



GENERAL SERVICE BULLETIN

FDRS Module Programming Job Aid

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Markets: North American markets only

Summary

This article provides support for module programming related concerns that may be encountered while using the FDRS scan tool. The information contained within this article assumes that all steps of the service repair process have been completed, including documenting the vehicle owner's current concern, reviewing TSB, SSM, FSA and the WSM. This document does not supersede or replace existing publication or warranty direction.

Service Information

Equipment, Tooling and Dealer Infrastructure

The FDRS scan tool utilizes a cloud-based architecture. The benefits of such an architecture include the ability for Ford to make real time improvements without the need for dealers to complete a lengthy diagnostic tool update. A cloud-based architecture reduces scan tool installation time by reducing installation package size. A result of this architecture may be that dealers experience extended software download time during module programming events if their dealer infrastructure does not meet Ford recommendations. Poor internet connection or upload/download (megabytes per second [Mbps]) times may contribute to extended software download times during module programming. These minimum dealer infrastructure requirements depend on several factors, including the number of devices connected to the dealers' network.

Internet Service Minimum Bandwidth Specifications

| Number Of Connected Devices | Network Download (Mbps) Speed Requirements | Network Upload (Mbps) Requirements |
|-----------------------------|--|------------------------------------|
| < 20 devices | >100 Mbps | >10 Mbps |
| 20-100 devices | >300 Mbps | >30 Mbps |
| >100 devices | >500 Mbps | >50 Mbps |

Minimum Recommendations – Diagnostic Equipment (Example – FDRS)

| | |
|---------------------|--|
| Processor | 5 Gen 10 or equivalent |
| System Memory (RAM) | 16 Gigabyte (GB) |
| Hard Disk Drive | Solid State 500 GB |
| USB Ports | 2 (Universal Serial Bus (USB) 3.1 Gen 1, USB 3.1 Gen 2) |
| Display | 20 inch monitor (1600x900 minimum resolution) |
| Network Adapter | Wired: Recommend Ethernet-based if available (1 Gigabit); Wireless: 802.11ac, 802.11ax preferred |
| Operating System | Microsoft Windows 10 |

Service Functions

Service functions refer to any application within FDRS that might complete a learning routine, calibration, or initialization. These routines include things like LIN new module initialization, ABS HCU pressure bleed, and camera alignments. These routines, from a high-level point of view, are not VIN-specific. These routines operate in a manner where FDRS instructs the responsible module on the vehicle to execute the routine. FDRS simply sends a go command to the module. The module will then perform the routine as it is coded to do. The most common causes for a service function errors are damaged circuits or components involved in the system. For example, if a BCM LIN

initialization routine fails, it is possible that a fault on the LIN network or a fault with the LIN device is the cause. A fault with the FDRS scan tool application could be ruled out by running it on another similarly equipped VIN since these applications are not VIN-specific.

Module Swapping And Ordering Using A Different VIN

Swapping a used module from a vehicle for diagnostic purposes or to complete repairs is likely to cause vehicle symptoms or programming errors and is not recommended. Ordering a replacement module using a VIN from a different vehicle is also not recommended. Most modules on these affected vehicles are VIN/vehicle specific, and hardware variations between modules do exist. Swapping a module from a vehicle or ordering a module using a different vehicle/ VIN can cause ineffective repairs and additional vehicle downtime. Make sure all appropriate WSM procedures are followed when diagnosing the condition before any module replacements and only order modules using the correct VIN.

Adding/Removing Features Using Programmable Parameters Due To Vehicle Modifications

Ford and Lincoln vehicle owners may request modifications to their vehicle such as enabling DRL, adding navigation, changing tire/axle sizes, and/or adding trailer brake control modules. A list of programmable parameters that are available for alteration is shown in WSM, Section 418-01A > Module Configuration. Parameters available for alteration will vary by model and model year. If the desired parameter is not listed in the right column of the Module Configuration And Parameter Chart, alteration of that parameter is not supported by Ford Motor Company. A list of supported parts that can be added to the vehicle is available at accessories.ford.com. Adding/removing accessories and/or programming vehicle features is not warrantable.

