ISSUE DATE:	5-28-2021
SERVICE BULLETIN SUBJECT:	18650 BMS, ESM, and Vehicle Controller Software Update
VINs or MODELS AFFECTED:	Service Specified Buses
COMPLETE BY:	Next Service Opportunity
SERVICE BULLETIN #:	SC-21-77
Labor Operation Code:	HC43Z

NOTICE! It is expected that this process will require 1 hour per bus. Please schedule appropriately to minimize vehicle downtime.

18650 BMS ESM AND VEHICLE CONTROLLER SOFTWARE UPDATE

Retrofit Description:

This procedure updates the BMS, ESM and Vehicle Controller software to the latest version.

PROTERRA
Headquarters: 1815 Rollins Road, Burlingame, CA 94010
East Coast Manufacturing: 1 Whitlee Court, Greenville, SC 29607
West Coast Manufacturing: 383 Cheryl Lane, City of Industry, CA 91789

Tools/Parts Required

Tools and Supplies Required:

- Proterra Service Laptop with Proterra Diagnostic Tool
- Nexiq USB Link2 Device and Cable

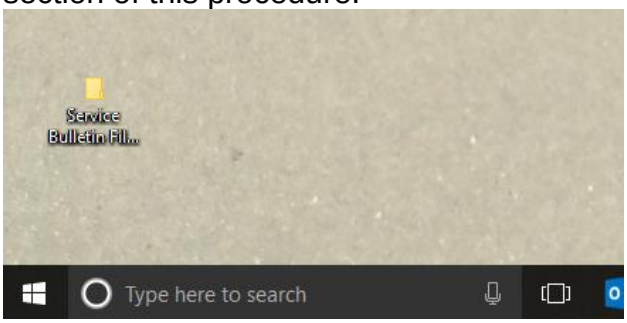
Parts Required:

- 057015 SOFTWARE, HV BMS MAIN CONTROLLER, GEN 2 18650 CMB6 R2005
- 057016 SOFTWARE, HV BMS SAFETY CONTROLLER, GEN 2 18650 CMB6 R2005
- 057775 SOFTWARE, ESM, 800V, 1.0.4
- 057052 SOFTWARE, VEHICLE CONTROLLER 800V V4.4.2

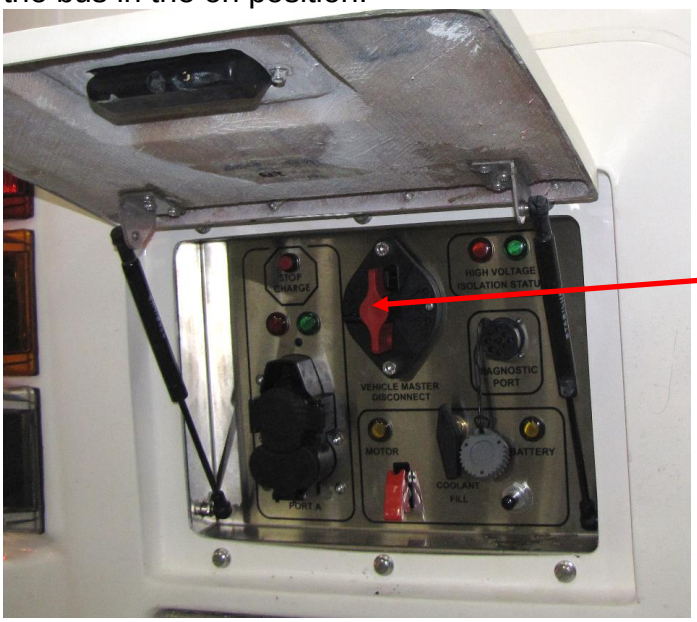
PROTERRA
Headquarters: 1815 Rollins Road, Burlingame, CA 94010
East Coast Manufacturing: 1 Whitlee Court, Greenville, SC 29607
West Coast Manufacturing: 383 Cheryl Lane, City of Industry, CA 91789

BMS Update:

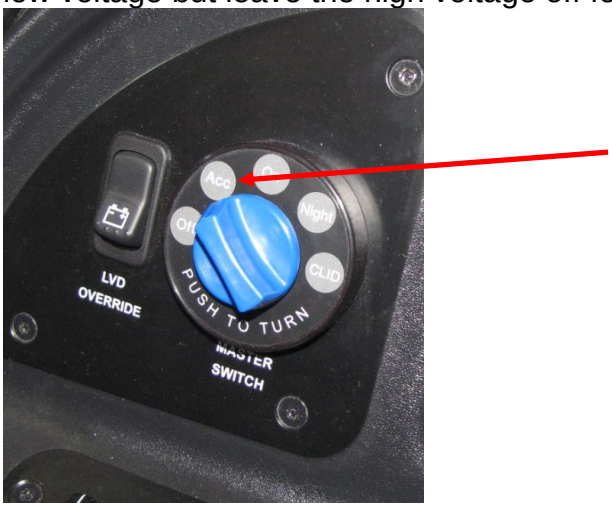
1. Navigate to the Service Bulleting folder by clicking the following link. \\bus.local\files\Engineering\Service Bulletins\ Copy the folder named “Service Bulletin Files for SC-21-77” to your desktop. This folder contains additional folders with the software for each section of this procedure.



2. Ensure that the bus is powered on with the vehicle master disconnect on the Curbside rear of the bus in the on position.

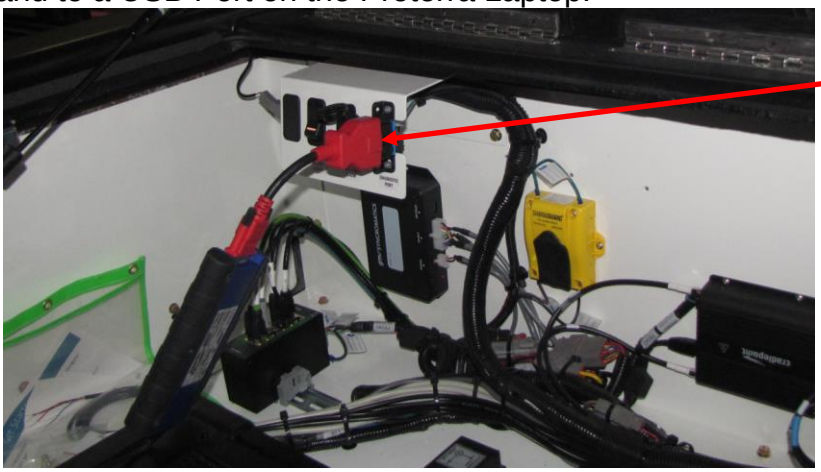


3. Working in the Driver’s area, turn the master switch to the ACC position. This will enable the low voltage but leave the high voltage off for battery programming.



PROTERRA
Headquarters: 1815 Rollins Road, Burlingame, CA 94010
East Coast Manufacturing: 1 Whitlee Court, Greenville, SC 29607
West Coast Manufacturing: 383 Cheryl Lane, City of Industry, CA 91789

4. Open the Streetside Wheel Well box. Connect the Nexiq programming cable to the OBDII Port and to a USB Port on the Proterra Laptop.



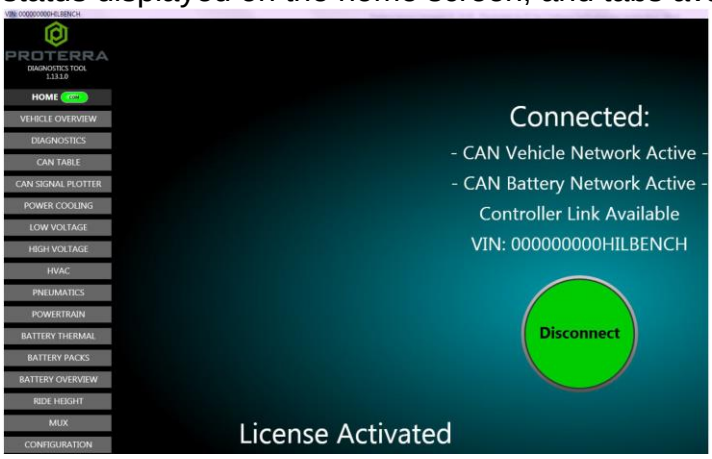
5. Start the Proterra Diagnostic Tool by double clicking on the desktop icon.

