

Overkill Solar BMS

Configuration for alternative cell counts



Section 1: What? Why?

This document describes how to modify an Overkill Solar BMS for alternative cell counts.

Overkill Solar normally stocks 3 basic BMS models, which are configured for the most common Lithium Iron Phosphate (LiFePO₄) battery setups: 4 cell 12v nominal, 8 cell 24v nominal, and 16 cell 48v nominal.

When using a different cell chemistry such as classic lithium ion, the number of cells needs to be adjusted to reach a usable system voltage. Common setups are 6 or 7 cells for a 24v system, and 12 or 13 cells for a 48v system.

Our BMSs all use similar Texas Instruments BQ series BMS chips. These chips measure the cell voltages and handle balancing and signal the high current FET array to switch on or off. These chips can be configured for a limited range of cell counts as outlined below. This configuration is done manually.

After correctly configuring the balance wire connections, use the Overkill Solar BMS app to set the “Number of Cells” parameter to match.

The procedure:

- Determine your cell count. Make sure your BMS can support this cell count.
- Modify the BMS balance connector/wiring as described in the appropriate section below.
- Program the new cell count and protection parameters into the BMS.
 - This depends on your specific cells. Consult your cell’s datasheet if possible.

Outline:

- Section 1: What? Why?
- Section 2: 4s BMS (JBD-SP04S020)
 - Table 2.1: Cell Connections for 4s BMS
 - Figure 2.2: 4 cell BMS connection detail.
 - Figure 2.3: 3 cell BMS connection detail.
- Section 3: 8s BMS (JBD-SP10S009)
 - Table 3.1: Cell Connections for 8s BMS
 - Figure 3.2: 8 cell BMS connection detail.
 - Figure 3.3: 6 cell BMS connection detail.
- Section 4: 16s BMS (JBD-SP25S003)
- Appendix a: Safety Warnings
- Appendix b: Links

Section 2: 4s BMS (JBD-SP04S020)

The 4s BMS uses the Texas Instruments BQ7692003 BMS frontend chip.

This chip can be used for 3 to 5 cells, however because the 4s circuit board does not include the 5th cell input, only 3 or 4 cell configurations are possible.

To change the cell count, the cell inputs must be jumpered together as shown in table 2.1.

This is usually done with a solder bridge between adjacent pins on the balance wire connector.

After making the required jumper connections, the connector should be relabeled to match your actual configuration.

The bridge/jumper connections are highlighted.

Table 2.1: Cell Connections for 4s BMS (JBD-SP04S020):

Input	3 cells (fig. 2.3)	4 cells (fig. 2.2)
4	BC3	BC4
3	BC3	BC3
2	BC2	BC2
1	BC1	BC1
0	BC0	BC0

This table was derived from Table 9-2 in the BQ769x0 datasheet from Texas Instruments
 Full datasheet: <https://www.ti.com/lit/ds/slusbk2i/slusbk2i.pdf>

Figure 2.2: 4 cell BMS connection detail.

This is the normal configuration for 4 cell LiFePO4. (12v nominal system)
This view is normally obscured by the heat sink.