Module Service Replacement Parts

The FDRS service scan tool functionality is largely based on the part number of the individual modules installed in each vehicle. If an incorrect module has been fitted to a vehicle, application and programming errors are likely. If a fault is occurring only on a replacement module, it is recommended that the installed part be verified as compatible by VIN using the Historical Vehicle Bill of Material (HVBoM), the Ford ECAT parts catalog or Ford Component Sales (FCS) online 1878 form (for infotainment modules). The first digit of the prefix in a part number indicates the model year that the part was intended for, identical to the 10th digit of the VIN.

- Example: MU5T-15604-A. The M indicates that this part is intended for a 2021 model year vehicle.
- Example: LU5T-15604-B. The L indicates that this part is intended for a 2020 model year vehicle.

Most often, replacement modules should share the same part number as the one which the vehicle was built with according to HVBoM, or a later level part found in ECAT or FCS 1878 order forms. For example, a 2021 model year vehicle built with an M prefix part should usually not receive an L prefix part from 2020 model year. This is a general rule for module part numbers and there are few exceptions. Other vehicle parts may not have the same model year correlation to their part numbers.

Module parts are often superseded and intended to be made backward compatible, though. For example, a 2021 model year vehicle built with an M prefix part may receive a superseded part with a prefix that begins with N for the 2022 model year.

Module Communication

The vast majority of FDRS functions require communication between the FDRS scan tool and one or more modules on the vehicle via the CAN. CAN and module communication related concerns should be addressed before programming is attempted. Programming while a CAN issue is present may result in damaged modules, unnecessary vehicle downtime and unnecessary warranty expenditure. This article will not discuss in depth how network diagnostics should be performed but will focus on a few key concepts as they relate to module programming. Diagnostics for network concerns should be performed per the direction in the WSM.

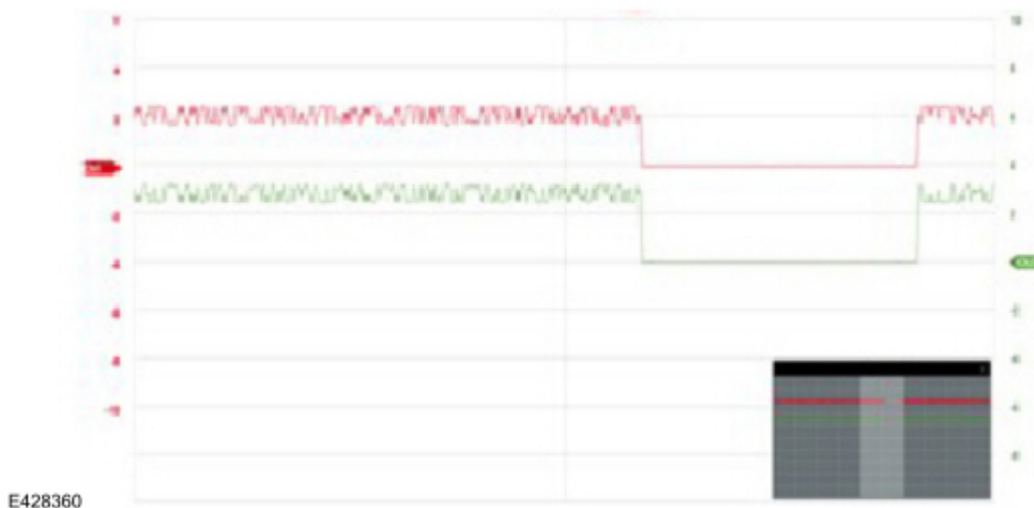
- On SYNC 4 equipped vehicles, certain modules are programmed between both the CAN and USB drive. These modules often include the infotainment modules such as the APIM, TCU, GWM and/or high level IPC. USB port, USB cable, ethernet network or CAN faults may contribute to programming errors.