6. When the program opens, read and click OK for the prompt.

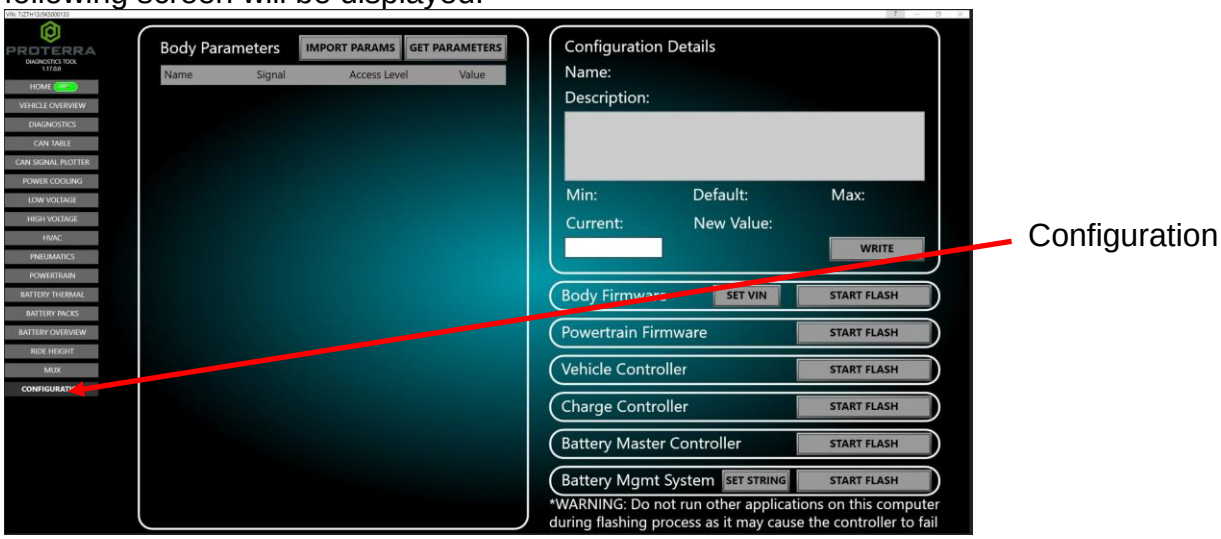
7. On the Home tab, select the appropriate device from the drop-down menu and click “Connect”.

PROTERRA
Headquarters: 1815 Rollins Road, Burlingame, CA 94010
East Coast Manufacturing: 1 Whitlee Court, Greenville, SC 29607
West Coast Manufacturing: 383 Cheryl Lane, City of Industry, CA 91789

9. Once the diagnostic tool has connected to the vehicle, you will have a VIN and connection status displayed on the home screen, and tabs available to navigate.



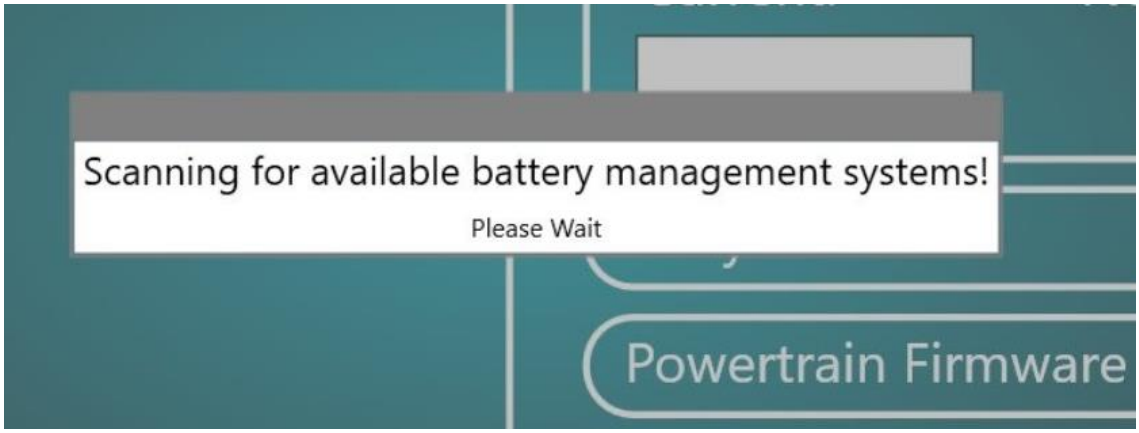
10. From the Home Screen, click the “Configuration” tab at the bottom left of the screen. The following screen will be displayed.



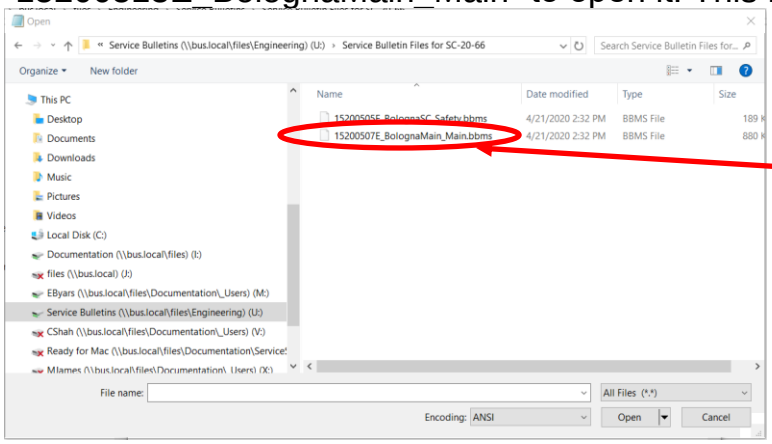
11. Click on the “Start Flash” button in the “Battery Mgmt System” at the lower right of the screen as shown below.

PROTERRA
Headquarters: 1815 Rollins Road, Burlingame, CA 94010
East Coast Manufacturing: 1 Whitlee Court, Greenville, SC 29607
West Coast Manufacturing: 383 Cheryl Lane, City of Industry, CA 91789

13. The following message will be displayed.
    Note: It may take several minutes for the Diagnostic Tool to gather the required information.



14. When the information gathering process is complete, the Diagnostic Tool will prompt you to select a file. Navigate to the desktop folder where the files were stored to perform this service campaign. Double click on the file named "15200513E_BolognaMain_Main" to open it. This file will be in the BMS subfolder.

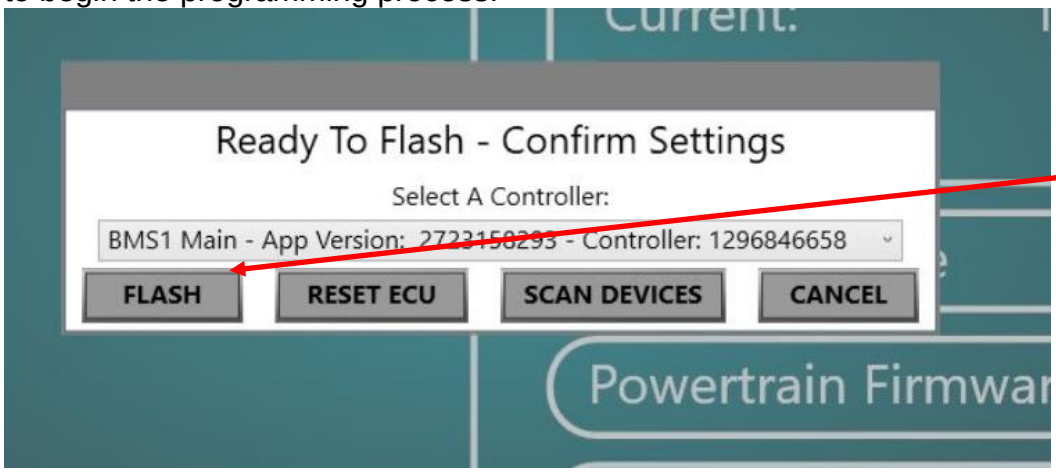


Double Click the "Main" Program

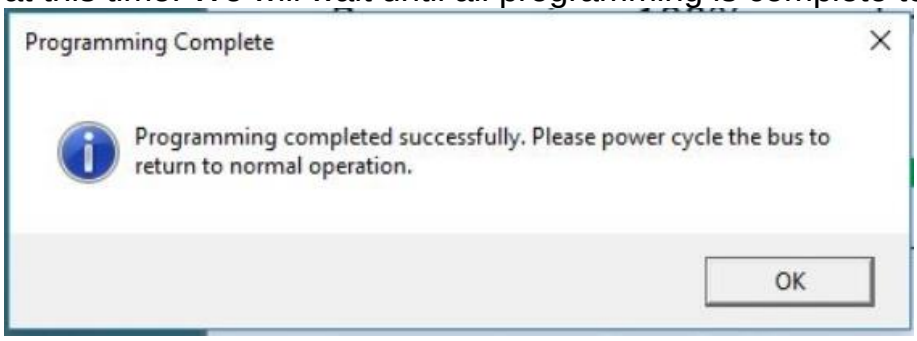
15. The following message will be displayed. Click on the drop-down arrow to select a controller.

PROTERRA
Headquarters: 1815 Rollins Road, Burlingame, CA 94010
East Coast Manufacturing: 1 Whitlee Court, Greenville, SC 29607
West Coast Manufacturing: 383 Cheryl Lane, City of Industry, CA 91789

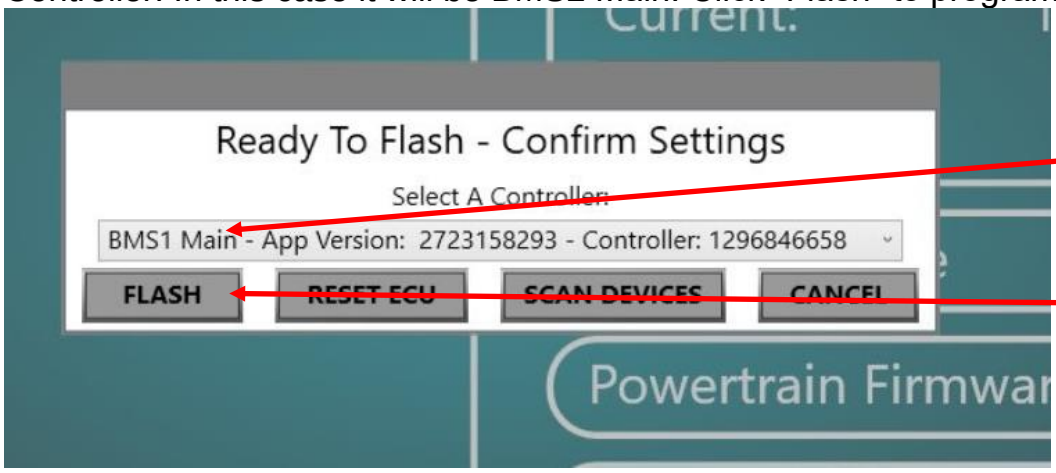
17. Select the first “BMS Main” entry as shown on the following screen. Click the “FLASH” button to begin the programming process.