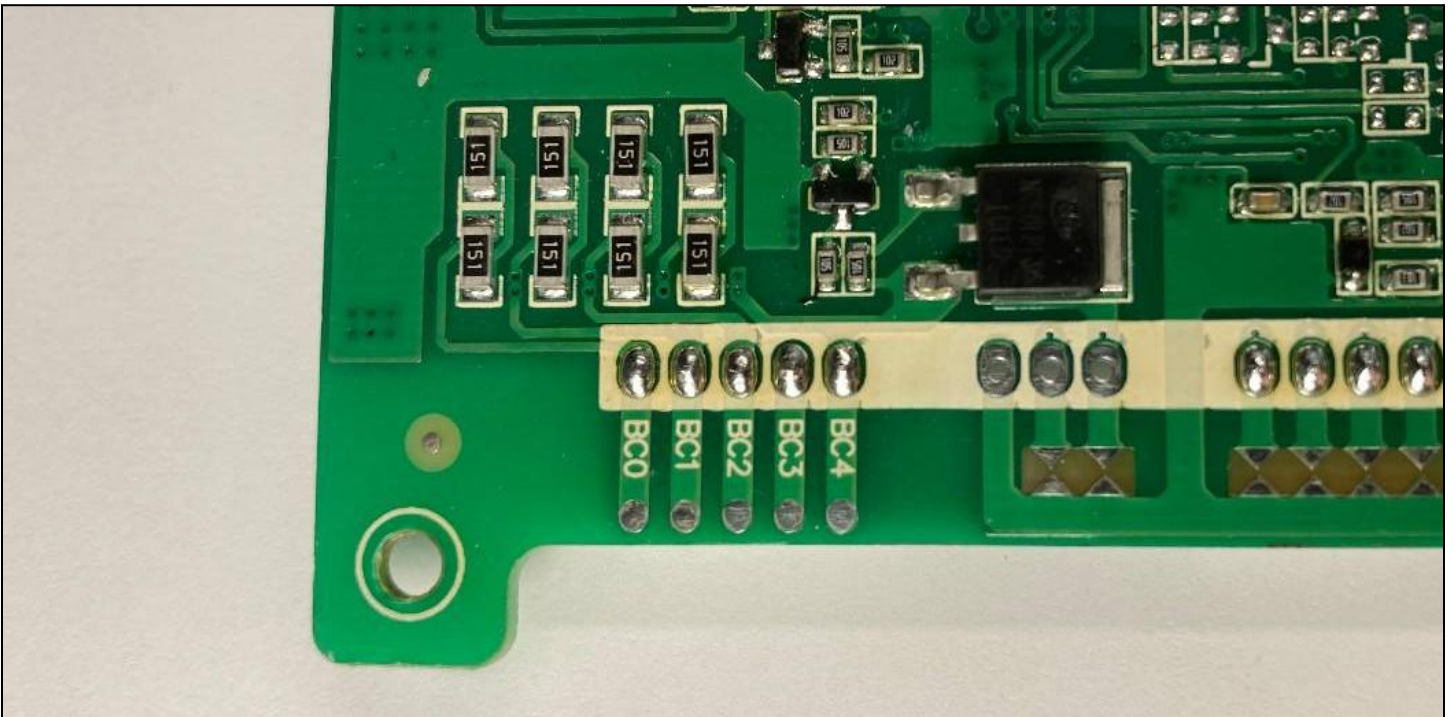
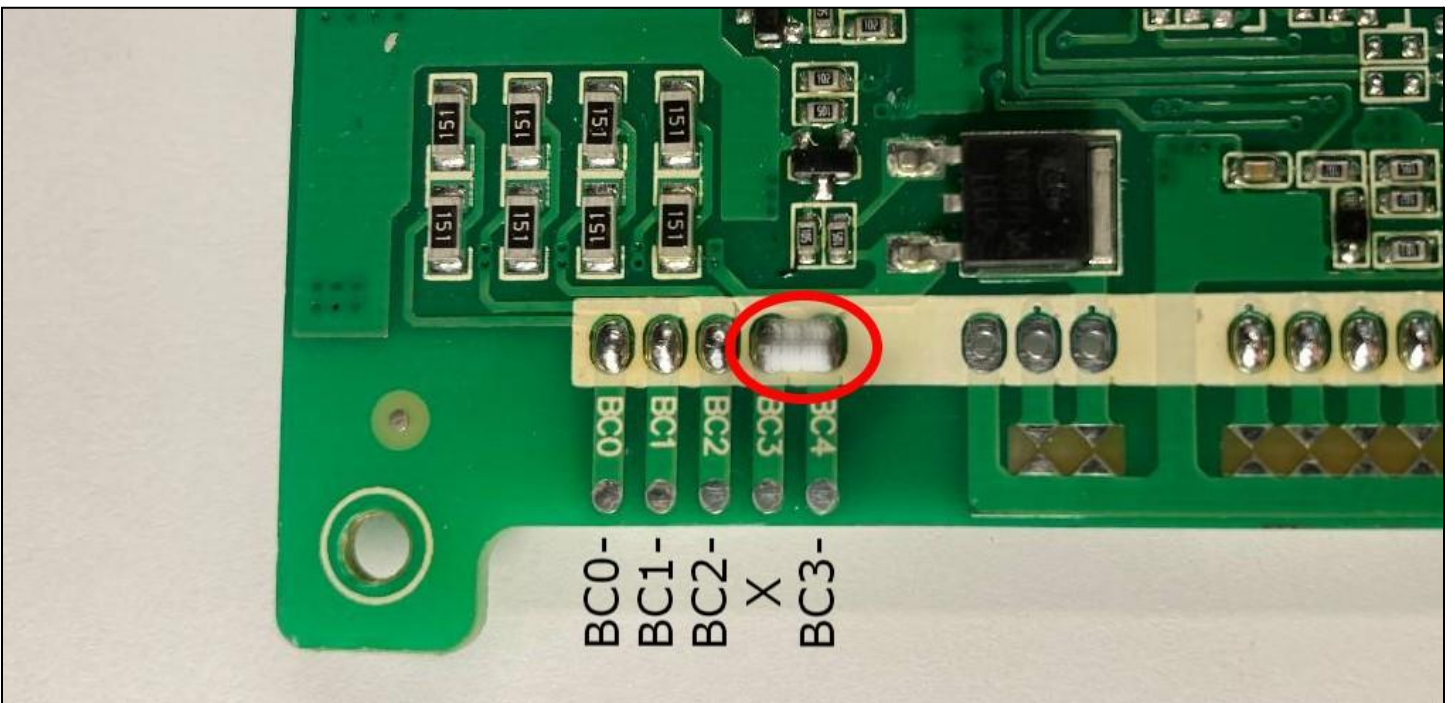


