



TECHNICAL SERVICE BULLETIN

ISSUE DATE:	09/29/2023
REVISION DATE:	12/13/2023
SERVICE BULLETIN SUBJECT:	BuSCoM 2.0 800vRR DuoPower Software Update
VINs or MODELS AFFECTED:	Service Specified Buses
COMPLETE BY:	Earliest Service Opportunity
SERVICE BULLETIN #:	SC-23-136
Labor Operation Code:	PP65Z

NOTICE! It is expected that this process may require up to 1.5 hour per bus. Please schedule appropriately to minimize vehicle downtime.

BuSCoM 2.0 800vRR DuoPower Software Update

Description

This procedure describes the process for updating the DuoPower Vehicle, Powertrain, Body Controller, ESM and Charge Controller software. This software update enables the following features when certain fault codes associated with Battery Pack liquid accumulation and/or a thermal event are detected. (1) prevent the vehicles Battery Pack from being charged, (2) engage a “limp mode” that imposes limitation on the Battery Pack regen and power discharge levels, and (3) trigger a flashing red warning light on the driver’s dash display and an audible alarm (collectively, the “Updated Software Features”).

Change Notes

Enhanced Battery Diagnostics:

- Coordinated changes for more robust system diagnostics
- Added distinct audio-visual response for critical battery fault
- Includes fix for external isolation false failure condition

Aux Heat startup bug fix

- Corrects a condition where Aux Heat could start as soon as bus starts before commanded for temperature control

Charging Robustness Improvements

- Improvements preventing false failure of lock motor failure to retract

Interlock Fault Tuning

- 520821 FMI 1 and 520822 FMI 1
- Tuned interlock low pressure fault to align performance with latest ZX5.A0X buses and increase robustness.

Tools/Programs Required

Tools Required:

- Laptop Computer
- Nexiq USB-Link 2
- T-30

Programs Required:

- Proterra Diagnostics Tool

Software Files Required / Preparation



IMPORTANT! NEVER access the software from the USB memory device, ALWAYS copy the software files to your computer hard drive and access the software from this location. Secure the bus with the Vehicle Master Disconnect in the rear ON.

Component	Part Number	Version	Execution Time
ESM Controller	066124	V3.0.5	Minutes
Charge Controller	065754	V 3.0.1	16 Minutes
Vehicle Controller	065726	V4.10.0	10 Minutes
Powertrain Controller	065645	V4.1.0	12 Minutes
Body Controller	065725	V7.0.1	16 Minutes

Public Link to SW Package: [https://business-site-](https://business-site-7460.my.salesforce.com/sfc/p/Ho000002fy70/a/Ho000000vAww/9QxCNSzgba2FCswVfjL.Ppe0N4GR)

[7460.my.salesforce.com/sfc/p/Ho000002fy70/a/Ho000000vAww/9QxCNSzgba2FCswVfjL.Ppe0N4GR](https://business-site-7460.my.salesforce.com/sfc/p/Ho000002fy70/a/Ho000000vAww/9QxCNSzgba2FCswVfjL.Ppe0N4GR)
[YzmdYFH3FCLVuag](https://business-site-7460.my.salesforce.com/sfc/p/Ho000002fy70/a/Ho000000vAww/9QxCNSzgba2FCswVfjL.Ppe0N4GR)

Procedure:

Preparing the Vehicle to be Programmed

When programming a vehicle, it is critical that the low-voltage batteries remain connected throughout the process. Ensure that the LV batteries are fully charged before starting the process. If they are low, use the vehicle to recharge them by turning on high-voltage or place the bus on a low-voltage charger for the duration of the process.

ESM Controller Update

1. Power up and login to the Proterra-Supplied laptop or a comparable PC that has the Proterra Diagnostics Tool software installed with a valid license.
2. Ensure the SW Package is on the computer's hard drive and unzipped if applicable. For this section the SW ESM_HV_BMS_RoadRunner_Bootloader_20231204_1354_Full.srec is to be used.
3. Turn ON the 12/24V rear Vehicle Master Disconnect located at the curbside rear charge port access panel.



Vehicle Master Disconnect

4. Connect the Nexiq USB Link2 device to the laptop and to the OBDII Diagnostic Port located in the streetside wheel well box.



5. Press and hold the streetside wheel well WORK LIGHT switch until the work lights turn on.

6. On the laptop, double-click on the Proterra Diagnostics Tool software icon to start the software.



7. When the program opens, read and click “OK” for the high-voltage safety prompt.

8. On the Home tab, select the appropriate device from the drop down and click “Connect”.



9. Once the diagnostic tool has connected to the vehicle, a VIN number and connection status will be displayed on the Home screen, and tabs available to navigate. If you do not see the Home Screen, check that the low-voltage batteries are connected and that the Nexiq tool is plugged in.

NOTE: 800V Proterra vehicles are equipped with an automatic battery disconnect that will protect the low-voltage batteries from a deep discharge.



10. Before beginning the programming process, check the bus for existing faults by clicking on the “Diagnostics” button below and make a note of any found.

11. Navigate to the “Software Versions” tab and take a screenshot of the current software versions incase any issues arise.

12. Turn the bus High-Voltage Master Switch to Accessory at the Driver's Workplace and ensure the Dash screen is ON. Set the Hazard Switch to ON.

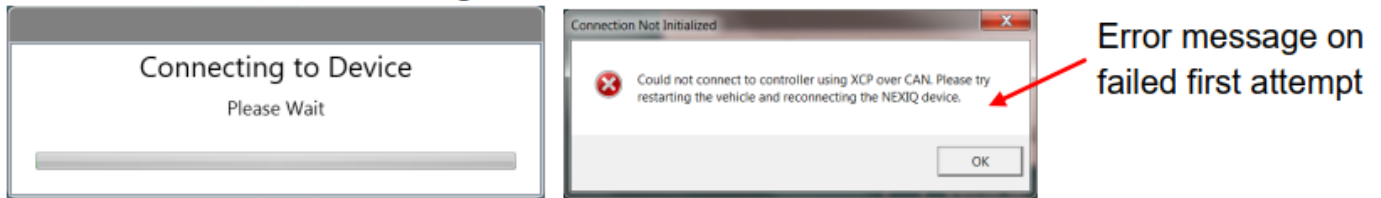
13. Click on the “Configuration Tab” to open the Configuration screen and then click start flash on the “Battery Master Controller” section.



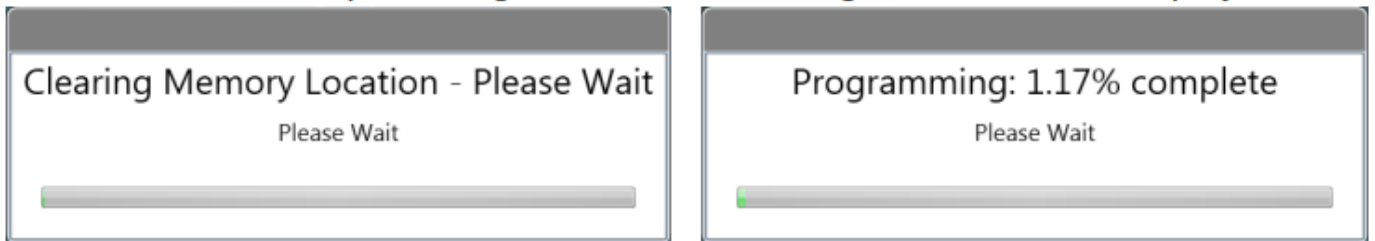
14. When prompted select file “ESM_HV_BMS_RoadRunner_Bootloader_20231204_1354_FULL.srec” from your hard drive, select open.

15. The Proterra Diagnostic Tool will attempt to connect to the device.

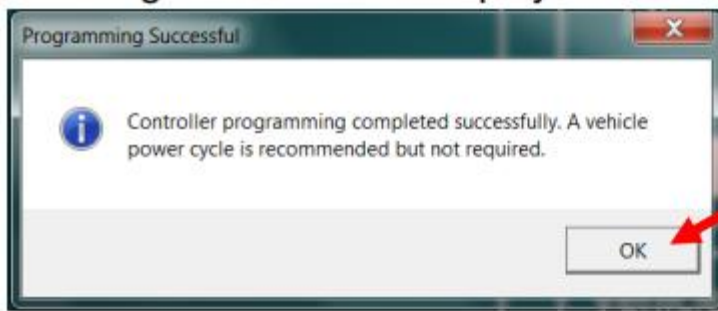
NOTE: You may receive an error on the first attempt. If so, retry by clicking the ESM Controller Start Flash button again.



