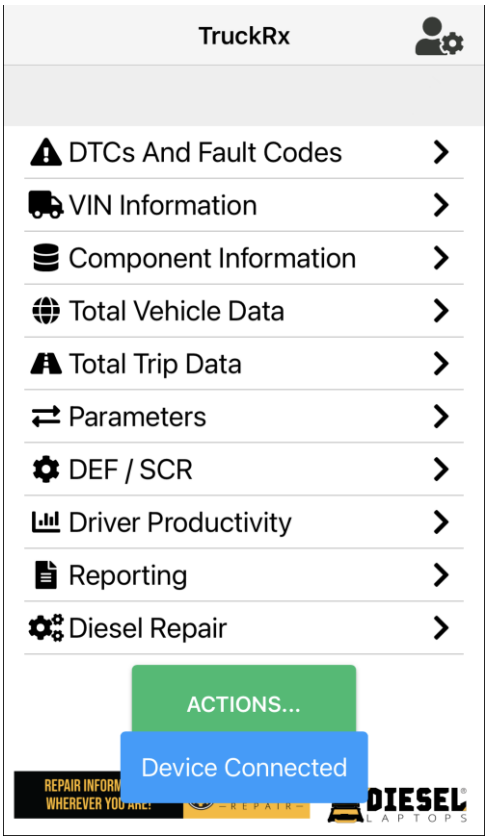

TruckRx
User Manual

Document Revision: 04/28/2022

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1. Table of Contents

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Safety Information

This product is designed to be used with the Diesel Laptops Miniature VDA (MVDA/Mini-VDA). The user is assumed to have a good understanding of the potential hazards of working with vehicles and equipment in a shop environment. There are numerous safety situations that cannot be enumerated or foreseen, so Diesel Laptops recommends that the user read and follow all safety messages in this manual, on all shop equipment, from vehicle manuals, internal shop documents, and operating procedures.

- Always block/chock all wheels when testing.
- Use caution when working around electricity due to the risk of shock from vehicle and building-level voltages.
- Do not smoke or allow sparks/flame near any part of the vehicle fuel system or vehicle batteries.
- Always work in a well-ventilated area. Route vehicle exhaust fumes to the outdoors.
- Do not use this product where fuel, fuel vapors, or other combustibles could ignite.

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2. Overview and Functionality

2.1. For the Driver and Small Fleet

TruckRx (DDM) software is aimed primarily at heavy-duty truck drivers and small fleets as a productivity tool. A truck driver can view live parameters such as "Instantaneous Fuel Economy," "Average Trip Fuel Economy," and "Hard Braking Events" along with DTCs and fault codes. The driver will also be able to store historical vehicle information in a Truck Data Report.

The software provides DTCs and faults so that the user can look up those DTCs and get repair information (wiring diagrams, component locators, labor time guides, and specification values) through applications like https://repair.diesellaptops.com and reference repair parts through https://parts.diesellaptops.com. The call can be made about stopping now or later, and possibly having repair parts waiting for the vehicle. The driver can also notify dispatch with the DTCs (or upload a Truck Data Report) to the fleet office and the dispatcher can set up an appointment for the driver along their intended route.

2.2. For the Technician

There are many times a technician needs a fast diagnosis of the complete vehicle since many OEM applications only focus on their specific ECM(s). DDM is a highly functional "triage" tool that provides the essential features needed in a generic J1708/J1587 and J1939 diagnostics application. The application only requires a smart phone (or tablet), so the technician does not need to break out a Windows-based laptop and an RP1210 vehicle diagnostic adapter.

DDM can be ran very quickly when connecting to a vehicle to get DTCs and parameters. If data suggests that running an OEM application is needed, then the user can launch the OEM application for more detailed diagnostics and testing of that ECM.

2.3. High-level Features

2.3.1. J1939 and J1708/J1587 DTCs

- Displays J1939 and J1708/J1587 DTCs from all ECMs in text form.
    - DDM displays all J1939 and J1708/J1587 DTC types (including emissions-related DTCs).
    - DDM displays J2012 (OBDII) DTCs transmitted over J1939.
    - DDM allows clearing of all J1939 DTCs, J1708/J1587 fault codes, and J1939 Emissions Monitors.

2.3.2. Parameters

- DDM can display over 17,000 J1939 parameters (PGNs/SPNs) and over 300 J1587 parameters (PIDs) both in English and Metric units. These parameters include numeric values (i.e. temps and pressures) as well as displaying complex binary parameters (i.e. Off, On, Engaged, Disengaged).
    - DDM displays Total Vehicle and Total Trip Information such as fuel used and total hours.
    - DDM allows the resetting of J1939 Trip information to help track and measure vehicle trip performance.

2.3.3. Component Information

- Display ECM component information such as VIN, Make, Model, Serial Number, and Unit Number.

2.3.4. Reporting

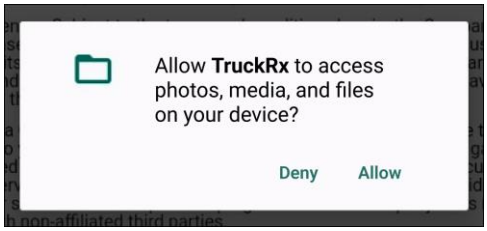
- DDM allows the user to generate a Truck Data Report in HTML form that can be viewed and printed by any web browser. The report can easily be emailed and shared with others.

