



TECHNICAL SERVICE BULLETIN

ISSUE DATE:	10/19/2020
SERVICE BULLETIN SUBJECT:	800 Volt Fall Software Release
VINs or MODELS AFFECTED:	Service Specified Buses
COMPLETE BY:	Next Service Opportunity
SERVICE BULLETIN #:	SB-20-147

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

VEHICLE SOFTWARE UPDATE

Description

The reason for this software update is to update various controllers to the latest state of the art software. This will improve vehicle up-time, reduce driver interactions with the doors, and improve diagnostic fault handling. All the included Proterra Catalyst 800V vehicles require a change to the software/configuration for the following items:

- Body Controller
- Vehicle Controller
- BMS Controller

Summary of Software Changes

There are three controllers that will be updated. Below are the high-level updates. More detailed information is available in the individual controller's release notes.

- **Body Controller**
 - Updated the interface between the doors to remove redundant control algorithms that were occurring between the body system and the door controller. Simplifies the interface and response from the door system.
 - Added a timer off debounce to the driver in seat sensor to reduce false notifications that were occurring on rough roads with lighter drivers.
 - Silence the drivers audible alert for the turn signals after 7 seconds to reduce audible distractions to the driver.
 - Disabled the exterior audible turn warning system when utilizing the right turn layover switch to reduce noise during layover operations.
 - Added an input for a momentary yield sign illuminate signal. When the left turn signal is pressed, and this new input is pressed, the yield sign will remain active until the left turn signal is released.
 - Mapped a new output to drive a horn relay. This will be active anytime the driver distress alarm is active.
 - Fixed a constant value bug that caused the variable to overflow and drive the gauge erratically.
 - Adjusted the exterior audible alert on kneel recover motion to use a timer instead of the vehicle motion inhibit signal from the ride height system. The vehicle motion inhibit was calibrated out by the vendor, causing the exiting buzzer to chirp, but not play through recovery.
- **Vehicle Controller**
 - A feature introduced in V4.0.0 to identify the type of unit (production or c-sample) had a bug. The bug was that the units produced early in the year 2020 would be marked as C-sample when it is actually a production unit. This bug leads to errors in ambient temperature and coolant temperature sensor values.
 - Added a wait to start boolean signal to tell the dash when there is a voltage disparity on the high voltage bus. Removed DM01 fault for high voltage bus disparity.
 - The DC-DC has a protection diode on the HV bus. The voltage doesn't need to be monitored at startup and shutdown. Added a calibration parameter to indicate in the software if the DC-DC has a protection diode.
 - Overhead Charge Shunt Over-temperature fault (SPN 520885 FMI 0) was too low. This has been increased to set at 100C and clear at 90C and will set a Protect Lamp when active.
 - Added 4 counters looking at the nominalized HVIL signal that increment when the change from one sample to the next exceeds a threshold. Counters added to CAN. Counters reset on key off.

- Added Debugging signals to CCP to monitor loop timing.
 - Moved HVIL initialization delay to IPRC_DiagEnbl flag instead of a timer off ignition on.
 - Battery Heater is now turned on for atleast 10 seconds or until all HV component voltages are below 50V upon disconnection of the high voltage batteries.
 - Removed separate timers for 5V power supply and diagnostics. Added into vehicle state machine to maintain consistent flow.
 - Added feature to limit current request if the shunt reported temperature is above 95C. The current request will be limited till the temperature reported is below 85C.
 - Improved response to ESM Shutdown Request signal. Vehicle will remain in Accessory state if ESM Shutdown Request is True.
 - Updated SPN from 2234 to 2247.
 - SPN 2033 Body Controller FMI 0 Lamp set to Amber, was previously Off.
 - Auxiliary Tank No Fill Fault SPN was set to 1090 instead of 1089.
 - Added fault 8234 FMI 31 for delta too high.
 - Overhead Charge Shunt Voltage Present Threshold increased to 50V.
- BMS Controller
 - Resolved safety controller unrecoverable state that occurred on transition to sleep.
 - The above scenario will no longer require a power cycle and will clear automatically.

Tools/Programs Required

Tools Required:

- Laptop Computer
- Nexiq USB-Link 2

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
Body Controller	055711	6.5.0
Vehicle Controller	054750	4.3.2
BMS Controller	055780, 055781	R20050CEB, R20050CE

It is recommended that you copy the entire “service bulletin files” folder to your local machine in order to more effectively keep track of the software versions you are deploying:

<\\bus.local\\files\\Engineering\\Service Bulletins\\Service Bulletin Files for SC-20-147\\>

Service Bulletin Execution

1. Update the Body Controller using the process in [Appendix A](#)
2. Update the Vehicle Controller Software using the process in [Appendix B](#)
3. Update the BMS Controller Software using the process in [Appendix C](#)
4. Verify software versions using the Proterra Service Tool
5. Update each work order in Service Max when complete

BODY SOFTWARE UPDATE PROCEDURE

Description

This document contains the necessary information to update the Body Controller on a Proterra Vehicle. This controller provides the control algorithms for body functionality on 800V models. This covers the control logic relating to driver inputs and display, stop requests, doors, interior and exterior lighting, and ramp control.

Tools/Programs Required

Tools Required:

- Laptop Computer
- Nexiq USB-Link 2

Programs Required:

- Proterra Diagnostics Tool

Software Files Required / Preparation

To program the body controller, you will need a *.ZR32A_A data file. This file contains the necessary firmware files and a baseline configuration to provide an operational bus body. The bus may need to be configured to match customer specific functionality after programming.

If the vehicle has already been configured, the Proterra Diagnostics Tool will attempt to automatically carry the configuration information forward into the new software version.

If needed, configuration information is contained in the released customer configuration documentation. Ensure that you also have the configuration definition for the customer's vehicle.



IMPORTANT! NEVER access the software from the USB memory device or network drive, ALWAYS copy the software files to your computer hard drive and access the software from this location.

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 you can use the vehicle to recharge them by turning on high voltage, or you can place the bus on a low voltage charger for the duration of the process.

Connecting to the Vehicle

This process will guide the user to connect to the vehicle with the Proterra Diagnostics Tool.

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.



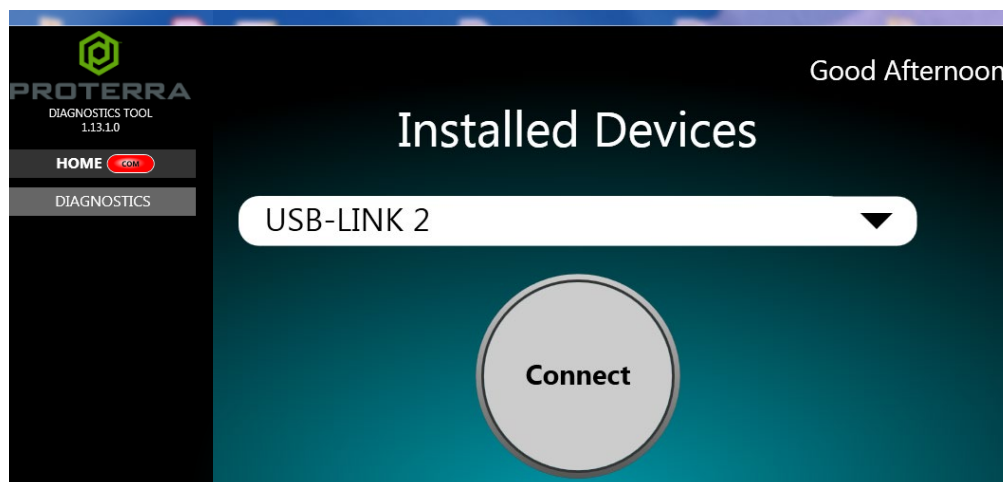
4. Turn the Driver's Master Switch to the **ACC** position.



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

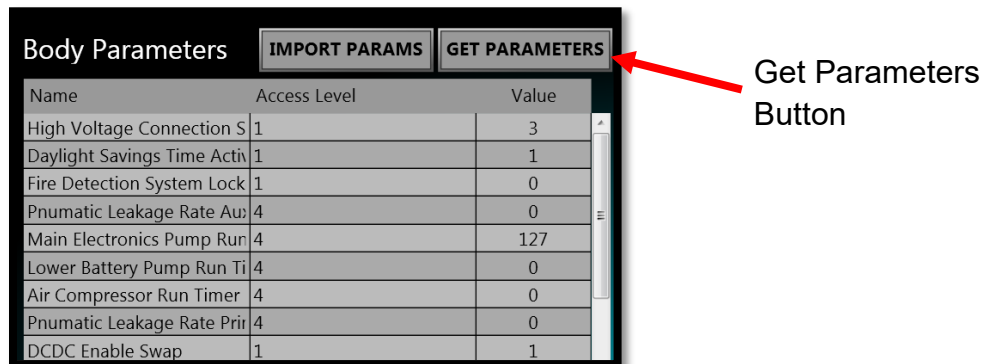


8. Once the Proterra Diagnostics Tool has connected to the vehicle, you will have a VIN number and connection status displayed on the home screen, and tabs available to navigate. If you don't, double check that the low voltage batteries are connected and that the Nexiq tool is plugged in.