16. When the software update begins, and the following screens will be displayed.



17. Once the following screen displays the update is now complete.



Click OK

18. Close the Proterra Diagnostic Tool (PDT), turn off work light and cycle the buses power and verify no faults.

Charge Controller Software Update

1. Ensure the LV batteries and laptop are charged.
2. Power up and login to the Proterra-Supplied laptop or a comparable PC that has the Proterra Diagnostics Tool software installed with a valid license.

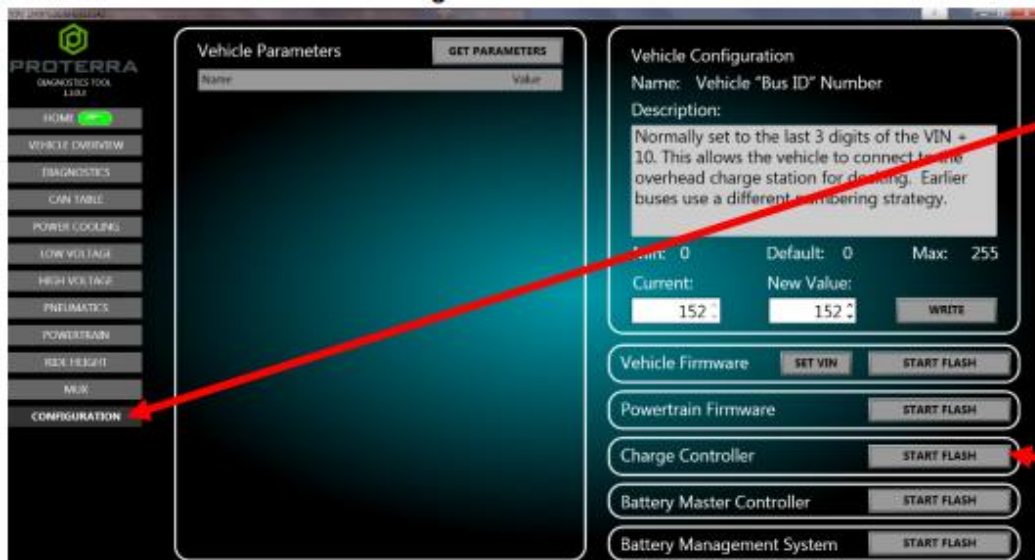


Vehicle Master Disconnect

3. Turn ON the 12/24V rear Vehicle Master Disconnect located at the curbside rear charge port access panel.
4. Turn the bus High-Voltage Master Switch to Accessory at the Driver's Workplace and ensure the Dash screen is ON. Set the Hazard Switch to ON.
5. Connect the Nexiq USB Link2 device to the laptop and to the OBDII Diagnostic Port located in the streetside wheel well box.



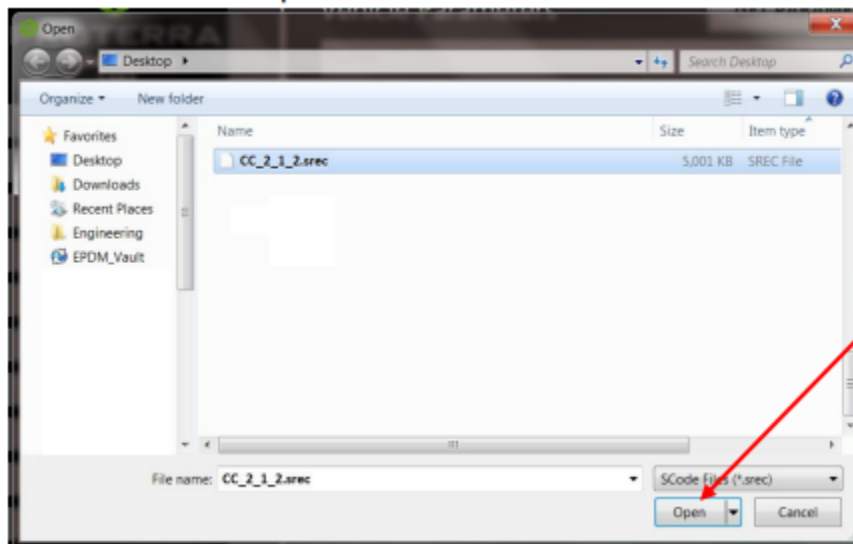
- Press and hold the streetside wheel well WORK LIGHT switch until the work lights turn on.
- Click on the “Configuration Button” to open the Configuration screen and then click Charge Controller “Start Flash” Button.



Click Configuration

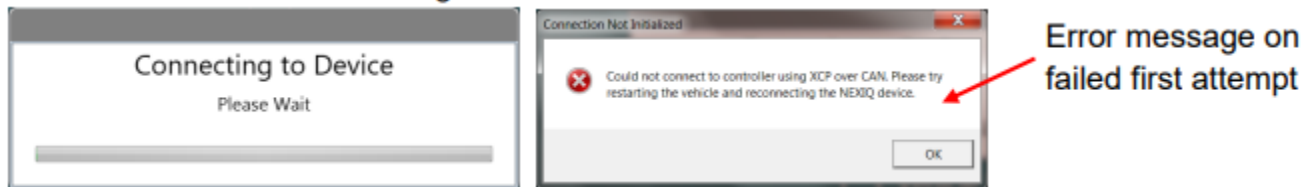
Beside Charge Controller, Click Start Flash

- The following screen will be displayed. Navigate to the location where you save the software package and select “cc-production_CC_RoadRunner_20230910_2128.srec”. Select the file and click “Open” to load the file.

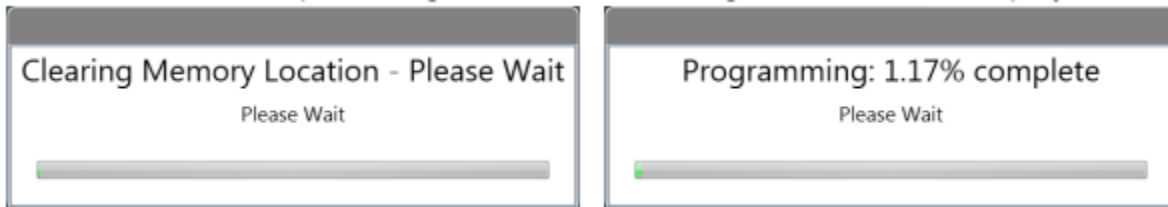


Select the file and Click Open

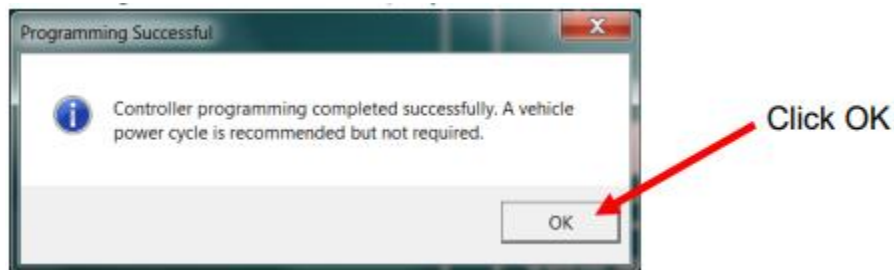
9. The Proterra Diagnostic Tool will attempt to connect to the device. NOTE: You may receive an error on the first attempt. If so, retry by clicking the Charge Controller Start Flash button again.



10. When the software update begins, and the following screens will be displayed.



11. The software update may take several minutes to complete. When the update is complete the following screen will be displayed. Click the "OK" button to complete the update process.



12. Software update is complete. Please close diagnostic tool and turn off work light, turn off the bus at the rear master switch located at the rear curbside access panel.

Vehicle Controller Software Update

1. Ensure the LV batteries and laptop are charged.
2. Power up and login to the Proterra-Supplied laptop or a comparable PC that has the Proterra Diagnostics Tool software installed with a valid license.
3. Turn ON the 12/24V rear Vehicle Master Disconnect located at the curbside rear charge port access panel.



Vehicle Master Disconnect

4. Turn OFF the bus High-Voltage Master Switch at the Driver's Workplace and ensure the Dash screen is OFF.
5. Connect the Nexiq USB Link2 device to the laptop and to the OBDII Diagnostic Port located in the streetside wheel well box.