18. Wait for the programming process to complete. When the process completes, the following dialog box will appear. Click on the “OK” button. Do not Power Cycle the bus at this time. We will wait until all programming is complete to Power Cycle the bus.



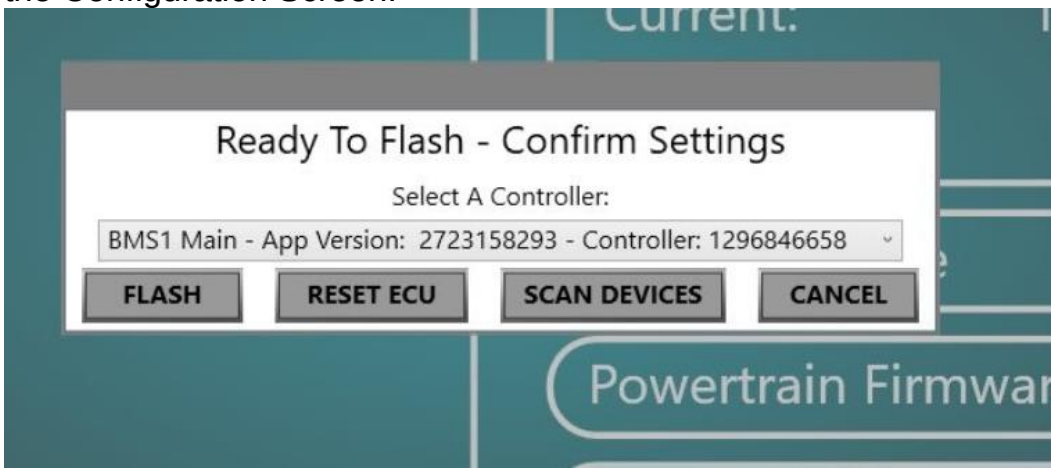
19. The following screen will appear. Click the drop-down arrow to select the next Main Controller. In this case it will be BMS2 Main. Click “Flash” to program the second BMS.



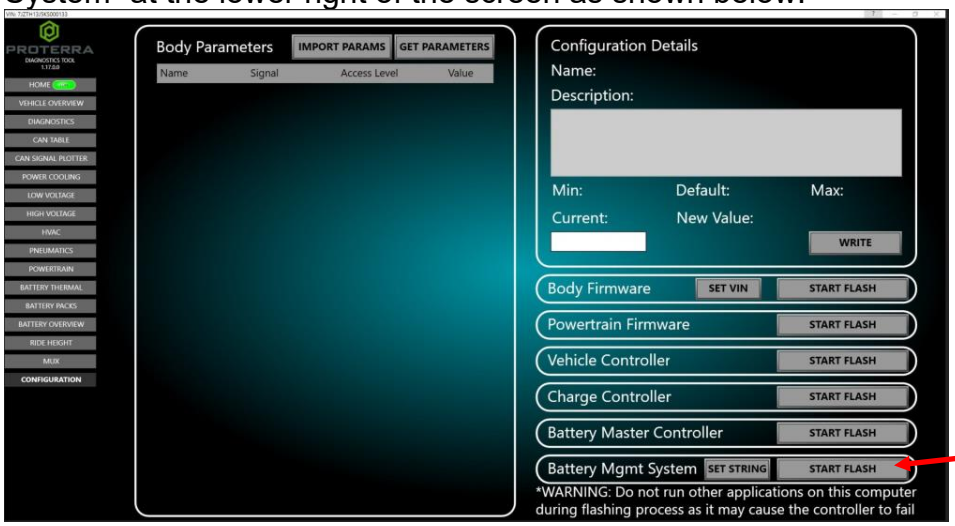
20. Repeat this process to program the remaining BMS Main controllers.

PROTERRA
Headquarters: 1815 Rollins Road, Burlingame, CA 94010
East Coast Manufacturing: 1 Whitlee Court, Greenville, SC 29607
West Coast Manufacturing: 383 Cheryl Lane, City of Industry, CA 91789

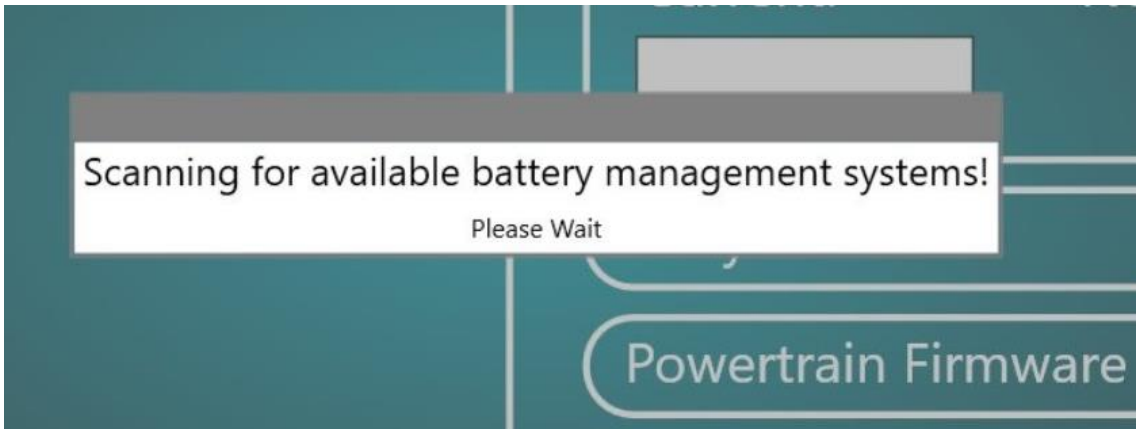
22. When all of the BMS Main controllers have been programmed, click “Cancel” to return the Configuration Screen.



23. The following screen appears. Click on the “Start Flash” button in the “Battery Mgmt System” at the lower right of the screen as shown below.

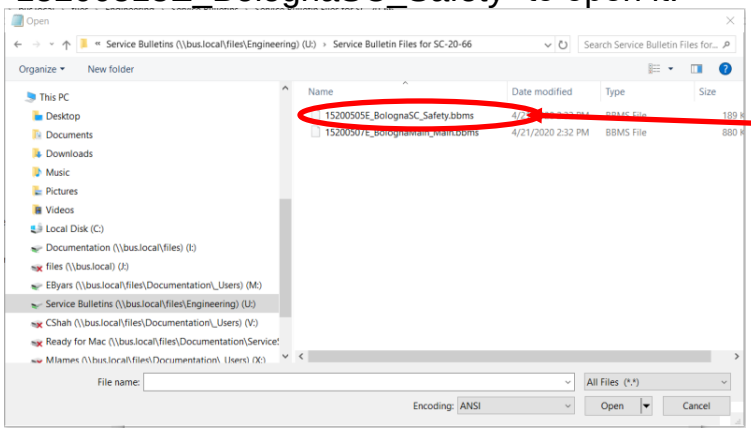


24. The following message will be displayed.
Note: It may take several minutes for the Diagnostic Tool to gather the required information.



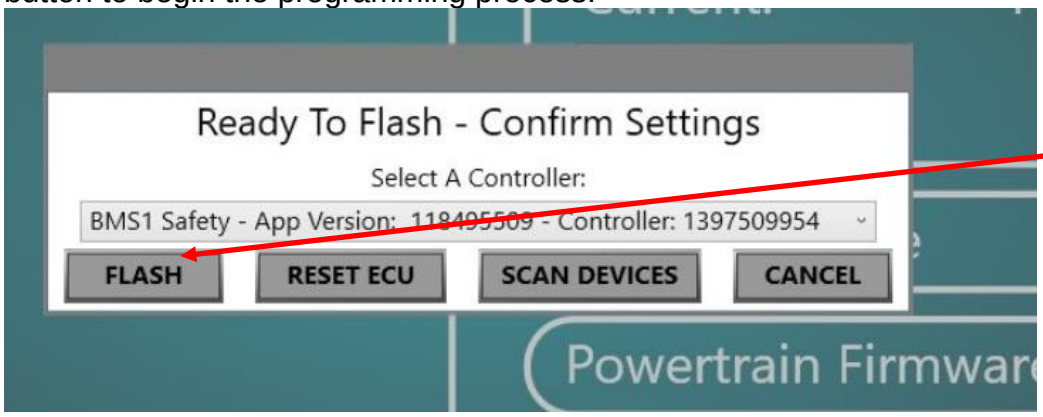
PROTERRA
Headquarters: 1815 Rollins Road, Burlingame, CA 94010
East Coast Manufacturing: 1 Whitlee Court, Greenville, SC 29607
West Coast Manufacturing: 383 Cheryl Lane, City of Industry, CA 91789

26. When the information gathering process is complete, the Diagnostic Tool will prompt you to select a file. Navigate to the desktop folder where the files were stored to perform this service campaign. Double click on the file named “15200513E_BolognaSC_Safety” to open it.



