# INSTRUCTION TO SERVICE

| ITS61435 | Sept 4, 2025 |
|---|---|
| **SECTION:** | 290-ELECTRICAL SCHEMATICS |
| **SUBJECT:** | FEBS BATTERY PROGRAM UPDATE PROCEDURE – FW 2524 |
| **SUMMARY:** | FW2524 offers:<br>• Robust detection of failure modes through DTCs<br>• SOHR accuracy improvement<br>• RTC battery DTCs removed.<br>• Logic improvements for better integration with application |
| **AFFECTED SR:** | ELFA3 XE and XHE Buses |

# ITS61435

| Ref. NHTSA Recall No. | Ref. Transport Canada Recall No. |
|---|---|
| NHTSA 25V566 | 2025-444 |

**THIS ITS DOCUMENT SHOULD BE RETAINED AND REFERRED TO FOR FUTURE MAINTENANCE UNTIL THE NEW FLYER PARTS AND/OR SERVICE MANUAL IS UPDATED TO REFLECT WORK DONE AS A RESULT OF THIS DOCUMENT. ENSURE THAT THIS DOCUMENT IS AVAILABLE FOR PARTS AND MAINTENANCE STAFF GOING FORWARD.**

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# Contents

## 1. EQUIPMENT/FILES REQUIRED:

1.1. NEXIQ with USB-Link 2 cable or PCAN tool

1.2. Battery diagnostic cable. NF P/N – 704950,

1.3. Software package

***Contact Service Engineering specialist for software package via sending email at [serviceorganization_electrical@newflyer.com](mailto:serviceorganization_electrical@newflyer.com)***

1.3.1. XST_2524_03 zip folder

1.3.2. Supplied bootloader 2150 file

1.3.3. Supplied BMS_00XX_XXXX03_02 and above

1.3.4. Supplied MCU _2150XX_XX.mot file

## 2. MANDATORY SAFETY CHECKLIST BEFORE STARTING THE UPDATE

**IMPORTANT: If the software was not updated successfully, you may be asked to share this checklist with SES. Please keep a record of all the following checkpoints before you proceed with every bus**

- ✅ SOC on the bus must be above 30% before starting
- ✅ LV batteries must be in good health
- ✅ Laptop must be fully charged
- ✅ Confirmed the correct file was retrieved from the email by comparing it with the supplied tracker
- ✅ Ensured HAZARD is ON the entire time
- ✅ Validated which CAN port to plug into for each step
- ✅ In Step 4, ensure absolute no DTCs are present on the Diagnostics tab
- ✅ Confirmed the baud rate of each CAN port by referencing the Electrical Schematic

If you have any doubts, please contact SES by emailing: ***[serviceorganization_electrical@newflyer.com](mailto:serviceorganization_electrical@newflyer.com)***

## 3. SET UP/INSTALL THE XST

3.1. Copy and paste the XST_2524.zip file provided by SES.

3.2. Extract the zip folder on your laptop. C drive preferred.

3.3. Navigate to the binary folder under the XST_2524 main folder and double click on the XST_2524_01.exe to install the software. A desktop shortcut will be added to the desktop.

3.4. Refer Xpand service tool user manual in the support documents folder provided with zip folder for any further information on how to use the xst.

## 4. MANDATORY: CHECK SOFTWARE VERSION BEFORE FIRMWARE DEPLOYMENT

4.1. Keep the MRS to the ON position, BUS IN EV MODE

4.2. Open the XST software, navigate to the Flash tab.

4.3. Connect the Nexiq CAN interface plug to the **Ebus black diag port**.

4.4. Connect the Nexiq USB plug to the laptop and launch XST_2524 software.

4.5. Use the settings CAN Channel - **Channel 1**; Baud rate – **500K**; Hardware – **Nexiq**.

4.6. Under the Live Data tab, you can find the current software version flashed on to the MCU and SCU at the bottom as shown in fig 1.