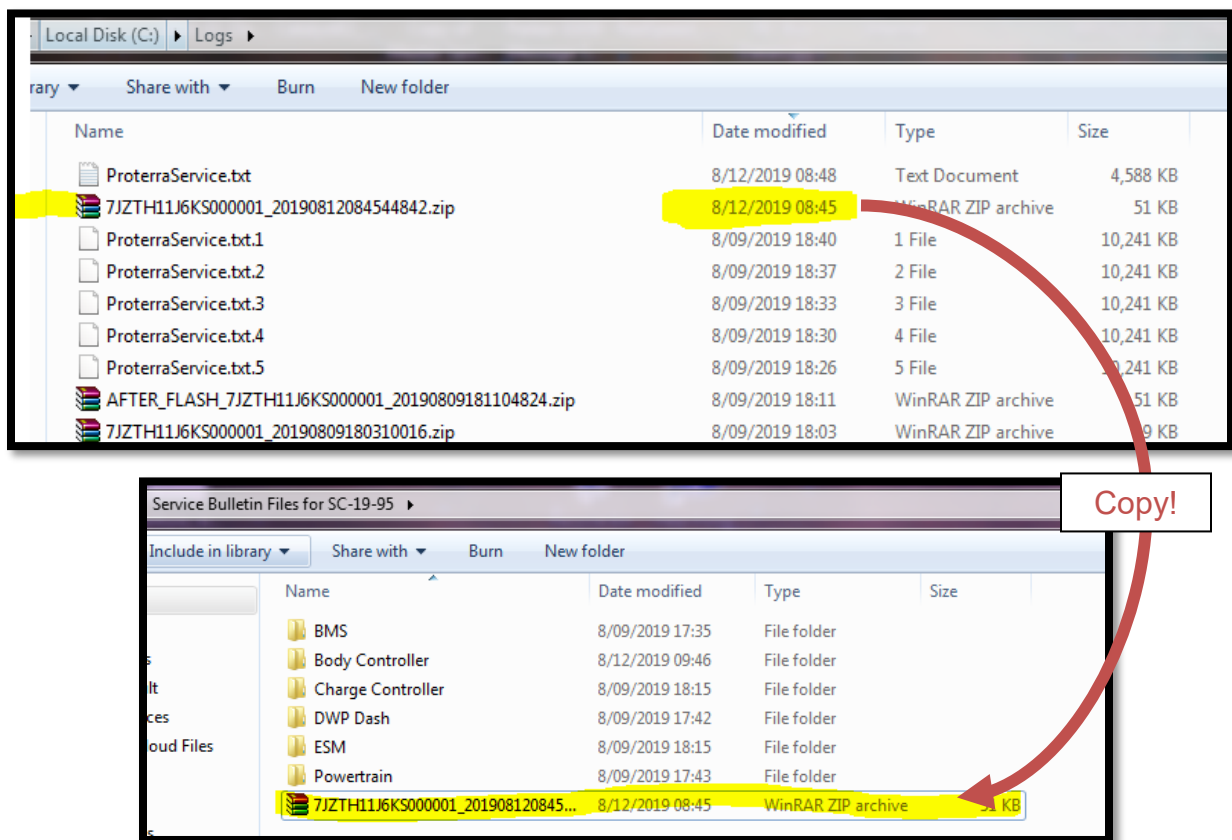
Download and Store Existing Parameters

Sometimes you might want to download and store the customer specific parameters from the vehicle. This can be useful when comparing two vehicles that are behaving differently, or if you are replacing the ZR32A controller on a vehicle.

1. After the first vehicle has been completed and verified, disconnect the Proterra Diagnostics Tool and then re-connect.
2. 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.



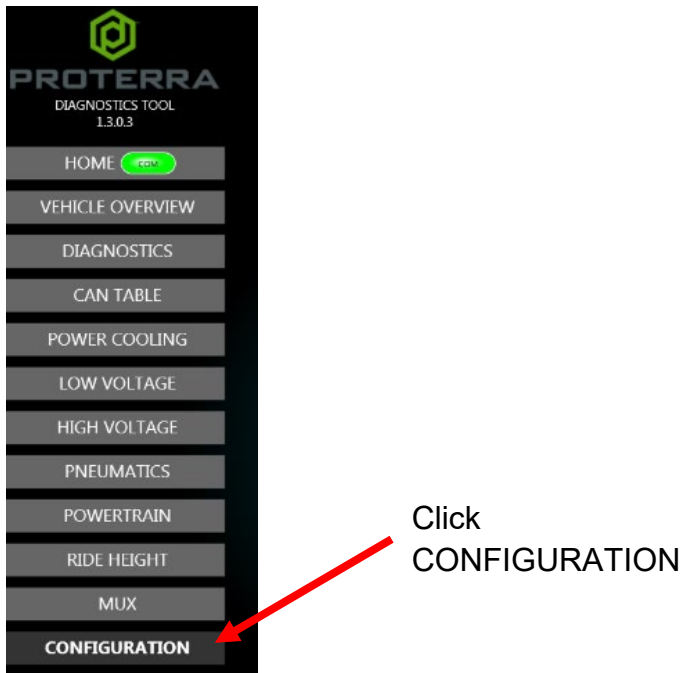
3. In windows file explorer, navigate to the C:\Logs folder. Copy the latest downloaded *.zip file to a folder for the specific customer and vehicle.



4. Do not rename the file as the tool will follow the naming convention when reloading the file.

Update Using the Proterra Diagnostic Tool

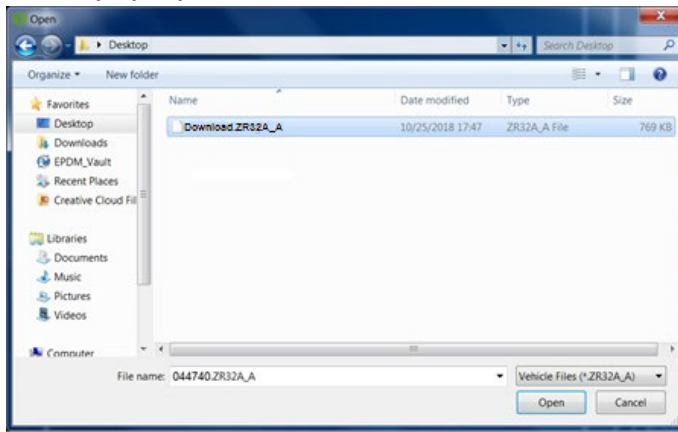
1. Navigate to the CONFIGURATION tab in the left menu.



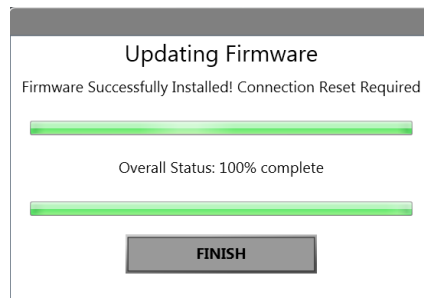
2. If this is a replacement controller, select the “SET VIN” and program the controller to match the vehicle VIN, then proceed to step 3. If not proceed to step 3.
3. Select the option for Body Firmware “START FLASH”.



4. In the pop-up window, select the software flash file to load to the controller.



5. The Programming window will come up and will take a few minutes to complete. The process will flash 5 different files to the controller.
6. After the controller is updated the tool will automatically try to copy over the original configuration into the new software. Since there is a possibility that configuration options change it is important to check the configuration after restarting the vehicle.



7. Once the process has finished, cycle power to the bus by moving the driver master switch back to the off position before continuing.

Appendix B

VEHICLE SOFTWARE UPDATE PROCEDURE

Description

This document contains the necessary information to update the Proterra Vehicle Integration Controller. This controller provides the electrical integration of ancillary systems on 800V models. It owns the vehicle operational state control, startup and shutdown, steering, pneumatics, thermal management, and brake interlock controls.

Tools/Programs Required

Tools Required:

- Laptop Computer
- Nexiq USB-Link 2

Programs Required:

- Proterra Diagnostics Tool

Software Files Required / Preparation

It is recommended that you download any files local to your machine. To program the vehicle controller, you will need a *.hex data file. This file will contain memory address and data information that will be written to the controller in order to update the user code space. This will not update the boot loader or other firmware files.



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.

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, you can use the vehicle to recharge them by turning on high voltage or you can place the bus on a low voltage charger for the duration of the process.