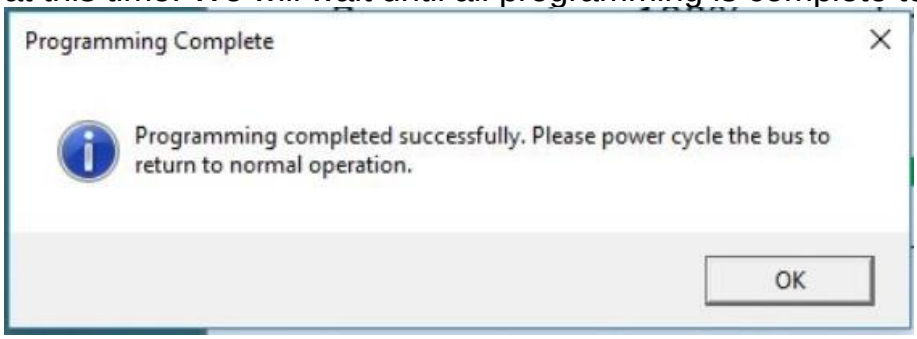
Double Click the “Safety” Program

27. Select the first “BMS Safety” entry as shown on the following screen. Click the “FLASH” button to begin the programming process.



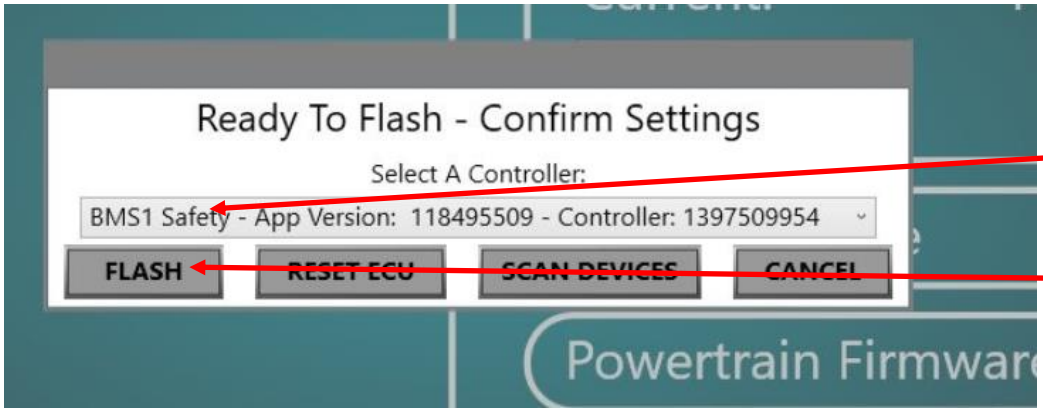
Click Flash

28. Wait for the programming process to complete. When the process completes, the following dialog box will appear. Click on the “OK” button. Do not Power Cycle the bus at this time. We will wait until all programming is complete to Power Cycle the bus.



PROTERRA
Headquarters: 1815 Rollins Road, Burlingame, CA 94010
East Coast Manufacturing: 1 Whitlee Court, Greenville, SC 29607
West Coast Manufacturing: 383 Cheryl Lane, City of Industry, CA 91789

30. The following screen will appear. Click the drop-down arrow to select the next Safety Controller. In this case it will be BMS2 Safety. Click “Flash” to program the second BMS.



Select “BMS2 Safety”

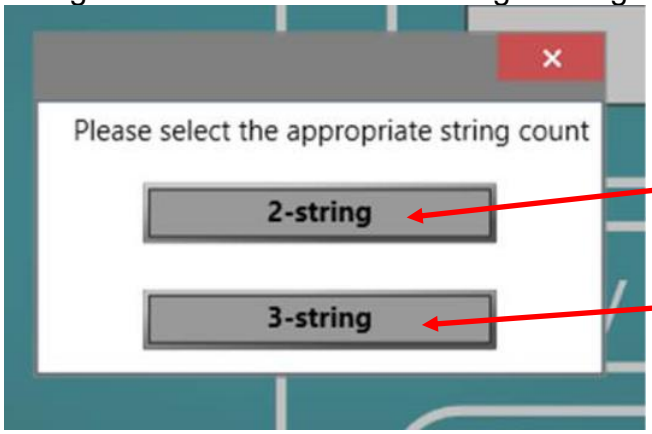
Click “Flash”

31. Repeat this process to program the remaining two BMS Safety controllers.

32. When all the BMS Safety controllers have been programmed, click “Cancel” to return the Configuration Screen. Click the “Set String” button as shown below.

Click Set String

33. Click the “2-String” Button on buses with four High Voltage Battery Packs or click the “3-String” Button for buses with six High Voltage Battery Packs.



Click 2-String for Buses with 4 High Voltage Battery Packs

Click 3-String for Buses with 6 High Voltage Battery Packs

PROTERRA
Headquarters: 1815 Rollins Road, Burlingame, CA 94010
East Coast Manufacturing: 1 Whitlee Court, Greenville, SC 29607
West Coast Manufacturing: 383 Cheryl Lane, City of Industry, CA 91789

35. The BMS Main and Safety Controller programming is now complete.

36. Working in the Driver's area, turn the master switch to the OFF position.

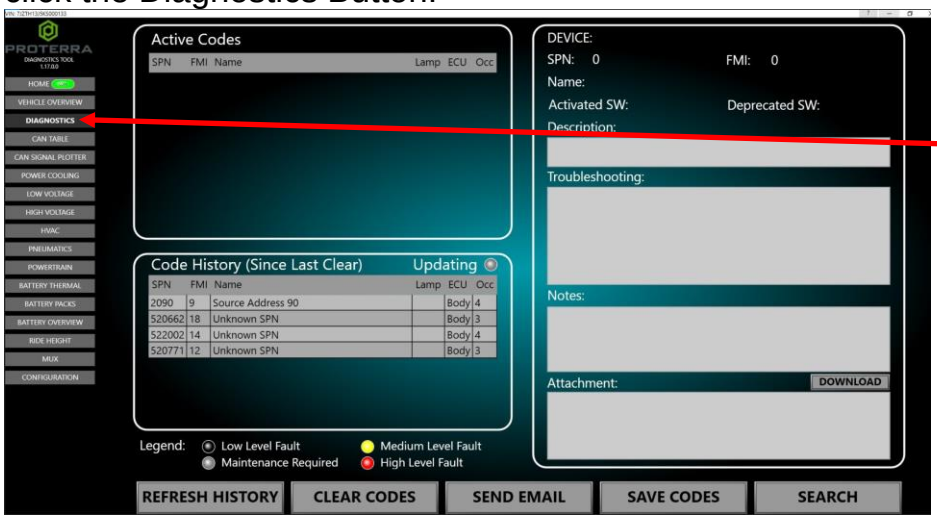
37. Open the hatch at the Curbside rear of the bus to access the vehicle master disconnect. Turn the disconnect to the Off position and leave it there for at least 10 seconds. Turn the vehicle master disconnect back to the On position.

38. Working in the Driver's workplace, turn the Master Switch to the On position.

PROTERRA
Headquarters: 1815 Rollins Road, Burlingame, CA 94010
East Coast Manufacturing: 1 Whitlee Court, Greenville, SC 29607
West Coast Manufacturing: 383 Cheryl Lane, City of Industry, CA 91789

39. The bus will power on. Allow a minute or so and verify that “Running” is displayed on the dash.

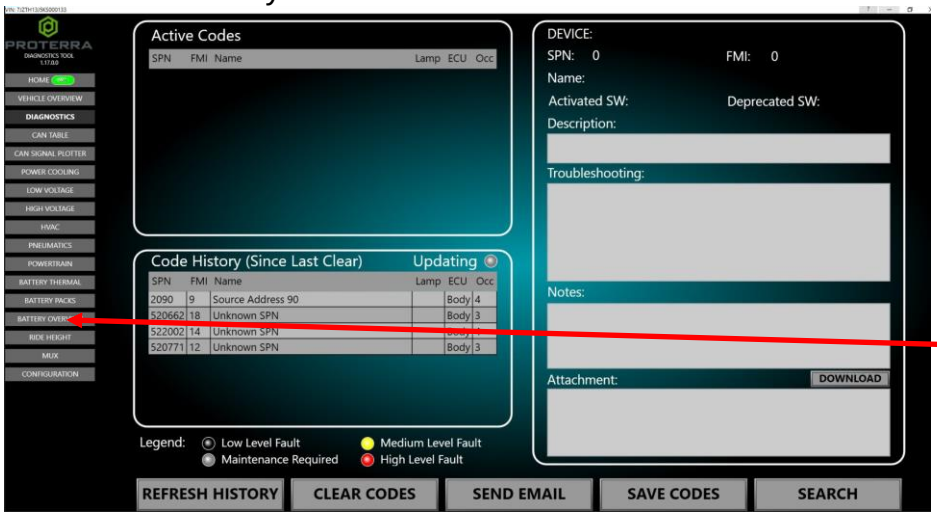
40. Re-start and re-connect the Diagnostic Tool. From the Home or Configuration screen, click the Diagnostics Button.



