



www.orionbms.com

Orion Jr. 2 Purchasing Guide

Rev. 1.0

The Orion Jr. 2 BMS is a low cost battery management system designed to manage low voltage lithium ion battery packs up to 48V nominal. The Orion Jr. 2 is built on the same technology as the standard Orion BMS, but it is smaller and lighter and is designed with features for stationary and light mobile applications such as solar & wind storage, UPS systems, golf carts, forklifts, scooters, etc.

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Ewert Energy Systems is a research & development company focusing on developing solutions for plug-in hybrid and electric vehicles and other energy storage applications. Ewert Energy provides custom solutions as well as off the shelf components.



Main Components

Orion Jr. 2 Unit



To reduce costs, the Orion Jr. 2 BMS is offered in different configurations with different parts loaded. The Orion Jr. 2 options are regarding the number of cells supported and whether the unit has a CANBUS interface or not. Please carefully read “Wiring the BMS” in the “Wiring Manual” before determining which size BMS is required. Ideally, the BMS can be ordered sized to the actual number of cells in the application. However, in some special cases, depending on the placement of fuses, safety disconnects or and any high resistance busbars / cables, the BMS may need to be sized for more cells than the pack actually has.

Units can be field configured for any number of cells less than or equal to the size of the unit. For example, a 16 cell unit can be connected to any number of cells less than 16. The following table shows the standard available cell number ordering options. Additional custom configurations can be requested for larger quantities.

<u>BMS Size</u>	<u>Cell Groups Populated</u>	<u>Without CAN Part #</u>	<u>CAN Enabled Part #</u>
8	1	J2BMS8 *	J2BMS8C
16	1, 2	J2BMS16	J2BMS16C

**This version is currently available by special order (minimum quantities apply)*

The enclosure drawings are available on downloads page of the Orion BMS website under “Orion Jr. 2” (<http://www.orionbms.com/support>).

The Orion Jr. 2 is designed to manage one battery string. If multiple strings are to be paralleled together, special care must be taken, and one Orion Jr. 2 BMS unit per string would be necessary. Please see the “Wiring and Installation Manual” for more information. Please note that one unit may be used for a single string where multiple cells have been paralleled together at the cell level.

Current Sensor



The current sensor should be sized to meet the highest amperage expected in an application. While no longer as important with these higher accuracy current sensors, they should be sized as small as possible to improve accuracy. For example, if an application has an expected maximum amperage of 275 amps, a 500A current sensor should be used. Some headroom should be left between the maximum expected amperage and the size of the current sensor to allow for brief current transients that may exceed the rating of the current sensor. For example, if the application is expected to draw 190 amps maximum, a 500A current sensor should be selected even though a 200A sensor is technically large enough. While accuracy is somewhat improved by using the smallest current sensor for the application, it is best to error on the side of getting a sensor that is larger than necessary since the accuracy is not greatly improved. Each sensor does allow for 20% overage before setting a fault.

The current sensors offered with the Orion Jr. 2 BMS are dual range sensors and contain 2 sensors in each package. One sensor is smaller than the other and this is used to provide both redundancy and to improve accuracy measuring smaller currents while maintaining the ability to measure large currents as well.

The following sizes are stocked:

Maximum Current	Part Number
+/- 200A	CS134200
+/- 500A	CS124500
+/- 800A	CS155800
+/- 1000A	CS1371K

When using the Orion Jr. 2 BMS with applications with AC to DC inverters, the 200A and 800A sensors are recommended because they have a higher frequency response time.

The Orion Jr. 2 BMS supports current sensors > 1000A, however those applications typically require more care to select. Please contact Ewert Energy if higher currents are necessary.

The current sensor is technically optional, however it is strongly recommended because the majority of the Orion Jr. 2 BMS systems' features depend on having an accurate current sensor.

Without a current sensor, the Orion BMS is unable to provide any of the following calculations:

- Internal resistance calculations
- Battery health monitoring
- Over-current protection (still provides over and under voltage protection)
- Current measurements
- Open cell voltage calculation
- Weak cell faults
- State of charge calculation or state of charge drift
- Calculation of Charge or Discharge current limits

Thermistors



200cm length thermistors pictured

The Orion Jr. 2 main unit supports 3 thermistors. If more than 3 thermistors are needed, additional thermistors can be connected to the Orion Jr. 2 unit using the Thermistor Expansion Module (sold separately).

Thermistors connected to the main unit are 10K thermistors with a B25/50 value of 3380K. Three (3) compatible 200cm length thermistors are included with the pre-wired Main I/O harnesses.

Optional Pre-Wired Harnesses

For your convenience, pre-assembled wiring harnesses are available for all Orion Jr. 2 connectors. These pre-wired harnesses are strongly encouraged for small run and prototype systems.

The Orion Jr. 2 BMS has 2 harnesses:

- 1) Cell voltage tap harness
- 2) Current sensor harness
- 3) Main I/O harness (CAN and non-CAN versions available)

Purchasing pre-assembled wiring harnesses is optional however it is strongly recommended as this greatly simplifies initial installations and prototyping.

