TECH/OPS

SEVCON

Gen4
Application
Note

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1. Introduction

An application may have a sophisticated BMS system that controls lithium battery packs. The Gen4 can be configured to interface with the BMS in a few ways.

This app note assumes that the reader has:

1. Knowledge of configuring VPDOs on the Gen4
2. Knowledge of setting up RPDOs on the Gen4
3. Confidence in using DVT and DVT Helper
4. Read through the Gen4 product manual

If this is not so, the app note will still give you some idea of what you would like to request from a Sevcon application engineer.

2. Interfacing Gen4 to BMS Outputs

The BMS may have three types of outputs that can interface with the Gen4.

1. Digital outputs
2. Analog outputs
3. CAN or CANOpen Communication

2.1. Digital Outputs

If the BMS has digital outputs capable of pulling to ground when active, then you can configure one or two of the Gen4's driveability profile switches.

⚠️ It is recommended that the drive profile for baseline, drive profile 1, and profile 2 are identical except for torque limit in drive. That way, speed limits do not cause unexpected drive feel for EV applications.

For example, you may limit the torque level on drive profile 1, so that the battery current limit is cut by a percentage. Note that battery current doesn't directly translate to a torque, but cutting the torque by a half or more will definitely lower the battery current draw of the application.
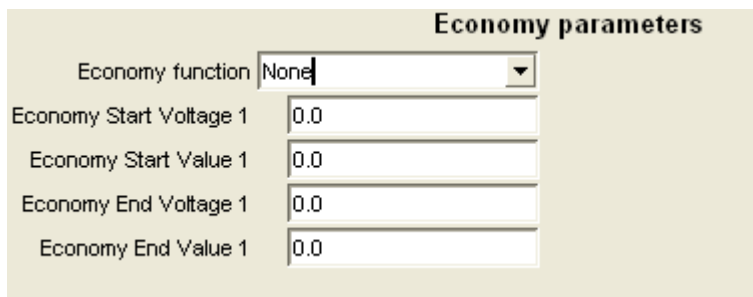
You may set drive profile 1 as a limp mode - and drive profile 2 as a complete shutdown (zero drive torque). Or you may just want to open the circuit when you want the battery to shut down completely.

2.2. Analog Outputs

For a BMS that is capable of outputting an analog voltage in the 0-5V or 0-10V range, you would configure the economy pot on the Gen4. This would give the BMS a refined control of the draw of the motor.

For EV applications using torque mode you would set the economy function to "Max Torque"

Set up the economy pot as you would a standard throttle – where economy value of one is equal to a total loss of torque.

Economy parameters

Economy function	None ▼
Economy Start Voltage 1	0.0
Economy Start Value 1	0.0
Economy End Voltage 1	0.0
Economy End Value 1	0.0

⚠️ Note: You may want to configure the analog input range on the gen4 to fault in the case of the BMS outputting an erroneous voltage – or if the wire falls off. A fault analysis should be done to understand the effects of a hardware fault.
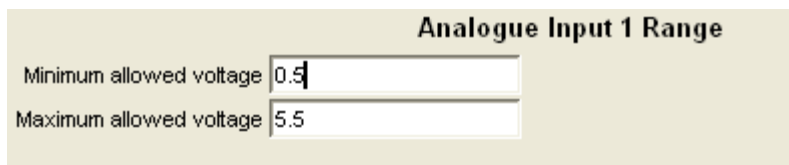
Analogue Input 1 Range

Minimum allowed voltage	0.5
Maximum allowed voltage	5.5

Figure 1: A voltage input that exceeds the chosen range will cause a very severe fault.

2.3. CAN or CANOpen Communication

The BMS must only send out standard size Cob-ids to be compatible with the gen4. Take note the battery cutback range should be configured correctly and the master battery current limit should be disabled.

Battery current limit

Maximum battery charge current	-100
Maximum battery discharge current	100
Cutback range	20.0
Battery current estimation correction factor	1.0

Master Battery Current Limit Parameters

Battery current limit data source	Disabled
Maximum battery discharge current	0.0
Maximum battery recharge current	0.0
Maximum battery discharge current in Drive Profile 1	0.0
Maximum battery discharge current in Drive Profile 2	0.0
Maximum battery discharge power	0.0
Maximum battery recharge power	0.0

The BMS should be able to send out two 16 bit values for the positive and negative limits for battery current. Discharge current is a positive number and recharge current is a negative value (2's compliment). One bit is equal to one amp.

The transmission rate should 250ms or faster so that CAN timeouts do not occur.

Here is an example configuration on the Gen4 where the CAN device sends out a message with COB-ID of 0x0205
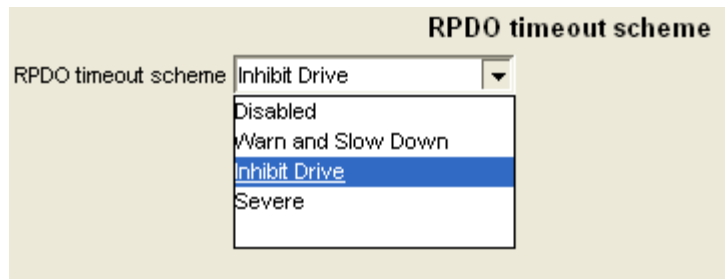
rpdo 1

Cob-ID for this TPDO:	0x00000205
Syncs Per Transmit:	1

Bits: 16 | Adr: 0x4623,1 | Maximum battery charge current
Bits: 16 | Adr: 0x4623,2 | Maximum battery discharge current

Bits Used:	32
Bits Left:	32

Remove Item	Add Item
Move Item Up	Move Item Down
Read PDO	Write PDO

Here the message id is 0x0205 and in the first 16 bits is sent the negative charge current limit and next the positive charge current. If the Gen4 properly receives this message it will try to limit the current.

Note the cutback will start at the limit minus the cutback range – so if the limit is 100 and the cutback range is 20 – torque will start dropping off at 80 Amps of draw.

If the BMS is CANOpen compliant, ensure that the heartbeat protocol is set up on the Gen4 and BMS. **NOTE:** A heartbeat fault is a severe fault that will stop the application and open the line contactor. If the BMS is not CANOpen compliant, then the customer must decide how the Gen4 should behave under a failure of the CAN bus.

RPDO timeout scheme

RPDO timeout scheme | Inhibit Drive

Disabled
Warn and Slow Down
Inhibit Drive
Severe

For non-CANOpen systems configure the RPDO Timeout scheme to fault if the message takes longer than 500 ms to send to the Gen4.

- Disabled – Use the last successful transmission value and continue running.
- Warn and Slow Down – A warning will be emitted to the CANOpen bus and the control will switch to drive profile 2 (Set the profile 2 to something with much less drive torque than the baseline profile)
- Inhibit drive – Stop the vehicle and if the fault clears you can put the drive into neutral and then try to drive again.
- Severe – only a key recycle and working CAN bus will permit the drive operate correctly. This setting will open the line contactor if configured and a timeout fault occurs.

3. Extras

A NOTE indicates important information that helps you make better use of your computer system.

A CAUTION indicates either potential damage to hardware or loss of data and tells you how to avoid the problem.

A WARNING indicates the potential for bodily harm and tells you how to avoid the problem.