Click Diagnostics

41. Look for any faults related to the battery system.

42. Click on the Battery Overview button on the left side of the screen.



Click Battery Overview

PROTERRA
Headquarters: 1815 Rollins Road, Burlingame, CA 94010
East Coast Manufacturing: 1 Whitlee Court, Greenville, SC 29607
West Coast Manufacturing: 383 Cheryl Lane, City of Industry, CA 91789

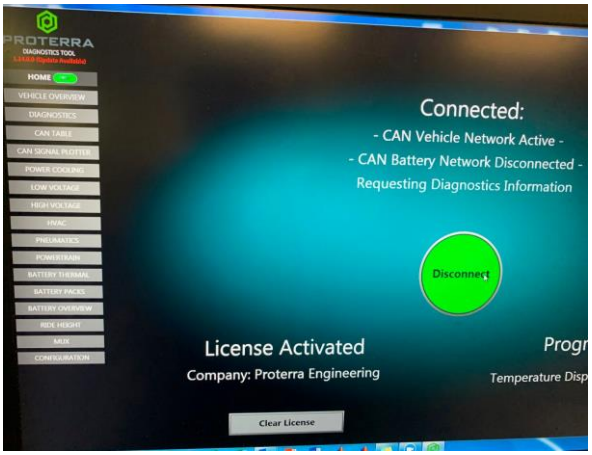
43. The following screen will appear. Verify that all battery packs are connected to the high voltage by the presence of the Green Contactor indicators as shown below.

Pack	Contactor	Moisture Detected	Max Voltage	Min Voltage	Voltage	Current	Max Temp	Min Temp	Energy Throughput
S1 P1			3.46 V	3.45 V	311.96 V	-1.80 A	84°F	82°F	841 kWh
S1 P2			3.46 V	3.45 V	312.48 V	-3.00 A	86°F	82°F	838 kWh
S2 P1			3.46 V	3.45 V	311.84 V	-1.80 A	82°F	82°F	828 kWh
S2 P2			3.46 V	3.45 V	313.88 V	-1.80 A	82°F	82°F	828 kWh

44. If no faults are found and the battery packs are all connected, disconnect the laptop, close the Streetside Wheel Well box, and return the bus to service.

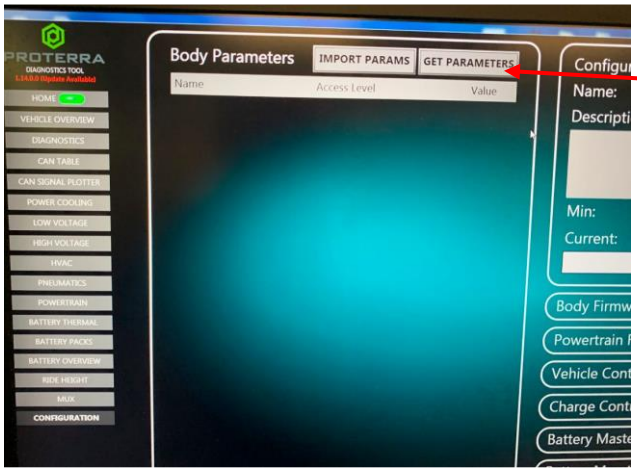
45. If faults are found or battery packs are not connected, contact Proterra Service for help in resolving these issues.

46. Click “Home” to return to the main screen.



Click Home

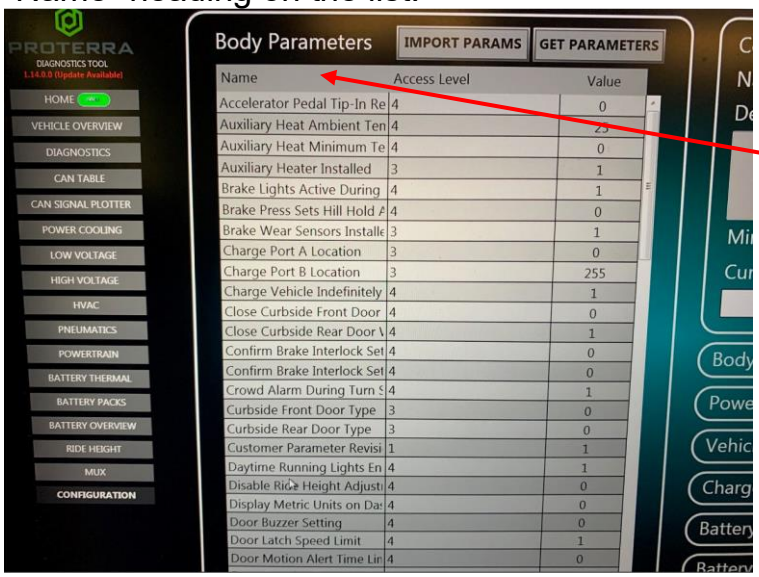
47. Click the “Configuration” button at the bottom of the screen. The following screen will appear. Clock on the “Get Parameters” button to download information for the vehicle. Allow a few seconds for the information to populate the screen.



Click Get Parameters

PROTERRA
Headquarters: 1815 Rollins Road, Burlingame, CA 94010
East Coast Manufacturing: 1 Whitlee Court, Greenville, SC 29607
West Coast Manufacturing: 383 Cheryl Lane, City of Industry, CA 91789

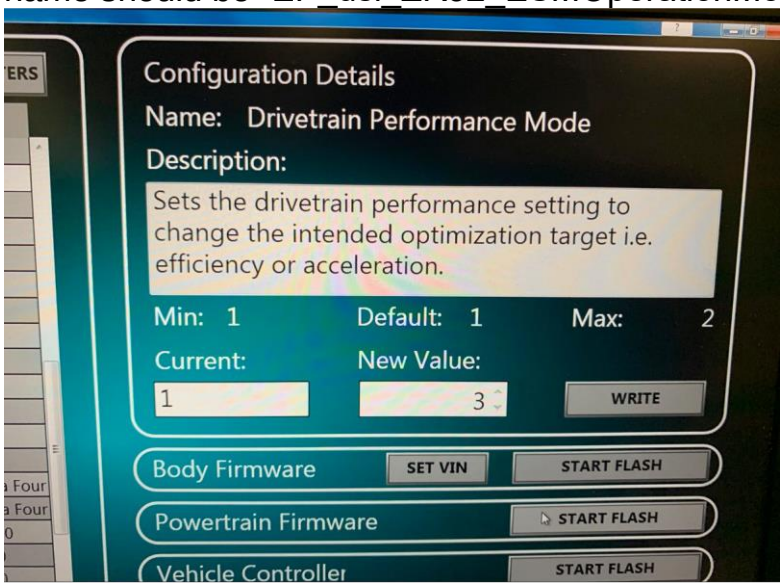
48. Once the screen has populated, sort the values alphabetically by clicking on the “Name” heading on the list.



Click Name

49. Scroll through the list to find the “EP_usi_ZR32_ESMOperationMode”. Click on the name of this parameter.

50. A screen similar to the following appears. The difference it the parameter name. The name should be “EP_usi_ZR32_ESMOperationMode”.



51. Enter a 13 in the “New Value” box and hit the “Write Button”.

52. Disconnect the cable from the ODB-II port.

53. Turn the bus off and back on before beginning the ESM Update.

PROTERRA
Headquarters: 1815 Rollins Road, Burlingame, CA 94010
East Coast Manufacturing: 1 Whitlee Court, Greenville, SC 29607
West Coast Manufacturing: 383 Cheryl Lane, City of Industry, CA 91789

ESM Update:

1. Access the ESM subfolder that you downloaded earlier to obtain the update files for the ESM

2. The file needed is **ESM_HV_BMS_RoadRunner_Bootloader_20210421_1211.srec.**

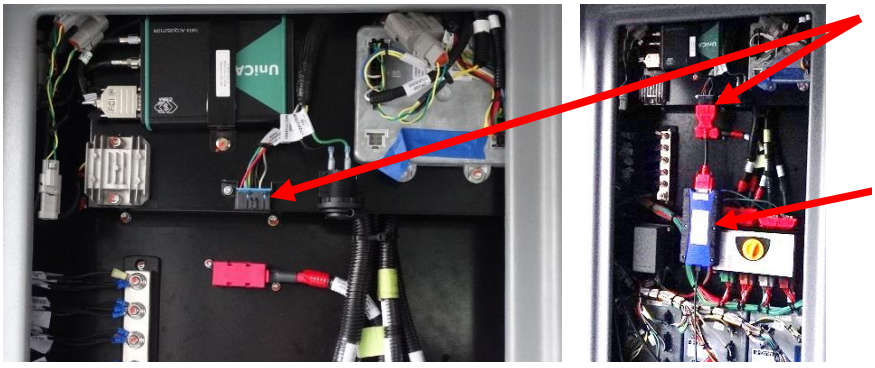
3. Turn **ON** the 12/24V rear Master Disconnect located behind the vehicle curbside rear upper access panel.