- For all other modules on SYNC 4 or previous generations of vehicles, programming is performed over the CAN. Module or network communication faults will contribute to vehicle symptoms and programming errors.
- A module needs three things to communicate properly on the CAN and with the FDRS scan tool: power to the module, ground to the module, and the CAN wiring.
- The FDRS Network Monitor application will ping each module or network enabled in the test and make sure that FDRS receives a response from the module, proving that communication is likely ok.
- Running the on-demand DTC self-tests will stress test the module communication by forcing the module to activate outputs during the test. Modules failing or aborting the on-demand DTC self-test (grey in color) suggests that the power, ground, or CAN wiring may be damaged.
- Modules that respond negatively (purple in color) suggest that the module is communicating but may have failed a previous programming attempt, possibly due to a module or network related communication concern.

When the customer's symptoms, DTCs, and any programming errors present themselves like a possible network concern, it is recommended to not only rely on self-test and network monitor results. These tests are great go/no-go type tests. However, due to network fault tolerance, these tests may pass and suggest that the network is OK. However, module programming often transmits significantly more data over the network than these tests, increasing the odds of an error only during programming. It may be necessary to perform loaded voltage drop testing on all of the module's power and ground circuits. The VCMM oscilloscope is a powerful tool for verifying the integrity of the CAN itself. Known good network waveforms are available in WSM, Section 418-00x and additional information regarding VCMM usage and setup can be found in STARS training.

The below example demonstrates a VCMM capture (Figure 1) of an HS-CAN network which is being shorted to ground (0.0v) but that the HS-CAN modules are communicating (green in color) with FDRS via the ALL CMDTC test. This example demonstrates the potential need to take network diagnostics further than running a network test or self-test.

Figure 1



Identifying A Programming Related Concern

Vehicle repairs have taken on additional complexity over the last decade. Many repairs include the need to complete module replacement programming, learning, or calibration routines. With repairs being so reliant on scan tools, it is critical to understand how the scan tool functions and when a vehicle symptom may result from a programming error. Determining when a vehicle symptom is programming-related is not always an easy task. It often requires a thorough understanding of the entire service repair process for the vehicle in question. A few of the key things to look for in the service process include:

- Original concern vs. current concern
 - If a vehicle came in for service for the same concern that is present after module replacement or programming, this is unlikely to be a programming-related issue.
 - The concern may be programming-related if a new DTC or symptom is present only after performing module programming or replacement. Verify that all installation steps per the WSM have

been completed properly. If the issue remains, it is likely that the module was flashed or configured incorrectly and requires support from the module programming team.

- **DTCs**

- Replacement modules have default or manufacturer substate **DTCs** stored that indicate they require programming, initialization, and/or calibration routines completed. If the same **DTC** the vehicle entered service with returns on the replacement, the concern is unlikely to require module replacement or programming. Most replacement modules will only store **DTCs** related to the steps required in the installation process, not circuit or performance related **DTCs**.
- **DTCs** stored for components which the vehicle is not equipped with per the build sheet and/or window sticker may suggest a programming-related concern. In some cases, a module may still have wiring for the component it is not equipped with and may still monitor for circuit faults. If the wiring is present, it should still be inspected, particularly for shorts to voltage or ground. These types of circuits are usually expected to be open.

- **Service messages**

- Review all available service messages that may relate to both the customer's original concern, current concern, and the programming error being encountered.

- **Intermittent vs hard faults**

- Modules are either programmed correctly or incorrectly. If the module is programmed incorrectly, the symptom or **DTC** will always be present. Intermittent **DTCs** suggest that a vehicle-side concern in wiring, connectors or components may be present.