Connecting to the Vehicle

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

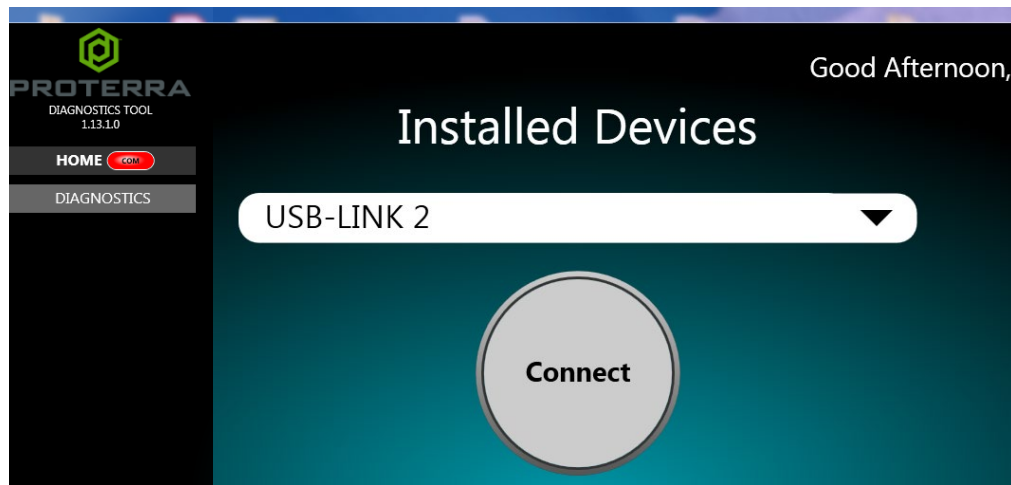
3. Connect the Nexiq USB Link2 device to the laptop and to the OBDII Diagnostic Port located in the Street-Side wheel well box.



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



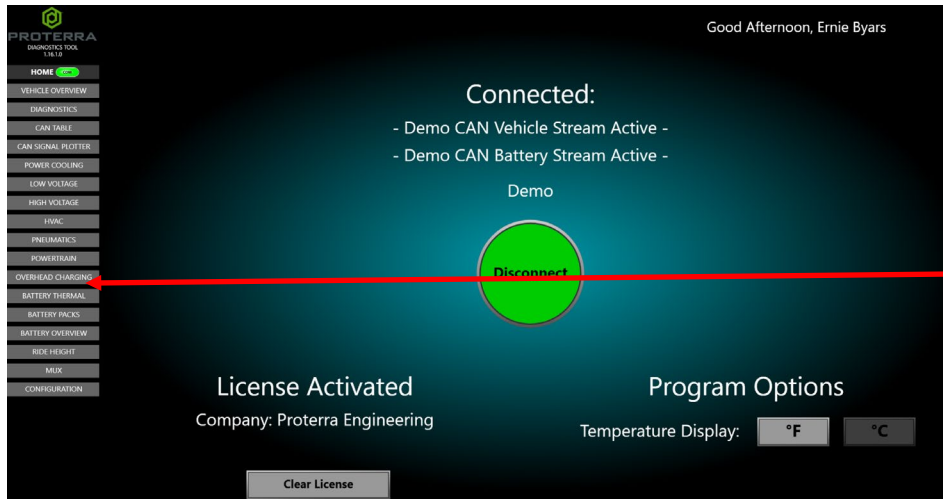
8. Once the diagnostic tool has connected to the vehicle, you will have a VIN number and connection status displayed on the home screen, and tabs available to navigate. If you don't see the Home Screen, double check that the low voltage batteries are connected and that the Nexiq tool is plugged in.

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

Update Using the Proterra Diagnostic Tool

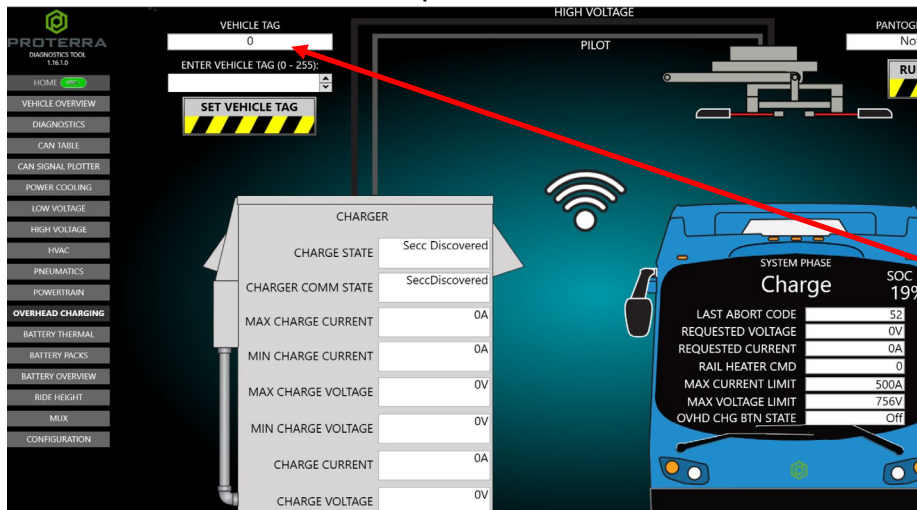
1. Click on the “Overhead Charging” button on the left side of the screen.

Note: If the bus that you are working on is not capable of Overhead Charging, skip to step 3 below.



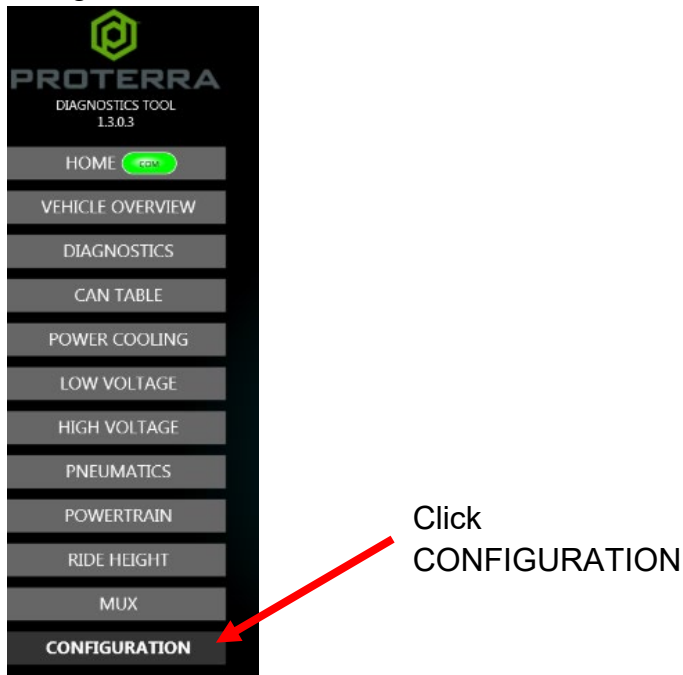
Click “Overhead Charging”

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



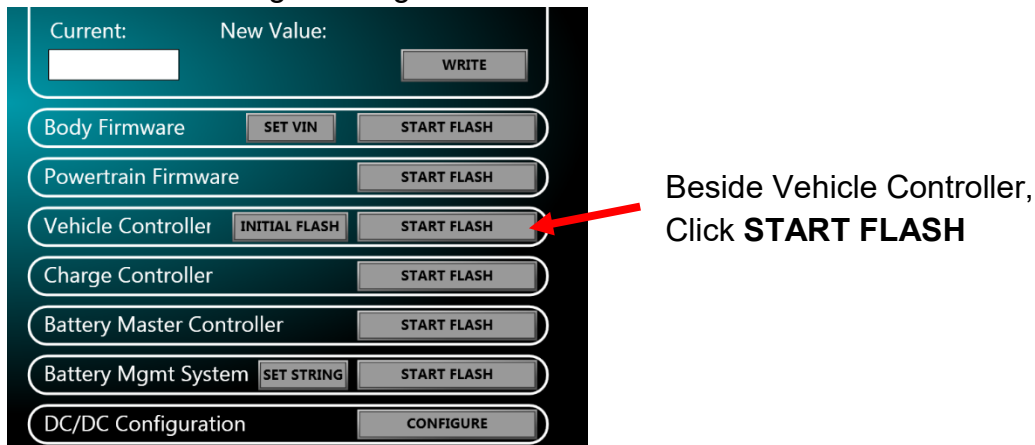
Record Vehicle Tag

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

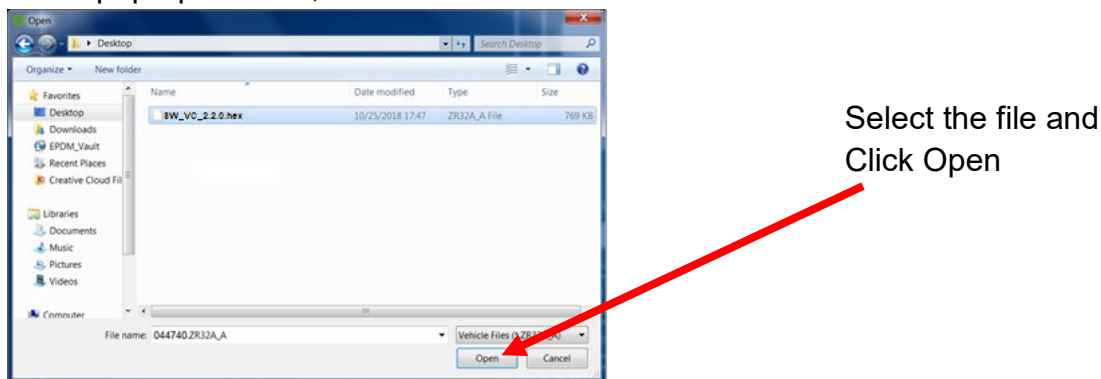


4. Select the option for Vehicle Controller “START FLASH”.

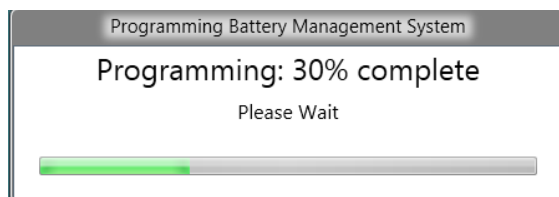
NOTICE: The “INITIAL FLASH” button is only for offline programming of the Vehicle Controller with an Offline Programming Kit.