4. Turn **OFF** the bus High-Voltage Master Switch at the Driver's Workplace and ensure the Dash screen is **OFF**.

5. Power up (boot) the Proterra-supplied laptop containing the Proterra Diagnostic Tool.

6. Connect the Nexiq USB Link to the laptop.
   Note: Using a USB cable connection, rather than Wi-Fi, is highly recommended.

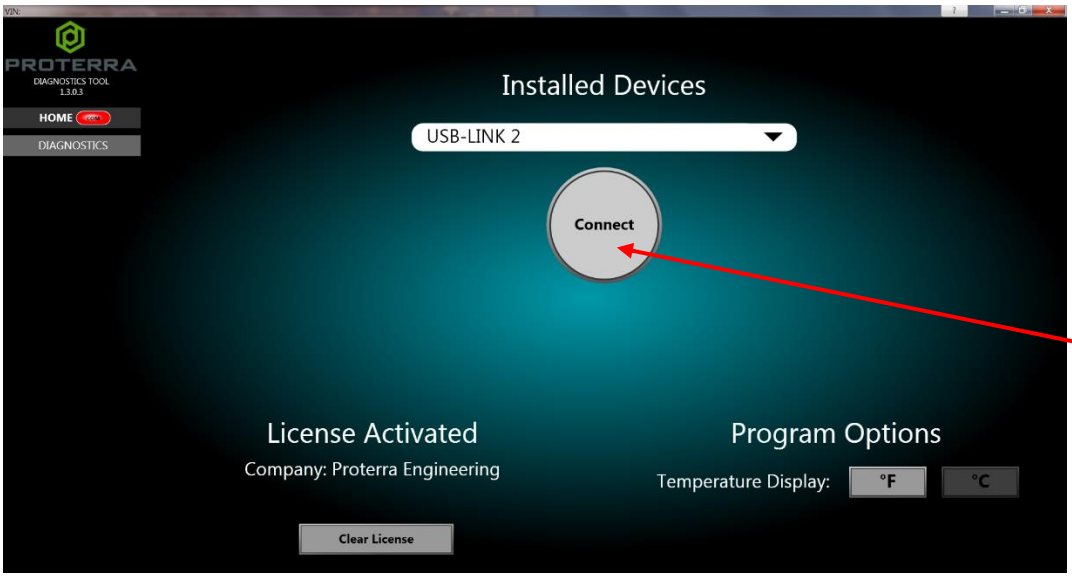
7. Connect the Nexiq USB Link to the Diagnostic Port located on the street side wheel well electronics cabinet (ECAB).



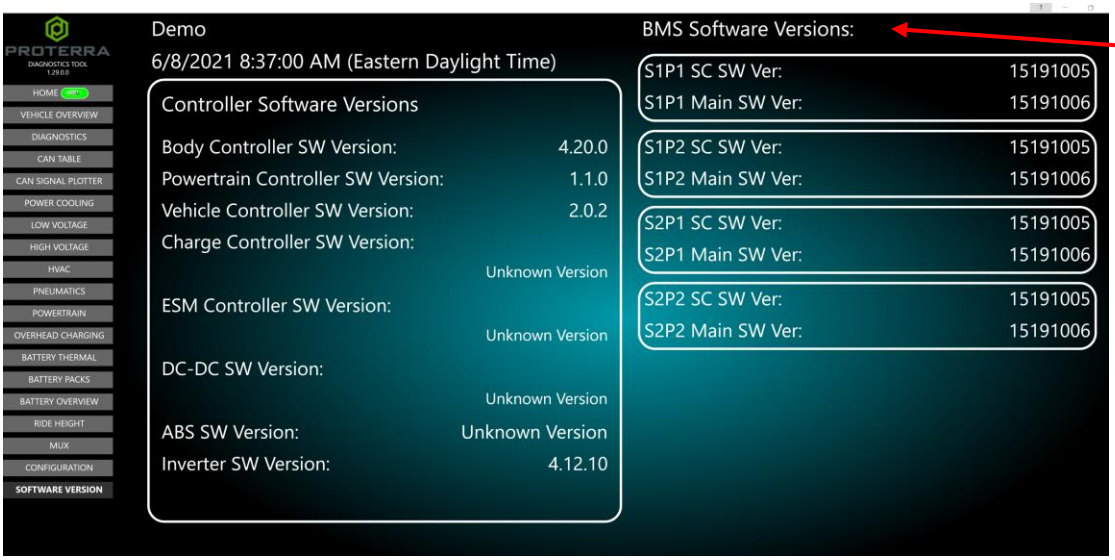
8. On the laptop, double-click on the Proterra Diagnostics Tool software icon to start the software.

PROTERRA
Headquarters: 1815 Rollins Road, Burlingame, CA 94010
East Coast Manufacturing: 1 Whitlee Court, Greenville, SC 29607
West Coast Manufacturing: 383 Cheryl Lane, City of Industry, CA 91789

9. On the Proterra Diagnostics screen, select “USB-LINK 2” in the drop-down box then click the “Connect Button.”

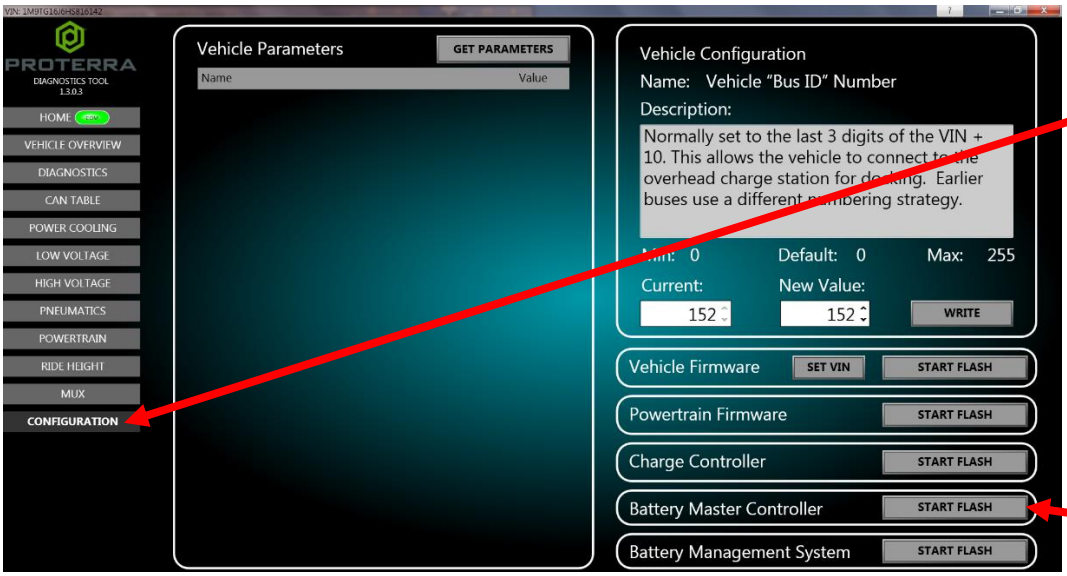


10. The Home screen will open. Click on the Software Version Button. Verify that each pack has the correct version of software. **Note:** If the software versions are not correct, Service Bulletin SB-18-67 must be performed before completing the rest of this procedure.



PROTERRA
Headquarters: 1815 Rollins Road, Burlingame, CA 94010
East Coast Manufacturing: 1 Whitlee Court, Greenville, SC 29607
West Coast Manufacturing: 383 Cheryl Lane, City of Industry, CA 91789

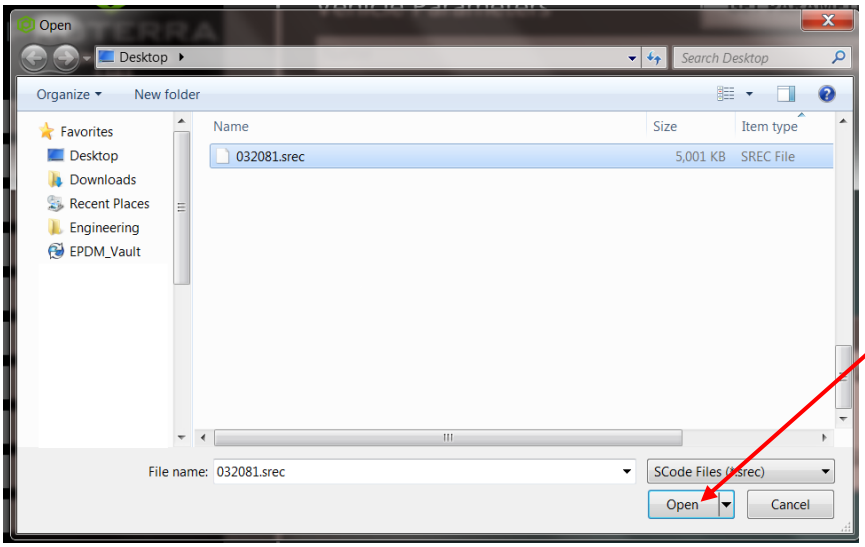
11. Click on the “Configuration Button” to open the Configuration screen and then click the ESM Controller“Start Flash” Button.