Figure 2.3: 3 cell BMS connection detail.

Inputs 3 and 4 are bridged together.
This configuration can be used for 3 cell lithium ion.



Section 3: 8s BMS (JBD-SP10S009)

The 8s BMS uses the Texas Instruments BQ7693003 BMS frontend chip.

This chip can be used for 6 to 10 cells. Lower cell counts are not possible with this chip.

To change the cell count, the cell inputs must be jumpered together as shown in table 3.1.

This is usually done with a solder bridge between adjacent pins on the balance wire connector.

The 8s BMS circuit board is actually labeled for all 10 balance wire connections. (see figure 3.2)

After making the required jumper connections, the connector should be relabeled to match your actual configuration.

The bridge/jumper connections are highlighted.

Table 3.1: Cell Connections for 8s BMS (JBD-SP10S009):

Input	6 cells (fig. 3.3)	7 cells	8 cells (fig. 3.2)	9 cells	10 cells
10	BC6	BC7	BC8	BC9	BC10
9	BC5	BC6	BC7	BC8	BC9
8	BC5	BC6	BC7	BC8	BC8
7	BC5	BC6	BC6	BC7	BC7
6	BC4	BC5	BC5	BC6	BC6
5	BC3	BC4	BC4	BC5	BC5
4	BC2	BC3	BC3	BC4	BC4
3	BC2	BC3	BC3	BC3	BC3
2	BC2	BC2	BC2	BC2	BC2
1	BC1	BC1	BC1	BC1	BC1
0	BC0	BC0	BC0	BC0	BC0

This table was derived from Table 9-3 in the BQ769x0 datasheet from Texas Instruments

Full datasheet: <https://www.ti.com/lit/ds/slusbk2i/slusbk2i.pdf>

Figure 3.2: 8 cell BMS connection detail.