The part numbers for the connectors and crimps used in these harnesses are all published in the Orion Jr. 2 BMS wiring manual.

Cell Voltage Tap Wiring Harness

The cell voltage tap wiring harness is what connects the battery cells to the BMS. It comes standard as a 6 foot (1.8 meter) length and is terminated in cut wire without any terminals. The wires are 22 AWG stranded and appropriate crimps should be used with them. Each wire on the wiring harness is numbered to simplify installation.



*16 Cell Voltage Tap Harness - p/n **CWHJ2166** pictured.*

NOTE: For the 8 cell version of the Orion Jr. 2 BMS a version of the harness with only 8 cells loaded is available. That part number is: **CWHJ286**

Current Sensor Wiring Harness

The current sensor wiring harness is what connects the hall effect current sensor to the BMS via 4 wires. The harness is approximately 18 inches long and comes with the correct mating connectors already installed on both ends.

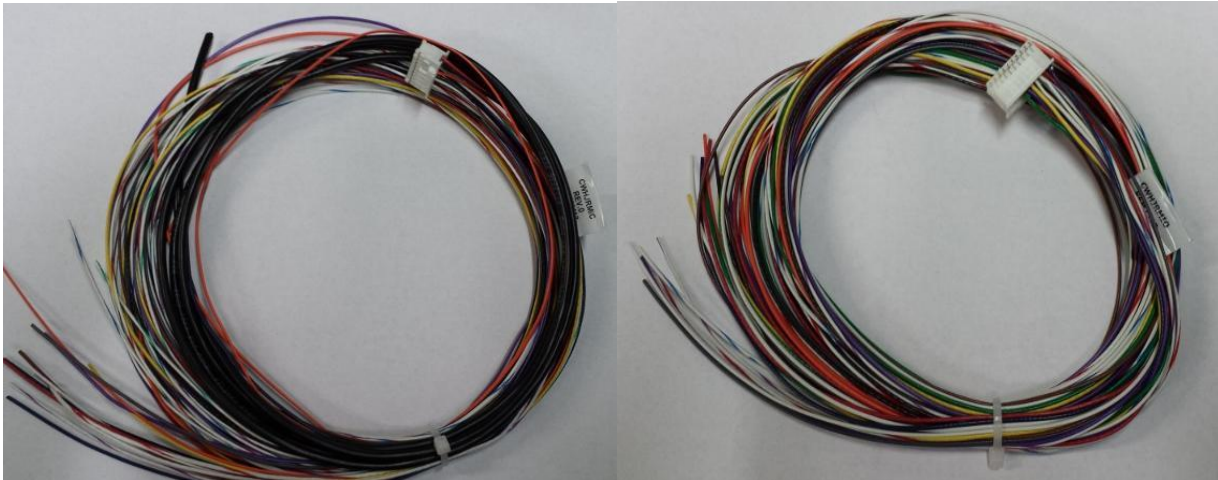


*Current Sensor Harness - p/n **CWHJ2CUR** pictured*

Main I/O Harness

Two versions of the Main I/O harness are available for the Orion Jr. 2 unit:

<u>Part Number</u>	<u>Description</u>
CWHJRM12	Standard Non-CAN wiring harness - 6ft length (1.8 meters)
CWHJRM2C	CAN enabled wiring harness - 6ft length (1.8 meters)



CAN-Version (p/n: CWHJRM2C)

Standard Version (p/n: CWHJRM12)

Both versions of the Main I/O harnesses are terminated in blunt cut wire. All usable pins are populated on both versions of the cable, but CAN wires are only present on the CAN enabled version. All wires including the optional CAN wires are 6 feet (1.8 meters) in length except for the CAN wires. CAN wires are a single shielded twisted pair cable.

In both cases, 3 thermistors are included.

Optional Add-On Modules

Thermal Expansion Module



Thermistor Expansion Module (p/n: OXMTEM80) pictured

The thermistor expansion module is used in applications where more than the 3 standard thermistors are needed for temperature monitoring. One thermal expansion module monitors up to 80 thermistors. The unit communicates with the Orion Jr. 2 BMS system via CANBUS or via two 5V analog signals (emulated thermistors). The thermal expansion module is programmable and can be setup for the exact number of thermistors the application requires. A software utility allows for viewing the value of each individual thermistor so that thermistor errors can easily be located.

The thermistor expansion module is compatible with both the CANBUS enabled and non-CANBUS enabled Orion Jr. 2 BMS products.

NOTE: A CANdapter is required for configuring the Thermistor Expansion Module.

Please see the Thermistor Expansion Module Purchasing Guide for more information on ordering options.

The thermistor expansion module requires 12vDC power to operate.

Basic Display Module



Basic Display Module (p/n: OXMBD48) pictured

The Basic Display module for the Orion Jr. BMS provides visual feedback of the essential information on a battery pack. This information includes State of Charge, Power Limited (reduced output power), and the Malfunction Indicator Status (error indicator).

