CCS Type 1 & 2 User Guide

FELTEN

Version 1.3

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Overview

The Combined Charging System (CCS) allows the use of AC and CCS charging with a single outlet. With fast charging, the vehicle can be charged at a much faster rate than most onboard AC chargers are designed, making driving an EV more convenient, especially for long journeys.

Important Note

This kit will only work if these requirements are met:

- Orion BMS System - Contact us **before ordering** if you want to integrate with a different BMS
- Minimum battery voltage of 200V
- Durakool or equivalent economiser contactors with less than 100mA standby current

Additionally this kit is designed to work only with the charge outlet and locking motor supplied with the kit. It is not recommended to use different parts, and operation **cannot be guaranteed**. There is a hardcoded maximum charge limit of 200A, 1000V. This gives a theoretical maximum of 200kW charging power capability.

This kit is designed as a complete system, allowing you to easily add fast-charge capability to an EV. Sophisticated communication protocols are involved between the CCS ECU and the charger station, along with several additional components to ensure the system operates safely considering the high amount of electrical power involved. Therefore it is important to follow these installation instructions closely to avoid any injury or damage. Fellten takes no responsibility for the installation method carried out by the individual fitting this kit and any subsequent harm or damage to parts due to improper installation or usage. Not suitable for aviation.

Use the correct crimp tools for the pins provided, Improper crimping can result in an unreliable system that may fail.

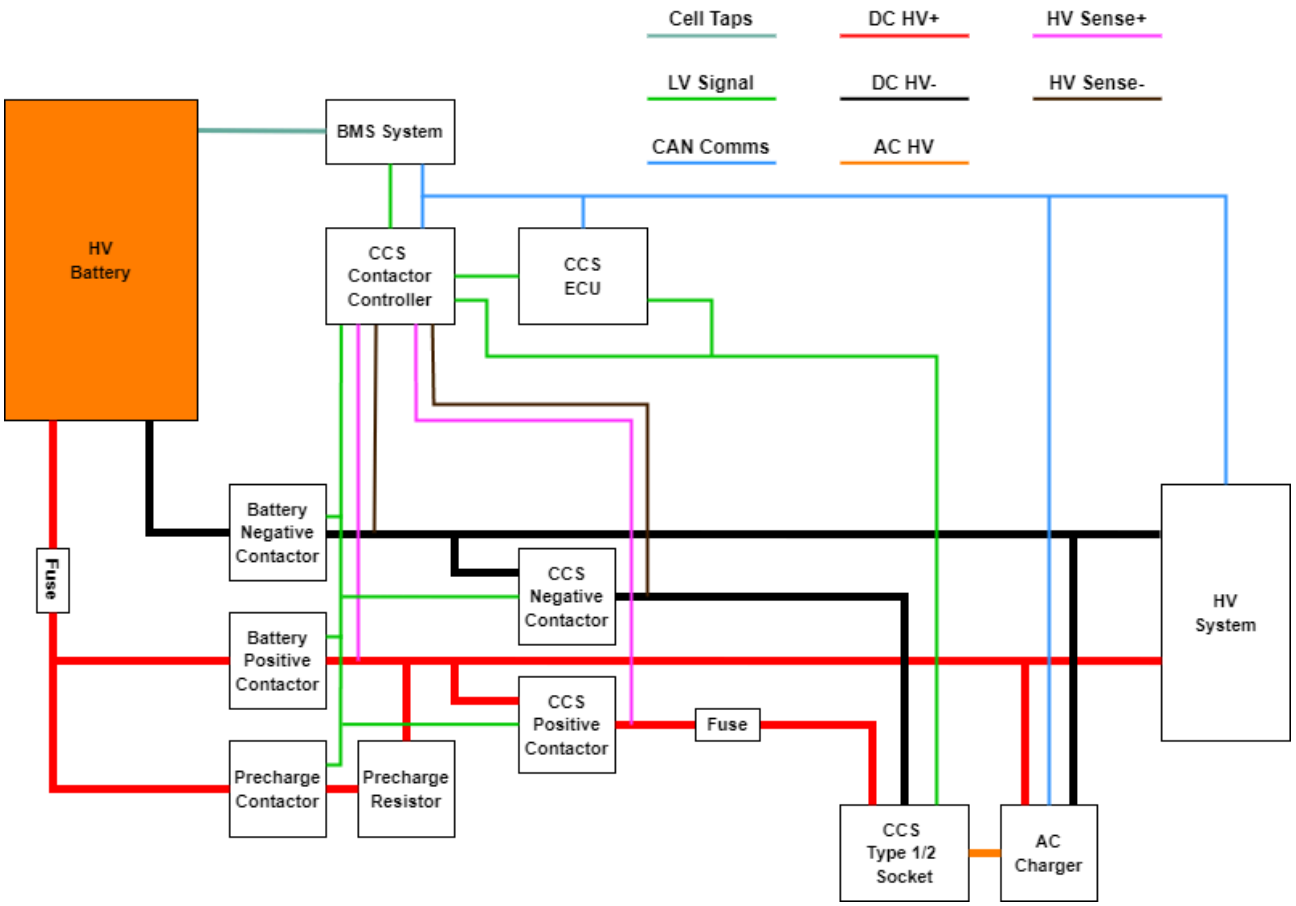
Design Considerations

This kit can either be retrofitted to an existing electric vehicle conversion or fitted during the assembly of a new electric vehicle. It is preferable to do the latter as the entire HV battery architecture needs to be designed around the CCS system. This is because the Fellten CCS system controls:

- HV Pre-charge
- HV Battery Contactors
- DCDC Enable signal
- CCS Contactors
- HVIL

The CCS System introduces a second High Voltage bus which is dedicated to CCS, and will only be live during fast charging. The original HV bus that powers all other HV components remains the same.

There are also physical constraints that must be considered such as charge port size, cable runs, placement of contactors and wiring harnesses. These dimensions are all detailed in the component mounting sections that follow.



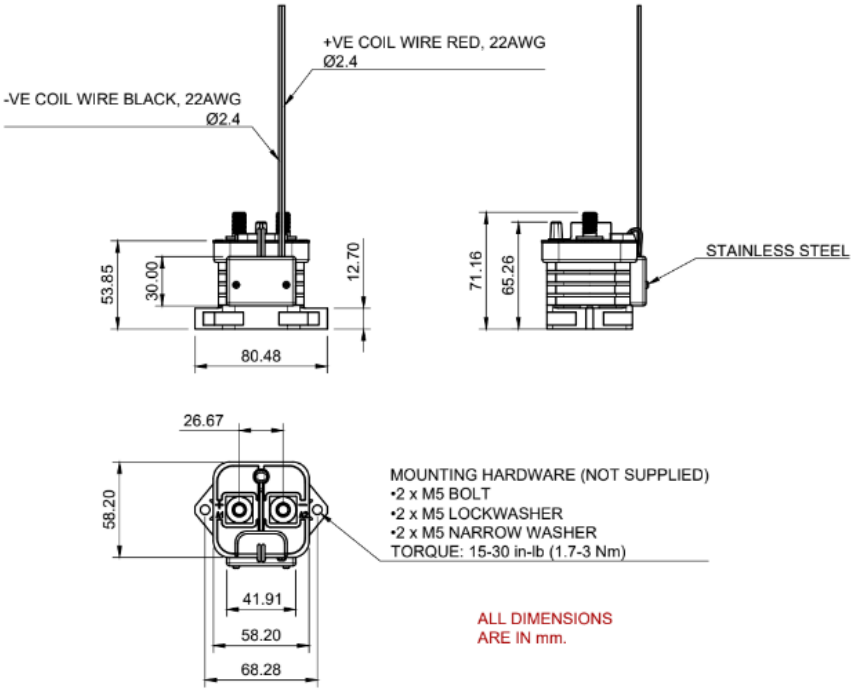
High Voltage CCS Bus

Ideally install the CCS contactors **inside** the battery box/enclosure. **There should be no un-switched live HV exiting the battery box when the system is powered down.** After the main pack fuse, the HV bus will split into two. One side will power all usual/existing components (e.g Motor, AC Charger, DCDC) and the other HV bus will be dedicated to CCS. This means there will now be two high-voltage, high-current connectors to the battery box/enclosure.