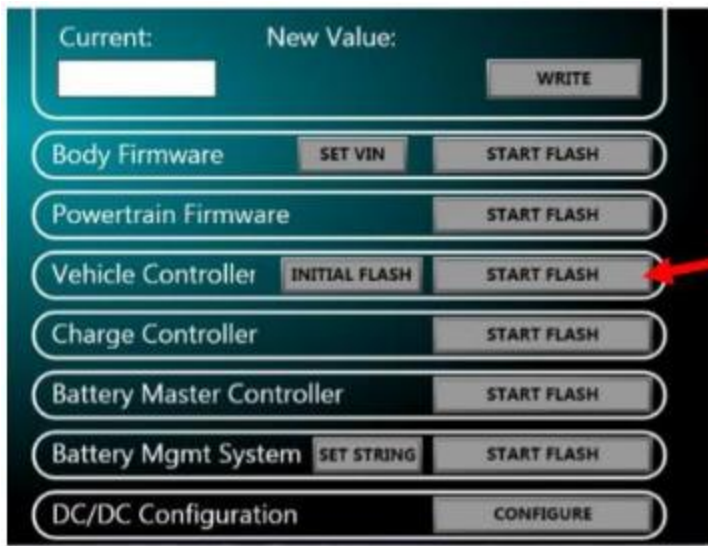


6. If vehicle is equipped with overhead charging, please use the Proterra diagnostic tool to navigate to the "Overhead Charging" page and record the vehicle tag number. This will be re-entered at the end of this section.



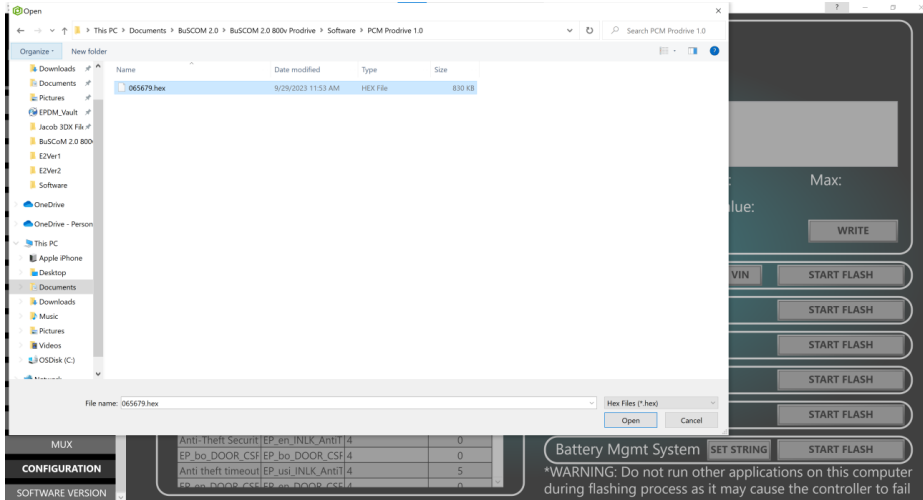
Record Vehicle Tag

7. Navigate to the "Configuration Tab" then Click Start Flash for the Vehicle Controller Sections.

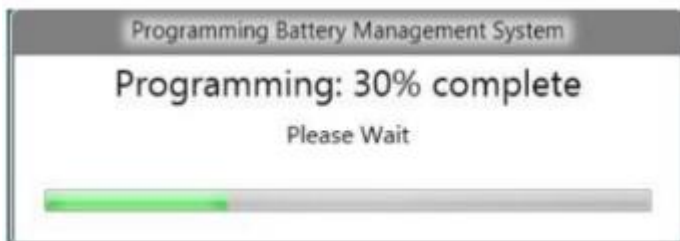


**Beside Vehicle Controller,
Click START FLASH**

8. When prompted select file “SW_VIC_4.10.0_065726.hex” from your hard drive, select open.



9. The Programming window will come up and will take several minutes to complete. Its important to note do not switch screens or have any CAN tools to be running in the background.



10. Once the software update is complete navigate to the Overhead Charging screen and set the Vehicle Tag Number previously recorded.

11. Close the PDT, turn off work light, turn off the bus at the rear master switch located at the rear curbside access panel.

Powertrain Controller Update

1. Ensure the LV batteries and laptop are charged.

2. Power up and login to the Proterra-Supplied laptop or a comparable PC that has the Proterra Diagnostics Tool software installed with a valid license.
3. Power ON the 12/24V rear Vehicle Master Disconnect located at the curbside rear charge port access panel.



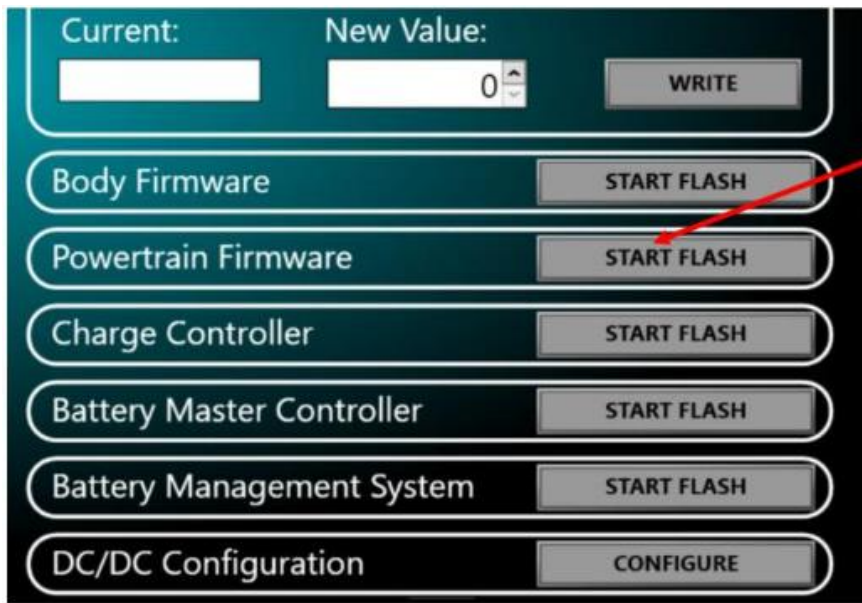
Vehicle Master Disconnect

4. Turn the Driver's Master Switch to the "ACC" position.



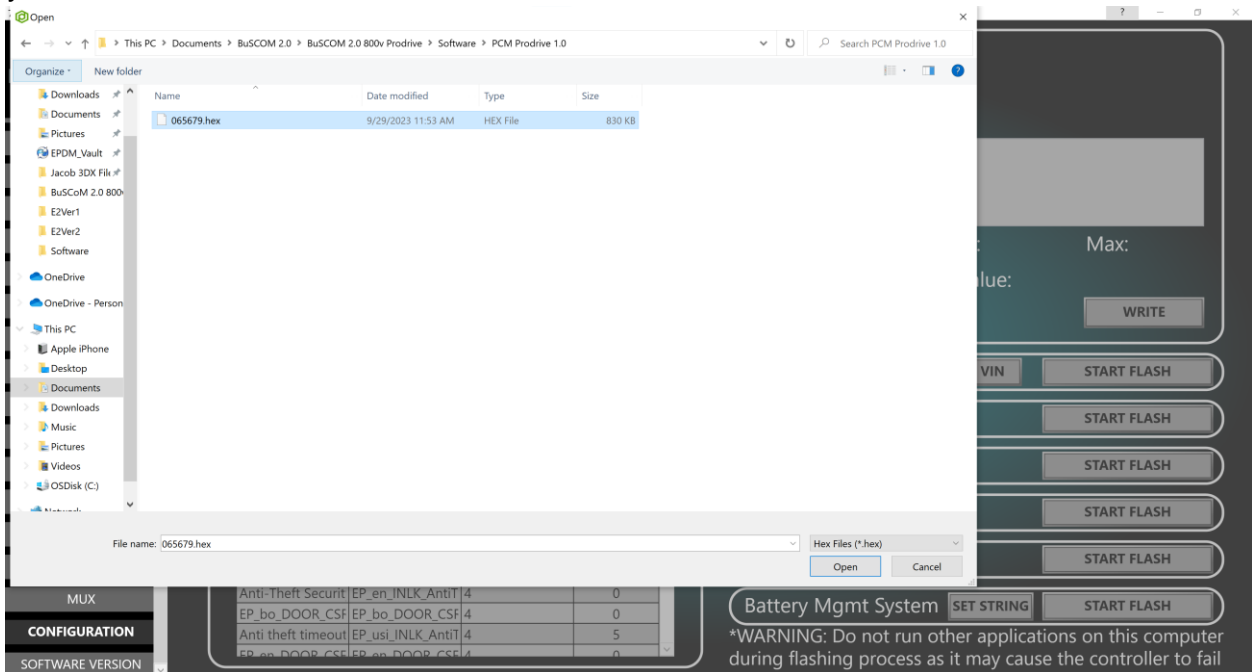
Master Switch "ACC"

5. Connect the Nexiq USB Link2 device to the laptop and to the OBDII Diagnostic Port located in the streetside wheel well box
6. On the PDT navigate to the configuration tab. Next, click the powertrain Firmware "Start Flash" Button.