4.7. If the MCU and SCU software version is 19.40 or 21.50 or 23.24 or 24.52 and the Bootloader version is **BOOT 21.50.2**, **skip steps 4, 5, and 6**. *Proceed directly to* ***step 7.***

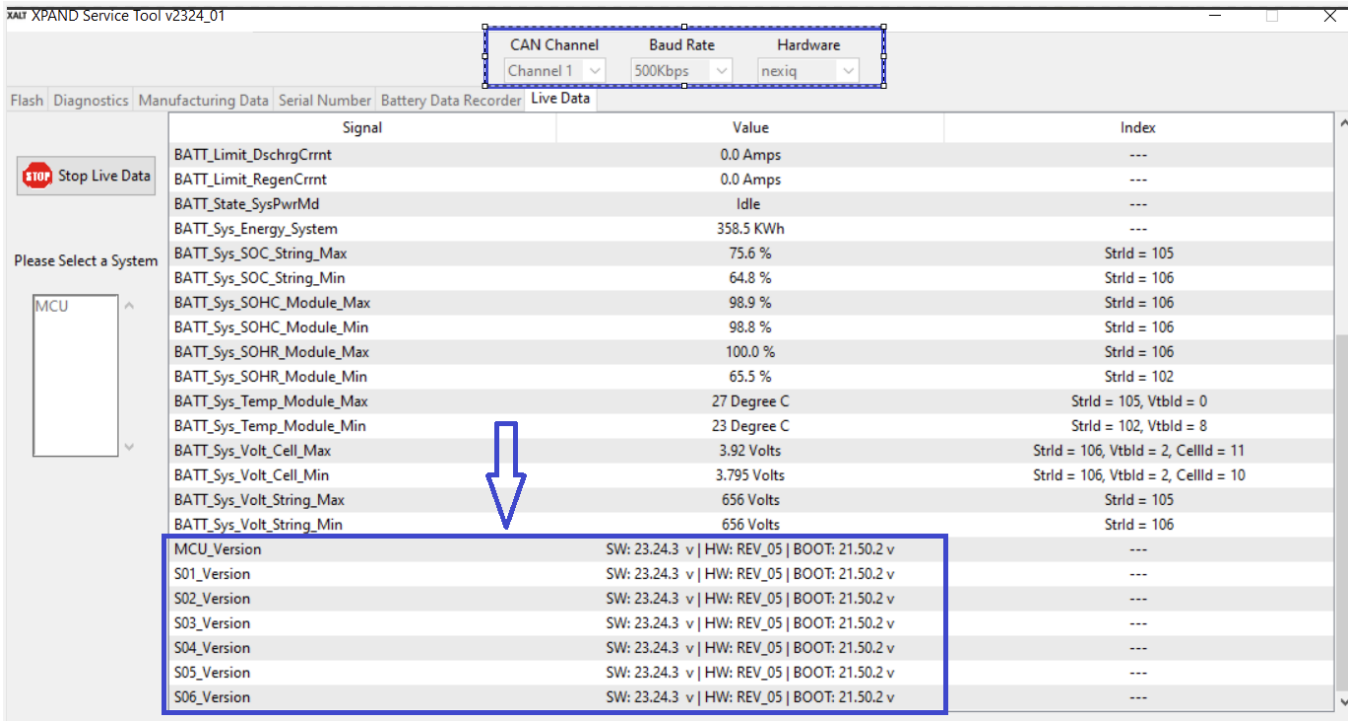


Fig 1: XST to verify the software and bootloader

## 5. FLASH THE BOOTLOADER ON SCU

**Updating the Boot Loader carries the risk of bricking the BDUs if the procedure is not followed correctly or is interrupted. It is crucial to ensure that both CAN communication and Unswitched Power (T30) remain uninterrupted during the update process. Therefore, take extra care to avoid any disruptions while performing the following procedure.**

**NOTE: Enable the Hazard light switch to make sure the bus will not go to sleep during the updates**

5.1. Turn MRS to the ON position.

5.2. Connect the interface harness aka octopus' cable to the NEXIQ and to the BDU diagnostic port. Connect the NEXIQ to your laptop with a USB cable.