This is the normal configuration for 8 cell LiFePO4. (24v nominal system)
Inputs 3-4 and 8-9 are bridged.

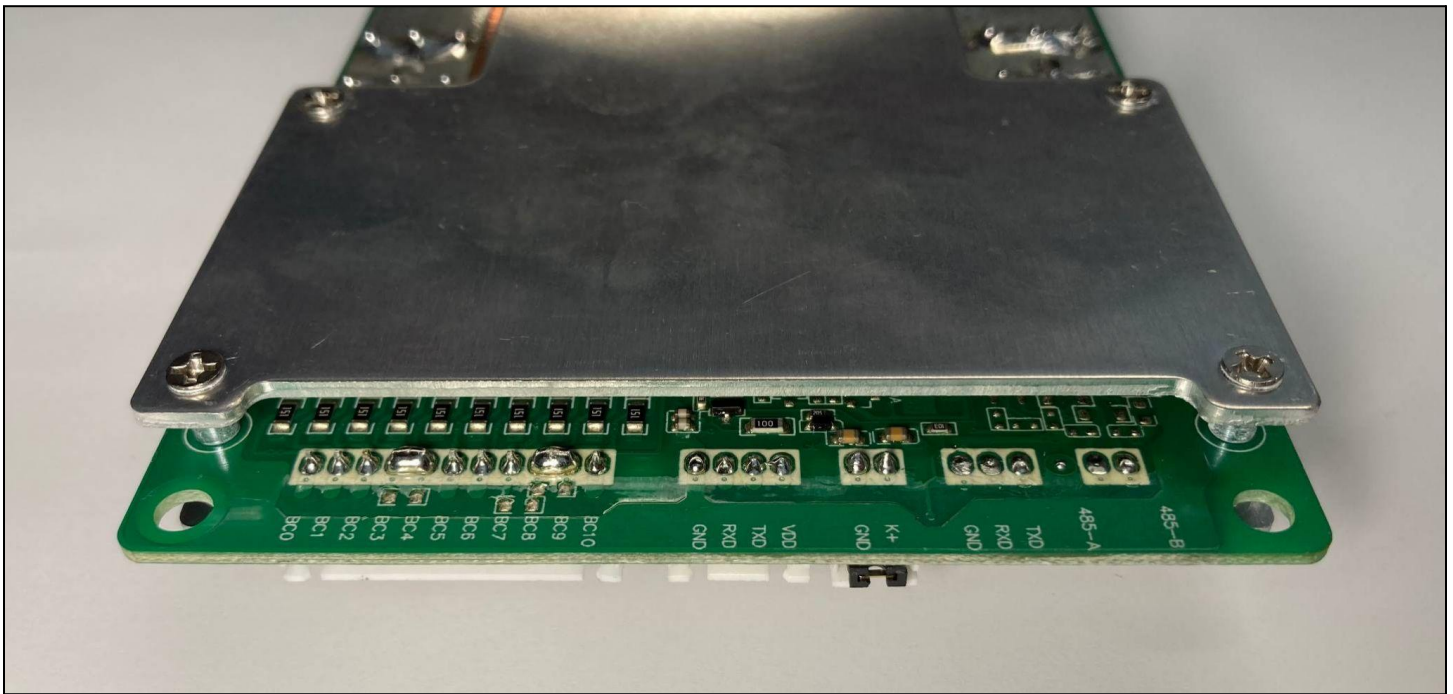
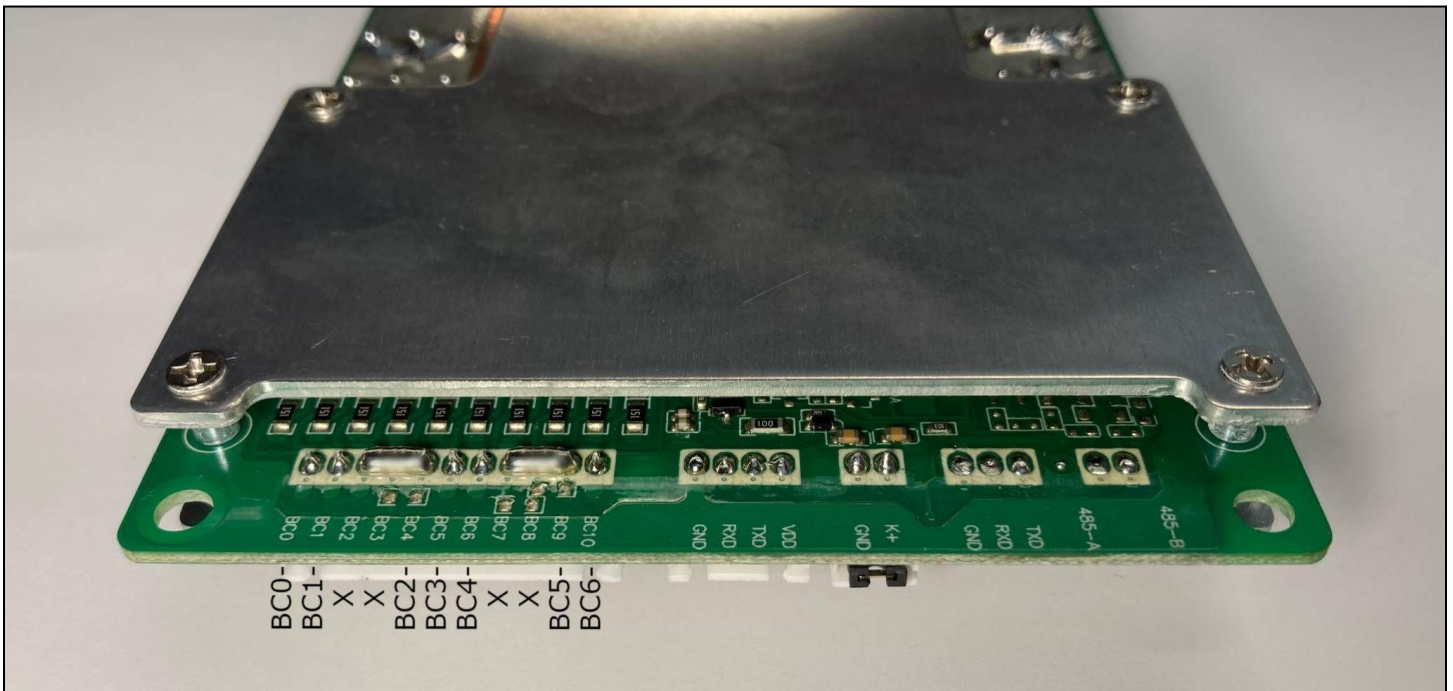


Figure 3.3: 6 cell BMS connection detail.

Inputs 2-3-4 and 7-8-9 are bridged.
This configuration can be used for 6 cell lithium ion batteries, such as Tesla Model S modules.
(24v nominal system)



Section 4: 16s BMS (JBD-SP25S003)

This BMS board is actually designed for up to 25 cells but the as-built configuration DOES NOT allow any cell counts other than 16s, unfortunately.

Appendix a: Safety Warnings



Carefully check, recheck, and triple check all your connections. Shorting adjacent cells with misplaced solder bridges **WILL** cause a fire.

Use a voltmeter to check the polarity of your cells! We have seen cells with the labels on backwards. Check it yourself. Reverse polarity will destroy the BMS and start a fire.

If you are using lithium ion cells, EXTREME care must be taken when making connections. This type of cell will burn vigorously if damaged. We suggest working on lithium ion cells on an open field 100 feet from combustible material or structures. If a fire starts, retreat to a safe distance.

Appendix b: links

Archived copy of the BQ769x0 datasheet from Texas Instruments:

https://github.com/FurTrader/OverkillSolarBMS/raw/master/BQ769X0_DATASHEET_archived_oct_2022.pdf