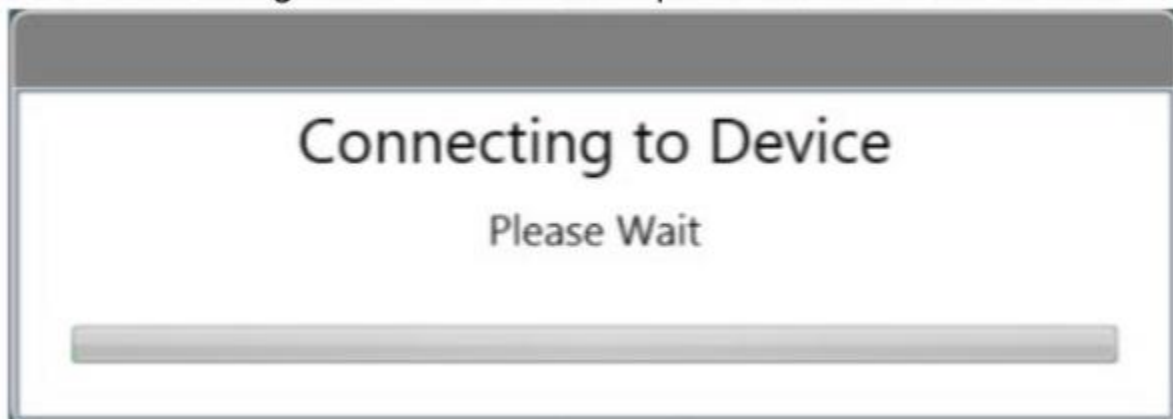


Click Powertrain Start Flash

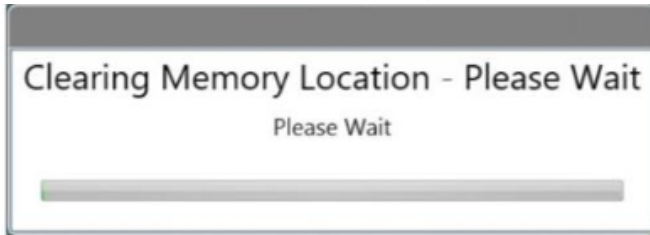
- The following screen should pop up. Select file "065645.hex" from the software package on your hard drive.



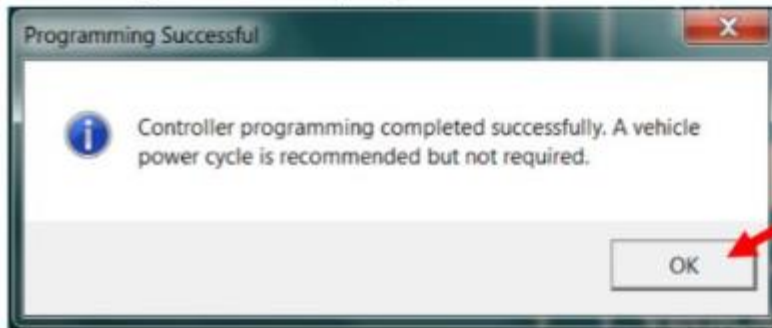
- The PDT will attempt to connect to the device.



9. When the software update begins, the following screens will be displayed.



10. The Software update may take several minutes to complete. When the software update is complete the following screens will be displayed. Click "OK" button to complete the update process.



Click OK

11. Power down the bus by selecting the off on the Driver Switch.



12. The Software update is now complete. Close the diagnostic tool and turn off power at the rear master disconnect.

Body Controller Update

1. Ensure the LV batteries and laptop are charged.
2. Power up and login to the Proterra-Supplied laptop or a comparable PC that has the Proterra Diagnostics Tool software installed with a valid license.



Vehicle Master Disconnect

3. Turn ON the 12/24V rear Vehicle Master Disconnect located at the curbside rear charge port access panel.



Vehicle Master Disconnect

4. Turn the Driver's Master Switch to the "ACC" position.



Master Switch "ACC"

5. Connect the Nexiq USB Link2 device to the laptop and to the OBDII Diagnostic Port located in the streetside wheel well box.
6. Navigate to the Configuration tab and click the "Get Parameters" button. This will download the latest parameter set to the "C:\Logs" folder on your machine.

Body Parameters		
Name	Access Level	Value
High Voltage Connection S	1	3
Daylight Savings Time Acti	1	1
Fire Detection System Lock	1	0
Pnumatic Leakage Rate Au	4	0
Main Electronics Pump Run	4	127
Lower Battery Pump Run Ti	4	0
Air Compressor Run Timer	4	0
Pnumatic Leakage Rate Pri	4	0
DCDC Enable Swap	1	1

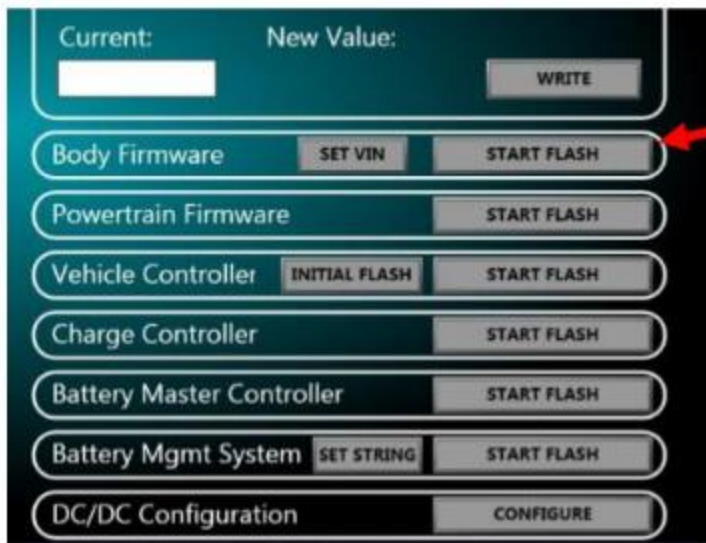
Get Parameters Button

- In the windows file explorer, navigate to the “C:\Logs” folder. Copy the latest downloaded *.zip file to a folder for the specific customer and vehicle.

Name	Date modified	Type	Size
ProterraService.txt	8/12/2019 08:48	Text Document	4,588 KB
7JZTH11J6KS000001_20190812084544842.zip	8/12/2019 08:45	WinRAR ZIP archive	51 KB
ProterraService.txt.1	8/09/2019 18:40	1 File	10,241 KB
ProterraService.txt.2	8/09/2019 18:37	2 File	10,241 KB
ProterraService.txt.3	8/09/2019 18:33	3 File	10,241 KB
ProterraService.txt.4	8/09/2019 18:30	4 File	10,241 KB
ProterraService.txt.5	8/09/2019 18:26	5 File	10,241 KB
AFTER_FLASH_7JZTH11J6KS000001_20190809181104824.zip	8/09/2019 18:11	WinRAR ZIP archive	51 KB
7JZTH11J6KS000001_20190809180310016.zip	8/09/2019 18:03	WinRAR ZIP archive	9 KB

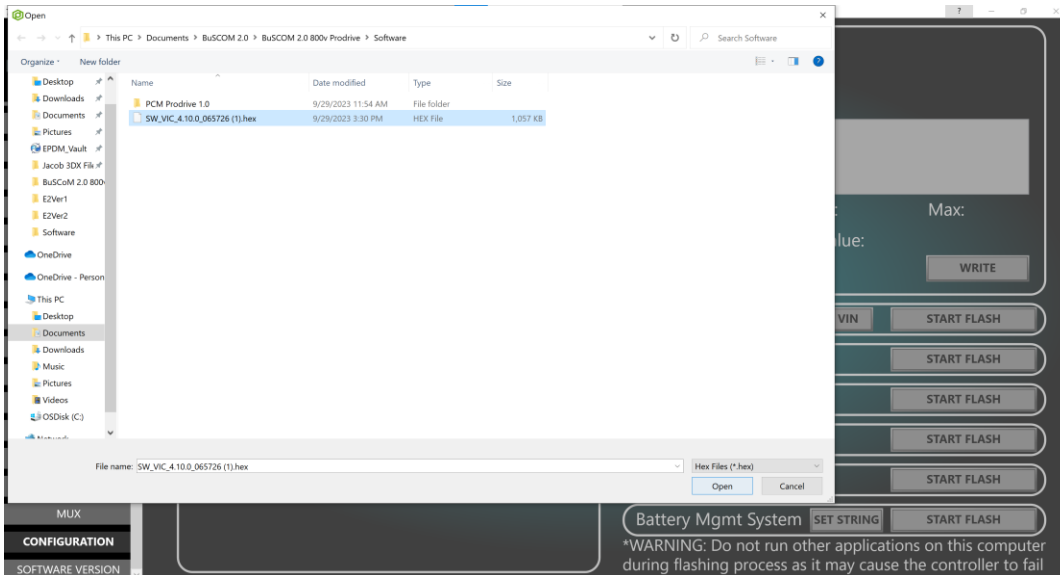
Name	Date modified	Type	Size
BMS	8/09/2019 17:35	File folder	
Body Controller	8/12/2019 09:46	File folder	
Charge Controller	8/09/2019 18:15	File folder	
DWP Dash	8/09/2019 17:42	File folder	
ESM	8/09/2019 18:15	File folder	
Powertrain	8/09/2019 17:43	File folder	
7JZTH11J6KS000001_20190812084544842.zip	8/12/2019 08:45	WinRAR ZIP archive	51 KB

- Navigate back to the PDT and the configuration tab. If this is a replacement controller, select the “SET VIN” and program the controller to match the VIN. Proceed to the next step.
- Select the “START FLASH” on the Body Firmware.