5.3. Within the interface harness, connect CAN 1 to STRING 1 (the NEXIQ with the XST tool only communicates on CAN 1 – so you're connecting the NEXIQ to one string at a time).

5.4. On the XST software navigate to the flash tab.

**5.5. Set the CAN Channel to Channel 1, Baud rate to 250K and Hardware to Nexiq.**

5.6. Select the "browse" button and navigate to where the **BOT_2150_02.mot** file is located. Choose the file and press the Flash button to start flashing the MCU.

5.7. Ensure that the flash progress reaches 100%, and the final message from the flash tool states: "FLASH: Positive response to STOP".

5.8. When done wait for 60 seconds before moving to the next SCU.

5.9. Repeat the flashing process for each SCU, closing and reopening the XST software after each flash.

## 6. FLASH THE BOOTLOADER ON MCU

Selecting the correct port for flashing the bootloader and MCU file to change the MCU baud rate is critical. Please verify your SR against this exception table. If your SR is listed, use the specified port accordingly.
For example, for SR2853:

- Flash the bootloader and MCU file using **Prop Diagnostic port at Channel 2 with 250K baud rate.**
- Flash the BMS file using **Ebus Diag port at Channel 2 with 500K baud rate.**

| SR | Diag Port For BMS Flash | Diag Port for Bootloader and MCU file |
|---|---|---|
| SR-2590 | Prop Diag CAN1 | EBUS Diag CAN2 |
| SR-2591 | Prop Diag CAN1 | EBUS Diag CAN2 |
| SR-2592 | Prop Diag CAN1 | EBUS Diag CAN2 |
| SR-2659 | EBUS Diag CAN2 | Prop Diag CAN2 |
| SR-2777 | EBUS Diag CAN2 | Prop Diag CAN2 |
| SR-2804 | EBUS Diag CAN2 | Prop Diag CAN2 |
| SR-2817 | EBUS Diag CAN2 | Prop Diag CAN2 |
| SR-2822 | EBUS Diag CAN2 | Prop Diag CAN2 |
| SR-2829 | EBUS Diag CAN2 | Prop Diag CAN2 |
| SR-2834 | EBUS Diag CAN2 | Prop Diag CAN2 |
| SR-2836 | EBUS Diag CAN2 | Prop Diag CAN2 |
| SR-2847 | EBUS Diag CAN2 | Prop Diag CAN2 |
| SR-2848 | EBUS Diag CAN2 | Prop Diag CAN2 |
| SR-2849 | EBUS Diag CAN2 | Prop Diag CAN2 |
| SR-2853 | EBUS Diag CAN2 | Prop Diag CAN2 |
| SR-2854 | EBUS Diag CAN2 | Prop Diag CAN2 |
| SR-2855 | EBUS Diag CAN2 | Prop Diag CAN2 |
| SR-2864 | EBUS Diag CAN2 | Prop Diag CAN2 |
| SR-2877 | EBUS Diag CAN2 | Prop Diag CAN2 |
| SR-2881 | EBUS Diag CAN2 | Prop Diag CAN2 |
| SR-2912 | EBUS Diag CAN2 | Prop Diag CAN2 |
| | | |
| ALL OTHER ELFA3: | Prop Diag CAN2 | EBUS Diag CAN2 |
| Baud Rates in all cases: | 500k | 250k |

Fig 2: ELFA 3 exceptions list

6.1. Turn MRS to the OFF position, Hazard lights on and ensuring the multiplex system is still awake

6.2. **Force MCU T15 to "TRUE"**

i. **For SRs with 1615 module –** Go to Vansco Diagnostics mode, force the MCU enable output signal to the active/ON state i.e. MCU T15 vansco