12-Volt Battery Testing, Charging, Maintenance And State Of Charge For Module Programming

Battery Health And Voltage Maintenance

- It is recommended to test the 12-volt battery(ies) using approved Rotunda tools prior to a programming event. Ford warranty supports the use of the GRX-3590 and/or DCA-8000 units to perform 12-volt battery testing.
- The battery(ies) should be fully charged or replaced prior to programming, based on the test results from the approved Rotunda tools.
- Once battery health is determined using approved Rotunda tools, the battery should be maintained in the 12.6 volt - 13.6 volt range for module programming. It may be necessary to verify that the voltage is within the desired range using displays on the charger, the battery monitor status at the bottom right corner of the **FDRS** scan tool or using a digital volt ohm meter (DVOM) connected to the battery.
- If equipped, the tool being utilized to maintain the battery should be adjusted to the maximum time limit possible, to prevent charger/maintainer time outs during long flash events.
- Battery charging should be performed per **WSM**, Section 414-01 > General Procedures. Depending on the vehicle, the proper charging procedure may vary, but is important so that the charger does not lead the **BMS** system to believe the vehicle's battery is being discharged. It is recommended to leave the battery connected and connect the battery charger negative clamp to chassis ground, not the battery negative post.

Example of Proper Charging Procedures per WSM, Section 414-01. Always refer to the specific manual for the vehicle in question.

| Charger Connected to Engine or Chassis Ground (Battery Connected) | Charger Connected to Battery Posts (Battery Disconnected) |
|--|--|
| <ol style="list-style-type: none"> 1. Connect the positive (red) charger clamp to the positive battery post. 2. Connect the negative (black) charger clamp to the negative battery ground cable stud or a body ground. 3. Charge the battery following the battery charger manufacturer's instructions. | <ol style="list-style-type: none"> 1. Disconnect the battery. Refer to WSM, Section 414-01, General Procedures, Battery Disconnect and Connect 2. Connect the positive (red) charger clamp to the positive battery post. 3. Connect the negative (black) charger clamp to the negative battery stud. |

| Charger Connected to Engine or Chassis Ground (Battery Connected) | Charger Connected to Battery Posts (Battery Disconnected) |
|---|--|
| | 4. Charge the battery following the battery charger manufacturer's instructions. |

NOTE: Connecting the battery charger negative clamp directly to the battery negative terminal might result in the SOC PID not immediately reflect the improvement from charging. It is not necessary to perform a BMS reset unless the battery is replaced or the battery is disconnected when charged. If the battery is charged with the battery charger negative clamp directly on the battery negative post while the battery is fully connected to the vehicle, it may take hours for the BMS PID to update.

Battery State of Charge Percentage (BATT_SOC%)

The BCM calculates the battery SOC using inputs from the BMS, known battery capacity, battery voltage, battery time in service and battery temperature. The battery SOC can be used to verify that the battery will support vehicle current consumption demands during module programming. If the battery is in poor condition and the BCM PID for BATT_SOC reports that SOC is low, offboard battery chargers may not be able to maintain the voltage or current demands required of both the battery and the vehicle, leading to programming faults. This may cause the vehicle load shed to activate and disable ignition switched power to certain modules. Certain modules also have requirements for the SOC to be at a certain percentage before programming can be performed. The FDRS programming applications will call attention to the SOC% requirement for modules that have this requirement. It is generally recommended that the battery SOC be at 75% or greater to be sure of successful programming.

Parameter Identifiers (PIDs) Related to Battery Health and Charging

Monitor the following BCM PIDs: BATT_SOC, BAT_CURRENT, VPWR_RAW. Example PID usage is provided in the tables below.