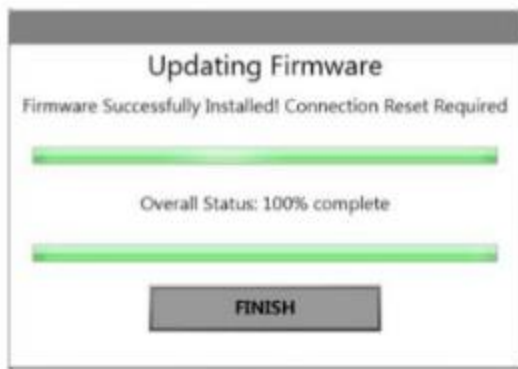
**Beside Body Firmware,
Click START FLASH**

10. In the popup window select the software file “Body_7_0_1_065725.ZR32A_A” from your harddrive.



11. The Programming window will come up and will take several minutes to complete. While the flashing is occurring do not change screens.

12. After the controller is updated, the tool will automatically upload the previous EEPROM values. Please verify that the EEPROMs values match the parameters that was exported above. If they do not match you may reimport the previous values. The bus might be buzzing and flashing faults. Cycle the buses power.



13. At this point the software update is complete. Close the PDT, turn the drivers switch to off and turn off the bus at the rear curbside master switch.

14. Remove all programming equipment and return vehicle to service.

Proterra EV Battery Fire Safety Guide

Thermal Event Diagnostics, Prevention & Response

LEGAL DISCLAIMER

PLEASE READ

This document provides general guidance to the owner/customer (“Owner”) to develop its own safe work procedures related to Proterra’s electric vehicle and electric vehicle battery pack (individually and collectively, the “Product”). Any reference to standards, regulations or laws is not exhaustive, nor intended to advise the Owner of its legal duties or compliance obligations.

This document is not based on a specific Product configuration. Proterra assumes that all who purchase the Product have expertise to properly and safely receive, handle, store, use, and service the Product. Accordingly, this document is intended as a helpful supplement for the Owner and not a substitute for the Owner’s expertise or responsibility regarding these topics. If any Owner lacks such expertise or does not agree to the foregoing limited purpose, such Owner should immediately notify Proterra in writing and should not procure, take delivery of, or use the Product.

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1 FIRE-SAFETY GUIDELINES FOR AN EV BATTERY

- a) In the event there is a battery fire, immediately stop operating or working in/around the vehicle. All individuals should move *at least* twenty feet away from the vehicle.
- b) Immediately call the local emergency number (e.g., “911”) to report the battery fire and ask for assistance from fire, police, and medical departments. See First Responder Guide below.
- c) It requires specialized training and personal protective equipment (“PPE”) to safely extinguish a battery fire. The Owner should establish a site-specific safety plan related to EV vehicles and all on-site first responders should be trained to execute the safety plan. The safety-plan should take the following factors into consideration:
 - i) A battery fire may require application of **large amounts of water** to the battery pack for a **long period of time** from a **safe distance** to extinguish a battery fire.

Do not:

- Stand close to the vehicle while attempting to extinguish a battery fire.
 - Attempt to open a battery pack for purposes of cooling it with water.
 - Attempt to extinguish a battery fire with a small, limited quantity of water.
 - Use an “ABC” rated fire extinguisher to put out a battery fire.
- ii) **Always** wear the appropriate PPE, including full body covering fire-fighting clothing and self-contained breathing apparatus. Hot metals may be ejected from the battery during a fire, and materials contained inside the battery pack are flammable, corrosive, and should not be inhaled or allowed to contact the eyes or skin.
 - iii) The battery pack may vent hot gases composed of volatile organic compounds such as alkyl-carbonates, methane, ethylene, and ethane, as well as hydrogen gas, carbon dioxide, carbon monoxide, soot, and particulates containing oxides of nickel, aluminum, lithium, copper, and cobalt. Vented gas temperatures may exceed 600°C. The gases may cause burns upon contact. The gases may ignite unexpectedly creating a fire or explosion.
 - iv) Battery pack fires may require up to 24 hours to extinguish. It may be necessary to allow the battery pack to burn while protecting structures or other objects in the vicinity. When all smoke and fire has visibly subsided and cleared, a thermal imaging camera should be used to actively measure the temperature of the high voltage battery and monitor temperature trends — i.e., is the battery consistently cooling down over time, or is it heating up again?
 - v) The battery pack must be completely cooled and there must not be fire, smoke, or heat present in the high voltage battery for at least one hour before the vehicle can be released to second responders (such as vehicle transporters). Second responders must be advised that

there is a risk of battery pack re-ignition. Damaged high voltage lithium ion batteries require special transportation measures, and therefore are prohibited from regular transportation.

- vi) Do not contact any high voltage components and always use insulated tools during overhaul.
- vii) A battery fire may damage the vehicle's airbag inflators, stored gas inflation cylinders, gas struts, and other components which can result in an unexpected explosion. A full "knock down" procedure should be performed.

d) First Aid Measures

- i) **Electric Shock/Electrocution:** Seek immediate medical attention (suspected or confirmed); call 911.
- ii) **Contact with Leaked Material (Electrolyte, Coolant):** The contents of an open or broken constituent battery cell may cause skin irritation and/or chemical burns. In the event of contact, immediately flush skin with water and wash affected area with soap/water. Seek immediate medical attention if a burn or other irritation does not resolve. For eye contact, immediately flush with a significant amount of water for at least 15 minutes without rubbing and seek immediate medical attention; call 911.
- iii) **Vapor or Gas Inhalation (Electrolyte Vapor, Vent Gas):** Immediately move to fresh air source. If not breathing, perform artificial respiration and call 911.

2 FIRST RESPONDER GUIDE

Information for first responders to respond to a battery fire involving an electric vehicle can be found at the National Fire Protection Association website:

<https://www.nfpa.org/Training-and-Events/By-topic/Alternative-Fuel-Vehicle-Safety-Training/Emergency-Response-Guides/Proterra>

A sample of the information for first responders located at this website is shown below for reference. First responders may also contact Proterra at service@proterra.com if they have any questions.

If a fire develops, the Incident Commander should determine whether an attempt will be made to suppress the fire (aggressive firefighting) or allow the battery pack to burn until it self extinguishes, while protecting surrounding materials (defensive firefighting). Establish a 20 foot radius "safety zone" around the vehicle.

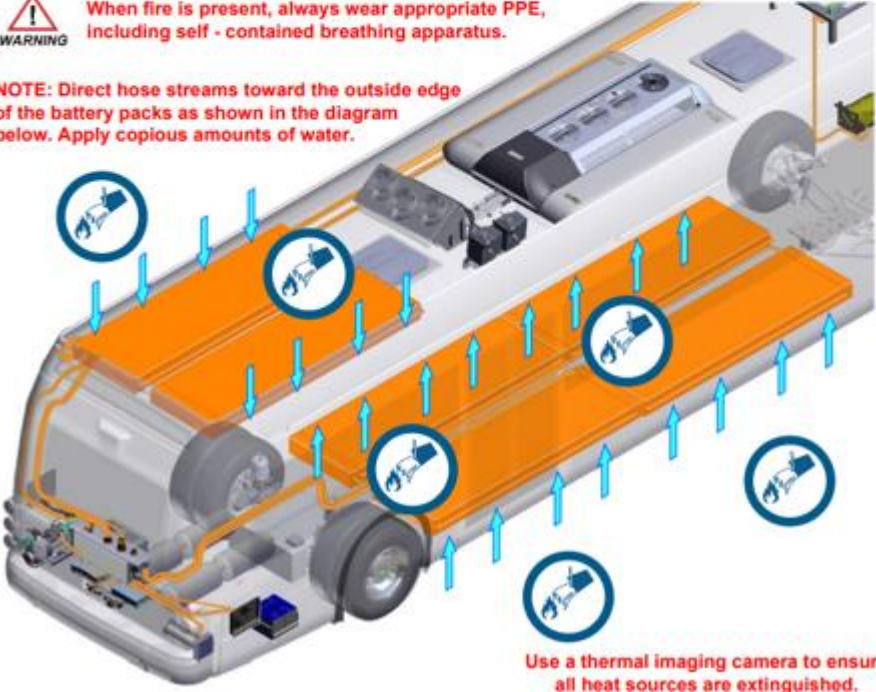
Virtually all fires involving lithium-ion batteries can be controlled with water. To date, water has been found to be the most effective agent for controlling lithium-ion battery fires. Water will suppress flames and can cool cells, limiting propagation of thermal runaway reactions. If water is used, electrolysis of water (splitting of water into hydrogen and oxygen) may contribute to the flammable gas mixture formed by venting cells, burning plastic, and burning of other combustibles. Thus copious volumes of water should be used to fight a lithium-ion battery fire.

