperature falls below this level, charging will be halted until temperature warms up again to protect cells from damage
Mos OTP	80	Transistor temperature which will trigger a shut-down
Mos OTPR	70	Following the above, this temperature will allow normal operation to resume
SCP Delay	5	Defines how long in uSeconds, a Short Circuit is tolerated before BMS shuts down
SCP PR Time	60	Defines how long in Seconds, the BMS waits before resuming discharge after Short Circuit Protection has been activated
Device Add	0	Address of BMS – 0 for the master, other address for any other linked bats
Data StoredPeriod	3600	How often the BMS records data (in seconds)
RCVtime	0.5	Defines period (in hours) that BMS must maintain battery at the Recommended Charge Voltage in order to allow cells to complete balancing and to trigger 100% SOC status.
RFVtime	5	Defines period (in hours) that BMS requests inverter/charger to maintain battery at the slightly reduced float voltage

Notes

State of Charge calculated by BMS – The *reported* SoC tends to drift relative to the *actual* SoC over time as more charge/discharge cycles take place. This is a common issue with many popular BMS such as JK and Seplos. The BMS is supposed to reset the SoC once it has charged to 100% but as the charge tapers off close to 100%, it can take a LONG time to reach 100%, and so the battery charging cycle (eg Solar-powered or cheap-rate electricity) may end before 100% has been reached – particularly for larger battery systems. One work-around is to use the JK mobile app to change the battery capacity slightly – eg from 314Ah to 315Ah. This will reset the SoC to a calculated value based on the current voltage.

If you have the ALARM LED lit on the Battery for no reason, check that you have changed the default password. The default password for JK BMS is 123456 to access the advanced settings. If you do not reset this to something else, the JK BMS will keep the ALARM LED lit until you have changed it.