Click Configuration

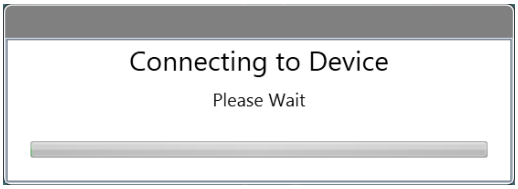
Beside Battery Master Controller, Click Start Flash

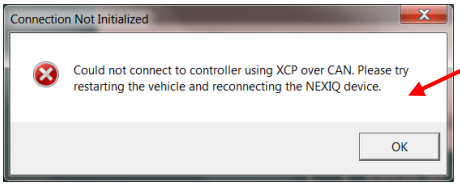
12. The following screen will be displayed. Navigate to the location where you stored the configuration file earlier. Select the file and click “Open” to load the file.



Select the file and Click Open

13. 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.

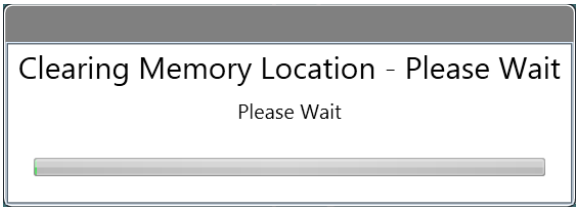


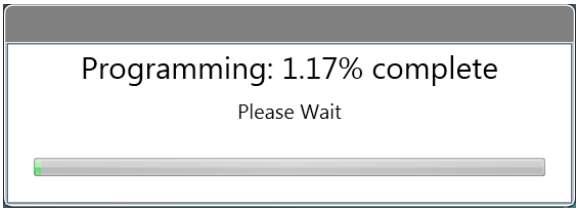


Error message on failed first attempt

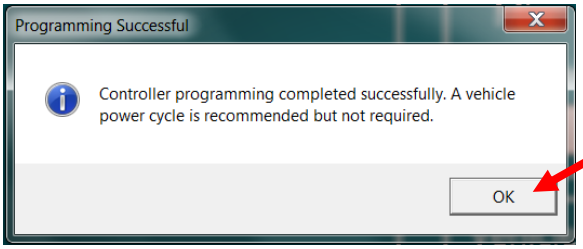
PROTERRA
Headquarters: 1815 Rollins Road, Burlingame, CA 94010
East Coast Manufacturing: 1 Whitlee Court, Greenville, SC 29607
West Coast Manufacturing: 383 Cheryl Lane, City of Industry, CA 91789

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





15. 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.



16. The software update is now complete.

17. Reset the bus.

18. Proceed to the Vehicle Controller section of this procedure.

PROTERRA
Headquarters: 1815 Rollins Road, Burlingame, CA 94010
East Coast Manufacturing: 1 Whitlee Court, Greenville, SC 29607
West Coast Manufacturing: 383 Cheryl Lane, City of Industry, CA 91789

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

Vehicle Master Disconnect

3. Connect the Nexiq USB Link2 device to the laptop and to the OBDII Diagnostic Port located in the Street-Side wheel well box.

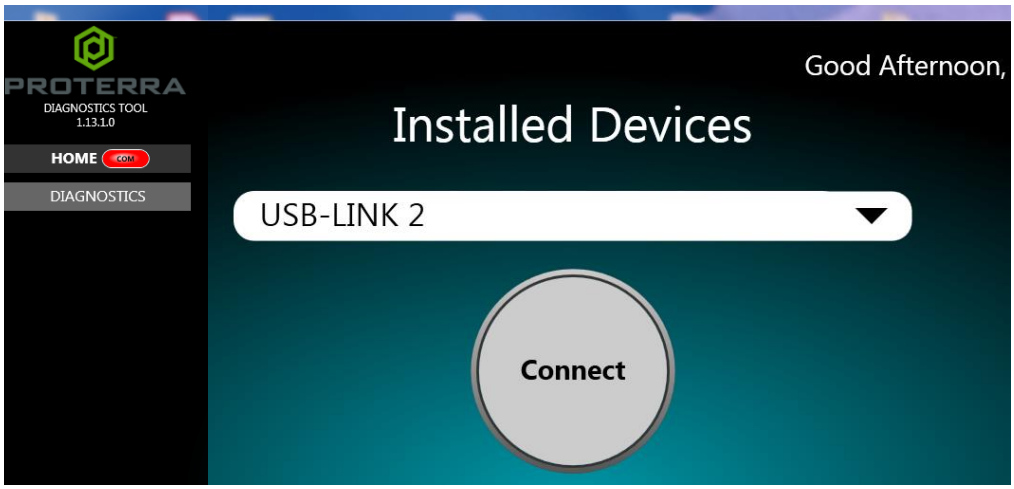
4. Press and hold the Street-Side Wheel Well WORK LIGHT switch until the work lights turn on.

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

6. When the program opens, read and click OK for the high voltage safety prompt.

PROTERRA
Headquarters: 1815 Rollins Road, Burlingame, CA 94010
East Coast Manufacturing: 1 Whitlee Court, Greenville, SC 29607
West Coast Manufacturing: 383 Cheryl Lane, City of Industry, CA 91789

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

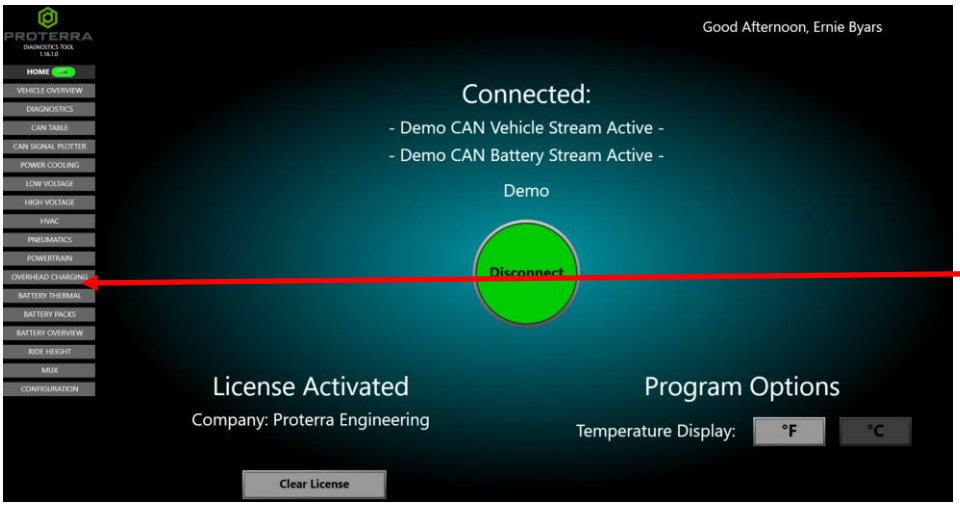


8. Once the diagnostic tool has connected to the vehicle, you will have a VIN number and connection status displayed on the home screen, and tabs available to navigate. If you don’t see the Home Screen, double check that the low voltage batteries are connected and that the Nexiq tool is plugged in.
   Note: 800V Proterra vehicles are equipped with an automatic battery disconnect that will protect the low voltage batteries from a deep discharge.

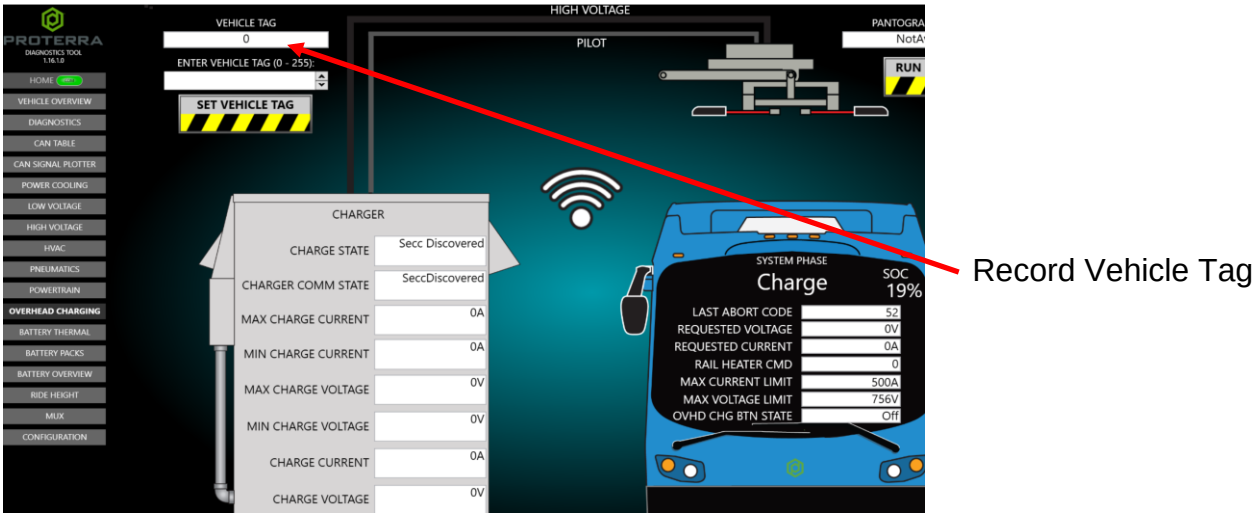
PROTERRA
Headquarters: 1815 Rollins Road, Burlingame, CA 94010
East Coast Manufacturing: 1 Whitlee Court, Greenville, SC 29607
West Coast Manufacturing: 383 Cheryl Lane, City of Industry, CA 91789

Update Using the Proterra Diagnostic Tool

9. Click on the “Overhead Charging” button on the left side of the screen.
   Note: If the bus that you are working on is not capable of Overhead Charging, skip to step 3 below.