There are no HV connectors supplied for the CCS bus in this kit, as the user may opt for a permanent wire passthrough or a specific connector for packaging reasons. However, it must be ensured any connector or cabling used on the CCS bus must be capable of **200A continuous.** It is recommended to use 70mm2 cable thickness. It is also recommended to not lengthen or splice any cables on the CCS bus, especially the ones coming from the charge outlet. There must be no additional HV loads on the CCS bus.

Installation

Installing Contactors



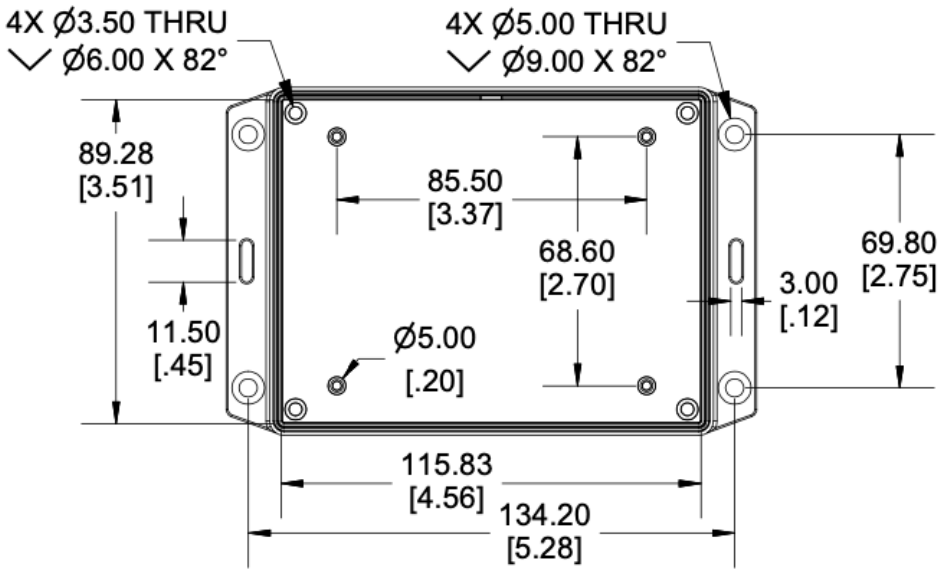
For the CCS contactors please refer to the diagram for mechanical properties. Spring washers are required on the power terminals and the retaining nuts should be tightened to 8.8-11Nm. It is recommended to make sure the busbar and contactor terminals are clean of all contaminants to ensure good contact.

The remaining 3 contactors (Precharge, Negative Battery, Positive Battery) are not supplied with this kit and should be mounted according to the manufacturer's specification. **They must be economised.**

Installing Fuses

The fuse should be installed on the positive side between the CCS contactor and the charge inlet. It can be directly installed on the contactor or installed part-way between the contactor and CCS inlet. It should ideally be installed inside the battery box, however could also be installed in an HV Junction box for easier access.

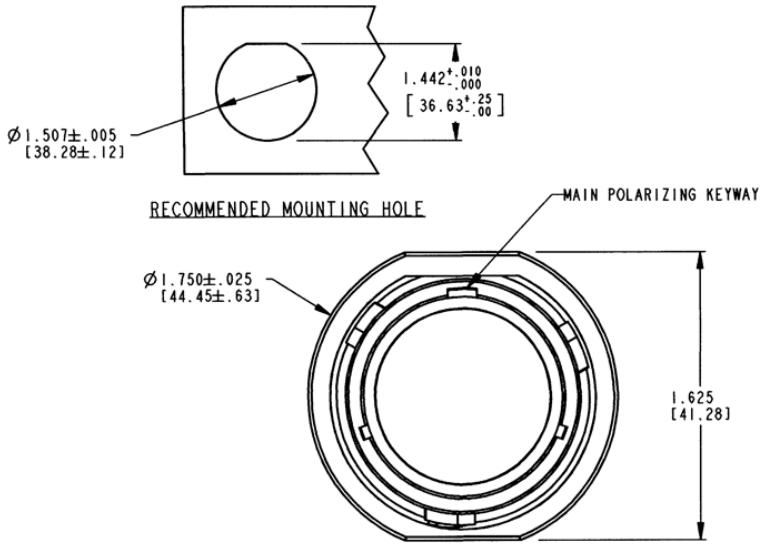
Mounting Contactor Controller



The Contactor Controller needs to be mounted inside the battery box (**It is not waterproof**). This is IP31-rated and requires HV connections. As a result, the contactor controller **should not under any circumstances be mounted outside the battery box**. It has both mounting slots and mounting screw holes.

Use an M5 Countersunk screw. The Contactor Controller can be mounted in any orientation, however, be mindful of harness connections, especially the high-voltage sense wires which will require extra clearance to low-voltage components. Additionally, the low-voltage harness will need strain relief/bend radius clearance.

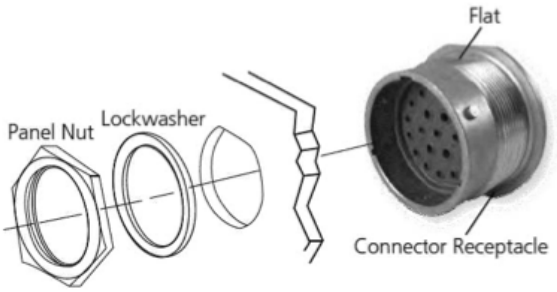
Mounting Battery Box Connector



To mount the circular multiway connector in the battery box, a hole of the following dimensions needs to be cut in the battery box.

The recommended panel/battery box wall thickness is 1.58 to 4.76mm. If the hole is to be cut manually then a punch tool can be purchased to make the process easier:
The manufacturer (TE Connectivity) part number is "*24-D-Punch*".