5. In the pop-up window, select the software flash file to load the controller.



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

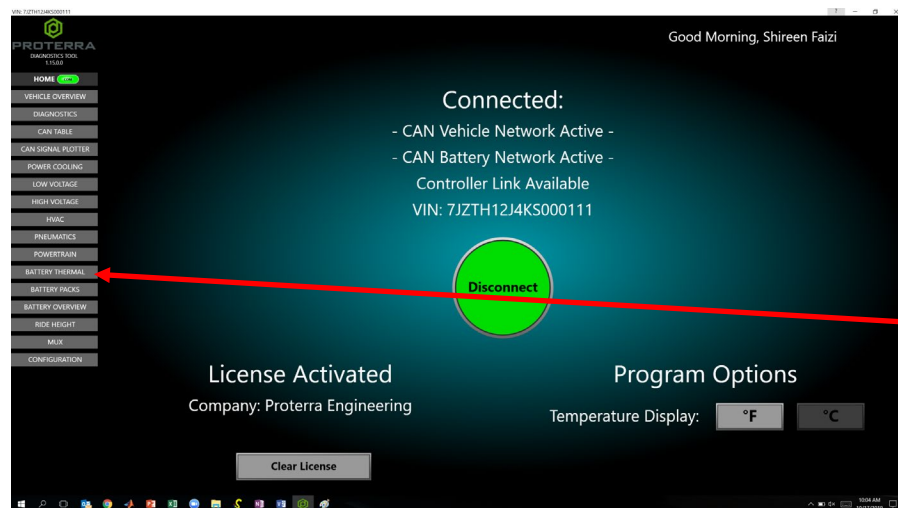


7. After completing the software update, Turn **OFF** the Work Light switch inside the street side wheel well box.



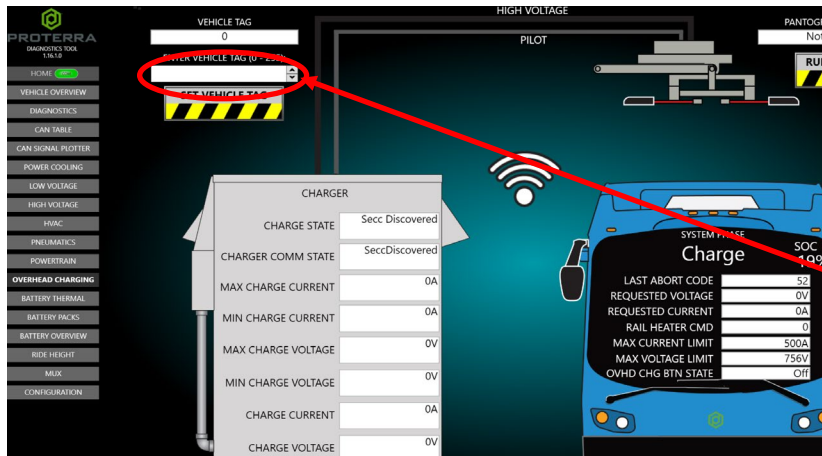
8. Click on the “Overhead Charging” button on the left side of the screen.

Note: If the bus that you are working on is not capable of Overhead Charging, skip to step 10 below.



Click “Overhead Charging”

9. 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.



Click “Button”

10. 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.



Vehicle Master Disconnect

11. Verify that the vehicle turns on with no faults and that it is capable of charging.
12. Return the vehicle to service.

Appendix C

800 VOLT BMS SOFTWARE UPDATE

Update Description:

This procedure updates the battery management system software to the latest version.

Tools/Parts Required

Tools and Supplies Required:

Tools/Programs Required

Tools Required:

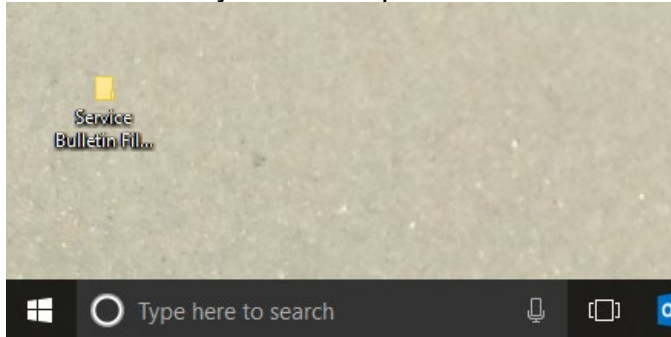
- Laptop Computer
- Nexiq USB-Link 2

Programs Required:

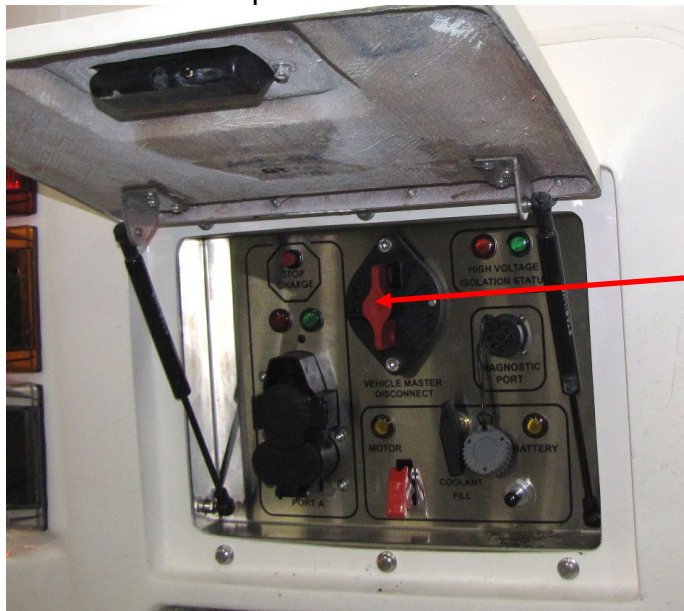
- Proterra Diagnostics Tool

Procedure

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-20-147” to your desktop.



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



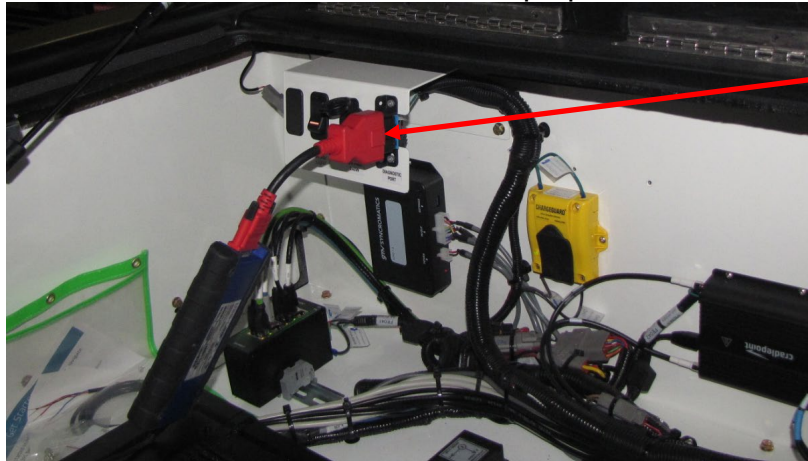
Master Disconnect On

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.



Master Switch ACC

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.