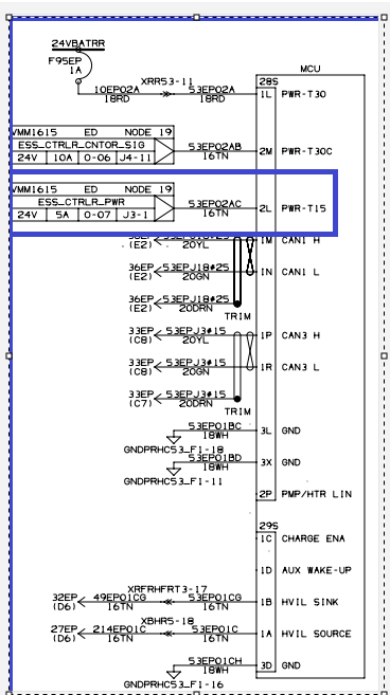


Fig 3: T15 from Vansco

output set to true. As an example, from Fig 3: Node 19 output 7 connected to T15 of the MCU, this means, search O19-7 in the PLC program to force it to be true while updating the Bootloader.

ii. **For SRs with 3033 module** – Open the project archive file in PEDS, click login button on the toolbar or press **Alt+F8** to scan the network and for live logic review. Once connection is established, **Node_02(Parker CM3033)** on the PEDS program will turn green. Check Electrical schematics for the MCU T15 node output as shown in Fig 3. Then, navigate to EP_ESS – EP_Battery_System Library, right click on the node output named as Node_04. OutputXX_DoutCmd which is labelled as ESS_Controller_Pwr inside the library, and force the Output to “TRUE”.

### 6.3. For XE and XHE buses not in exception list as per Fig 2

6.3.1. Connect the Nexiq CAN interface plug to the **Ebus black diag port** and connect the Nexiq USB plug to the laptop and launch XST_2524 software.

6.3.2. On the XST software navigate to the flash tab.

6.3.3. Set the CAN Channel to Channel 2, Baud rate to 250K and Hardware to Nexiq.

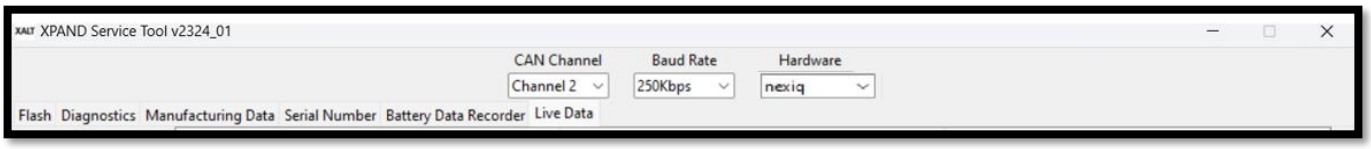


Fig 4: XST setup for MCU bootloader

6.4. Select the “browse” button and navigate to where the **BOT_2150_02.mot** file is located. Choose the file and press the Flash button to start flashing the MCU.

6.5. Ensure that the flash progress reaches 100%, and the final message from the flash tool states: “FLASH: Positive response to STOP”.

## 7. UPDATING THE ESS NETWORK TO 500K BAUD RATE

**NOTE: At this point, the bootloader has been updated, but the system is now running at 250k baud rate. Follow the step below to bring the network to 500K baud rate to be compatible with single binary flash.**

7.1. Keep the MRS to the OFF position and re-ensure the multiplex system is still awake

7.2. Load the supplied BMS 2150 file appropriate (MCU_XXXX_0002_XX.mot) for the batteries.

**7.3. For XE and XHE buses not in exception list as per Fig 2**

7.3.1. Connect the Nexiq CAN interface plug to the **Ebus black diag port**.

7.3.2. Connect the Nexiq USB plug to the laptop and launch XST_2524 software.

7.3.3. On the XST software navigate to the flash tab.

7.3.4. **Set the CAN Channel to Channel 2, Baud rate to 250K and Hardware to Nexiq**

7.4. Select the “browse” button and navigate to where the supplied MCU_XXXX_0002_XX.mot file is located. Choose the file and press the Flash button to start flashing the MCU.

**7.5.** Monitor the XST tool completion bar at the bottom of the flash tab on the tool.

**7.6.** Ensure that the flash progress reaches 100%, and the final message from the flash tool states: “FLASH: Positive response to STOP”.