Hole Punch Tool

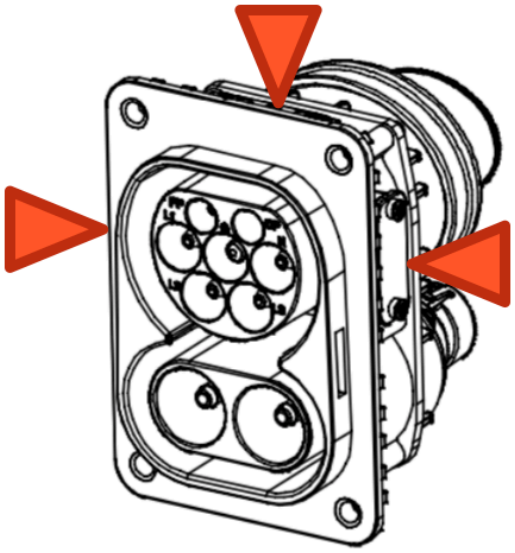


Fitting Order

Install the gasket onto the connector before inserting it through the panel hole. Then attach the lock washer and panel nut on the outer side. Tighten to 10 Nm.

Mounting Locking Motor to Charge Port

The locking motor should be mounted to the charge port before fitting into the vehicle. The lock motor can be installed in 3 possible orientations (highlighted red) as follows:



(Image for CCS2 port. This will be different for CCS1)

Remove the relevant blanking plate and install the locking motor in its place. Be sure to retain the rubber sealing grommet when installing the locking motor. The choice of location is purely based on packaging constraints for your particular setup/vehicle, and in no way affects operation. All charge plugs work with locking pins in any of the 3 locations.

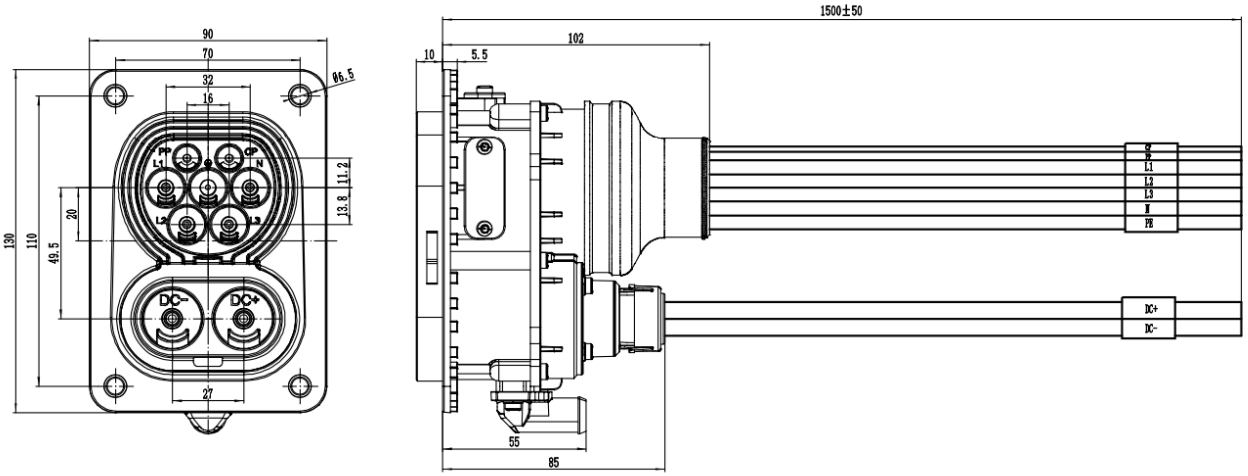
The locking motor also has an emergency unlock pull cord. This should be accessible from inside the vehicle once the charge port is fully fitted and allows emergency unlocking of the charge plug if there is a failure.

Mounting Stop Charge Switch

The stop charge switch with integrated status LED should be mounted near the charge port if possible. A 19mm hole is required, with a maximum panel thickness of 8mm. To install:

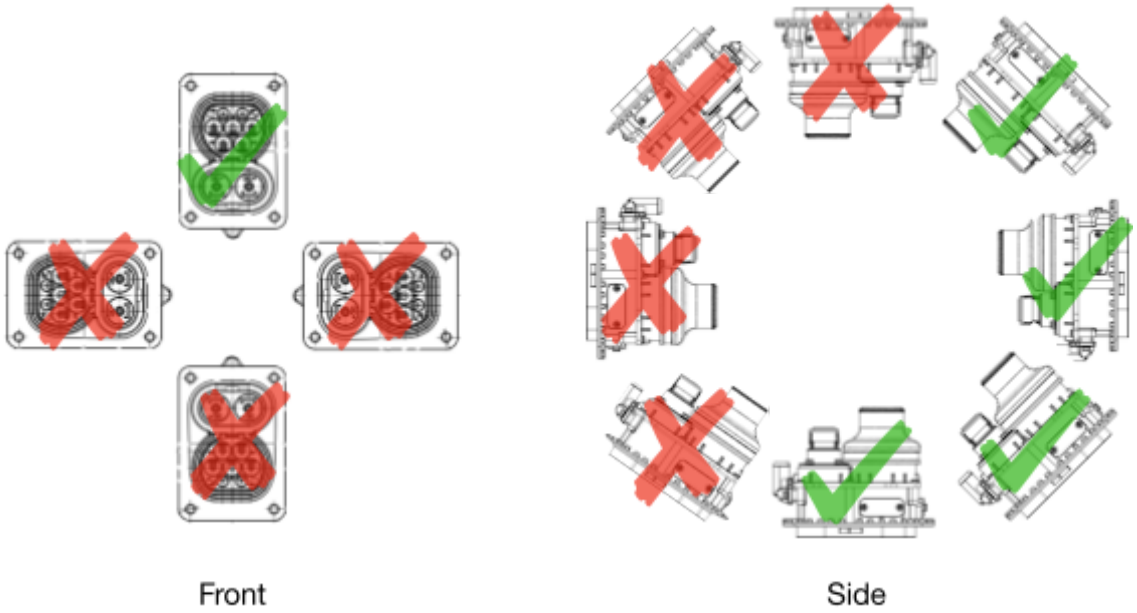
- Remove yellow harness connector
- Install rubber sealing ring onto the switch
- Insert into panel hole with intended mounting position and orientation
- Install locking nut, tighten to 5nm
- Reinstall yellow harness connector **(caution to connect the correct way around as it can be connected wrong!) The latching notch on the button should match up with the latch on the connector**
- Recommended: Install glue-shrink tubing over the yellow connector to seal/waterproof

Mounting Charge Inlet



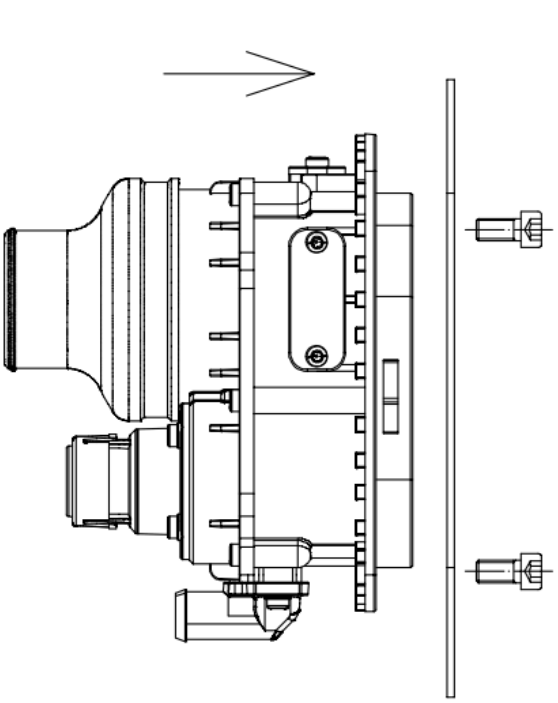
The CCS Charge inlet is significantly larger than a Type 1/2 AC Charge inlet.