2.3.5. Historic Vehicle Data

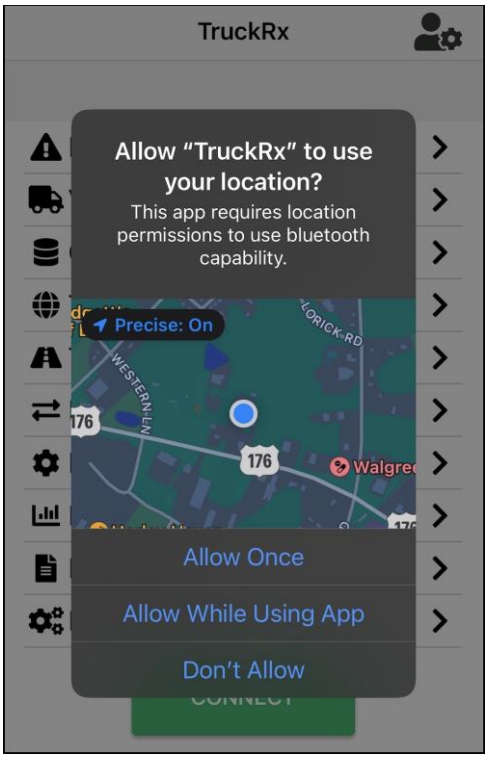
- After DDM connects and reads vehicle data, DDM transmits the data to a Diesel Laptop server for storage. This data can be accessed by the owner of the vehicle (or a delegated third party) and allows discovery of maintenance patterns and trends over the vehicle's lifetime.
    - Diesel Laptops does not share this data with any third parties.
    - Vehicle reports are available through email if the end-user can prove ownership of the vehicle.
        - If a user can provide ownership of a vehicle, that person will be able to designate a third-party for access to their vehicle data.
    - In the future a web-based portal (requiring secure sign-in/authentication) will be available allowing the user access to these reports.
        - Until this web portal is complete, users can request access to these reports via email.

3. Installing and Running the Application

When DDM runs on a mobile phone or tablet for the first time, it will request permission to access the filesystem. The application uses this access to store the User's Manual and vehicle reports such that the PDF and HTML viewers can access the files. Click **Allow** to continue.



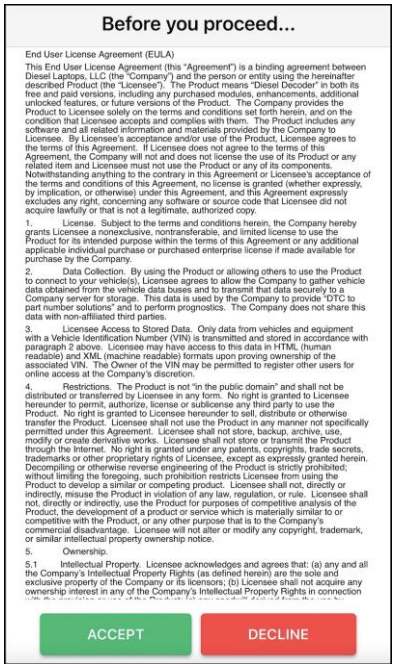
When the user attempts to connect to an MVDA for the first time, DDM will request permission to access the device's location. This is required by the operating system to allow access to the Bluetooth radio, which is used to communicate with the MVDA. Click **Allow Once** or **Allow While Using App** to continue.



4. Licensing the Application

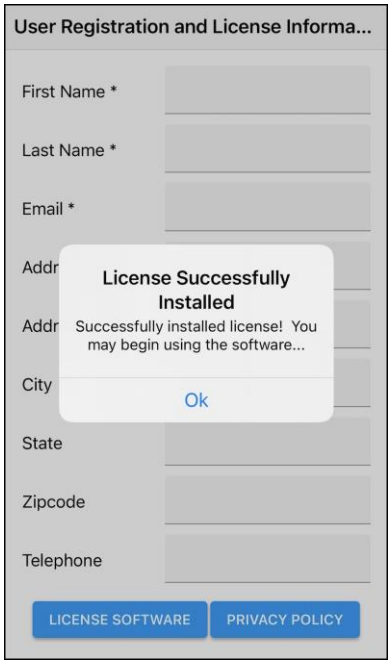
Once a user clicks **ACCEPT** on the End-User-License-Agreement (EULA), the first thing DDM does is to check for the existence of a valid license. DDM is free-of-charge, however the application must be licensed. In the absence of a license, the following dialog box will appear.

NOTE: You must be connected to the Internet to install a valid license.



The mandatory fields are the users **First Name**, **Last Name**, and **Email Address**. If you wish for Diesel Laptops to send you periodic mailers or call you with important information, you can fill in the address and telephone number fields.

Once you have filled in the form, press the **License Software** button. If successful, then the following dialog box will appear, and the **License Information** grid will be populated with license information.



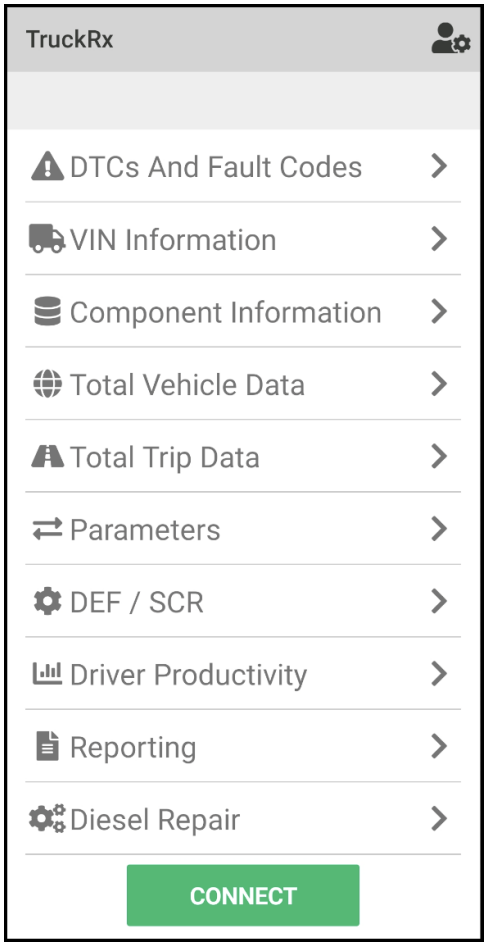
After this dialog box appears, you will not be prompted to install a license again. Click **OK** to continue.

5. Main Screen

The main screen will now appear. Each entry on the main screen will take the user to a specialized screen and these are covered in their own section of this user manual.

