



## DTC P0AFA - Low Cell Voltage Fault

Orion Product	Fault Supported
Orion BMS [Original] (24 - 180 Cell)	YES
Orion BMS 2 (24 - 180 Cell)	YES
Orion JR [Original] (16 Cell)	YES
Orion JR 2 (16 Cell)	YES

### **FAULT DESCRIPTION**

This fault code is triggered when the voltage of one or more cells within the pack fall below a specific threshold voltage (outlined below in the fault thresholds section). This fault can be caused by a cell that is incorrectly set in the BMS profile as a “populated” cell, a disconnected cell wiring harness, a very dead cell, or a wiring error. It can also indicate two or more cell voltage tap wires are connected backwards.

**IMPORTANT WARNING:** If cell voltage tap wires are backwards, the cell voltage tap connectors should be immediately disconnected from the BMS unit until the issue is corrected as permanent damage may occur to the unit and may drain the attached cells damaging them.

**NEVER LEAVE A DAMAGED ORION BMS UNIT CONNECTED TO THE BATTERY PACK.**

**SAFETY WARNING:** Cells which have been over-charged or over-discharged may not be safe to use even after bringing the voltage into a correct range. A cell which has previously been over-charged or over-discharged at any time may develop internal damage, compromising the safety of the cell. Always consult the cell manufacturer for advice on whether a cell can be safely used after an over-charge or over-discharge event.

Fault Code	Fault Description	Possible Trouble Area
P0AFA	One or more cell voltages are measured as being dangerously low or zero.	<ul style="list-style-type: none"> <li>• High Voltage Battery Assembly</li> <li>• Cell Wiring Assembly</li> <li>• Internal BMS Fault</li> </ul>

## **FAULT BEHAVIOR**

This fault will trigger **Voltage Failsafe Mode** which will inhibit the BMS from allowing charging or discharging of the battery pack.

## **FAULT THRESHOLDS**

Fault will trigger when the following condition is satisfied	(a)
(a) Cell voltage registers as dangerously low or zero volts.	<p>One or more cells within the pack are measured below the low cell voltage threshold.</p> <p><b>Original Orion BMS:</b> 90mV  <b>Original Orion JR:</b> 90mV  <b>Orion BMS 2:</b> 500mV  <b>Orion Jr 2:</b> 500mV</p>

## **DIAGNOSTIC STEPS**

<b>1.</b>	<p><b>Immediately disconnect any loads from the pack.</b></p> <p>If a load is malfunctioning or failing to turn off (or if a relay or contactor is stuck ON) it may be severely over-discharging the battery pack. Make sure no discharge loads of any kind are connected to the battery pack.</p>
<b>2.</b>	<p><b>Determine which cells are registering as extremely low.</b></p>

	<p>The BMS will categorize which cells (by cell ID number) are registering this fault code.</p> <p>Steps to view the list of Low Cell IDs:</p> <ol style="list-style-type: none"> <li>1) Connect to the BMS using the Orion BMS utility.</li> <li>2) Click the "Diagnostic Trouble Codes" tab at the top.</li> <li>3) View the "Low Cells" section on the far right hand side of the window.</li> </ol>
<p><b>3.</b></p>	<p><b>Download the freeze frame for the fault code using the BMS Utility.</b></p> <p>The BMS will normally produce a freeze frame on the "Diagnostic Trouble Codes" screen in the BMS Utility when this fault code occurs that contains a comprehensive list of BMS data parameters at the time the fault occurred. <b>It is strongly recommended that the freeze frame be downloaded from the BMS and saved to disk before the fault is cleared again</b> as this data may assist in the future if further diagnostics are required. <u>Additionally this freeze frame data may be requested by Technical Support if further assistance is required.</u></p> <p><b>NOTE:</b> Only Fault Codes with a (F) next to them have freeze frame data available for download. If there is no (F) next to the fault, there is no stored freeze frame available and this step can be skipped.</p> <p>Steps to download the Freeze Frame:</p> <ol style="list-style-type: none"> <li>1) Connect to the BMS using the Orion BMS utility.</li> <li>2) Click the "Diagnostic Trouble Codes" tab at the top.</li> <li>3) Select the correct fault code by clicking on the ID on the left side of the screen to initiate the Freeze Frame retrieval.</li> <li>4) Once the retrieval process is complete, click the "Export (CSV)" button to save the freeze frame data to the computer disk.</li> </ol>
<p><b>4.</b></p>	<p><b>Determine if the affected cells are supposed to be monitored.</b></p> <p>The Orion BMS is sold in increments of 12 cells, and most applications do not have exactly the same number of cells that the BMS supports. Because of this, the BMS must be told which cells are connected, or "populated." If the cell triggering the error code is not supposed to be a "populated" cell, open the cell population table in the BMS utility and adjust the cell population table accordingly and upload the updated profile to the BMS. Care should be taken to ensure that the correct profile is being modified. For profile instructions, please refer to the Orion BMS software manual.</p>
<p><b>5.</b></p>	<p><b>Measure the actual cell voltages using a multimeter.</b></p> <p>If cell voltage does not match the voltage reported in the BMS, there likely is a wiring error and/or internal damage to the BMS unit. The BMS is designed to recover automatically after minor wiring faults less than 24 volts, but wiring faults more than 24 volts may damage the BMS and require service. <b>Never</b></p>

	<p><b>leave a damaged Orion BMS unit connected to the battery pack.</b> Please contact the factory for repair information. Please refer to the Orion BMS wiring manual for more information on proper wiring.</p>
6.	<p><b>Ensure that the cell tap wiring harnesses are properly connected.</b></p> <p>Note that even though the Orion BMS units only have certain cell groups populated internally according to the size unit purchased. Taps connected to cell groups that are “unpopulated” internally are ignored. If the cell voltage tap connectors are not connected in the proper order, or were connected after the unit was powered up, reseal the connectors and clear the error codes using the Orion BMS utility. Note that clearing error codes may clear other codes containing useful information, so any additional information should be retrieved before codes are cleared.</p>
7.	<p><b>Verify that the BMS has the ability to terminate discharge / loads.</b></p> <p>If the BMS is unable to stop or inhibit charging the battery pack then it will not be able to protect cells from being overcharged. <b>The BMS needs the ability to shut off any loads / discharge in order to protect the battery pack from being over-discharged.</b></p>
8.	<p><b>If the problem persists, contact technical support.</b></p> <p>If all above steps fail to determine the cause of the fault then additional support is needed.</p> <p><b>Please contact the company or reseller that the BMS was originally purchased from for additional questions, warranty claims, repair requests and technical support.</b></p>