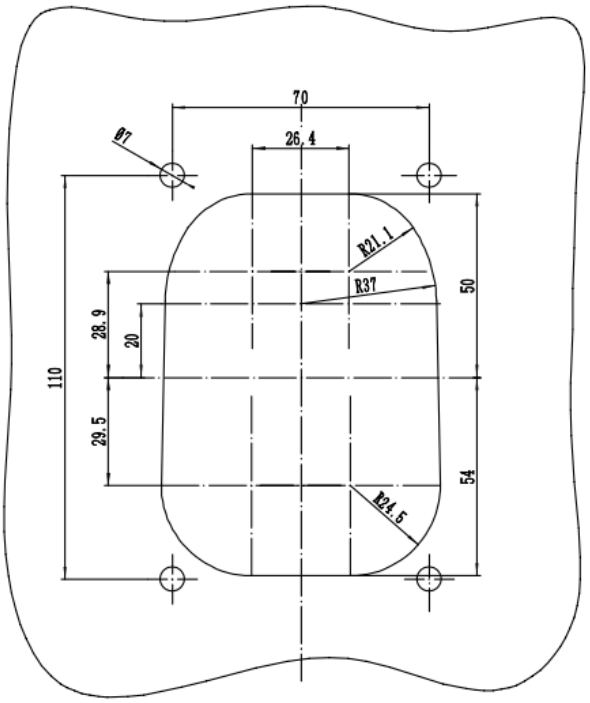
The allowable mounting orientations are shown in the diagram.
Keep in mind this does not include the additional size of the locking motor.
The minimum bend radius of the large DC- and DC+ cables is 120mm.
The charge port should be orientated in a certain way to prevent water accumulation inside the socket. It is IP55 rated and there is a water drain fitting on the bottom.



(Allowable mounting orientations)

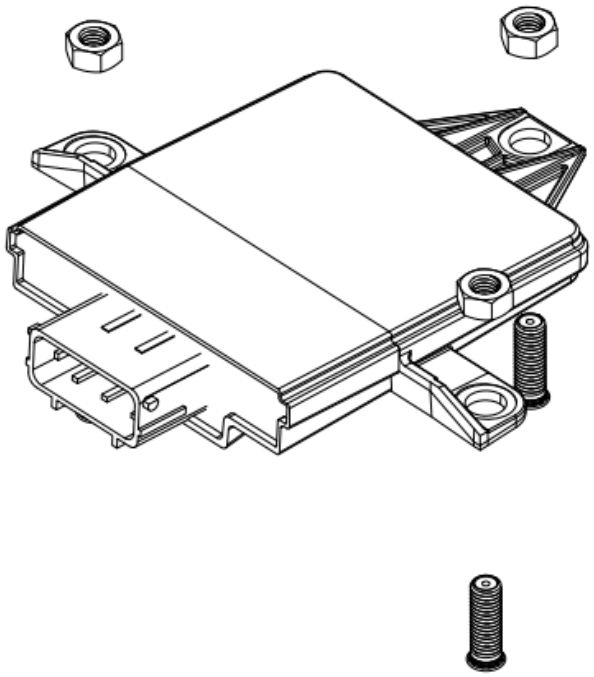
A cutout is required on the mating surface of the charge outlet along with 4 holes for the fixings.





The bolts required are M6 (not supplied in the kit). The maximum mounting panel thickness is 8mm. When choosing where to place the charge port keep in mind the stop charge button should ideally also be mounted close by.

Mounting CCS ECU



Install the ECU using three M8 hex socket head screws (not included) with a minimum engagement length of 7.2mm. It is recommended to use spring washers or lock washers to secure the screws. The ECU is IP67 rated and can be installed outside the battery box, however should not be mounted in any area susceptible to road dirt/stones being thrown up at it.

AC Onboard Charger (if applicable)

With DC fast charging, the use of an onboard AC charger is now optional. While most installations will still have an onboard charger, there are some specific applications such as motorsport (where weight savings are valuable) to forgo having an onboard charger. Additionally, as the number of DC fast charging stations increases AC charging will become less common.

If not using an AC onboard charger, the phase cables (N, L1, L2, L3) should be removed from the charge socket or insulated safely. The earth cable still needs to be connected to the chassis earth/ground.

If using an AC onboard charger, the CCS ECU still interfaces with the Control Pilot (CP) and Proximity Pilot (PP) signals to the charge port. When the CCS ECU detects a valid AC charge plug it will automatically lock the plug and attempt to turn on AC voltage, regardless of whether an onboard charger is present or what model it is. The stop switch can then be used in the same manner as DC fast charging to end the charge session and unlock the plug.

The onboard AC charger should be connected to the 3-phase AC wires from the charge outlet. The relevant HV, LV and CANbus connections should then be made according to the model of the charger, connecting as normal. The software configuration will be addressed later in this document.

System Matrix

Description	Signal name	Connector					
		Fly Leads	Lock Motor	Charge Plug	Stop LED	CCS ECU	Contactor controller
Permanent 12V supply voltage for contactor controller	12V_CC	X					17
	12V_CC	X					18
Permanent 12V supply voltage for CCS ECU						1	
	12V_CCS_ECU	X				7	
Permanent 12V supply voltage for charge port	12V_LOCK	X	4				
	12V_STOP_SW	X			2		
Switched ignition wake input	IGN_WAKE	X					5
Contactor controller ground	GND	X					3
	GND	X					4
CCS ECU and Stop LED ground	GND	X			3	2	
Switched active high output signal when pre charge is complete and main battery contactors are closed and HV is present	HV_PRESENT	X					1
Switched active high output signal when a charger has been inserted into the charge port, typically used to wake an on board charger	CHARGE_WAKE	X				19	6
Unterminated 500k CAN communication bus - this needs to be connected to the same bus as the BMS	CAN1_L	X				4	8
	CAN1_H	X				3	9
High voltage interlock - connect through HV components and connectors to create a continuous loop	HVIL_OUT	X					12
	HVIL_IN	X					21

Signals / Rows with more than 2 numbers or X’s require splicing together.

System Matrix (Cont.)

Description	Signal name	Connector					
		Fly Leads	Lock Motor	Charge Plug	Stop LED	CCS ECU	Contactor controller
Charge port lock motor actuator	FB_OUT0		1			9	
	FB_OUT1		2			10	
Charge port control pilot	CP			1		5	
Charge port DC temperature sensor	PTC0+			4		13	
Charge port DC temperature sensor	PTC0-			3		14	
Charge port DC temperature sensor	PTC1+			6		15	
Charge port DC temperature sensor	PTC1-			5		16	
Blue stop switch indicator LED	LED_2				6	20	
Green stop switch indicator LED	LED_1				5	21	
Red stop switch indicator LED	LED_0				4	22	
Lock motor feedback ground	GND					12	14
Inverted lock motor feedback switch input	POS_FB					11	15
Lock motor feedback switch input	LOCKMOTOR_SW		3				16
Charge port proximity pilot	PP					6	19
	PP			2			20
Stop switch - active high input to stop charge	STOP_SW				1		22

Signals / Rows with more than 2 numbers or X's require splicing together.