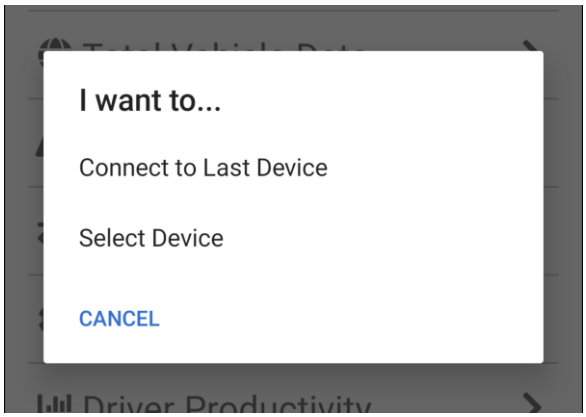
To change program settings, please press the settings icon in the upper right corner of the screen. This will take you to the Settings Screen.

To start a connection, press the ***CONNECT*** button. You will be prompted as to what device you would like to connect to. See the next chapter, MVDA Selection Screen.

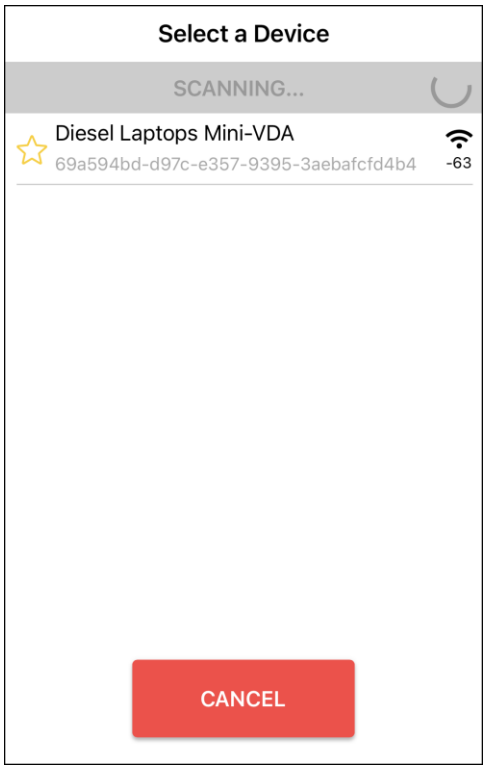


6. MVDA Selection Screen

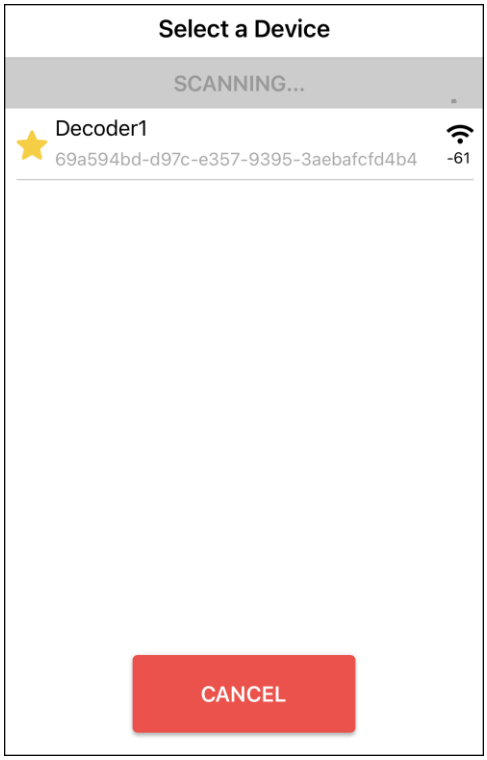
When the user presses the **CONNECT** button, it gives the user the option of connecting to the last used MVDA or selecting another device from a list of devices that are available. The following is the dialog box that will appear.



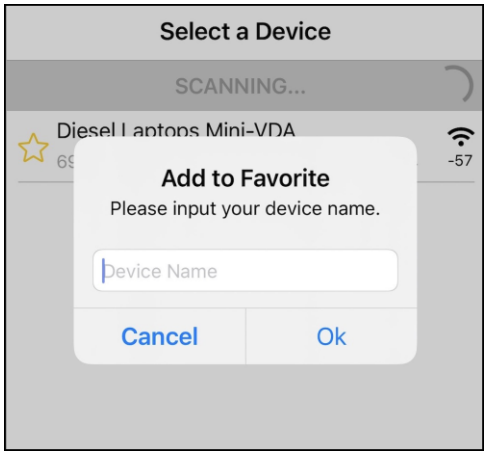
- **Connect to Last Device** will connect to the last MVDA device that was successfully connected to.
- **Select Device** will bring up a list of MVDA devices that are awake (powered up) and within range.
    - The following screen will appear.



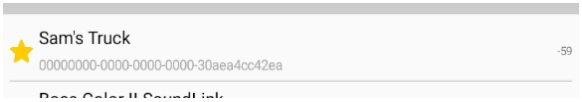
In this image, there is only one "**Diesel Laptops Mini-VDA**" listed. In the event there were two or more devices (such as in a shop environment with multiple trucks - below) you would look at the numbers below the MVDA. These numbers represent the Bluetooth address of the device, and the last 12 digits will match the device's serial number as printed on the packaging. If the serial number is not available, we recommend that you determine the correct device by turning off other devices in the area or moving to a different location. After establishing the serial number of the correct device, it may be labeled with a "favorite device" name as explained below.



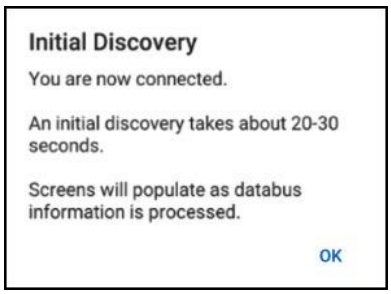
NOTE: Since there could be multiple devices within range, we recommend that the end-user click on the star icon to the left of your device to make it a "favorite device" and give a name to it.



Below is "Sam's Truck" MVDA.



After you select the device, you will see the following dialog box if the connection is successful:



Press the **OK** button and you will be returned to the main screen, from where you can begin your diagnostics session.