7.7. Force the T15 output to “False” and close the 2524.xst

## 8. FLASH THE BMS FILE TO THE MCU

8.1. Keep the MRS to the ON position.

8.2. Reopen the XST software, navigate to the Flash tab.

8.3. Ensure your **CAN interface device (Nexiq) is connected to the Application CAN for a 500K baud** rate. Refer to the electrical schematics of the respective SR for confirmation.

**8.4. For XE and XHE buses not in exception list as per Fig 2**

8.4.1.1. Open the **ES** and search for the **PROP RR GN DIAG PORT, refer Fig 4**

8.4.1.2. Follow the cable code as highlighted connected to pin **HJ that is Channel 2** of the diagnostic port

8.4.1.3. The BMS file must be flashed via the APPLICATION CAN network. **Prop RR diag port** (as shown in *Fig 5 and Fig 6*, Channel 2 - HJ pin) is connected to the same CAN network as the MCU and operates at 500 Kbps. Ensure these settings are selected when flashing the BMS file**.**

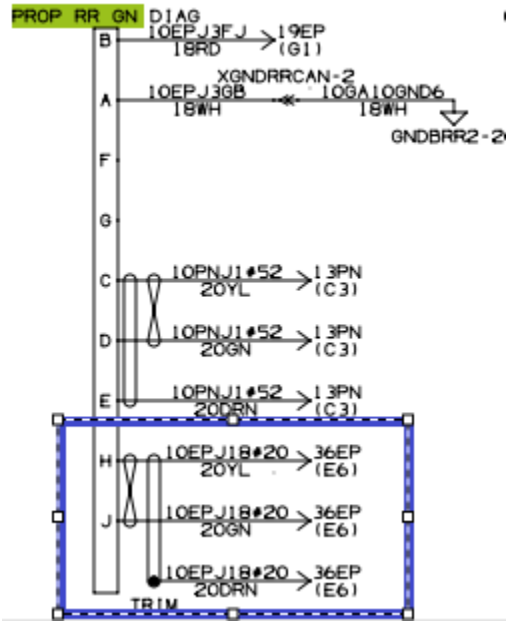


Fig 5: ELFA3 Channel 2 – HJ pin

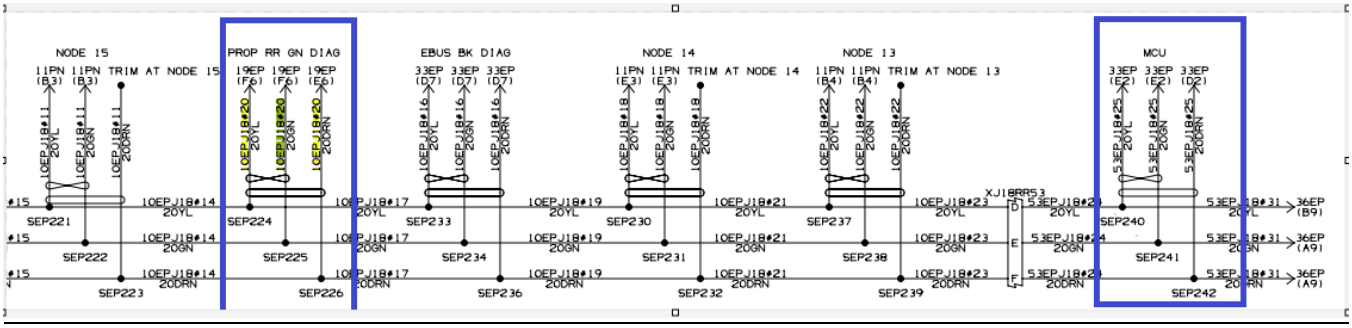


Fig 6: ELFA3 Application CAN – Baud Rate 500K

**8.5. Set the CAN Channel at Channel 2; Baud rate – 500K; Hardware – Nexiq.**

8.6. Press the browse button and choose the supplied BMS_00XX_252404_01.mot.

☞ ***NOTE: BMS file is specific to battery type***

8.7. Press the Flash button and wait until the flash bar reaches 100%.

8.8. Ensure that the flash progress reaches 100%, and the final message from the flash tool states: “FLASH: Positive response to STOP.