May lead to programming faults

| BCM PID | Value | Detail |
|--------------|------------|--|
| VPWR_RAW | 11.8 volts | Voltage is below minimum recommended voltage of 12.6 volts to 13.6 volts |
| BATT_SOC | 65% | Battery state of charge is below recommended 75% |
| BATT_CURRENT | -17.0 amps | The vehicle is consuming more amperage (power) than the is being provided to the battery |

Acceptable values which will support successful programming

| BCM PID | Value | Detail |
|--------------|------------|---|
| VPWR_RAW | 13.2 volts | The voltage is within the recommended range of 12.6 volts to 13.6 volts |
| BATT_SOC | 77% | The battery state of charge is above the minimum recommend value of 75% |
| BATT_CURRENT | 2.0 amps | The battery is being provided enough power to meet vehicle demands |

FDRS Vehicle Identification Process

Starting a vehicle session requires the user to select the Read VIN From Vehicle button in FDRS. Once the Read VIN From Vehicle button is selected, FDRS will read the VIN via the CAN from the PCM using OB2-II protocol from PCM Mode 09 data. The PCM will report the VIN to FDRS, which displays it in the VIN entry box. The user will then select Go, at which time FDRS will retrieve a vehicle model from the servers for that VIN, including which modules are equipped, the powertrain type, and the vehicle program information. This process occurs while FDRS displays a progress bar stating, Downloading Vehicle Information. Once obtained, FDRS will perform a network test on the vehicle and read the part numbers and DTC in all equipped modules.

Vehicle Identification Process Errors

| Error Encountered | Detailed Description | Repair Action |
|---|---|--|
| <p>Error: A problem occurred while performing the Vehicle Identification process. Please check the VIN and Internet connectivity and try again.</p> | <p>FDRS obtained the VIN from the vehicle and then tried to download vehicle specific data from the servers but was unable. Firewalls, anti-virus programs, poor internet connection or speed, and server outages are possible causes.</p> | <ol style="list-style-type: none"> 1. Check the FDRS Help > Announcement space on the login page and PTS Alerts for messages regarding potential outages. 2. Attempt to identify a different VIN to rule out a VIN or vehicle specific issue. <p>Verify internet speed and connection meets minimum requirements. (Requirements can be found by clicking the settings icon in FDRS, refer to Figure 2 at the end of this table)</p> |
| <p>Incorrect VIN displayed after user selects Read VIN From Vehicle</p> | <p>The BCM is the VIN master module. At ignition-on events, the BCM sends the VIN via the CAN network to the PCM. The PCM stores the VIN that it receives and reports it to the scan tool via OBDII mode 09. It is possible that either PCM or BCM have the incorrect VIN stored to cause the VIN to be displayed incorrectly.</p> | <ol style="list-style-type: none"> 1. Start a manual vehicle session using the proper VIN. 2. Download and run the BCM-Configuration application. 3. Download and run the PCM-Relearn Vehicle Data Application 4. Cycle the ignition and clear all DTCs. 5. Verify the PCM now reports the proper VIN by restarting the scan tool session or by running the PCM OBD-II Mode 09 application. |
| <p>VIN Mismatch Window displaying a message stating that one or more modules contain the incorrect VIN</p> | <p>The modules displayed with the incorrect VIN may have been swapped or configured incorrectly.</p> | <ol style="list-style-type: none"> 1. Determine if the module(s) was swapped from another vehicle. Module swapping is not supported. Install a service replacement part per the WSM installation procedures. 2. If no modules were swapped, download, and run the configuration application for the module containing the incorrect VIN. 3. Cycle the ignition off/on 2x. Run the ALL CMDTC test and clear DTCs. Verify that no U3002 DTCs for VIN mismatch return. |
| <p>Unable to Retrieve VIN or VIN displayed is XXXXXXXXX</p> | <p>When FDRS is unable to obtain the VIN from the PCM, it will attempt to obtain the VIN from the BCM as a backup. If FDRS cannot obtain the VIN from either module, FDRS will not be able to automatically obtain the VIN and start a session. This may be due to an error in communication between FDRS, VCM and these two modules. Suspect a vehicle side concern.</p> | <p>Start a manual vehicle entry session and then run the network monitor application. Document the modules which are not responding to FDRS. Follow the appropriate diagnostic path from WSM, Section 418-00 to identify the cause of the network concern.</p> |