Signal Explanations

A few signals can be difficult to ascertain where they should be routed. Below is an outline of some of these pins.

POS_FB - This signal is an adjusted value based on the LOCKMOTOR_SW signal generated by the supplied lock motor. The CCS VCU uses a different signal check to the lock motor used. We pass this signal through the contactor controller so it works with the CCS ECU. If another lock motor is used and functions the same as what is expected by the CCS ECU then this can be used directly to the lock motor.

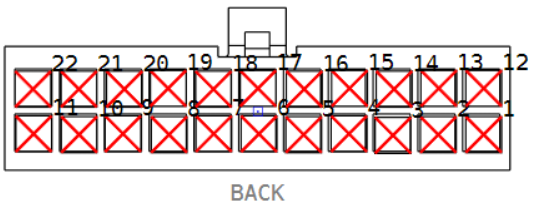
FB_OUT0 & FB_OUT1 - These are driving signals for the lock motor. To lock, one is driven with 12V while the other is sent to ground. When unlocking the opposite happens. This is because the lock motor is a coiled actuator.

CHARGE_WAKE - This can be used to control the state of the vehicle while in charge mode. For example, when this pin is driven high the motor inverter can be disabled to stop the user from driving away while the vehicle is in charge mode. This signal can also be used to wake components of the vehicle that require power while charging.

Connectors and pins

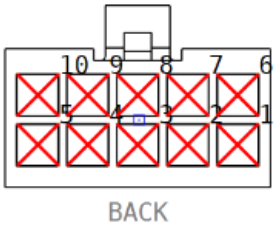
Contactor Controller Connector 1

Connector: 43025-2200 Pins: 43030-0001		
1	HV_PRESENT	Switched active high output signal when pre charge is complete and main battery contactors are closed and HV is present
2		
3	GND	Contactor controller ground
4	GND	Contactor controller ground
5	IGN_WAKE	Switched ignition wake input
6	CHARGE_WAKE	Switched charge wake input
7		
8	CAN1_L	Unterminated 500k CAN communication bus - this needs to be connected to the same bus as the BMS
9	CAN1_H	
10		
11		
12	HVIL_OUT	High voltage interlock - connect through HV components and connectors to create a continuous loop
13		
14	GND	Contactor controller ground
15	POS_FB	Inverted lock motor feedback switch input
16	LOCKMOTOR_SW	Lock motor feedback switch input
17	12V_CC	Permanent 12V supply voltage for contactor controller
18	12V_CC	
19	PP	Charge port proximity pilot
20	PP	
21	HVIL_IN	High voltage interlock - connect through HV components and connectors to create a continuous loop
22	STOP_SW	Stop switch - active high input to stop charge



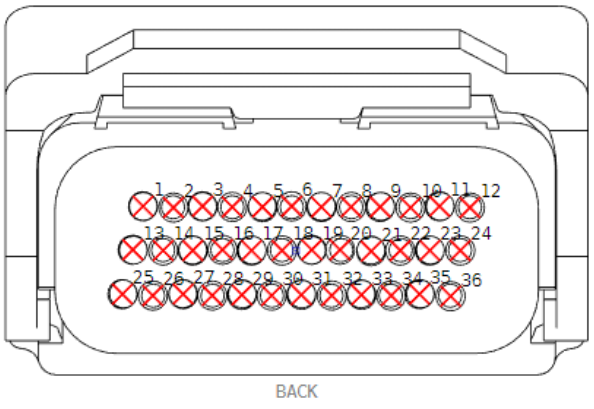
Contactor Controller Connector 2

Connector: 43025-1000 Pins: 43030-0001		
1	GND	Contactor activation return
2	GND	Contactor activation return
3	GND	Contactor activation return
4	GND	Contactor activation return
5	GND	Contactor activation return
6	BATTERY_NEG	Active high output to close the main battery negative contactor
7	PRECHARGE	Active high output to close the precharge contactor
8	CCS_NEG	Active high output to close the CCS negative contactor
9	CCS_POS	Active high output to close the CCS positive contactor
10	BATTERY_POS	Active high output to close the main battery positive contactor



CCS ECU

Connector: 36ZRO-B-2A Pins: SZRO-A021T-M0.64		
1	12V_CCS_ECU	Power input - Valid voltage range is from 10-30VDC.
2	GND	Ground / Protective Earth - Must be connected to PE on EV charge port as Control Pilot (CP) is referenced to this level.
3	CAN1_H	Unterminated 500k CAN communication bus
4	CAN1_L	
5	CP	Charge port control pilot
6	PP	Charge port proximity pilot
7	12V_CCS_ECU	Power input - Valid voltage range is from 10-30VDC.
8		
9	FB_OUT0	Charge port lock motor actuator
10	FB_OUT1	
11	POS_FB	Socket locking sense
12	GND	
13	PTC0+	PT1000 Temp input 1 (Required).
14	PTC0-	
15	PTC1+	PT1000 Temp input 2 (Optional).
16	PTC1-	
17		
18		
19	CHARGE_WAKE	Switched active high output signal when a charger has been inserted into the charge port, typically used to wake an on-board charger
20	LED_2	Blue stop switch indicator LED
21	LED_1	Green stop switch indicator LED
22	LED_0	Red stop switch indicator LED
Pins 23 - 36 are not used and left unterminated		



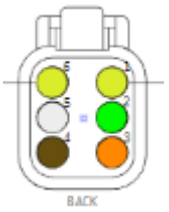
Charge Port connectors

Aftermarket Charge Ports, such as the one provided with this kit, typically do not contain the required Proximity Pilot resistor. We have accounted for this in our contactor controller. There is a 3-position switch on the board that can add this resistance. By default, these are shipped with the resistor set for your region. If you are using a Charge port with a resistor in, this switch will need to be set to the middle to remove the resistance.
The resistance between PP and PE should be 2.7k Ohms for Type 1 charging and 4.7k Ohms for Type 2 charging.
There is an AC temperature sensor that we leave unused. This can be taped back or

Lock Motor

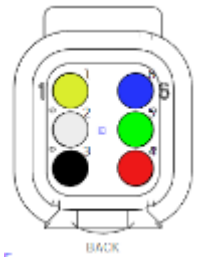
Connector: DTM06-4S Pins: 1062-20-xxxx		
1	FB_OUT0	Charge port lock motor actuator
2	FB_OUT1	
3	LOCKMOTOR_SW	Lock motor feedback switch input
4	12V_LOCK	Permanent 12V supply voltage for charge port
		

Charge Socket

Connector: DTM06-6S Pins: 1062-20-xxxx		
1	CP	Charge port control pilot
2	PP	Charge port proximity pilot
3	PTC0-	PT1000 Temp input 1 (Required).
4	PTC0+	
5	PTC1-	PT1000 Temp input 2 (Optional).
6	PTC1+	
		