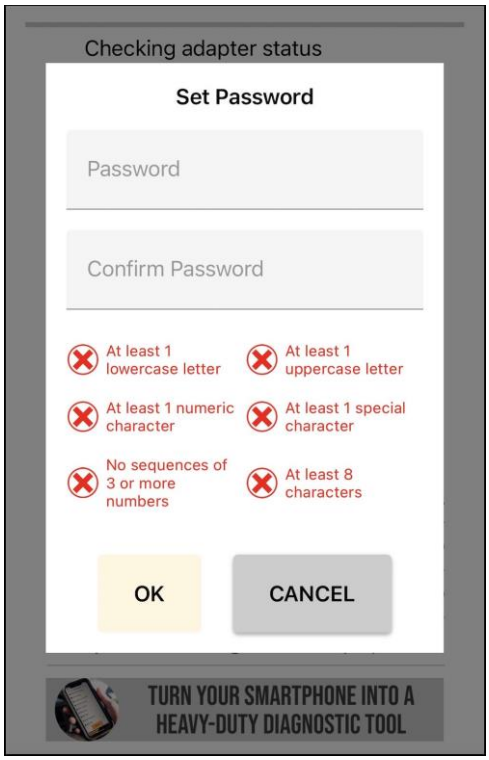
7. Protecting Access to the MVDA

Diesel Laptops has gone to great lengths to prevent unauthorized access to your vehicle data. The hardware, firmware, and software all have safeguards built in to protect unauthorized access to your vehicle's information.

7.1. Setting the MVDA password

The first time an MVDA is connected to, Diesel Laptops requires protecting access to that MVDA by prompting for a password required to access that MVDA. The application cannot continue until a password has been set.

Like many Bluetooth devices, the MVDA ships without a password, and relies on the initial pairing process to establish a secure connection between the MVDA and the mobile device. We recommend that the initial setup of a new MVDA be performed in a secure environment, away from other potential users of the Diesel Decode software and other MVDAs. This ensures completing the password setup without another user connecting to your MVDA.



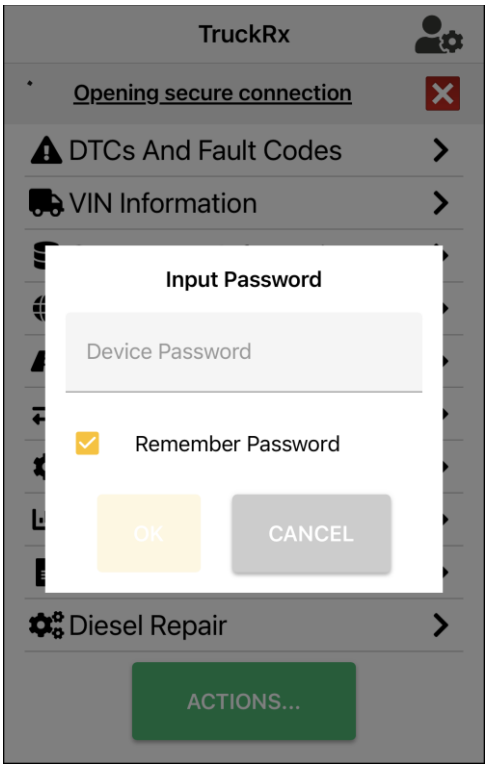
NOTE: It is highly recommended that the user provides a very strong and secure password.

The password must:

- Be at least 8 characters in length.
- Must include at least 1 lowercase and at least 1 uppercase letter.
- Must include at least 1 number and 1 special character (~`!@#$%^&*()_+={}|\[],./?><).
- Must contain no sequences of letters or numbers greater than three (i.e. 234, abc).

7.2. Using the MVDA password

When the DDM application connects to an MVDA, it uses the password to unlock access to the vehicle data over that connection. The user can select **Remember Password** to avoid re-entering the password on every connection. The password is stored securely in a private storage area on the mobile device.



7.3. Resetting the Password (Factory Reset)

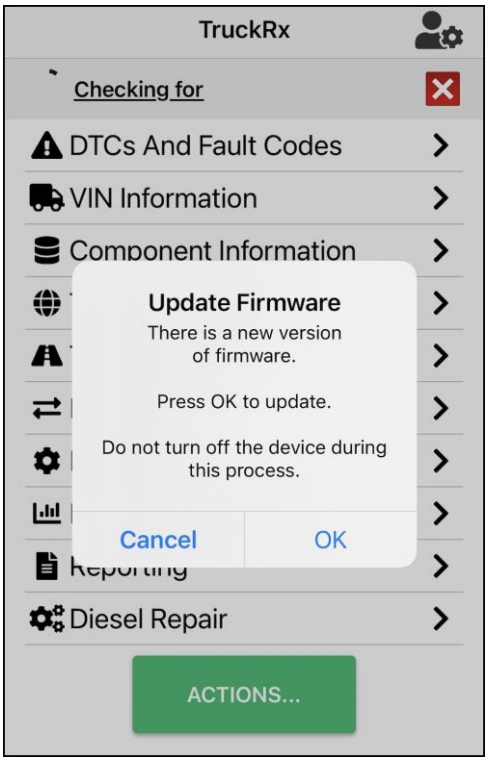
If the password to an MVDA is lost, it may be reset by installing the MVDA in a vehicle and following these steps:

- Ensure the parking brake remains set for this entire procedure.
- Turn the key to accessory position.
- Perform the following actions, with no more than 10 seconds between the first and last accelerator pedal press.
    - Accelerator pedal down, release.
    - Brake pedal down, release (1st time).
    - Brake pedal down, release (2nd time).
    - Brake pedal down, release (3rd time).
    - Brake pedal down, release (4th time).
    - Brake pedal down, release (5th time).
    - Accelerator pedal down, release.