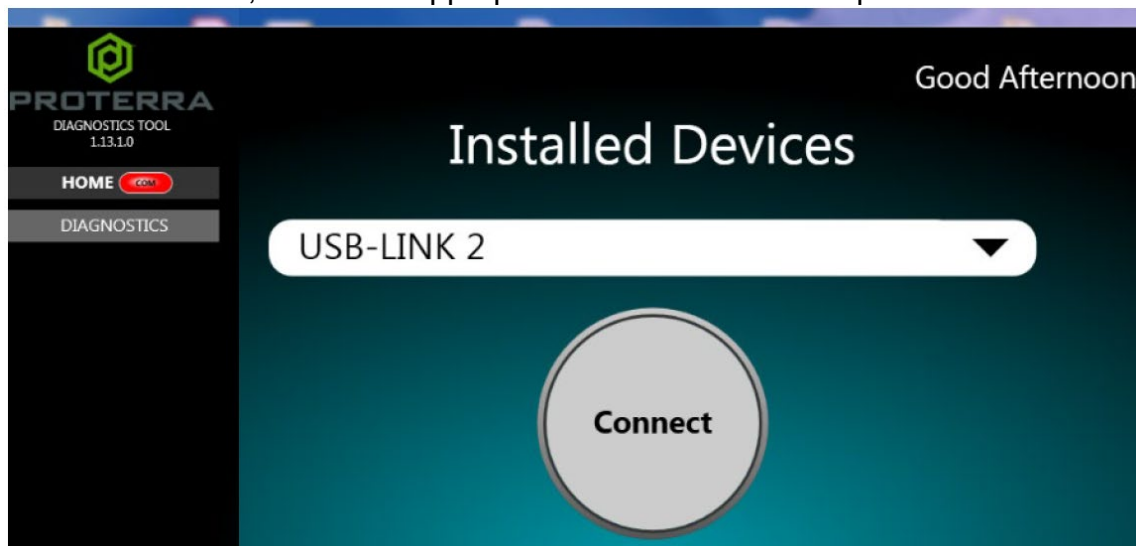


Master Switch ACC

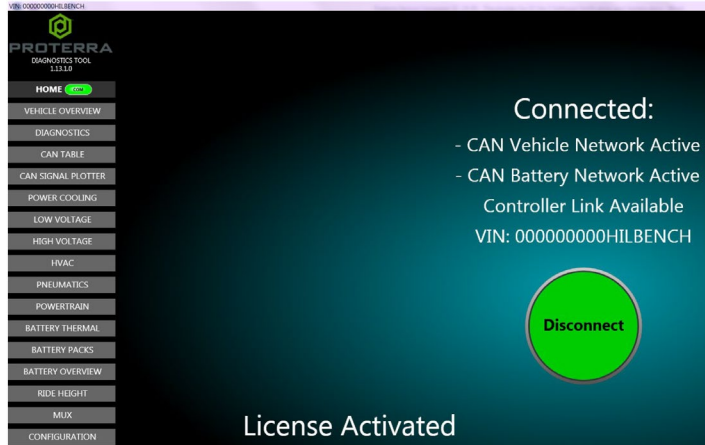
5. Start the Proterra Diagnostic Tool by double clicking on the desktop icon.



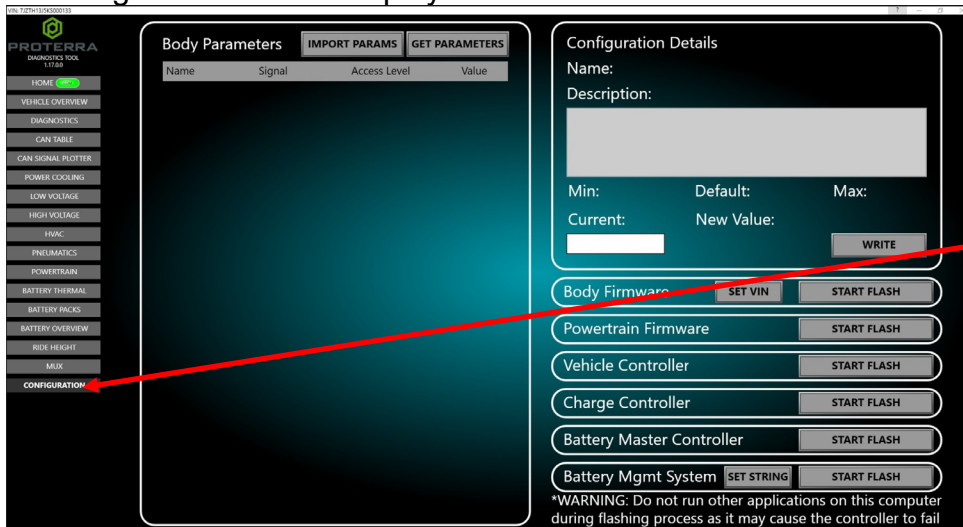
6. When the program opens, read and click OK for the prompt.
7. On the Home tab, select the appropriate device from the drop-down menu and click "Connect".



8. 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.



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



Configuration

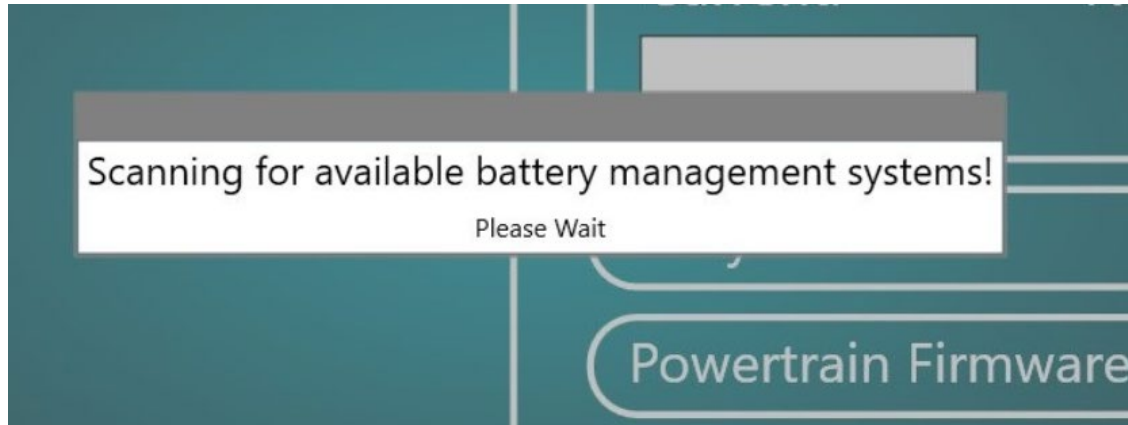
10. Click on the “Start Flash” button in the “Battery Mgmt System” at the lower right of the screen as shown below.



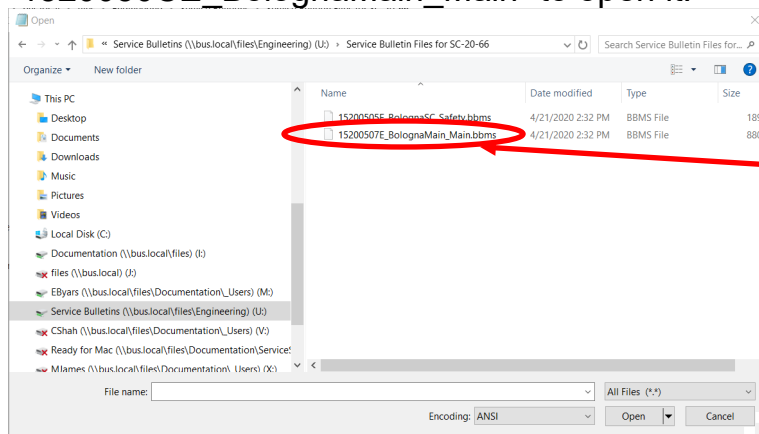
Start Flash

11. The following message will be displayed.

Note: It may take several minutes for the Diagnostic Tool to gather the required information.

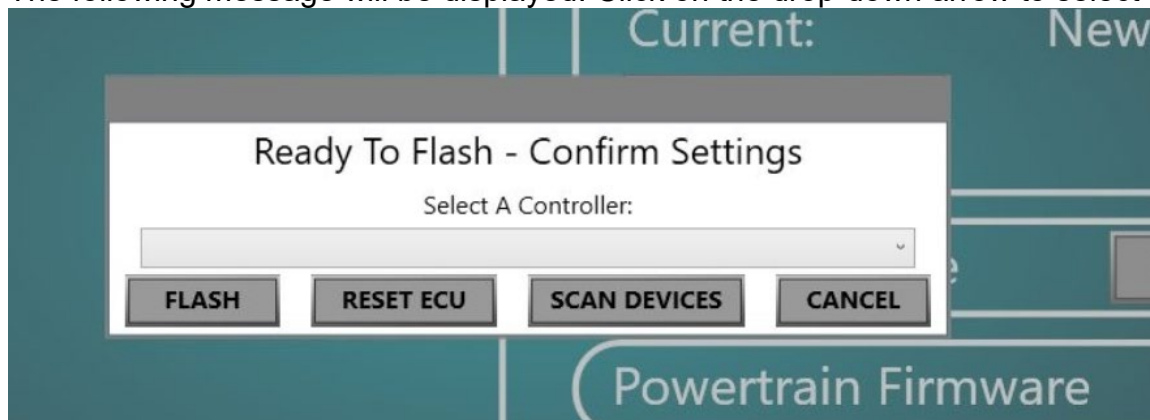


12. When the information gathering process is complete, the Diagnostic Tool will prompt you to select a file. Navigate to the desktop folder where the files were stored to perform this service campaign. Double click on the file named "1520050CE_BolognaMain_Main" to open it.