Figure 2



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Module Programming Pre-Checks

- Verify that the 12-volt battery is maintained between 12.6 volts and 13.6 volts using approved Rotunda tools, including the GRX-3590 or DCA-8000 units. Refer to the 12-Volt Battery Testing, Charging, Maintenance And State Of Charge For Module Programming section in this article for additional recommendations and testing.
- Verify that the BCM Battery State of Charge % (BATT_SOC%) PID is reading 75% or greater. Refer to the 12-Volt Battery Testing, Charging, Maintenance And State Of Charge For Module Programming section in this article for additional recommendations and testing.
- Inspect the vehicle for possible aftermarket electronic accessories that may be connected to the vehicle's network wiring. These devices may include remote start kits, GPS devices, radios, alarms, insurance dataloggers, gauge packs/pods, and hotspot devices. They may be located on or near the kick panels, dash A-pillars, glove box, center console, or near the DLC.
- Verify that accessory loads are off, including headlamps, heated/cooled seats, and the climate control system blower motor.
- Verify that the scan tool and vehicle communication interface are at the latest available software levels. The latest levels of each can be downloaded from PTS > Rotunda tab > Diagnostic Tool Support > Download Software.
- Verify that if a module has been replaced, that the correct replacement part has been installed. Refer to the Service Replacement Parts section in this article.
- Verify that the module is properly communicating. Refer to the Module Communication section in this article.
- Verify that service messages (PTS Alerts, TSB, SSM, etc) have been reviewed, not only for the customer's original vehicle concern but also for messages which might be related to the programming being attempted.

Module Programming Errors And Troubleshooting

Communication Errors

| Error Encountered | Detailed Description | Repair Action |
|---|---|--|
| <ul style="list-style-type: none"> • Unable To Communicate With The Module • Could Not Communicate With The VCM | <p>FDRS was unable to communicate with the module. This may be due to a fault on the vehicle's network or with communication to a specific module. It may also be possible that a diagnostic file used by the FDRS scan tool or</p> | <ul style="list-style-type: none"> • Re-attempt the programming application with a different laptop, uninstall/reinstall FDRS, or delete the VIN from the previous sessions list and retry. |

| Error Encountered | Detailed Description | Repair Action |
|--|---|--|
| <ul style="list-style-type: none"> • Procedure Unsuccessful - EstablishComms Could Not Communicate With The VCM. • Make Sure That All Cables Are Connected • Unable To Communicate With The Vehicle. Check All Cable Connections And Make Sure The Ignition Is Switched On. | <p>information within the <u>FDRS</u> servers is incorrect.</p> | <ul style="list-style-type: none"> • Determine if the module can complete an on-demand <u>DTC</u> self-test and pass a network test. If the module(s) fail either test, suspect a module or network communication fault. Refer to the Module Communication section in this article. |

Missing Data Errors

| Error Encountered | Detailed Description | Repair Action |
|---|--|---|
| <ul style="list-style-type: none"> • Exception Trying To Obtain Backup Configuration Data • Unable To Obtain Software Binary File • Modified Configuration Data Is Missing From Ford Server • Manifest Not Found In FENIX Responses • Software Files Not Found. Please Report This To The Technical Hotline. • Diagnostic Tester Was Not Able To Retrieve New Flash Files From The Server • Unable To Obtain DExx Range Data | <p><u>FDRS</u> was unable to obtain module configuration data or software files from the Ford servers. Internet connectivity, upload/download speeds or missing data from the Ford servers may contribute to these errors.</p> | <ul style="list-style-type: none"> • Re-attempt the programming application with a different laptop, uninstall/reinstall <u>FDRS</u>, or delete the <u>VIN</u> from the previous sessions list and retry. • Verify that the computer being used has a strong internet connection, fast internet connection and all anti-virus and firewall type programs are disabled. Refer to the Equipment, Tooling And Dealer Infrastructure section in this article. • Retry on a different network, a hardwired vs. wireless internet connection, and/or with a mobile hotspot. Refer to the Equipment, Tooling And Dealer Infrastructure section in this article. |