8.9. Close the XST software.

8.10. Once completed successfully – Turn the MRS to the OFF position for 5 minutes (USE TIMER) and then Turn the MRS to the ON position

## 9. SOFTWARE VERIFICATION AFTER FLASHING THE BMS FILE

9.1. Keep the MRS to the ON position

9.2. Reopen the XST software, navigate to the Flash tab.

9.3. Use the settings CAN Channel - **Channel 2**; Baud rate – **500K**; Hardware – **Nexiq**.

9.4. Under the Live Data tab, you can find the current software version flashed to the MCU, and each battery string. This means, the process is successful.

9.5. After loading the files, you may notice the **HV battery fail** light triggered on the dash, even though all the strings are connected. In such cases, turn the MRS off -> wait for 5 mins -> knife off the bus -> wait for 1 min -> restart the bus and eventually no light should trigger. Additionally, please reverify diagnostics tab for any active DTCs

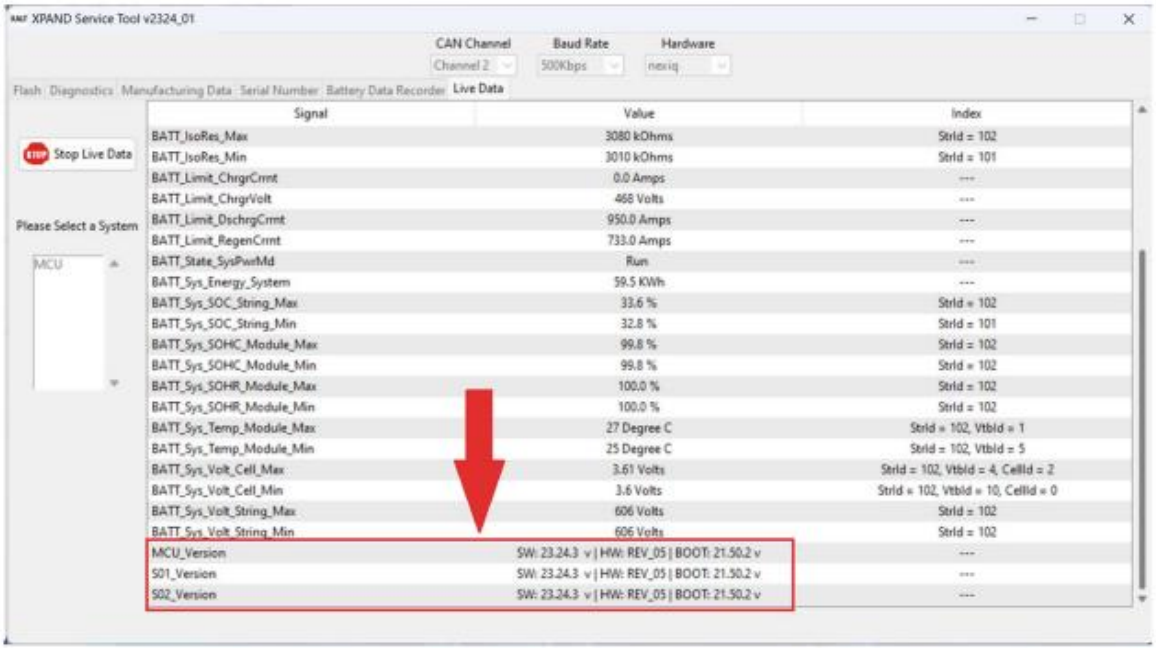


Fig 7: XST to verify the software and bootloader

## 10. TROUBLESHOOTING: BDU FAILS TO INITIALIZE

If the BDU fails to initialize after a BMS flash, follow these steps to diagnose the issue:

10.1. Refer Electrical schematics and locate T15 as shown in Fig 2. Set the T15 to 24V

10.2. Refer Electrical schematics and locate T30 as shown in Fig 2. Use multimeter to monitor the current draw at the T30. Initially, the current should be around 130 mA.