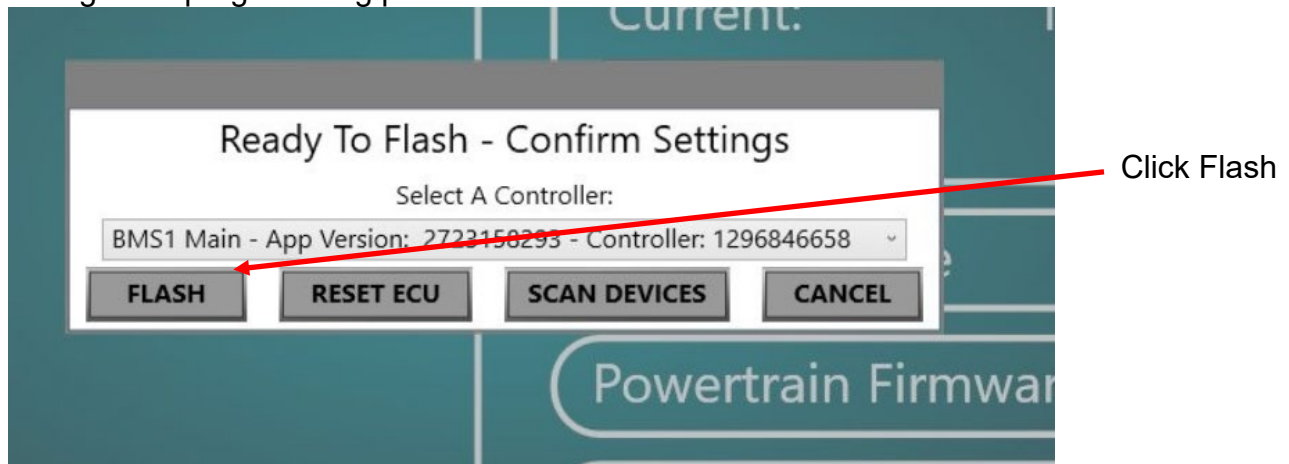


Double Click the "Main" Program

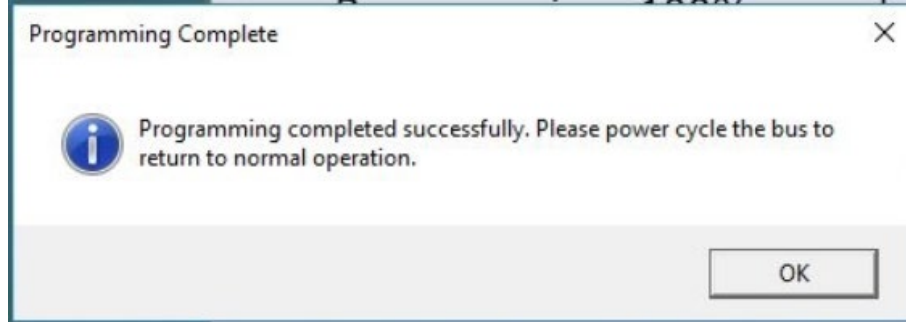
13. The following message will be displayed. Click on the drop-down arrow to select a controller.



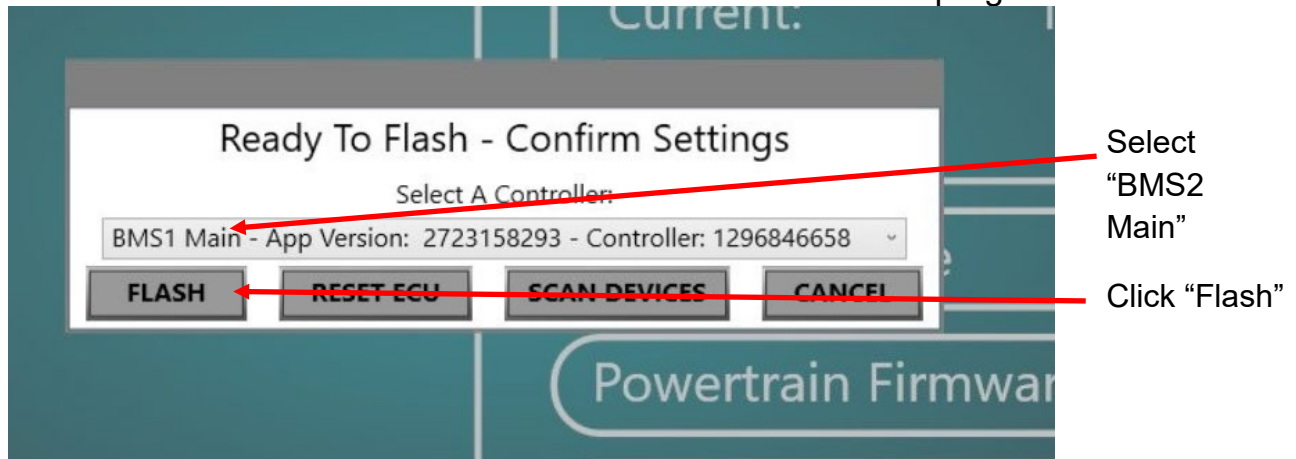
14. Select the first “BMS Main” entry as shown on the following screen. Click the “FLASH” button to begin the programming process.



15. 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.

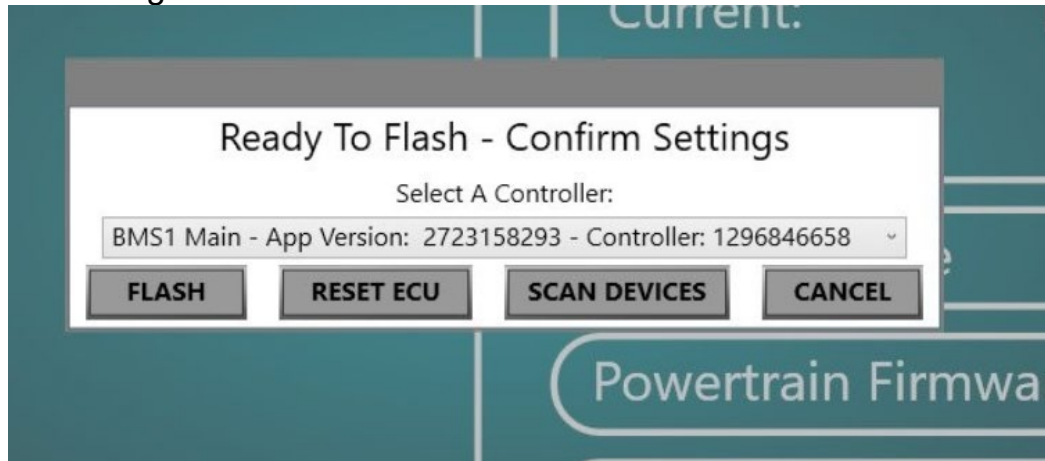


16. The following screen will appear. Click the drop-down arrow to select the next Main Controller. In this case it will be BMS2 Main. Click “Flash” to program the second BMS.