The Basic Display now has an operating voltage range of 12vDC to 48vDC (**NOTE: Requires part-number OXMBD48 for 48v tolerance!**), allowing it to be powered directly off the battery pack in many cases. Older basic displays (part-number OXMBDISP) had a limitation of 12vDC operation.

Data Logging Display Module



The Data Logging Display for the Orion Jr. 2 BMS (**compatible with CAN enabled units only**) provides visual feedback of the essential information on a battery pack as well as data logging capabilities for diagnostics. This display and logging combo connects to an Orion BMS unit via CAN (Controller Area Network) and logs user-selected data to a memory card while displaying State of Charge, Power Limited (reduced output power), and the Malfunction Indicator Status (error indicator).

Product Specifications

- Logs BMS parameters to memory card at user selectable sampling rate
- Connects to the Orion Jr. 2 BMS via CAN (no analog connections)
- Supports brightness dimming for automotive use (via CAN)
- External “event trigger” input which can flag events for future review
- Log graphing and analysis software
- Real time clock to store data and time of each charge / discharge cycle
- Supports CAN frequencies of 125, 250, 500Kbps, and 1 Mbps
- User customizable logging frequency from 100mS to 10 seconds
- Compatible with any size “micro SD” type memory card up to 32Gb in size (required for data logging; memory card not included with purchase)

The data logging display requires 12vDC power to operate.

Orion Connect WiFi Module



The Orion BMS Connect is an internet based remote monitoring system that enables monitoring battery packs through a web browser, smartphone, or tablet. Instant data, charts of recent history, and diagnostic information including recent events, fault codes, and freeze frame data are available. The device can also optionally log data to a local memory card and generate emailed alerts when certain events occur. Onboard memory allows this device to be used in certain mobile applications where data can be synchronized periodically.

Product Specifications

- Monitors parameters in real time: Pack amperage, pack voltage, highest and lowest cell voltages and temperatures, pack state of charge, DTC codes including freeze-frame data.
- Optional memory card data logging
- Supports multiple WiFi protocols (802.11 b/g/n)
- 12-48v DC power supply
- Compatible with Orion BMS, Orion BMS 2 and CANBUS-enabled Orion Jr. 2 BMS units

Optional Installation Tools

Tap Validation Tool



The tap validation tool is used to determine if the battery tap connectors are properly wired before connecting to the Orion Jr. 2 BMS. Improperly wired connectors can cause permanent damage to the Orion BMS unit that is not covered by warranty.

The tap validation tool is available both for weekly rentals for single use applications as well as for purchase for OEMs that need the tool for use on an assembly line.

A minimum firmware version of V0.4 is required to be compatible with the Orion Jr. 2 BMS. Older tap tools may need to be sent in for factory reprogramming to be compatible.

NOTE: An adapter is required to use the tap tool with the Orion Jr. 2 BMS (p/n: CWHJ2VAL).

CANdapter



CANBUS to USB adapter (CANdapter)

The CANdapter is a low cost CAN to USB adapter used to monitor CAN traffic for diagnostic purposes and can be used to upload and download configuration settings. **The Orion Jr. unit does not require the CANdapter for programming [the RS232 interface can be used instead], but it may be a useful support tool for CAN enabled units.** All programming and diagnostics for the Orion Jr. unit are performed using the RS-232 interface on the BMS.

More info on the CANdapter can be found at: <http://www.candapter.com>

Required Components (Not Available for Purchase from Ewert Energy)

USB-to-Serial adapter (RS-232 interface needed to program Orion Jr. units)

The Orion Jr. 2 BMS must be programmed using a computer and the Orion Jr. 2 BMS utility in order to operate. **The BMS will not function until programmed.** The necessary utility can be downloaded from www.orionbms.com/downloads.

The Orion Jr. can either be programmed by connecting to a computer's RS-232 port or directly to a USB to Serial adapter. A USB to Serial adapter can be plugged directly into the BMS without an extension cable. However, if a serial extension cable is used to physically extend the connection, it must be a **straight through serial cable**. Any other type of RS-232 cable including a null-modem cable will **not** work.

Straight Through Pinout

Connector 1		Connector 2
2 (RX)	---	2 (RX)
3 (TX)	---	3 (TX)
5 (GND)	---	5 (GND)
7 (RTS) *	---	7 (RTS) *
8 (CTS)	---	8 (CTS)

Minimum required connection for straight through serial cable (additional wires 1-1, 4-4, 6-6 and 9-9 may also be present but are not necessary for proper operation.)

*The BMS serial transceiver is powered by the RTS pin and will not function without it.

OEM & Reseller Sales

Prices listed on the Orion BMS website are our suggested retail prices for single quantity units. We offer a favorable pricing structure for OEMs, so please request a quote for pricing for quantities over 5 units. For larger orders, custom modifications are possible.