Gaseous agents such as CO2 or Halon, or dry chemical suppressants may temporarily suppress flaming of lithium-ion battery packs, but they will not cool lithium-ion batteries and will not limit the propagation of cell thermal runaway reactions. Metal fire suppressants such as LITH-X, graphite powder, or copper powder are not appropriate agents for suppressing fires involving lithium-ion battery packs as they are unlikely to be effective.

A battery fire may continue for several hours and it may take 24 hours or longer for the battery pack to cool. A lithium-ion battery fire that has been extinguished can re-ignite due to the exothermic reaction of constituent materials from broken or damaged cells. To avoid this, remove sources of ignition and cool the burned mass by flooding with water.

WARNING When fire is present, always wear appropriate PPE, including self-contained breathing apparatus.

NOTE: Direct hose streams toward the outside edge of the battery packs as shown in the diagram below. Apply copious amounts of water.



Use a thermal imaging camera to ensure all heat sources are extinguished.

3 BACKGROUND

3.1 THERMAL EVENT VS. THERMAL RUNAWAY.

Each Proterra battery consists of multiple battery cells. Proterra’s diagnostic system is set up to detect a battery “thermal event” where a single battery cell fails in a manner that may cause an unintended chemical reaction to occur inside the cell. The battery pack is designed to contain a single battery cell “thermal event” and prevent a “thermal runaway” (or fire) that involves neighboring battery cells. A “thermal runaway” may occur if other abnormal conditions exist such that the single cell “thermal event” is not contained (e.g., physical impact that causes significant damage to the battery pack). A “thermal runaway” is detectable by smoke, a burning smell, a flame, and other indications of a fire.

If there are any signs that the battery pack may be experiencing a “thermal runaway,” or fire (e.g. smoke, a burning smell, abnormal popping or whistling noises, a flame, etc.), then you must immediately discontinue use of the vehicle and follow the emergency guidelines outlined in the above Fire-Safety Guidelines for an EV Battery.

3.2 DIAGNOSTICS, DRIVER NOTIFICATION & VEHICLE RESPONSE

Proterra vehicles have battery sensors and diagnostics used to detect signals related to temperature, humidity, internal pack air pressure and isolation. If an abnormal battery condition is detected, Proterra’s diagnostic system will transmit a message on the vehicle CAN bus. This information will be communicated to the driver via the vehicle dash as described below.

Critical battery faults which indicate the potential for a thermal event will result in a Fast Flash Red Stop Lamp in the vehicle dash that blinks at a rate of two times per second, and an audible alarm that pulses twice per second (collectively, the “Critical Battery Fault Warnings”). *Critical Battery Fault Warnings indicate a critical battery failure which could result in a thermal event.* When the Critical Battery Fault Warnings are active, please immediately follow the procedures set forth in the Operator/Driver Guidelines section below, as well as the instructions in any applicable sections of the Proterra Driver’s manual.

For any other types of driver’s dash display warning lights (including but not limited to solid, non-flashing red or yellow “warning” lights) and/or audible alarms, please refer to the vehicle owner’s manual for an explanation of these warnings and recommended actions.

Figure 1 below shows the Red Stop Lamp as presented on the original Proterra dash. Figure 2 below shows the Red Stop Lamp as presented on the updated Proterra digital dash.

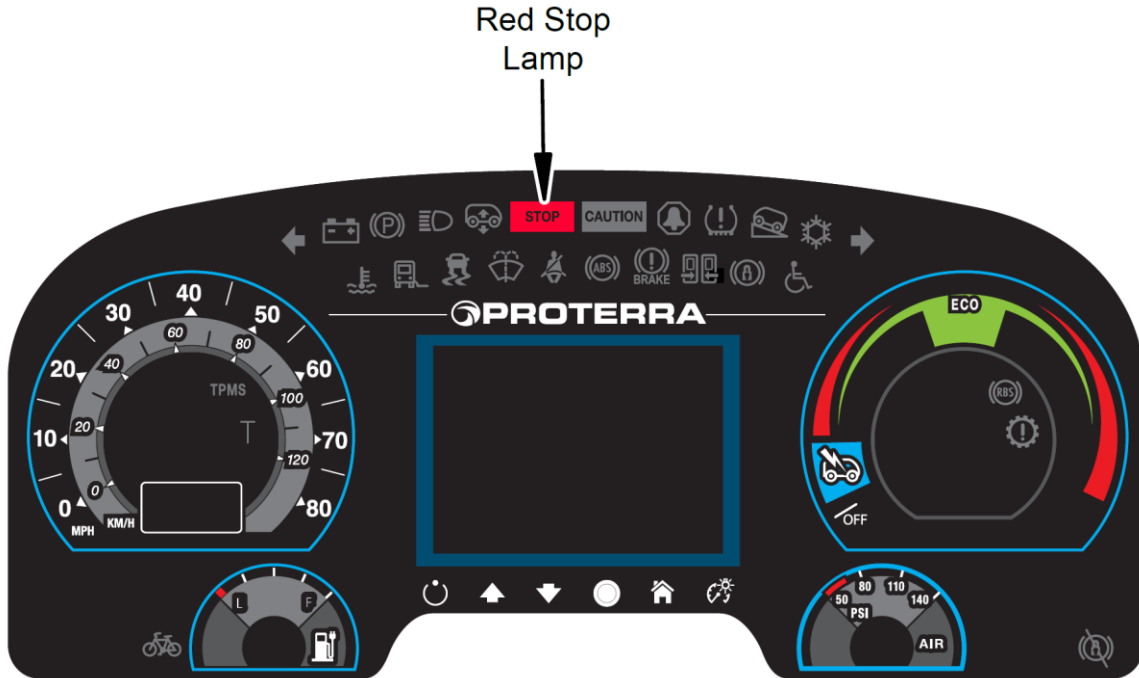


Figure 1 – Red Stop Lamp on Original Dash

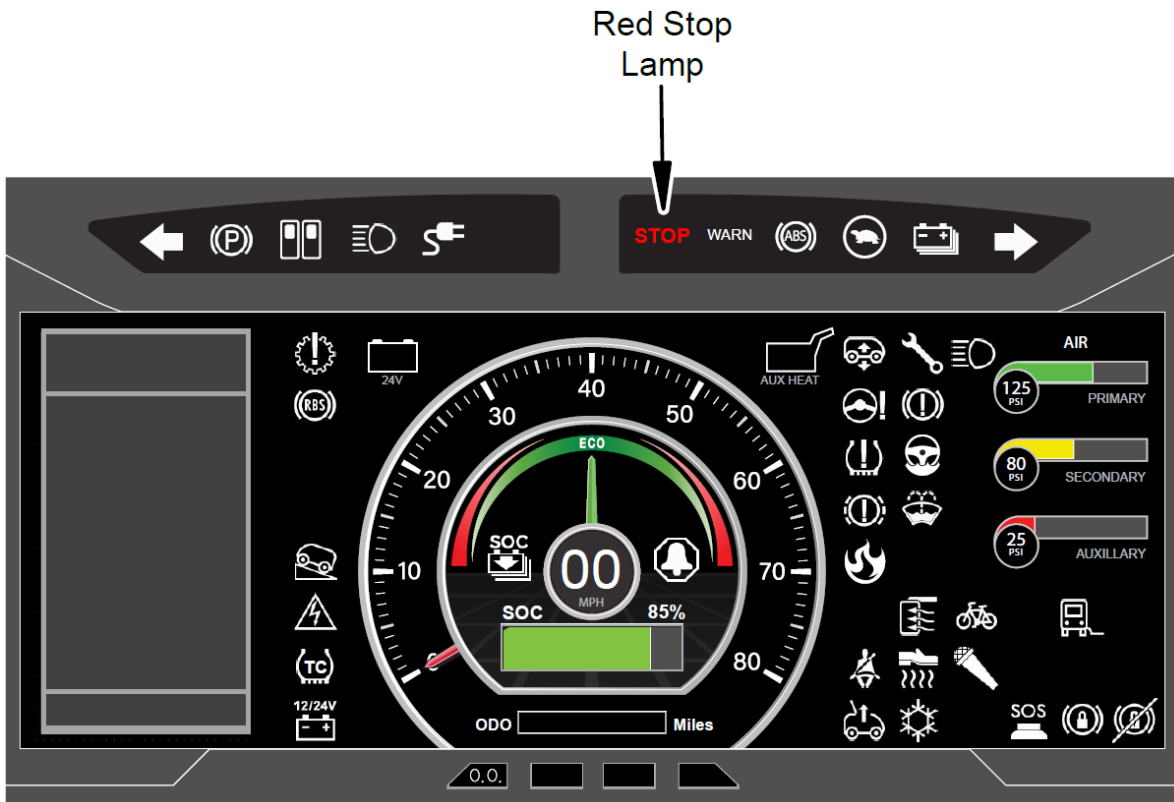


Figure 2 – Red Stop Lamp on Digital Dash

OWNERS SHOULD ALWAYS MONITOR AND RESPOND TO DASH FAULT LIGHTS AS PART OF THE VEHICLE OPERATION AND MAINTENANCE ROUTINE. OWNERS MUST PERFORM FOLLOW-UP INVESTIGATION WHEN DASH FAULT LIGHTS PRESENT. DO NOT IGNORE A DASH FAULT LIGHT.