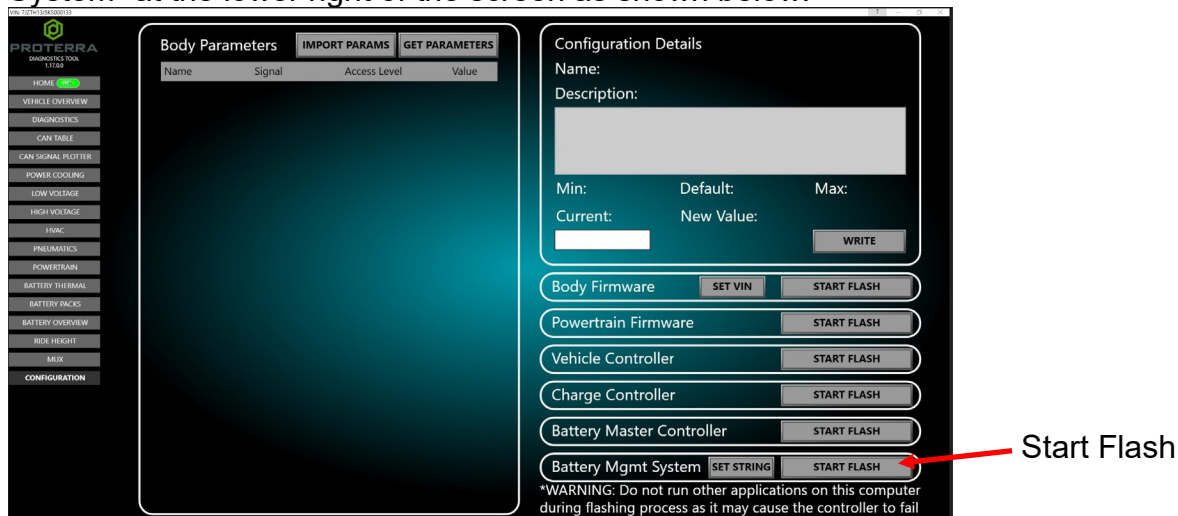


17. Repeat this process to program the remaining BMS Main controllers.

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

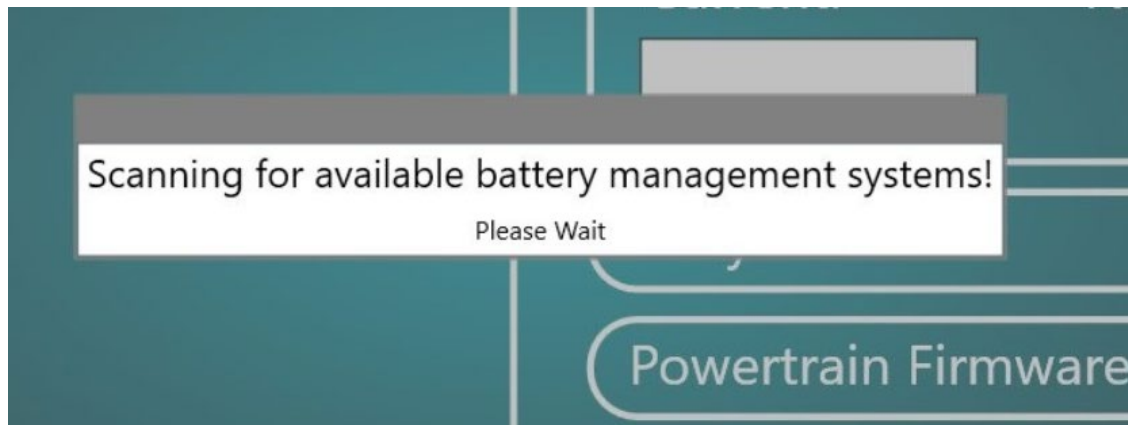


19. The following screen appears. Click on the “Start Flash” button in the “Battery Mgmt System” at the lower right of the screen as shown below.

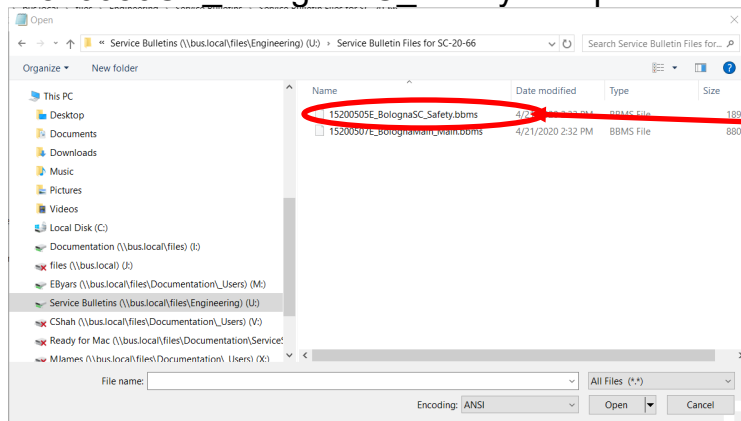


20. The following message will be displayed.

Note: It may take several minutes for the Diagnostic Tool to gather the required information.

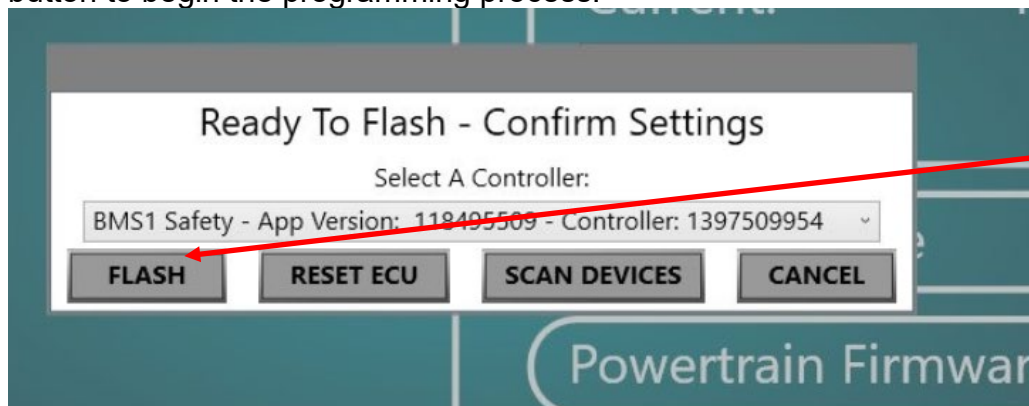


21. When the information gathering process is complete, the Diagnostic Tool will prompt you to select a file. Navigate to the desktop folder where the files were stored to perform this service campaign. Double click on the file named “1520050CE_BolognaSC_Safety” to open it.



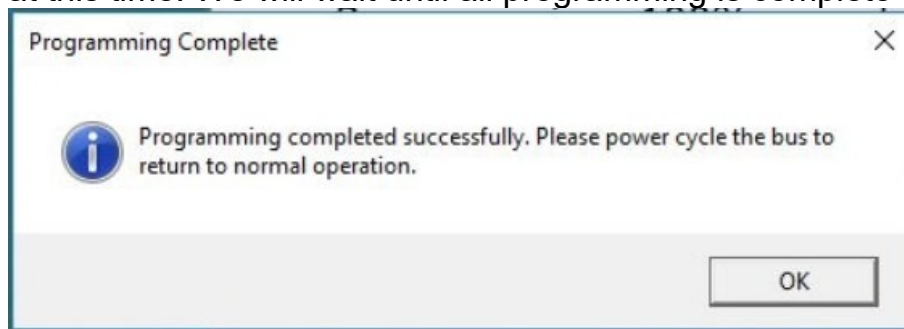
Double Click the “Safety” Program

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

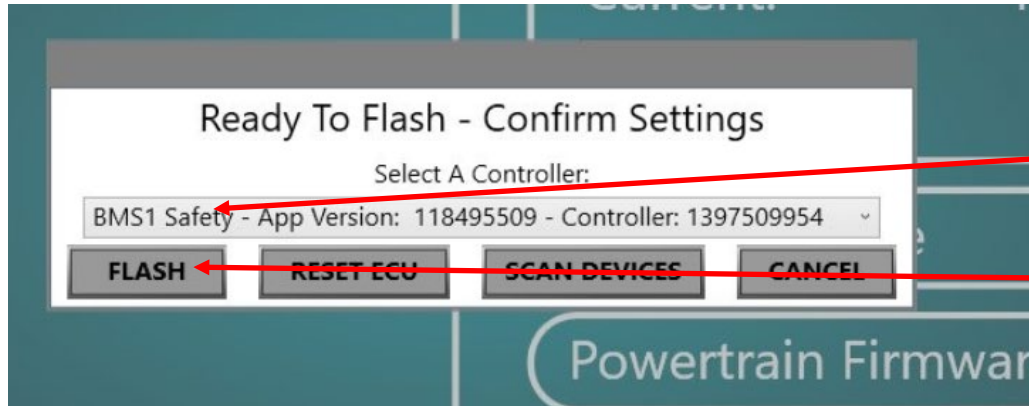


Click Flash

23. 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.



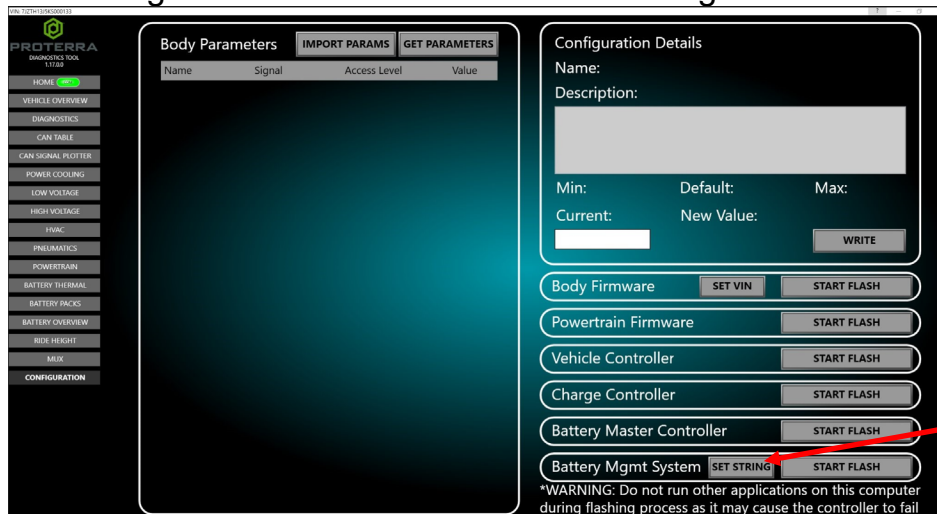
24. The following screen will appear. Click the drop-down arrow to select the next Safety Controller. In this case it will be BMS2 Safety. Click “Flash” to program the second BMS.