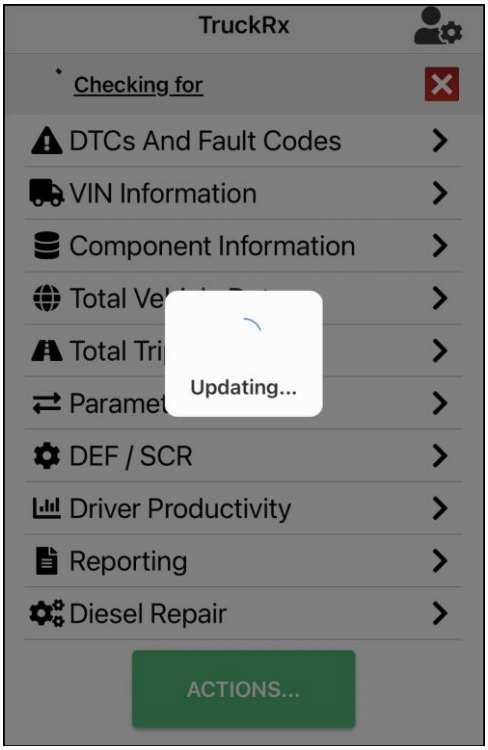
When this sequence is observed on the data bus by the MVDA, it will reboot, and the LED will flash blue/red alternating. This indicates that the MVDA has been reset to factory condition and is ready to accept a new password.

8. MVDA Firmware Updates

Occasionally, Diesel Laptops may release updates for the firmware that runs inside the MVDA device. When an update is available, DDM will prompt to begin the update. Press **OK** to update the firmware.



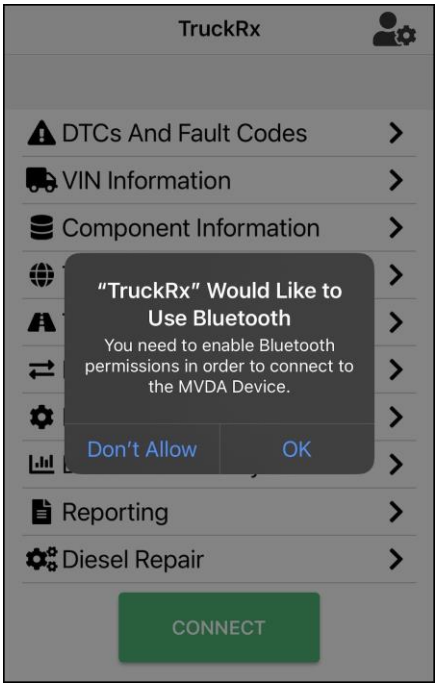
The update typically takes 6-10 minutes and will display a progress indicator while it is running.



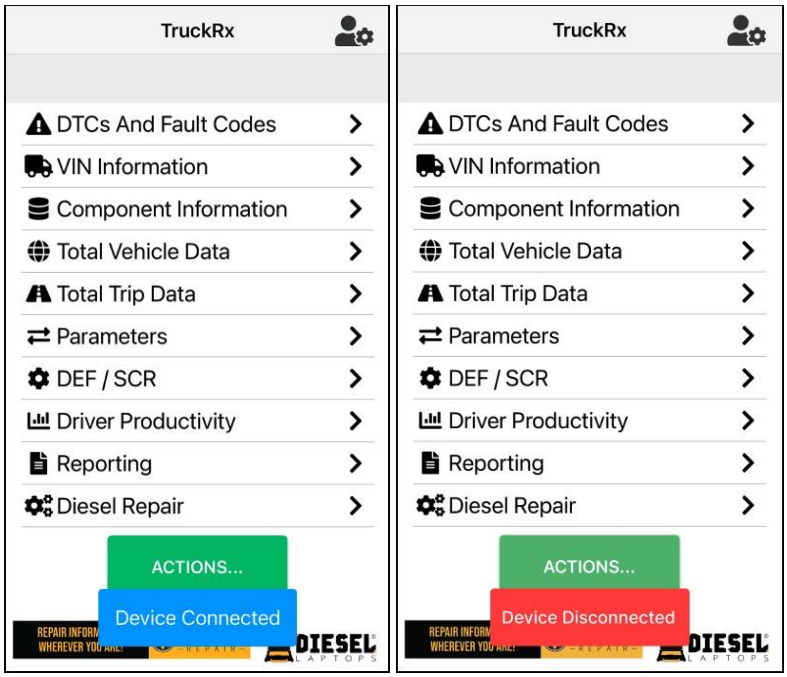
When the update is complete, the device will reboot and DDM will attempt to reconnect. The new firmware version may be verified on the MVDA INFO screen.

9. Bluetooth Connectivity Status

TruckRx will ask users if they would like to use a Bluetooth connection which is required in order to connect to the MVDA Device. Click **OK** to connect.

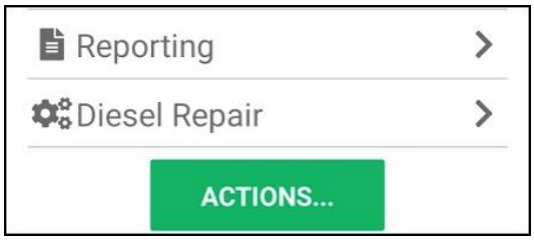


Additionally, TruckRx's Bluetooth Connectivity feature communicates whether a user is successfully connected via Bluetooth. If a user is successfully connected they will notice a blue-colored banner at the bottom of the screen reading, "Device Connected." If a user is not properly connected or becomes disconnected for some reason, a red-colored banner reading, "Device Disconnected" will appear, warning them of their disconnected status.

