DTC P0A06 - Charge Limit Enforcement Fault

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

FAULT DESCRIPTION

This fault is caused when the charge current going into the battery pack either exceeds the limit set by the BMS or if current continues flowing into the battery pack after the digital on/off Charge Enable output is turned off. For example, if the BMS has set a charge current limit (CCL) of 50 amps and the BMS measures 100 amps going into the pack for an amount of time, it will set the charge limit enforcement fault since more current is entering the pack than is allowed.

The same fault will get set if the BMS turns off the Charge Enable Output (and the Charge Enable Output is enabled by the BMS) and any sizable current continues to enter the pack after the set amount of time passes. **The current threshold that this fault will trigger depends on which current sensor is selected (see troubleshooting step #4 below for details).**

DANGER: This fault code can indicate a serious condition. This fault code indicates that the battery charger, other charging source, or load may have failed to stop charging or discharging when commanded by the BMS. This condition may lead to over-charge or over-discharge and risk of fire. DO NOT CONTINUE CHARGING OR DISCHARGING THE BATTERY UNTIL THIS ISSUE HAS BEEN IDENTIFIED AND RESOLVED.

IMPORTANT NOTE: This fault can be falsely triggered if the current sensor polarity is backwards. The BMS should read **NEGATIVE current while charging** and **POSITIVE current while discharging.** If this is not the case, the polarity of the current sensor can be inverted in software via the “Current Sensor Polarity Inverted” option on the “General Settings” tab of the BMS profile utility settings.

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Fault Code	Fault Description	Possible Trouble Area
P0A06: Subcode 1	The BMS has detected charge current entering the battery that exceeds the published Charge Current Limit (**Charge Enable Relay is NOT enabled in the configuration settings**).	• User Application • Configuration Settings
P0A06: Subcode 2	The BMS has detected charge current entering the battery after Charge Enable Relay output has been turned off (**Charge Enable Relay IS enabled in the configuration settings**).	• Charge Enable Relay Circuit • User Application • Configuration Settings

FAULT BEHAVIOR

This fault will trigger **Relay Failsafe Mode** which will inhibit the four primary relay outputs from operating.

This prevents the following relay outputs from operating:

- Charge Enable Relay Output
- Discharge Enable Relay Output
- Charger Safety Relay Output
- Multi Purpose Enable Output

FAULT THRESHOLDS

Fault will trigger when **ANY** of the following conditions are satisfied	(a) **OR** (b)
(a) Charge current going into the battery pack exceeds the published Charge Current Limit. **The threshold that this fault will trigger depends on which current sensor is selected (see troubleshooting step #4 below for details).**	Measured current going into the battery pack is greater than the allowed Charge Current Limit published by the BMS (**only if Charge Enable Relay is NOT enabled in the configuration settings**).

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(b) Charge current is still going into the battery pack even after Charge Enable Relay output is turned off. **The threshold that this fault will trigger depends on which current sensor is selected (see troubleshooting step #4 below for details).**	Current is measured going into the battery pack after the Charge Enable Relay is turned off by the BMS (**only if Charge Enable Relay IS enabled in the configuration settings**).

DIAGNOSTIC STEPS

1.	**Verify that the pack is not actively being over-charged.** Immediately determine whether the pack is in-fact being over-charged and disconnect any potential charging sources (battery charger, inverter charger, generator, solar charge controller, etc). **Only proceed to the next step once the pack is in a safe state.** **SAFETY WARNING: Cells which have been overcharged or over-discharged may not be safe to use even after bringing the voltage into a correct range. A cell which has previously been overcharged 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.**
2.	**Download the freeze frame for the fault code using the BMS Utility.** 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. **It is strongly recommended that the freeze frame be downloaded from the BMS and saved to disk before the fault is cleared** as this data may assist in the future if further diagnostics are required. Additionally this freeze frame data may be requested by Technical Support if further assistance is required. **NOTE:** 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. Steps to download the Freeze Frame: 1) Connect to the BMS using the Orion BMS utility. 2) Click the "Diagnostic Trouble Codes" tab at the top. 3) Select the correct fault code by clicking on the fault code on the left side of the screen to initiate the Freeze Frame retrieval.

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4) Once the retrieval process is complete, click the "Export (CSV)" button to save the freeze frame data to the computer disk.

3. **Verify correct orientation of the current sensor.**

Current going into the battery pack should read negative and current leaving the battery pack should show up as positive. If the current sensor is backwards, it charge current will register as discharge current. Inspect the freeze frame data and if voltages on cells are being pulled up while the pack amperage shows a positive value, it indicates the current sensor is backwards. Likewise if cell voltages are being pulled down and the current is negative, the current sensor is backwards.

IMPORTANT NOTE:
The BMS should read **NEGATIVE current while charging** and **POSITIVE current while discharging.** If this is not the case, the polarity of the current sensor can be inverted in software via the "Current Sensor Polarity Inverted" option on the "General Settings" tab of the BMS profile utility settings.

4. **Review the freeze frame data to determine the original fault conditions.**

Using the freeze frame data collected from the previous step, determine what the Charge Current Limit value was when the fault occurred. Compare this with the pack current value (which is the amount of amperage going into the battery pack when the fault was set).

If the battery pack amperage is greater than the Charge Current Limit published by the BMS that means the application is not respecting (enforcing) the current limits published by the BMS.

NOTE: The maximum current threshold for this fault to trigger depends on which current sensor is selected. Please see the table below for the threshold values for each supported current sensor:

Current Sensor	Max Current Threshold
200A Hall Effect	-0.4A
500A Hall Effect	-0.8A
750A Hall Effect	-0.8A
800A Hall Effect	-0.8A
1000A Hall Effect	-0.8A
2x 750A Hall Effect	-1.2A
2x 1000A Hall Effect	-1.8A
All Shunt Sensors (JR)	-0.4A

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	If the battery current is exceeding the above published thresholds while the BMS is prohibiting charge then this fault will set.
5.	**Ensure that the BMS has the means to terminate all charge.** **It is absolutely vital that the BMS has the ability to terminate any and all charge entering the battery pack once the Charge Current Limit hits 0 Amps (charge not permitted).** **IT IS NOT SUFFICIENT OR PERMISSIBLE TO SOLELY RELY ON MAXIMUM VOLTAGE PARAMETERS ON A CHARGER OR CHARGE CONTROLLER.** Without the ability to directly terminate charge the BMS cannot fully protect the battery pack from being overcharged and damaged as there may be many conditions where the BMS would need to terminate charging prematurely (including extreme temperature conditions or battery malfunctions). This functionality could be accomplished through a number of ways, including but not limited to: • Transmitting the Charge Current Limit via CANBUS to the application and having the application limit charging based on that. • Using the Charge Enable Relay to control when the application is permitted to charge the battery pack. • Using the Charge Current limit (CCL) 0-5v analog output on the BMS to communicate the current limit to the application **(NOTE: This method MUST have a secondary backup as the CCL 0-5v analog output does not have the same internal safety circuitry for boosted reliability).** Please see the Orion BMS Wiring Manual for details and examples on how these various options can be used to control the application. **SAFETY WARNING: Be certain to fully test any charge limit enforcement mechanisms fully before deploying them or leaving them unattended.**
6.	**If the problem persists, contact technical support.** If all above steps fail to determine the cause of the fault then additional support is needed. **Please contact the company or reseller that the BMS was originally purchased from for additional questions, warranty claims, repair requests and technical support.**

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