Select
“BMS2
Safety”

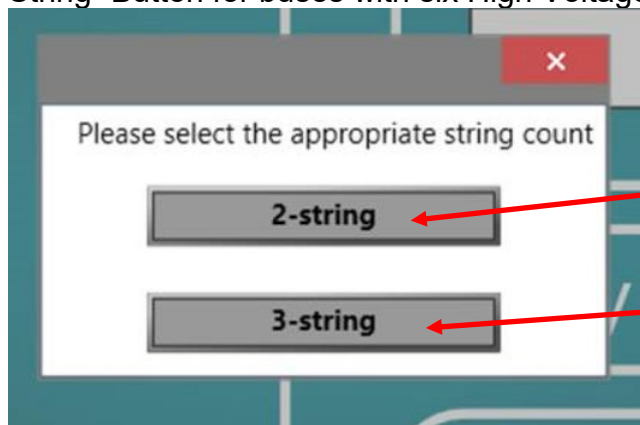
Click “Flash”

25. Repeat this process to program the remaining two BMS Safety controllers.
26. 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

27. 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

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

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



30. 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.



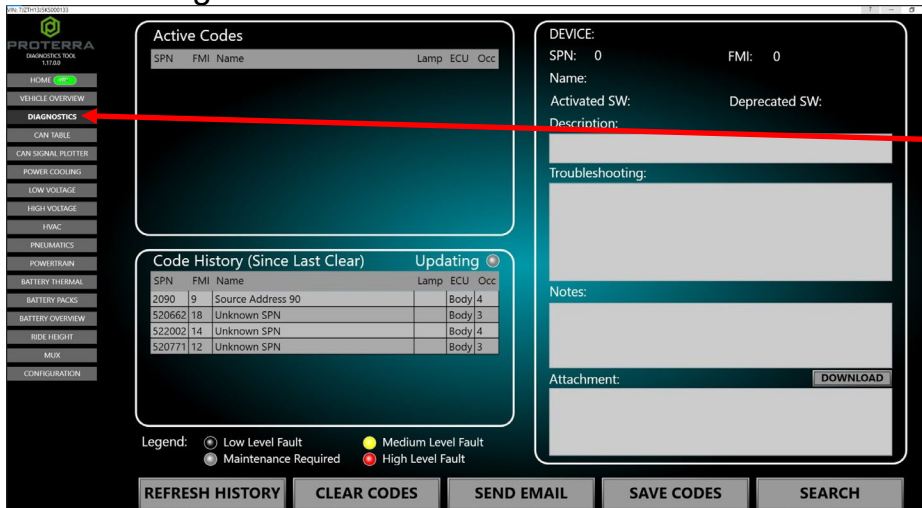
31. Working in the Driver's workplace, turn the Master Switch to the On position.



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



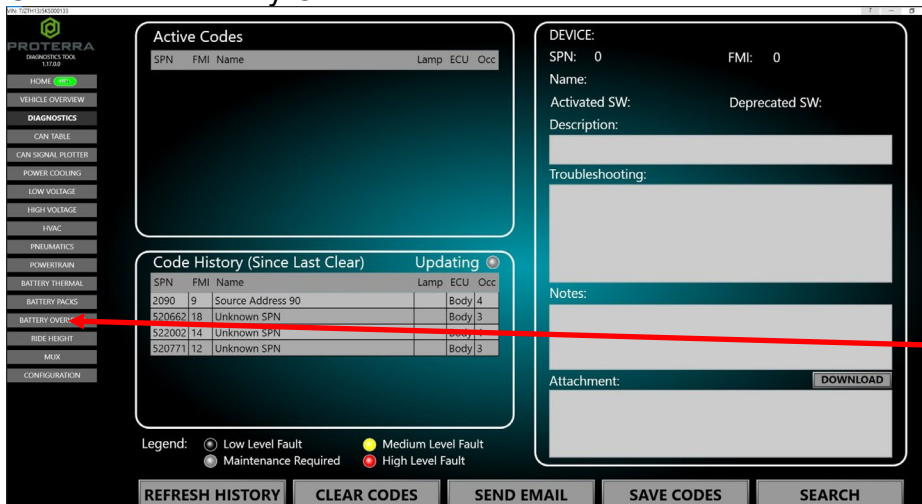
33. Re-start and re-connect the Diagnostic Tool. From the Home or Configuration screen, click the Diagnostics Button.



Click Diagnostics

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

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

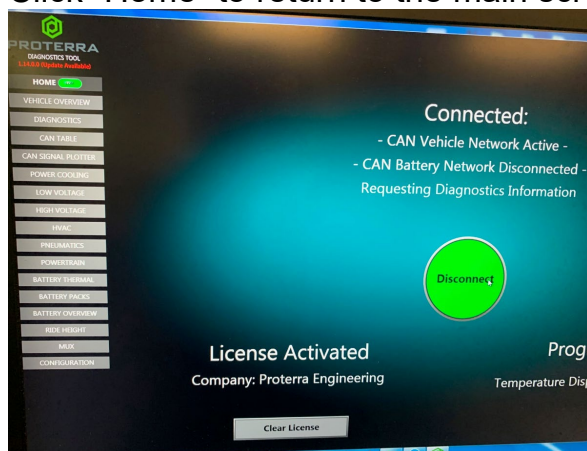


Click Diagnostics

36. 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.

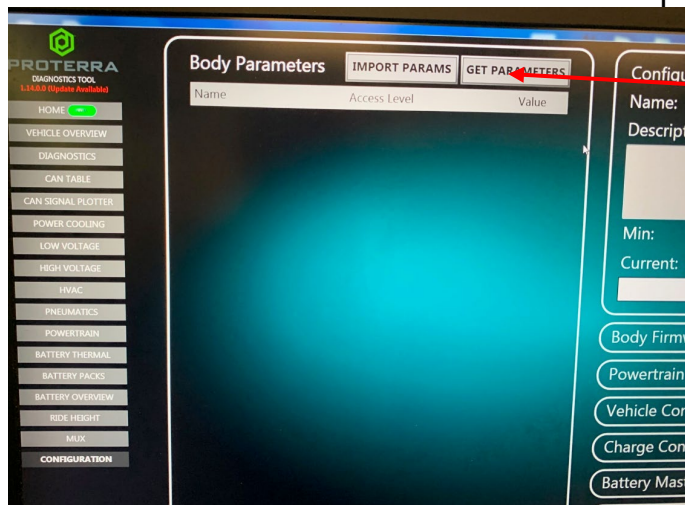
Pack	Moisture Contactor	Detected	Max Voltage	Min Voltage	Voltage	Current	Max Temp	Min Temp	Energy Throughput
S1 P1			3.46 V	3.45 V	311.96 V	-1.80 A	84°F	82°F	841 kWh
S1 P2			3.46 V	3.45 V	312.48 V	-3.00 A	86°F	82°F	838 kWh
S2 P1			3.46 V	3.45 V	311.84 V	-1.80 A	82°F	82°F	828 kWh
S2 P2			3.46 V	3.45 V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

37. 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.
38. If faults are found or battery packs are not connected, contact Proterra Service for help in resolving these issues. Do not return the bus to service until the issues are resolved.
39. Click “Home” to return to the main screen.



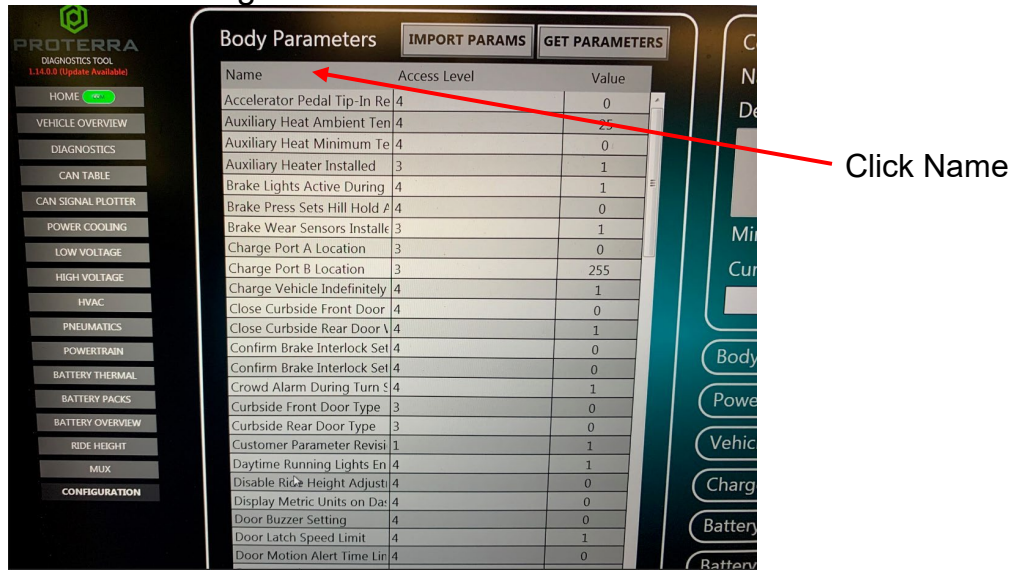
Click Home

40. Click the “Configuration” button at the bottom of the screen. The following screen will appear. Click 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

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



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

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



44. Enter a 13 in the “New Value” box and hit the “Write Button”.
45. Disconnect the cable from the ODB-II port.
46. Turn the bus off and back on before returning it to service.