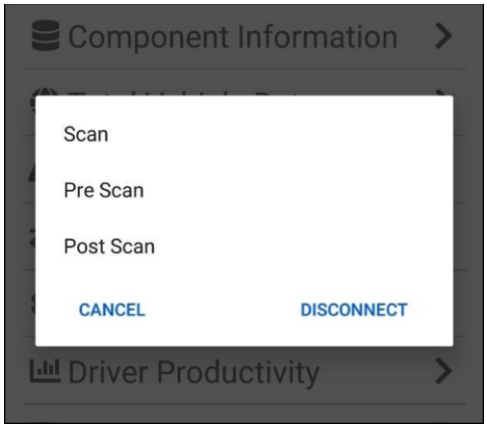


10. Actions Page and Button

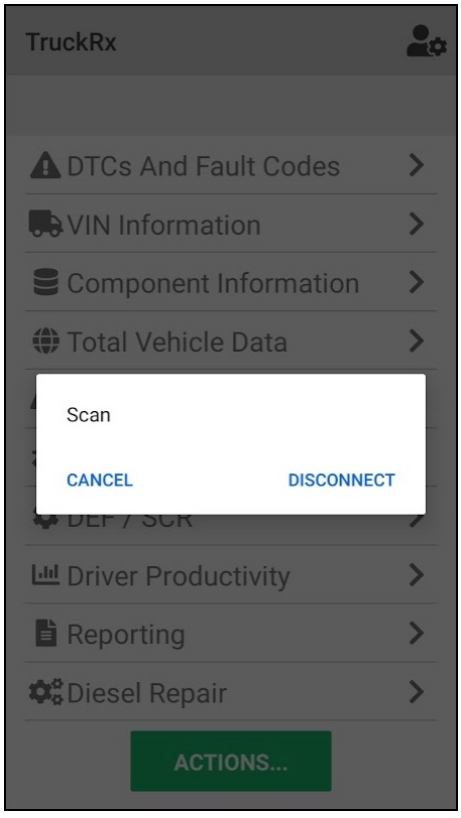
This feature allows users to choose an action they wish to perform. Users will be able to choose between Scan, Pre Scan, and Post Scan to start their work.



Once a user clicks on the **ACTIONS** button, the screen will display any available scanning options. Users who possess a shop ID will see Scan, Pre Scan and Post Scan. Users without a shop ID will only see Scan as an option. When a user selects the type of scan they wish to perform, the scan process will initiate.

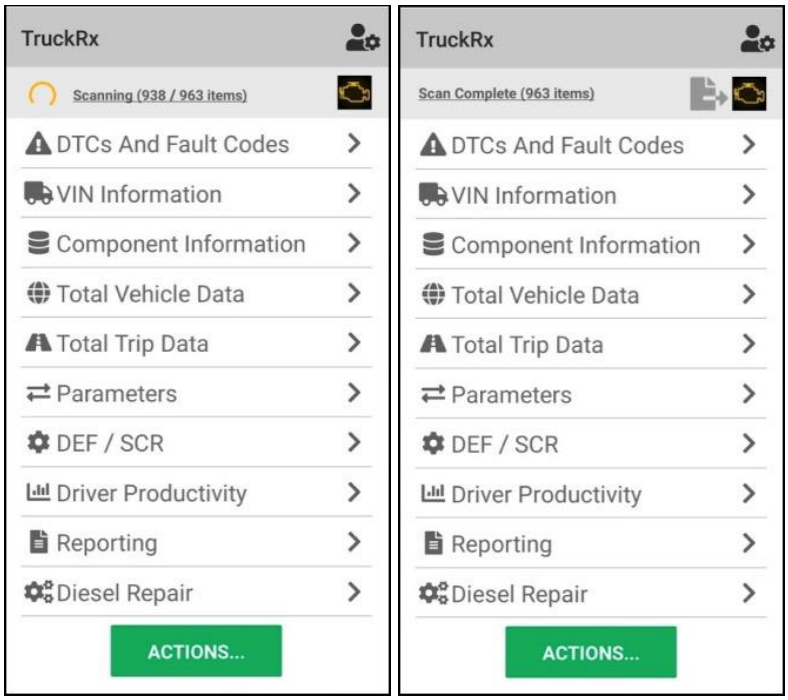


In order to disconnect from the vehicle being scanned, a user must select **DISCONNECT**.

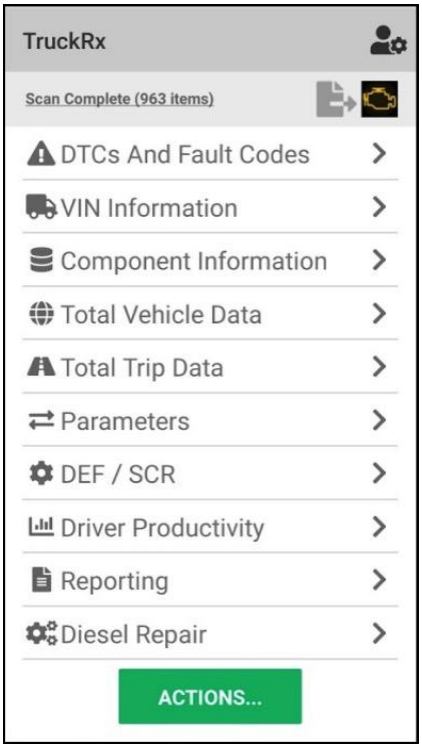


11. Scanning Progress Icon, Progress Tracker, and Scan Sending Icon

This feature displays the progress for each scan a user performs, giving users the information they need to be informed on how long it will take for a vehicle's data to be made available in-app. Users will see a clickable "Scanning XXX/XXX Items" on each scan. Once a scan is complete, the tracker will read, "Scan Complete XX/XXX."



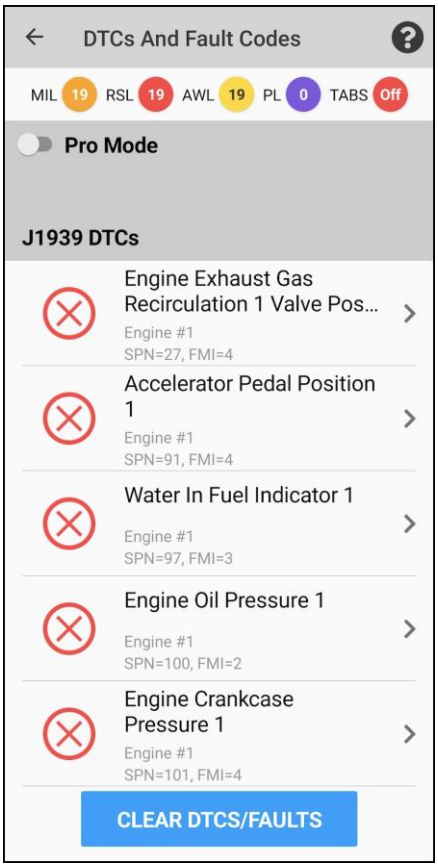
To the right of the Scanning Progress Tracker is the Scan Sending icon, comprised of a page and an arrow that indicates when a pre or post scan has been sent. When in the process of sending, the icon will appear grey in color, and if the scan fails to send, the icon will turn red.



