www.orionbms.com

Orion Jr. Purchasing Guide
Rev. 1.2

The Orion Jr. BMS is a low cost battery management system designed to manage low voltage lithium ion battery packs up to 48V nominal. The Orion Jr. 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.

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. Unit

In order to reduce costs, the Orion Jr. BMS is offered in different configurations with different parts loaded. The Orion Jr. 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.

BMS Size	Cell Groups Populated	Without CAN Part #	CAN Enabled Part #
12	1	ORION12J *	ORION12C *
16	1, 2	ORION16	ORION16C

12 cell versions currently available by special order (minimum quantities apply)

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

The Orion Jr. is designed to manage one battery string. If multiple strings are to be paralleled together,

special care must be taken, and one Orion Jr. 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 Orion Jr. uses inline shunt current sensors to measure current. Inline shunts are more cost effective than hall effect sensors and are available in many sizes from many different manufactures.

The current sensor should be sized larger than the highest peak amperage expected in an application (including momentary spikes lasting more than 1 second), but should be sized as small as possible to improve accuracy. 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 195 amps maximum, a 200A current sensor should not be used. Additionally, as shunt current sensors heat up, some manufactures specify a maximum continuous average amperage of only ⅔ the rated amperage of the sensor and some airflow may be necessary. For this reason, sometimes it is desirable to use a larger size sensor or a 75mV shunt as a 50mV shunt.

The Orion Jr. BMS is compatible with 50mV shunts. 75mV shunts can also be used, but the current measurement is limited by the equivalent 50mV rating (⅔ of the 75mV rating.) For example, a 200A 75mV shunt may be used as a 150A 50mV shunt. In this example, the maximum amperage is 150A even though the shunt is rated 200A / 75mV. The table below lists currently supported shunt sizes. Support for additional sizes is available on request.

Max Current	50mV Shunt	75mV Shunt Equivalent	Maximum Amperage
+/- 20A	20A / 50mV	30A / 75mV	20A
+/- 50A	50A / 50mV	75A / 75mV	50A
+/- 100A	100A / 50mV	150A / 75mV	100A
+/- 150A	150A / 50mV	200A / 75mV	150A
+/- 200A	200A / 50mV	300A / 75mV	200A
+/- 333A	N/A	500A / 75mV	333A
+/- 400A	400A / 50mV	600A / 75mV	400A
+/- 500A	500A / 50mV	750A / 75mV	500A
+/- 600A*	600A / 50mV	900A / 75mV	600A
+/- 1000A*	1000A / 50mV	1500A / 75mV	1000A

Accuracy is reduced when using current sensors over 500A

While the current sensor is technically optional, it is strongly recommended because the majority of the Orion Jr. BMS system's features depend on having an accurate current sensor.

Without a current sensor, the Orion Jr. is unable to provide any of the following calculations:
- Internal resistance calculations
- Battery health

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

For your convenience, Ewert Energy currently stocks the following size sensors: **50A, 150A, 200A, 500A.** Shunt current sensors may be purchased from other manufacturers and used with the Orion Jr. Please note that some shunt current sensor manufacturers specify a lower maximum continuous amperage for heat dissipation and some lower cost shunt current sensors may have a wide accuracy tolerance. The Orion Jr. utility has a provision for manually calibrating a current sensor if a low accuracy tolerance sensor is used. However, we recommend using a higher accuracy sensor.

Thermistors

2x thermistors pictured, 200cm length

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

Thermistors connected to the main unit are 10K thermistors with a B25/50 value of 3380K. Two 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. connectors. These pre-wired harnesses are strongly encouraged for small run and prototype systems.

The Orion Jr. BMS has 2 harnesses:
1) Cell voltage tap harness
2) Main I/O harness (CAN and non-CAN versions available)

Purchasing pre-assembled wiring harnesses is optional. If the Orion Jr. BMS units are ordered without the pre-assembled wiring harnesses, crimps and connectors are provided. If the pre-wired harnesses are ordered, the crimps and connectors are not included since they are not necessary.

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.
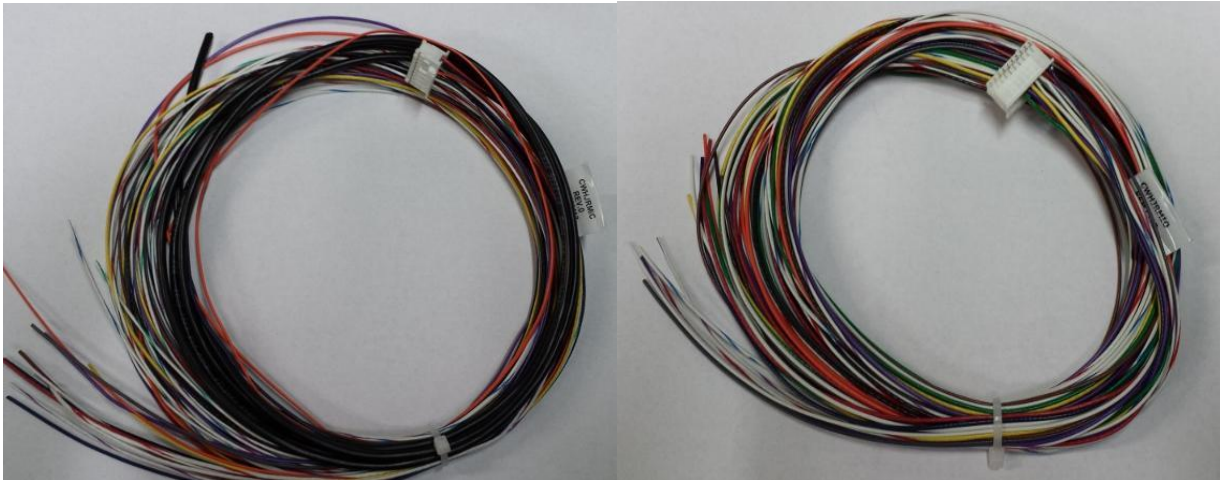

Cell Voltage Tap Harness - p/n CWH166 pictured

Main I/O Harness

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

Part Number	Description
CWHJRMIO	Standard Non-CAN wiring harness - 6ft length (1.8 meters)
CHWJRMIC	CAN enabled wiring harness - 6ft length (1.8 meters)

CAN-Version (CWHJRMIC)   *Standard Version (CWHJRMIO)*

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, 2 thermistors are included.

Optional Add-On Modules

Thermal Expansion Module

The thermistor expansion module is used in applications where more than the 2 standard thermistors are needed for temperature monitoring. One thermal expansion module monitors up to 80 thermistors. The unit communicates with the Orion Jr. BMS system 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.

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.

Basic Display Module

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).

Data Logging Display Module

The CAN Data Logger and Display module for the Orion Jr. 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. 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)

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 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.

CANdapter

CANBUS to USB adapter (CANdapter)

The CANdapter is a low cost CAN to USB adapter used to monitor CAN traffic for diagnostic purposes. **The Orion Jr. unit does not use the CANdapter for programming and no CANdapter is required, 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. unit must be programmed using a computer and the Orion Jr. 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.