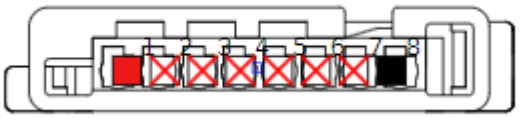
Stop LED

Connector: DTM04-6P Pins: 1060-20-xxxx		
1	STOP_SW	Stop switch - active high input to stop charge
2	12V_STOP_SW	Permanent 12V supply voltage for charge port
3	GND	Stop LED ground
4	LED_0	Red stop switch indicator LED
5	LED_1	Green stop switch indicator LED
6	LED_2	Blue stop switch indicator LED



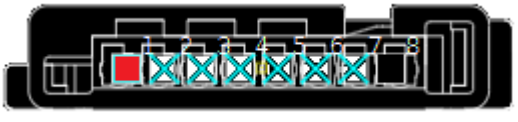
HV Battery Sense

Connector: 1743282-1 Pins: 5-963715-1		
1	HV+	HV Positive to be connected after the main battery contactor
8	HV-	HV Negative to be connected after the main battery contactor



HV CCS Sense

Connector: 1-1743282-2 Pins: 5-963715-1		
1	HV+	HV Positive to be connected after the CCS contactor
8	HV-	HV Negative to be connected after the CCS contactor



High Voltage Interlock Loop

A high voltage interlock loop (HVIL) is used to increase safety by monitoring high voltage connections and access panels in a vehicle to detect if any one point is opened/disconnected. This allows the contactor controller to shut off the HV system in the event that high voltage is potentially exposed to the user. The simple underlying principle is a large loop of switches connected in series that are made when the correct connector or cover is in place.

The signals HVIL_OUT and HVIL_IN from the contactor controller are used for HVIL. **For the controller to close any contactors there must be a connection between these two signals.** If the connection between these signals is opened while any of the contactors are closed, the ECU will wait for HV current to be below 10A and then forcibly open all contactors. This should very rarely happen and could cause damage to contactors if current is passing through them and possibly other components. **Do not use this system as a means to turn off HV power. Additionally, if HVIL is not being used these two signals should be connected together to bypass the HVIL system.**

It is a good idea to leave the HVIL open/disconnected until the BMS software setup is completed. This will prevent contactors closing while software is configured, and possible premature closing of contactors if the BMS is not sending the pack voltage correctly yet , as precharge is based on this value being correct.

We recommend when designing your HV system to outline which connectors have HVIL and keep this for reference as diagnosing HVIL can be difficult when multiple connectors are used. This includes any connections between looms as a bad crimp can cause the same HVIL loop disconnection.

If you require further information please follow this link:
https://www.guchen-connector.com/blog/industry-blog/hvil.html

Stop Switch colours and DTC error code descriptions

The LED stop switch not only acts as a button to stop charging but also can output crucial information in the event of a fault. Due to its close relationship with the contactor controller, we have designed a robust error system which gives the user an oversight of some minor and major issues.

Stop switch error messages

The specific error messages are shown via the stop switch in a series of RED blinks followed by a longer BLUE blink to show the end of the message.
The error can then be found by referencing the amount of RED blinks to the following table.

2 x RED - 1 x long BLUE	HVIL fault	Check along the HVIL loop for potential cable disconnects. We recommend keeping a record of what connectors have a HVIL loop so you can check all connectors in series.
3 x RED - 1 x long BLUE	BMS comms fault	BMS comms fault can be either that the BMS is not reporting over CAN or is reporting too slow. Check power to BMS while the system is online and check CAN between the BMS and the contactor controller.
4 x RED - 1 x long BLUE	BMS DTC fault	(Orion specific) The Orion outputs all Diagnostic trouble codes over CAN. If one of these is set the stop switch will indicate this. There is an outline of minor DTC's (system will still function) and major DTCs (system will open contactors) in this document. Check BMS and repair any faults displayed before restarting the system.
5 x RED - 1 x long BLUE	Precharge fault	Precharge has taken longer than the expected time to be satisfied. As a result, the contactors will re-open and this flash will show. This is usually because either the HV sense lines to the contactor controller are missing or wired wrong or there is something drawing current on the HV bus while precharging. (eg. a PTC heater connected)
6 x RED - 1 x long BLUE	Lock motor fault	The Lock motor has either failed to engage or disengage. Check wiring or fouling on the charge port itself when connecting.
7 x RED - 1 x long BLUE	DC temp sensor fault	The Temperature sensors on the DC charge socket pins are reading out of range. This is usually because they have become disconnected. Check wiring.

There is an exception to the trouble codes where the lock motor will partially engage but the CCS ECU does not see the lock feedback from the motor. In this case, you may see the stop switch from white to blue and then to red repeatedly. This is because the CCS ECU is retrying the lock motor and overriding the lock motor fault message.

Stop switch standard use colours

Alongside the fault code colour system there are also standard use and expected LED colours while charging.
These differ between **AC** and **DC** charging.

Stop switch status colours while **AC** charging or in standby is as follows:

- White: on and ready to charge, no plug detected
- Red: Charging error
- Blue: Plug detected, locking plug to start charge
- Green: Charging, cable locked
- 5 presses changes to 110v (IGN must be on) changes to purple
- Purple is 110v mode

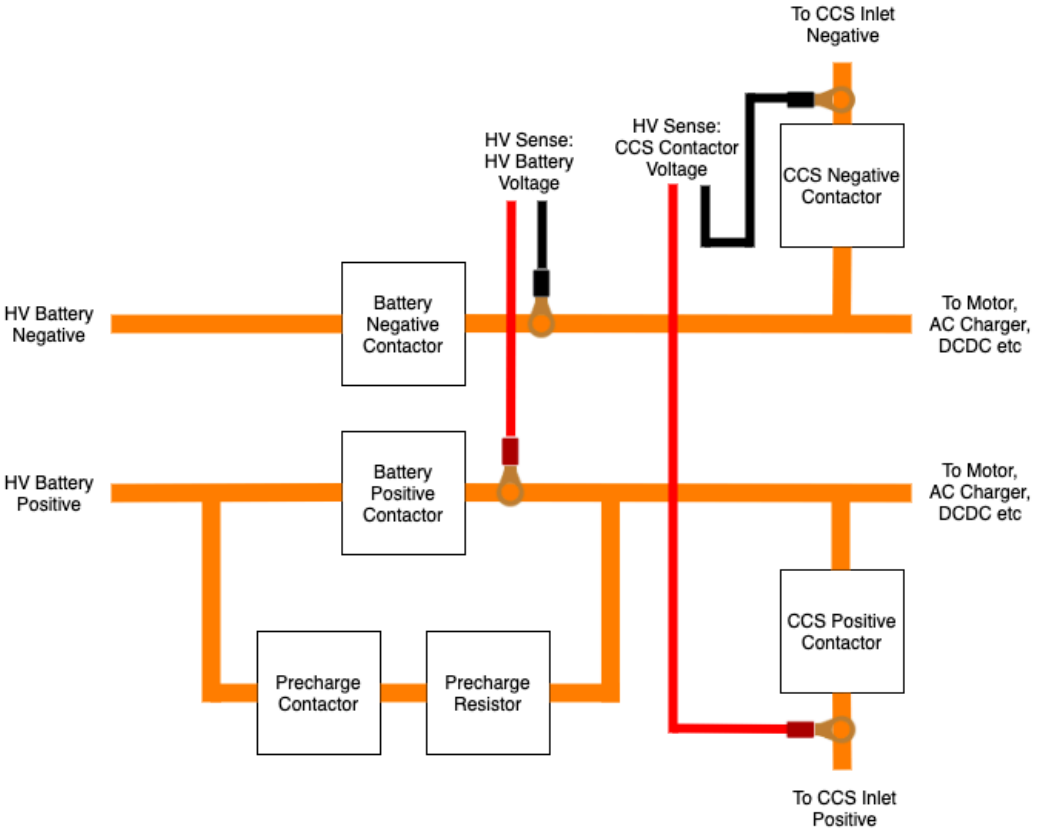
Stop switch status colours while **DC** charging is as follows:

- Red: Charging error
- Blue: Plug detected & locking/unlocking plug
- Purple: initiating SLAC communication between charger and vehicle
- Blue:Teal: CCS cable resistance check and CCS cable precharge underway
- Green: Charging, cable locked

Any other colour is not correct, you may have a wiring fault.

High Voltage Wiring

Please see the diagram as an overview of how the contactors should be setup:



Wiring HV Sense

The CCS Contactor Controller needs to monitor HV Bus voltages. The wire between the HV bus and the contactor controller must be HV-rated wire.

These voltage sense feeds should be located **after** the contactors for both battery and CCS sense (i.e. on the side further away from the battery). Please see the diagram above for clarification. It can be convenient to simply secure the ring terminals onto the studs from the contactors.

HV0 Sense = HV Battery Voltage = Natural/Beige coloured connector
HV1 Sense = CCS Inlet Voltage = Black coloured connector

The HV sense wires are polarity dependent so please ensure the positive and negative wires on each go to the HV+ and HV- respectively.

Wiring Contactors

The Contactor controller controls these contactors:

- Battery Negative
- Battery Positive
- Precharge
- CCS Negative
- CCS Positive

When choosing the battery and precharge contactors please keep in mind the CCS contactor controller can **only supply a maximum of 800mA continuous**, therefore economiser contactors are required. The ECU has short circuit and overcurrent protection so if a contactor output is overloaded it will not damage the controller, and reset operation on a power cycle.

The Contactor controller will attempt to do the following during power on:

- Monitor HVIL circuit before closing any contactors
- Check for BMS CAN data and monitor the reported battery voltage
- Energise battery negative and precharge contactors
- Monitor Battery HV Sense during precharge
- Once Battery HV Sense is within 20v of BMS reported battery voltage (via can bus) and at least 200v, the positive contactor will close and the precharge contactor will open. HV Present output will also be turned on to indicate the HV bus is now live
- If precharge has not been completed within 5 seconds, all contactors will be opened and a precharge fault will occur
- The HVIL circuit will be continuously monitored thereafter and if broken will cause all contactors to open when the reported amperage draw of the battery is either below 10A or above -10A.

HV Present (switching on DC/DC and PTC heaters)

Some components in the vehicle need to know when the powertrain HV bus is energized such as the DC/DC converter and PTC heater/AC compressor. For this, a low-voltage digital output from the signal HV_PRESENT can be used.
This output will be low (0V) when there is no HV present, and high (+12V) when HV is present. This output is designed as a signal only and can provide up to 500mA of current. If more current is required an additional relay should be used.

We recommend using this signal to use anything that will draw current from the HV bus as precharge will fail if any item on the HV bus is drawing current while precharging.

The precharge system is designed to slow the inrush current to the motor inverter. Any other load on the bus will cause HV to not reach the full pack voltage and cause precharge to fail.

Software Configuration

Step 0: BMS Firmware Update

The Orion 2 BMS will require firmware version v3.7.0 RC3 or later. Click the link to download:
https://drive.google.com/file/d/1x3e1SRM0oTLD2j4tWOP85KH6ViaRWr5D/view?usp=sharing

Note you need JAVA Version 1.8.0_172. Download here:
http://www.oracle.com/technetwork/java/javase/downloads/jre8-downloads-2133155.html

The latest beta Orion Utility should be downloaded from:
https://www.orionbms.com/downloads/orionbms2_utility_beta.exe

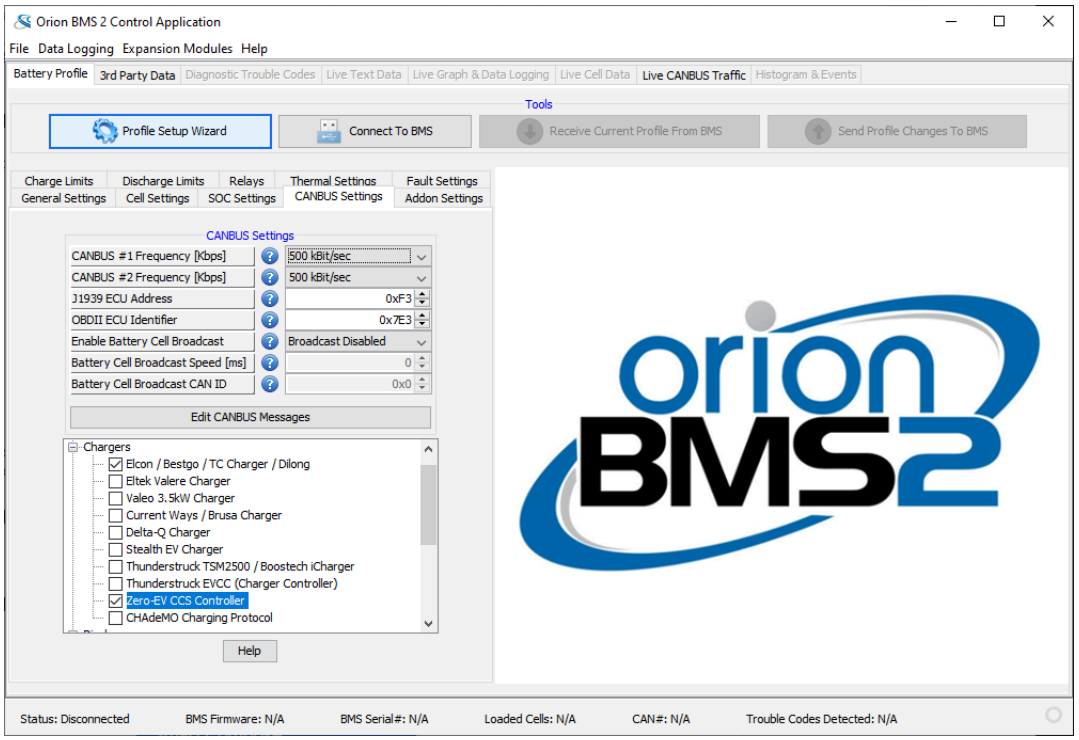
Step 1: Verify correct BMS utility and firmware versions

Verify you have Orion BMS Utility 2.1.29 or later by going to Help > About…

Connect to the BMS and verify you have firmware v3.7.0 RC3 or later in the bottom left of the screen.