In addition to the Critical Battery Fault Warnings, a critical battery fault will prevent the vehicle from charging and cause the vehicle to immediately enter a “limp home” state where the propulsion system is limited to 50 kW. The “limp home” state will provide enough power to launch the vehicle and maintain 35 mph on a flat road with an unloaded bus. In addition to the Critical Battery Fault Warnings, the Owner’s service technicians should be trained by Proterra in use of Proterra’s diagnostic tool to identify and detect abnormal battery conditions (see <https://www.proterra.com/proterra-diagnostics-tool/> to download the tool and access training material). The Owner’s consistent and routine use of the Proterra diagnostic tool is recommended to identify and monitor issues that may require further investigation.

4 OPERATOR/DRIVER GUIDELINES

Prior to operating the vehicle, the driver must perform all recommended safety checks set forth in the Proterra Driver's Manual. This inspection includes, but is not limited to, a visual inspection for signs of damage/malfunction and confirmation that the fault lights in the dashboard display are not illuminated.

If there are any signs of fire prior to operation or while the vehicle is in use (e.g., smoke, a burning smell, abnormal popping or whistling noises, a flame, etc.), the driver must immediately stop the vehicle in a safe location and evacuate all passengers in accordance with the emergency guidelines in Fire-Safety Guidelines for an EV Battery (Section 1). Note -- the vehicle may be in a "limp home" state with limited propulsion as described above.

If the Critical Battery Fault Warnings are active as described in Section 3.2 (but there is no smoke, burning smell, abnormal popping or whistling noises, flame, etc.), the vehicle should be promptly parked in a safe outdoor location at least 20 feet away from other objects such as buildings, trees and other vehicles, and at least 100 feet away from highly flammable items such as gas stations or propane tanks. Once the vehicle has been moved to a safe location, the operator and passengers may exit the vehicle and the vehicle should be removed from service.

The vehicle high voltage system may be left in either state; on or turned off. However, DO NOT open the 12/24 Master Disconnect Switch or Battery Saver Switch (if equipped). Keeping these switches closed will allow the battery coolant pumps to operate as intended to mitigate heat buildup as well as providing power to telemetry systems for remote data review.

Next Steps

- Call the Proterra Regional Field Service Representative (FSR) as soon as possible to report the issue. Proterra will respond within 2 hours (Mon- Fri between 6 am-6pm ET) or by 9 AM ET the following business day.
- DO NOT attempt to charge the vehicle.
- Continue to monitor the vehicle for signs that there could be a thermal runaway (smoke, burning smell, abnormal popping or whistling noises, flame, etc.).
- DO NOT operate or work on the vehicle until Proterra's service personnel have had the opportunity to assess the situation and the parties have an agreed action plan.
If there are any signs of a fire (e.g., smoke, a burning smell, abnormal popping or whistling noises, a flame, etc.), follow the emergency guidelines outlined in Fire-Safety Guidelines for an EV Battery (Section 1).

5 MONITORING BATTERIES WITH DIAGNOSTIC TOOL

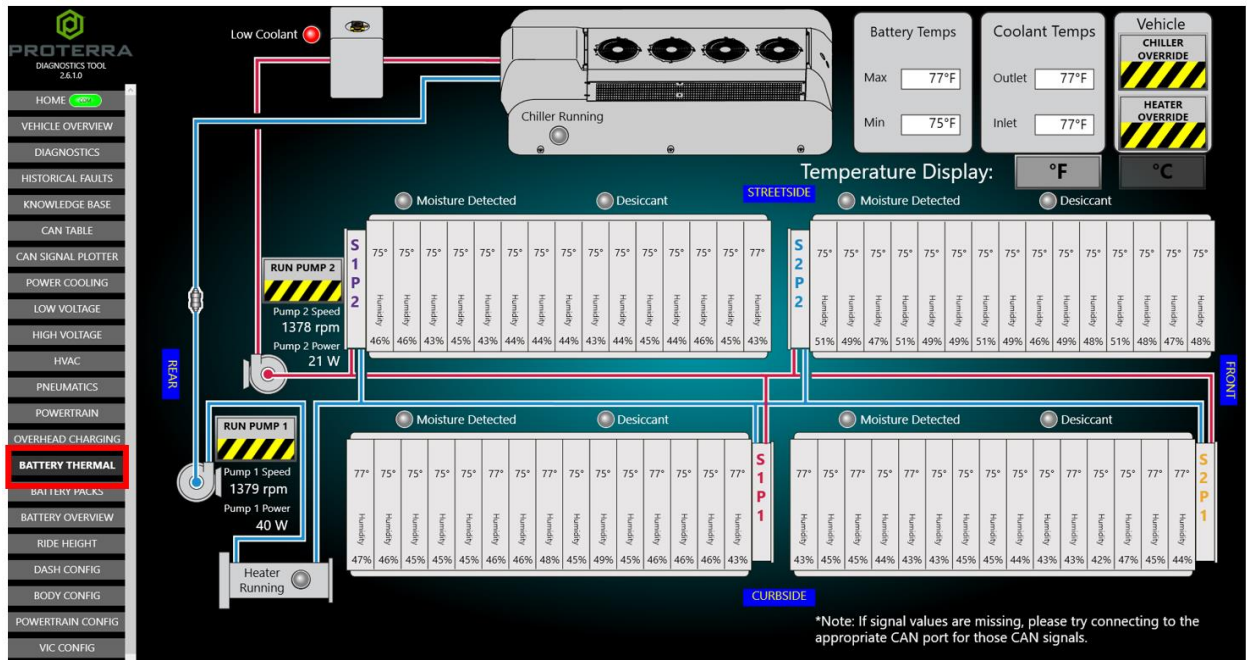
The Proterra Diagnostic Tool (the "Diagnostic Tool") enables customers to monitor the humidity and isolation levels of a battery pack that may indicate a critical battery safety condition. These metrics are used by the software systems described above. **As part of a customer's routine maintenance program, the Diagnostic Tool should be used every *three months* to monitor the humidity and internal isolation levels of each battery pack as described below. If a vehicle has been turned off for three months or**

more, the customer must use the Diagnostic Tool to check each battery pack prior to starting, operating or charging the vehicle.

Steps to Use Diagnostic Tool to Check Humidity and Internal Isolation of Battery Packs