NOTE: Silent reports do not yield the Scan Sending icon.

12. DTCs and Fault Codes Screen

This screen displays J1939 DTCs (all J1939 DTC types), J1708/J1587 fault codes, and J2012 DTCs (OBDII DTCs transmitted over the J1939 data bus). It also allows the end-user to request clearing of those DTCs.



12.1. DTC Vehicle Health-at-a-Glance Sections

There are two sections that provide a quick display of overall vehicle health. They are the **J1939 DTC Counts** section and **Individual DTC Counts** section.

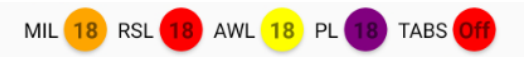
12.1.1. J1939 DTC Counts

This section (at the top) shows information from the J1939 "DTC Counts" (PGN 40448) message. This information is typically from the ECM that is required to send "emissions-regulated" data.

Field	Description
Perm	Current number of Permanent DTCs that are Active.
Act MIL	Current number of Emission-Related MIL-On DTCs.
MIL On	Current number of Emission-Related Inactive MIL-On DTCs.
All Pnd	Current total number of All Pending DTCs, including Emission-Related.
Pnd	Current total number of Pending DTCs, including Emission-Related.

12.1.2. Overall DTC Counts

This section (at the bottom) shows overall DTC totals where a DTC is requesting a dashboard lamps to be illuminated. These totals are different than the "J1939 DTC Counts" section above. This section provides a count of all the DTCs (from all ECMs) that have requested one of the malfunction lights (i.e. MIL, RSL) be illuminated.

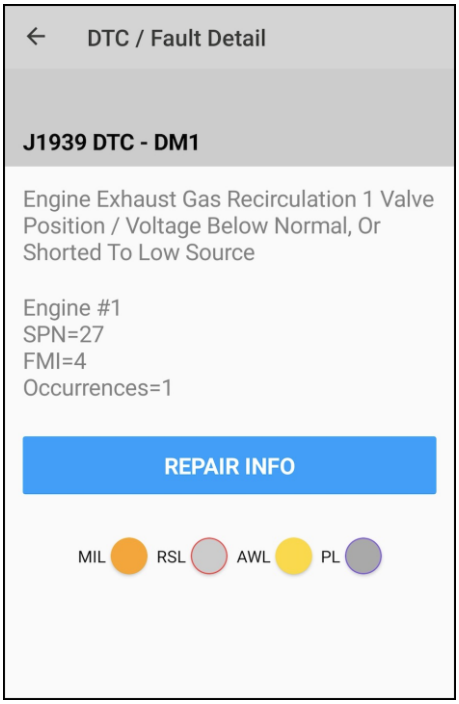


Field	Description
MIL	Number of Malfunction Indicator Lamp (MIL) MIL-On DTCs
RSL	Number of Red Stop Lamp (RSL) RSL-On DTCs
AWL	Number of Amber Warning Lamp (AWL) AWL-On DTCs
PL	Number of Protect Lamp (PL) PL-On DTCs
TABS	Indicates if the Trailer ABS (TABS) Fault Lamp is "On" (see note below).

- The TABS (Trailer ABS) lamp will illuminate if the vehicle is gatewaying PLC4TRUCK information from the trailer to the J1708/J1587 databus and the TABS fault message is being sent by the trailer ABS module.

12.2. DTCs Grid

The DTCs grid shows all the J1939 DTCs, J2012 DTCs, and J1587 fault codes. Due to the space limitations on a mobile device, the initial screen only has a brief description (Code/FMI). For more information press the ">" button on the right to be taken to the ***DTC / Fault Detail*** screen. The screen displayed will have more information:



A DM43 (DTC-A Previously Active) DTC with SPN=1010, FMI=12, Count=10
Lamps Turned On for DTC = MIL, RSL, AWL, PL

For more information about DTC types, press the Help (**Question Mark**) button in the upper right corner. This will bring up the DTC Types Screen.

12.3. J1939 DTCs

The following are a description of the fields in the J1939 section and in the DTC/Fault Detail screen:

Field	Field Description
Type + Icon	The J1939 DTC Type (see DTC Types Screen).
SRC Description	The description of the source address (i.e. Engine #1).
SPN	The Suspect Parameter Number (SPN) of the DTC as defined by SAE.

FMI	The Failure Mode Indicator (FMI) as defined by SAE.
Count	The Occurrence Count of the DTC.
SPN/FMI Description	The SPN/FMI converted to text as defined by SAE.

12.4. J1939 J2012 DTCs

These are J2012 (OBDII) DTCs (sometimes called "P" codes) that are transmitted over the J1939 data bus. Some OEMs and component manufacturers transmit DTCs in J2012 format (i.e. Allison Transmissions).

The J2012 DTC is a letter followed by a 4-letter number (the "code"). The first digit indicates the source of the code:

- P Powertrain
- C Chassis
- B Body
- U Network

The following are a description of the fields in the J2012 section and in the DTC/Fault Detail screen:

Field	Field Description
Type + Icon	Active and Inactive are the two J2012 fault types.
SRC Description	The description of the source address (i.e. Engine #1).
Code	The OBDII (J1979) fault code defined in SAE J2012 (i.e. "P" code).
Code Description	The fault code converted to text as defined by SAE J2012.
Count	The Occurrence Count of the DTC.

12.5. J1587/J1708 Fault Codes

The following are a description of the fields in the section and in the DTC/Fault Detail screen:

Field	Field Description
Type + Icon	Active and Inactive are the only two J1587 fault types.
MID	The MID (source address) of the DTC.
MID Description	The description of the MID (i.e. Engine #1).
Type	There are two sub-types of faults in J1587: • PID – indicates trouble with a "parameter" (i.e. Engine Oil Pressure). • SID – indicates trouble with a "component" (i.e. Oil Pressure Sensor).
Code	The actual fault code (two detailed fault types – see "Type" above): • PID/FMI • SID/FMI
FMI	The Failure Mode Indicator (FMI) as defined by SAE.
Count	The Occurrence Count of the DTC.
Code/FMI Description	The PID/FMI or SID/FMI converted to text as defined by SAE.