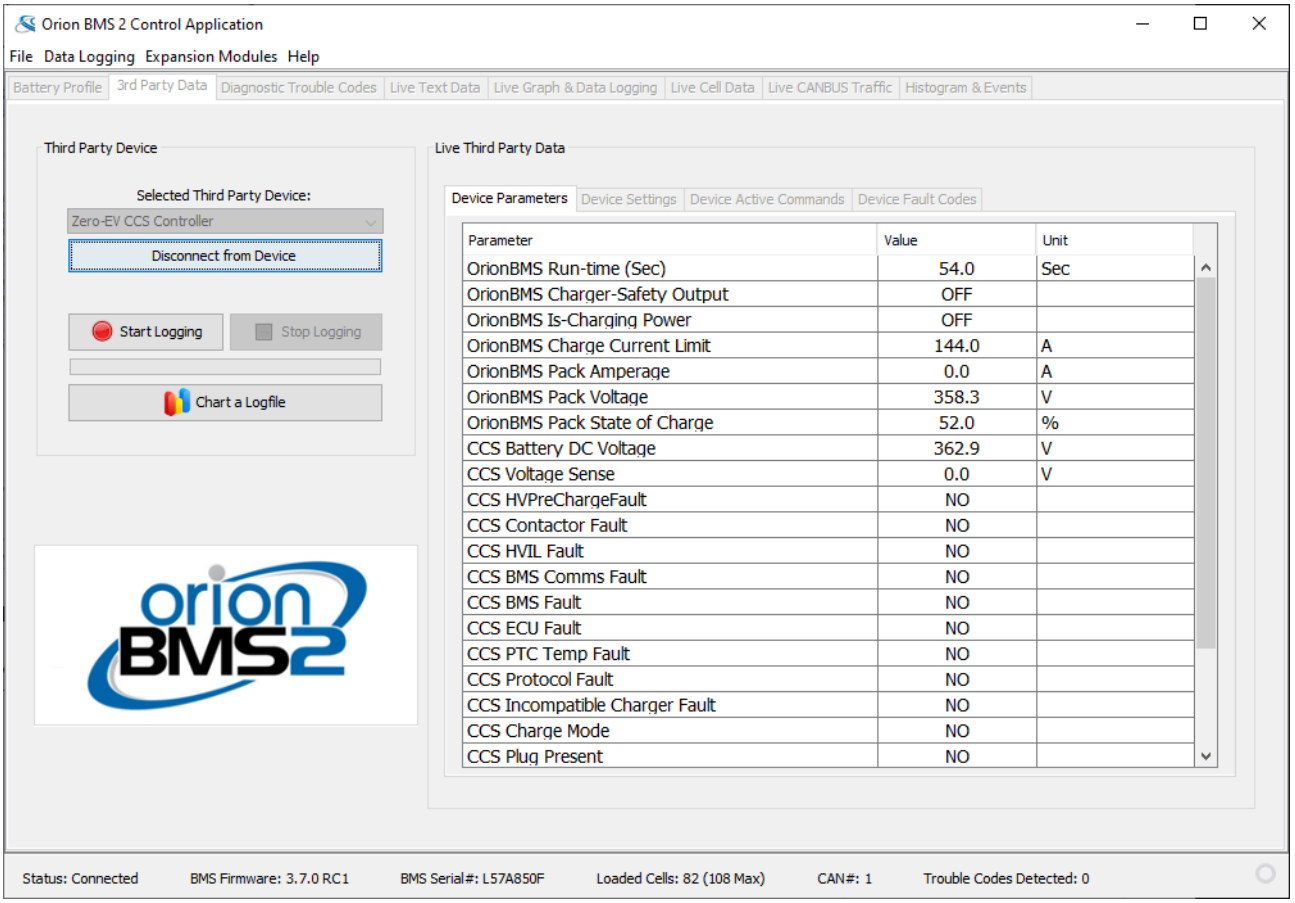
Step 2: Enable CCS System

Start with HVIL signals open (i.e. unconnected to each other) for safety. Tick the “Zero-EV CCS Controller” option in the Canbus tab. Now turn the vehicle off and connect the HVIL wires together to enable contactors to attempt precharge, but ensure no capacitive loads are connected yet (ie Motor). Turn the vehicle on and ensure precharge happens successfully and HV is on. If precharge was ok, turn the system off and now connect any other HV components such as the motor/inverter.



Step 3: Ensure the vehicle is ready to charge

Your vehicle should be ready to charge if the indicator LED / stopcharge switch is illuminated white. If not, there are several handy debug values that can be monitored in the “3rd Party Data” tab. Ensure the “CCS Battery DC Voltage” is within 20v of the “OrionBMS Pack Voltage” parameter. Now any remaining HV components can be connected (ie Motor).



Quick Help Guide

Below is a list of issues that can occur when fitting the Fellten CCS kit. We have offered solutions to them to help diagnose quickly and efficiently.

Type of fault	**Possible solutions**
Contactors won't close	Check HVIL. Check BMS errors. Check power to the contactor controller. Check ignition to the contactor controller.
Contactors close but then immediately open after precharge	Check BMS errors while attempting to turn on. Possible HV isolation fault.
Precharge starts but then fails	Check for anything potentially drawing current from the HV bus while precharging. Check for wiring faults on the HV sense lines to the contactor controller.
Contactors close and work but will open soon after driving	Some battery modules can hold capacitance on the outer casing while being used, as a result, we find that the Orion BMS isolation monitoring can pick this up while testing and cause a failure. Reduce the sensitivity of the isolation monitoring to stop this from happening.
System is stuck in charge mode	The CCS VCU is reporting a wrong value for the proximity pilot. Check for 4.7K(type 2) / 2.7k (type 1) resistance on the proximity pilot line while the system is fully powered off.
System won't wake to charge	Check the charge wake signal from the CCS ECU to the BMS and contactor controller. Check the proximity pilot is correctly connected to the charge socket.
If the Stop LED is not lit up	Check it is pinned correctly. Check for power on the Contactor Controller and CCS ECU. Check CAN between the Contactor Controller and CCS ECU.
If Stop LED is purple	The yellow connector on the Stop LED is connected 180° off

Type of fault	Possible solutions
Stop LED flashes white, red and blue when attempting to charge	Lock motor fault. Check the connections to the lock motor or remove the lock motor from the port and test on the loom but out of the socket.
The system allows (AC) charging but no current is drawn from the charger	Check the on-board charger is waking and demanding current. Check CAN data to see if the correct message is being sent to the charger. Check that the CCL from the BMS is set to 0 through a DTC.
The system does not start (DC) charging session	Possible communication signal issue. Check the control pilot is a twisted pair from the charge port to the CCS ECU. Incompatible charger. See list of incompatible chargers.
System fails (DC) charging session after a few minutes	Check that the vehicle has no form of isolation monitoring active while on charge. (OrionBMS isolation monitoring is disabled while DC charging when using our profile)

Incompatible Chargers

Although every care is taken to accommodate all types of AC and DC chargers, some chargers run on protocols that have not been widely adopted yet. As a result, you may find some chargers may not work with the system.

If you come across any AC or DC charger that doesn't work, please let us know and we can work with you on finding a solution.

Currently, the only charger manufacturer that we are aware of that doesn't work is Shell. We are working hard to solve this and will hopefully have a solution soon.