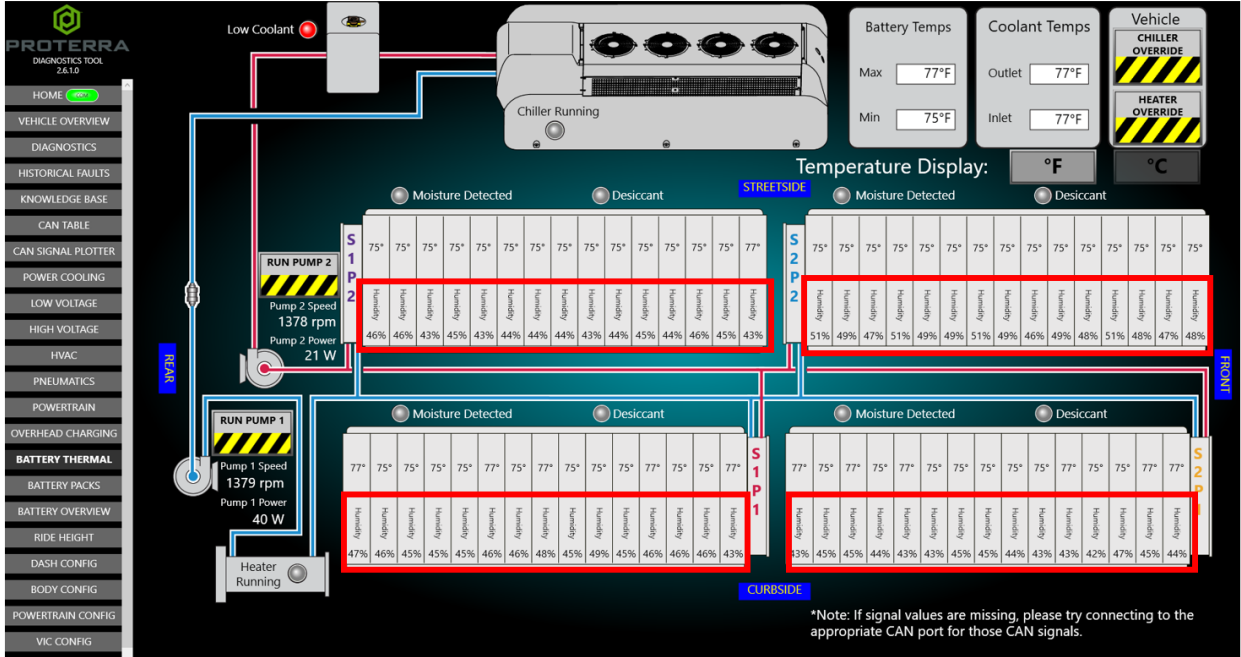
Step 1: Connect the Diagnostic tool to a vehicle diagnostic port that has BCAN access. NOTE: The diagnostic port location varies based on the vintage of the vehicle.

Step 2: View the “Battery Thermal” screen on the left-hand side. Example:



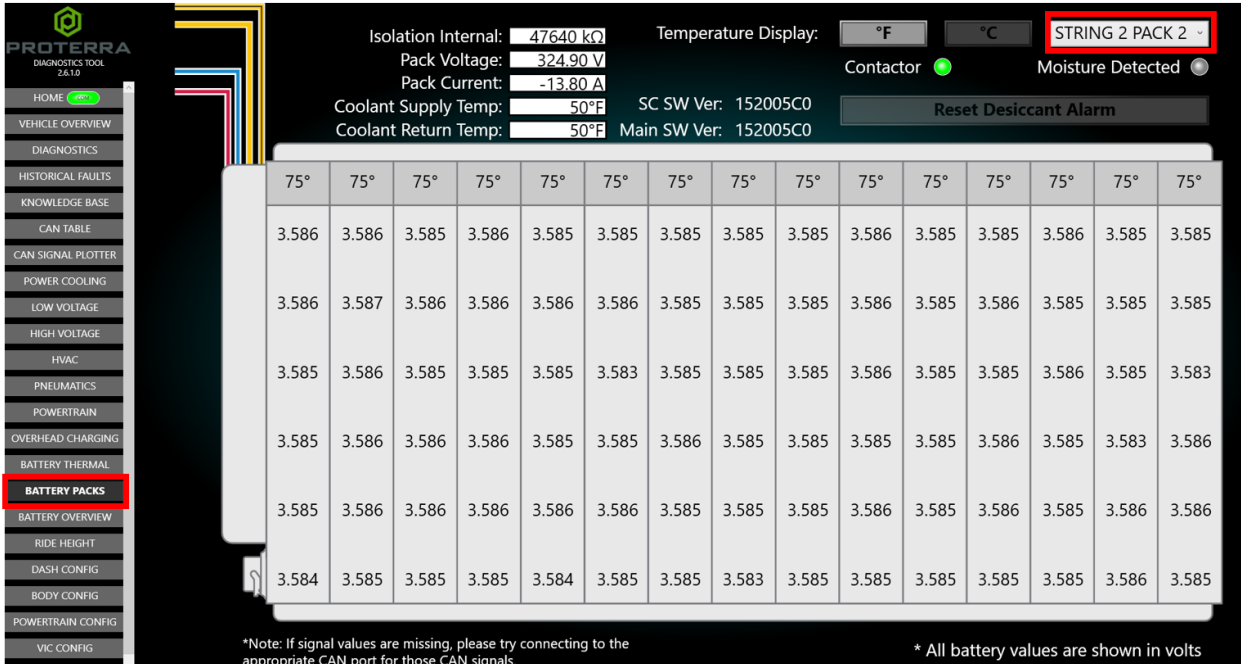
Step 3: View the humidity level of each module per battery pack; the pack ID is located on the graphic of the A-Bay. If the module humidity levels are less than 70%, the battery pack check is complete. If there is one or more module(s) that exceeds 70% humidity, you must proceed to the next step.

Example: S1P1, S1P2, S2P1 and S2P2 as shown below. NOTE: your screen and Pack ID may look different based on the vintage of vehicle.



Step 4: (i) View the “Battery Packs” screen (see the “Battery Thermal” screen on the left-hand side below); and (ii) select the Pack ID of any battery pack(s) with a humidity level that exceeds 70% (see the pull-down menu in the upper right-hand corner below).

Example: If S2P2 has humidity of 70%, select “String 2 Pack 2” in the pull-down window.



Step 5: With the relevant Pack ID selected in the pulldown menu, the internal isolation value should be recorded.

PROTERRA DIAGNOSTICS TOOL 2.6.1.0

HOME VEHICLE OVERVIEW DIAGNOSTICS HISTORICAL FAULTS KNOWLEDGE BASE CAN TABLE CAN SIGNAL PLOTTER POWER COOLING LOW VOLTAGE HIGH VOLTAGE HVAC PNEUMATICS POWERTRAIN OVERHEAD CHARGING BATTERY THERMAL **BATTERY PACKS** BATTERY OVERVIEW RIDE HEIGHT DASH CONFIG BODY CONFIG POWERTRAIN CONFIG VIC CONFIG

Isolation Internal: **47640 kΩ** Temperature Display: °F °C STRING 2 PACK 2

Pack Voltage: 324.90 V Pack Current: -13.80 A

Coolant Supply Temp: 50°F SC SW Ver: 152005C0

Coolant Return Temp: 50°F Main SW Ver: 152005C0

Contactor: Moisture Detected: Reset Desiccant Alarm

75°	75°	75°	75°	75°	75°	75°	75°	75°	75°	75°	75°	75°	75°	75°
3.586	3.586	3.585	3.586	3.585	3.585	3.585	3.585	3.585	3.586	3.585	3.585	3.586	3.585	3.585
3.586	3.587	3.586	3.586	3.586	3.586	3.585	3.585	3.585	3.586	3.585	3.586	3.585	3.585	3.585
3.585	3.586	3.585	3.585	3.585	3.583	3.585	3.585	3.585	3.586	3.585	3.585	3.586	3.585	3.583
3.585	3.586	3.586	3.586	3.585	3.585	3.586	3.585	3.585	3.585	3.585	3.586	3.585	3.583	3.586
3.585	3.586	3.586	3.586	3.586	3.586	3.585	3.585	3.585	3.586	3.585	3.586	3.585	3.586	3.586
3.584	3.585	3.585	3.585	3.584	3.585	3.585	3.583	3.585	3.585	3.585	3.585	3.585	3.586	3.585

*Note: If signal values are missing, please try connecting to the appropriate CAN port for those CAN signals. * All battery values are shown in volts

Step 6: If either of the following conditions are met, proceed to [Step 7](#) below.

- a. Condition 1:
 - Humidity greater than 90%
- b. Condition 2:
 - Humidity greater than 70% AND
 - Internal Isolation less than 20,000 Kohms

If neither of these conditions are met, no issue has been found with respect to the recorded battery pack(s) humidity and internal isolation levels, and the battery pack check is complete.

Step 7: If Condition 1 or 2 are present:

The vehicle should be promptly parked in a safe outdoor location at least 20 feet away from other objects such as buildings, trees and other vehicles, and at least 100 feet away from highly flammable items such as gas stations or propane tanks. Once the vehicle has been moved to a safe location, the operator and passengers may exit the vehicle and the vehicle should be removed from service.

The vehicle high voltage system may be left in either state; on or turned off. However, DO NOT open the 12/24 Master Disconnect Switch or Battery Saver Switch (if equipped). Keeping these switches closed will allow the battery coolant pumps to operate as intended to mitigate heat buildup as well as providing power to telemetry systems for remote data review.

- Call the Proterra Regional Field Service Representative (FSR) as soon as possible to report the issue. Proterra will respond within 2 hours (Mon- Fri between 6 am-6pm ET) or by 9 AM ET the following business day.
- DO NOT attempt to charge the vehicle.
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- DO NOT operate or work on the vehicle until Proterra's service personnel have had the opportunity to assess the situation and the parties have an agreed action plan.

If there are any signs of a fire (e.g., smoke, a burning smell, abnormal popping or whistling noises, a flame, etc.), follow the emergency guidelines outlined in Fire-Safety Guidelines for an EV Battery (Section 1).