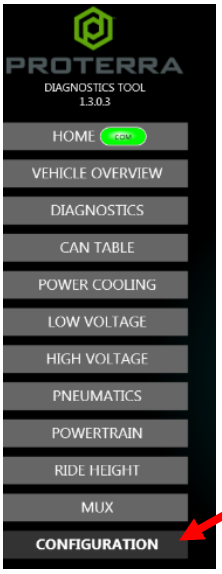


10. Record the value displayed in the “Vehicle Tag” data field. This will be re-entered into the controller after the software update.



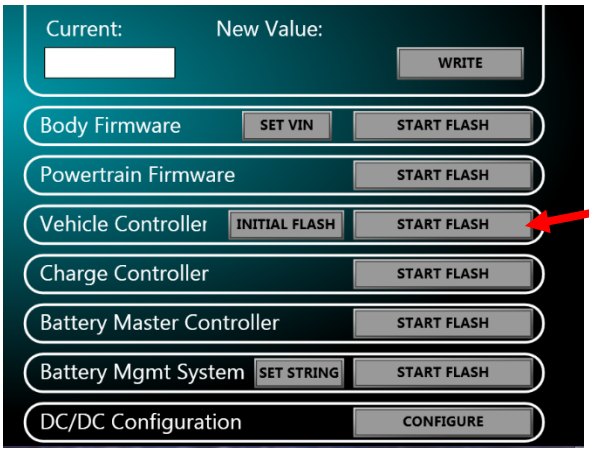
PROTERRA
Headquarters: 1815 Rollins Road, Burlingame, CA 94010
East Coast Manufacturing: 1 Whitlee Court, Greenville, SC 29607
West Coast Manufacturing: 383 Cheryl Lane, City of Industry, CA 91789

11. Navigate to the CONFIGURATION tab in the left menu.



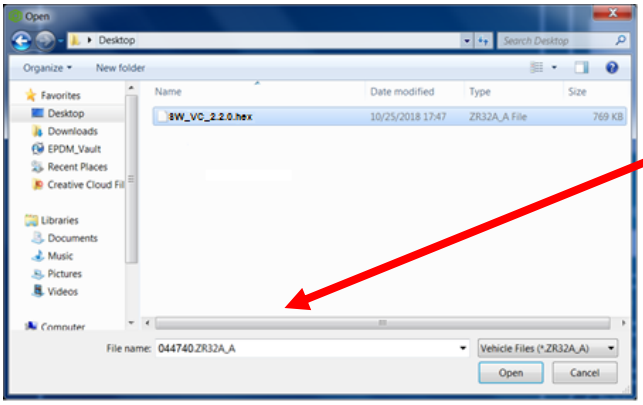
Click
CONFIGURATION

12. Select the option for Vehicle Controller “START FLASH”.
NOTICE: The “INITIAL FLASH” button is only for offline programing of the Vehicle Controller with an Offline Programming Kit.



Beside Vehicle Controller,
Click **START FLASH**

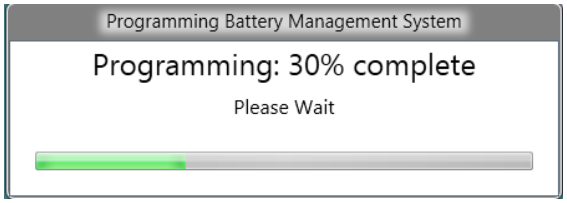
13. In the pop-up window, select the software flash file to load the controller. This file is named “SW_VC_4.4.2” and is located in the Vehicle Controller subfolder of the folder that was downloaded earlier.



Select the file and Click
Open

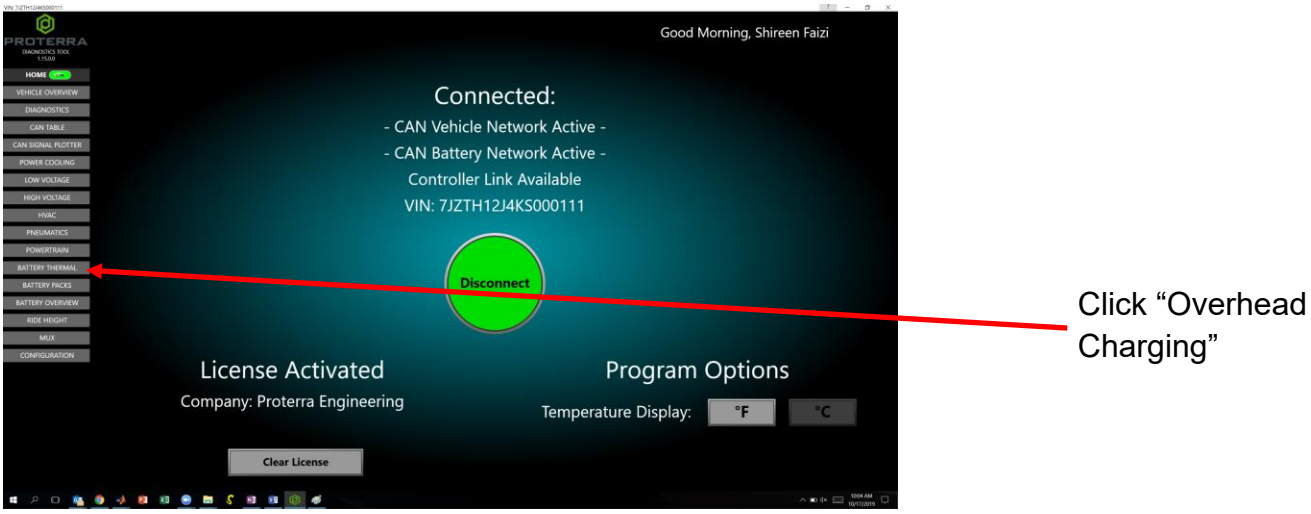
PROTERRA
Headquarters: 1815 Rollins Road, Burlingame, CA 94010
East Coast Manufacturing: 1 Whitlee Court, Greenville, SC 29607
West Coast Manufacturing: 383 Cheryl Lane, City of Industry, CA 91789

14. The Programming window will come up and may take a few minutes to complete.



15. After completing the software update, Turn **OFF** the Work Light switch inside the street side wheel well box.

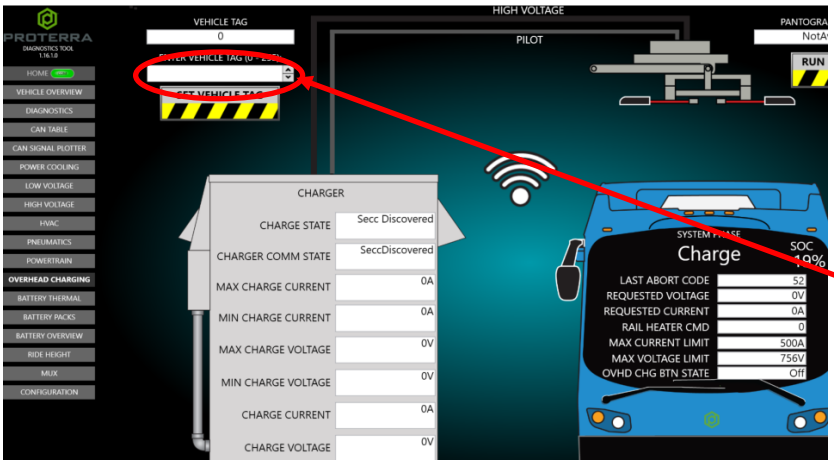
16. Click on the “Overhead Charging” button on the left side of the screen.
Note: If the bus that you are working on is not capable of Overhead Charging, skip to step 10 below.



Click “Overhead Charging”

PROTERRA
Headquarters: 1815 Rollins Road, Burlingame, CA 94010
East Coast Manufacturing: 1 Whitlee Court, Greenville, SC 29607
West Coast Manufacturing: 383 Cheryl Lane, City of Industry, CA 91789

17. The following screen will appear. Enter the “Vehicle Tag” that you recorded previously into the field circled in red below. Click the Button under the field. This will populate the “Vehicle Tag” into the field above and into the controller.



18. Turn **OFF** the 12/24V rear Vehicle Master Disconnect located behind the vehicle curbside rear charge port access panel, wait 10 seconds, and then turn back to ON.

19. Verify that the vehicle turns on with no faults and that it is capable of charging.

20. Return the vehicle to service.

PROTERRA
Headquarters: 1815 Rollins Road, Burlingame, CA 94010
East Coast Manufacturing: 1 Whitlee Court, Greenville, SC 29607
West Coast Manufacturing: 383 Cheryl Lane, City of Industry, CA 91789