Parts and GVMS Warning Errors

| Error Encountered | Detailed Description | Repair Action |
|--|---|--|
| <ul style="list-style-type: none"> • Invalid Hardware • Part Number Is Null For: | <p><u>FDRS</u> reads the part number from the vehicle and was unable to find a corresponding software lineage on the Ford servers. This may be due to the incorrect module having been installed or</p> | <ul style="list-style-type: none"> • Verify that service messages (<u>PTS</u> Alerts, <u>TSB</u>, <u>SSM</u>, etc.) have been reviewed, not only for the customers original vehicle concern but also for messages which might be related to |

| Error Encountered | Detailed Description | Repair Action |
|--|---|---|
| <ul style="list-style-type: none"> • Procedure Aborted - Get Files From GIVIS • Unable To Obtain Flash Action Part Numbers | <p>a fault with the software lineage on the Ford servers.</p> | <p>the programming being attempted. Refer to the Emerging And Known Concerns section in this article.</p> <ul style="list-style-type: none"> • If a module was replaced, verify that both the installed service part number and engineering part number are valid for the VIN. Verify against the HVBoM, the online 1878 order form (infotainment modules) or the ECAT catalog that the part installed is correct. Refer to the Service Replacement Parts section in this article. |

Flash Failures

| Error Encountered | Detailed Description | Repair Action |
|---|--|--|
| <ul style="list-style-type: none"> • Reprogramming Has Failed. Would You Like To Retry? • Application Not Valid – Programming Failure • Check Valid App Fail • Procedure Unsuccessful- ValidateFlashActionDIDsAgainstModule Update Was Not Successful • The Software Update Process Does Not Apply To New Modules. Please Run The PMI Process For New Modules. | <p>The module has failed the flash process via the CAN. It is possible that the module programming pre-checks have not been completed, that a module or network communication fault exists, or that an error in the Ford servers exists.</p> | <ul style="list-style-type: none"> • Verify that all programming pre-checks have been completed. Refer to the Module Programming Pre-Checks section in this article. • Verify that the module power, ground, and network wiring has been checked. Refer to the Module Communication section in this article. • If a module has been replaced, verify that is correct for the vehicle. Refer to the Service Replacement Parts section in this article. |

Security Failures

| Error Encountered | Detailed Description | Repair Action |
|---|---|--|
| <ul style="list-style-type: none"> • Security Access Failure • This Application Has Been Aborted • Unable To Acquire Module Security Clearance | <p>FDRS was unable to successfully gain security access to the Module. This may be caused by module or network communication errors. This may also be caused by the FDRS database containing the incorrect security key for the module.</p> | <p>Verify that the module can complete a network test and/or on-demand DTC self-test. Refer to the Module Communication section in this article.</p> |

Configuration Failures

| Error Encountered | Detailed Description | Repair Action |
|--|---|---|
| <ul style="list-style-type: none">• DE0x Range Failure• Failed To Restore Module Configuration.• Exception Writing Configuration To Module | <p>The module did not accept the configuration data written to it in one or more Data Identifier (DID) ranges. This may happen when the configuration data being written is incorrect for the installed hardware or based on the software on the module. This may be the result of an incorrect part being installed, the module being flashed with the wrong software, or the configuration data being written is incorrect.</p> | <ul style="list-style-type: none">• Verify that all programming pre-checks have been completed. Refer to the Module Programming Pre-Checks section in this article.• Verify that the module can complete a network test and/or On-Demand DTC self-test. Refer to the Module Communication section in this article. |

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NOTE: This information is not intended to replace or supersede any warranty, parts and service policy, workshop manual (WSM) procedures or technical training or wiring diagram information.