WaveSculptor 22 Motor Drive Technical Note MPPT Compatibility

29 July 2013

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TECHNICAL NOTE

WaveSculptor 22 Motor Drive
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1 PROBLEM

This document describes some technical issues regarding operation of the Tritium Wavesculptor22 (WS22) motor controller with boost type solar MPPT devices.

Boost MPPTs will often have a failure mode where the output voltage rises above the usual maximum during a load dump (disconnection under load) event.

In particular, the Drivetek MPPTs (as noted in the user's manual for the MPPTs) can potentially supply up to 236V during a DC disconnection event. Other makes are quite likely to be similar, depending on the energy in the boost inductor and output capacitors, and the control loop response times.

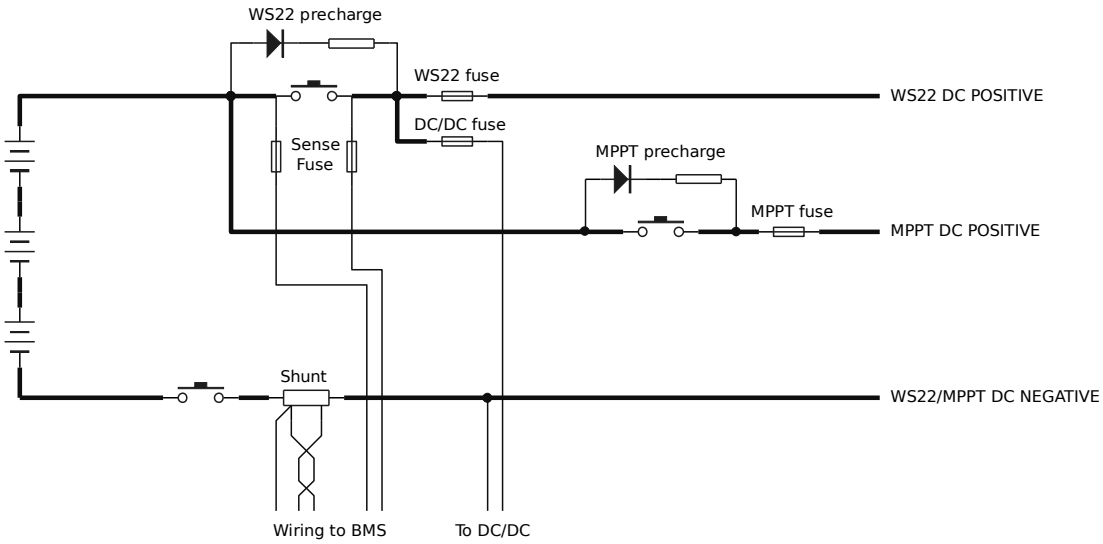
This voltage is far beyond the allowable 165V maximum on the WS22 motor controller, and will almost certainly cause damage to the power stage of the device, resulting in a failure shortly afterwards.

The problem arises if both the WS22 and the MPPTs are connected together on the vehicle side of the battery pack contactors / disconnects.

Tritium has seen several controller failures due to this cause during the past few weeks, and this technical note is to help raise awareness of this issue with our solarcar customers.

2 SOLUTION

One possible solution to this problem is to have the WS22 and the MPPTs switched separately by the battery management system, such that when the pack HV connections are opened, the WS22 and MPPTs are also disconnected from each other, as well as from the battery pack. This is shown in the diagram below.



This solution means that the high voltage from the MPPTs is not seen by the WS22.

Note that the diode in the MPPT precharge circuit must be present to prevent high voltage coming back into the WS22 via the precharge resistors. This diode

must be rated to the maximum expected precharge current.

The BMS can still perform the normal precharge functionality on the WS22 by monitoring the voltage across the WS22 contactor.

The Drivetek MPPTs automatically precharge themselves to some extent, so precharging the MPPTs may or may not be necessary, depending on the battery voltage used, the settings in the MPPTs, and the allowable voltage across the MPPT contactor when it is closed. Other makes of MPPT may require a different solution.

Having effectively two precharge circuits in action presents some additional problems during failure-mode analysis compared to a simpler 'conventional' BMS, so all due consideration should be provided to work through a FMEA for your battery and powertrain system as a whole.

3 REVISION RECORD

REV	*DATE*	*CHANGE*
1	29 July 2013	Document creation (JMK)