10.3. Observe if the current gradually drops to approximately 0 mA within 5 seconds.

⚠ **If this behavior occurs, it indicates a failure in initialization. In such cases, proceed with the BDU recovery procedure to resolve the issue.**

**RECOVERY PROCEDURE FROM FEBS**

10.4. Have access of SCU_1940XXXX_XX.mot file on your laptop. Contact SES group to share the file if needed.

10.5. Access to either the BDU's Service CAN or isolated Internal CAN

10.6. Ensure the XST and its CAN interface is connected to the BDU (via Internal or Service CAN)

10.7. Verify T15 is OFF (0 Volts).

10.8. Within the XST, load the 1940 based SCU software into the tool, but do not "Start Flashing".

10.9. Set T15 ON (24 Volts) and within 5 seconds, "Start Flashing" via the XST.

10.10. The XST will provide positive feedback that flashing was successful.

10.11. Put the BMS to sleep by setting T15 OFF (0 Volts).

10.12. Wait either 5 minutes OR until T30 (unswitched power supply) current draw falls to ~0 mA.

10.13. Wake-Up the BMS by setting T15 ON (24 Volts)

10.14. Repeat steps 8 through 10, for a total of two sleep-wake cycles.

10.15. Within the XST, load the Production Intent BMS software, and "Start Flashing"

10.16. The XST will provide positive feedback that flashing was successful.

10.17. Put the BMS to sleep by setting T15 OFF (0 Volts).

10.18. Wait either 5 minutes OR until T30 (unswitched power supply) current draw falls to ~0 mA.

10.19. Restore the BDU into the system with other strings, MCU, low voltage wiring, etc.

10.20. Set T15 ON (24 Volts) and, via Application CAN check that:

i. BATT_Comm_StringsAddressed is equal to the number of BDUs in the system.

ii. BATT_State_sysPwrdMd is IDLE

## 11. DIAGNOSTIC AND RECOVERY STEPS

### 11.1. If you're unsuccessful in loading the BMS file after flashing the Bootloader successfully:

11.1.1. Reverify the BMS file with the SES group by sending an email to serviceorganization_electrical@newflyer.com.

11.1.2. Once the BMS file is reverified, close and reopen the 2524.xst file, then try flashing the BMS file multiple times with the key on. Ensure that T30 is uninterrupted. If you still see the message "No Positive Response to Reset Command," proceed to the next step.

11.1.3. Program the SCUs with bootloader 2150 respectively. The bootloader will reset the file and allow you to try flashing the BMS file again from the application.

11.2. **If one string is offline after flashing the BMS file that is SCU Won't Communicate on CAN and Loss of BDU HVIL**

11.2.1. Isolate the offline string by pulling the breaker of the other string. Then, flash the bootloader followed by the BMS file on the application CAN.

11.2.2. **Check for HVIL addressing loop is completed as below.**

***NOTE*** HVIL in this case is *not* referring to the bus High Voltage Interlock Loop that acts as a confirmation of no exposed HV, this is the HVIL Addressing Loop that the BMS uses to verify and address the order of string controllers. If there is an "HV INTERLOCK" light on the dash, then that needs to be addressed first and foremost as all major controllers on the bus are forced off which means all other symptoms are likely a consequence of the HV INTERLOCK.

This issue can manifest differently depending on the bus type and BMS software installed. The general problem is that one of the BDUs or the MCU can't or won't communicate on CAN for one reason or another, causing the addressing of the BMS controllers to fail in some regard. Any of the following conditions may occur when this happens:

1. SOC 0% + TRACTION SYSTEM DISABLED light on dash means either the MCU itself has the HVIL issue or the CAN line issue, or it means there's a version of software installed where the general system response to an addressing timeout is for the MCU to report out a 0% SOC due to the other underlying comms issue.
2. Similar case to above, but there end up being no telltales or warnings due to MCU still communicating some valid SOC. The bus simply won't start into EV mode and sometimes a KEY STRT ACK will appear after pressing the start button if the bus is ELFA3, and if the bus is ELFA2 it will eventually get a STOP SYS light, and the only fault will likely be a Pre-Charge Too Long.
3. Bus starts into EV mode without issue, but the affected strings are simply offline. This is what happens when the BMS software is such that the system can start with an HVIL issue on all strings that lack an HVIL issue and the MCU is unaffected by the fault.

Step 1 for this issue is always to take a CAN log off of the battery internal CAN line to identify if any strings are not communicating, and what the HVIL voltages and currents look like to identify where the issue is likely to be. The source and sink voltages and sink currents should be close to 3V and 20mA respectively, and all strings should be reporting data on CAN.

If the HVIL sink current is 0mA or the sink voltage is 0V from a given BDU, then the break is with the previous BDU or between the previous BDU and the BDU with those conditions. Alternatively, if the source voltage is 14V then the open circuit is with the next BDU or harness between. As an example, if BDU4 has 14V for HVIL source voltage and BDU5 has 0V and 0mA then there's likely a harness issue on the HVIL wire between BDU4 and BDU5.

If a string is not reporting any data on CAN, but all HVIL voltages and currents that are reporting on the CAN log seem correct, then string's CAN harness is likely the issue and it should be inspected next. For example, if BDU3 is not reporting any data on the CAN log, but BDU2 HVIL source voltage is 3V and BDU4 HVIL sink voltage and current are 3V and 20mA respectively, then the HVIL loop is fine and BDU3 is fine despite not reporting on CAN, so the issue must be with the CAN line itself.

If a string is not reporting on CAN *and* the HVIL sink after the missing string and the source before the missing string are incorrect, then the issue is that the BDU won't wakeup, whether it is because the BDU has an internal issue or it's lost power or not being enabled. For example, if BDU1 HVIL source is 14V, BDU3 HVIL sink voltage and current 0V and 0A respectively, and BDU2 is also not reporting on CAN, then BDU2 is not waking up and the power supply and enables need to be inspected for possible missing power supply to the controller, or the controller itself is damaged in some capacity on BDU2.

Once the above information has been used to determine where the LV harness issue needs to be between, this harness needs to be inspected for continuity, pushed pins, and a drag test if nothing else is found. If the harness checks out okay, then the issue is likely within one of the offending ESS tub harnesses and the ESS needs to be opened up, and the internal harnesses inspected in the same way for the same issues. Work with NF service Engineering to find the associated harness or parts needed to address the issue.

## 12. CLEAR CODE INSTRUCTIONS FOR 2150-2524 XST

12.1. Click and highlight the Permanent fault.

12.2. Right click on the permanent fault.

12.3. Select the bottom most option for clear fault in drop down window.

12.4. Insert above clear code into newest pop-up window using CTRL+C (to copy) and CTRL+V (to paste).

12.5. Copy and paste the Authorization Code into the "Authentication Code" window.

12.6. Be sure when copying that no blank or invisible characters populate at the beginning or end of the code.

12.7. You will get confirmation that it was activated.

12.8. You will need to right click on each string and then select "clear fault".

12.9. It will state something along the lines of code still active.

12.10. After doing this for all strings key the bus off for 10 minutes.

12.11. Key the bus back on and then check with XST to ensure no faults remain.

## LIST OF ABBREVIATIONS

| Abbreviations | Description |
|---|---|
| APP | Application |
| BDU | Battery Disconnect Unit |
| BMS | Battery Management System |
| CAN | Controller Area Network |
| FBPS | Freudenberg Battery Power Systems |
| HV | High Voltage |
| LV | Low Voltage |
| MCU | Master Control Unit |
| SCU | String Control Unit |
| XST | XPAND Service Tool |
| SES aka TSS | Service Engineering Specialist. |

| LABOUR ESTIMATE | | | | |
|---|---|---|---|---|
| | Operation | Number of Technician(s) | Hours | Labor Time T X HR |
| 1 | Rework - Update FEBS software to rev 2524 | 1 | 0.25 | 0.25 |
| | | | | |