12.6. Clear DTCs/Faults Button

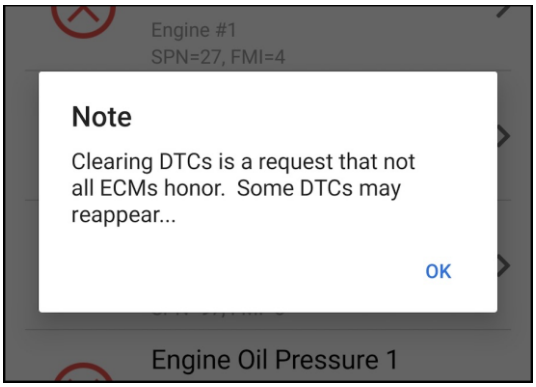
This button will request that **"ALL"** J1939 DTCs and J1587 Inactive Fault Codes be cleared from all ECMs. Note that this may clear other information such as J1939 OBD Monitors (see Notes Pertaining to Clearing DTCs below).

The key should be on and the engine should not be running!

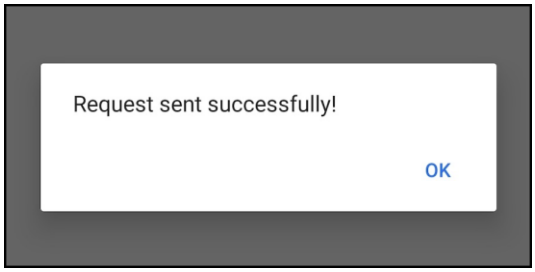
Clearing of DTCs and faults is a "request". Not all ECMs will honor that request. Some DTCs and faults may reappear.

This action sends out the J1939 DM3, DM11, and DM55 message to all active ECMs on the J1939 databus. It also sends out J1587 PID 195. For more information on what each message clears, see Notes Pertaining to Clearing DTCs below.

When the button is pressed, the following dialog box appears. Press the **OK** button to continue.



After the button is pressed, the following dialog box will appear that the request has been sent.



12.6.1. Notes Pertaining to Clearing DTCs

Message	Notes from J1939/73
DM3	Used to clear all diagnostic information pertaining to Inactive DTCs. Products not subject to OBD regulations may choose to support DM3. When supported, all diagnostic information pertaining to Inactive DTCs should be erased. The diagnostic data associated with Active DTCs will not be affected. For products subject to OBD regulations, the DM3 service shall not be supported.

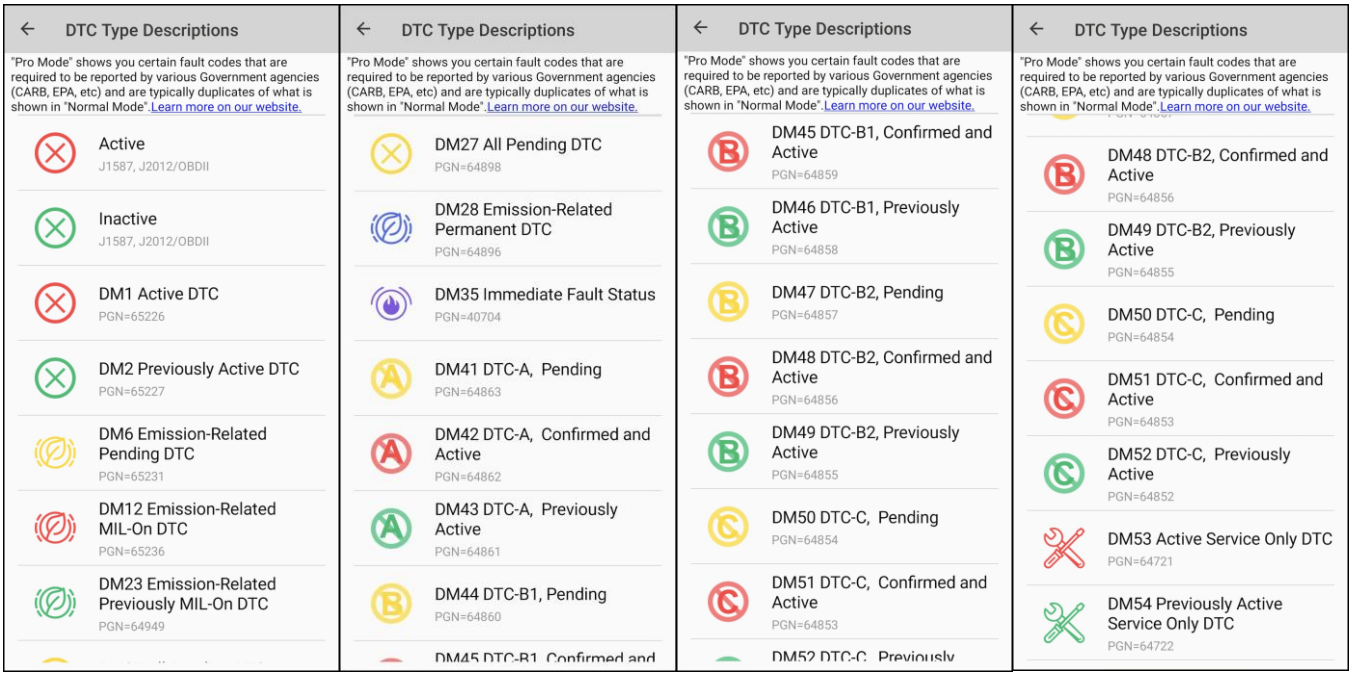
DM11	Clears all diagnostic information pertaining to Active DTCs. The following items are affected:
	• Number of DTCs.
	• DTCs for Pending, Active and Inactive malfunctions.
	  ○ Active DTCs.
	  ○ Inactive DTCs.
	  ○ Emission-Related Pending DTCs.
	  ○ Emission-Related Previously MIL-On DTCs.
	  ○ All Pending DTCs.
	• Number of DTCs and readiness information.
	  ○ Number of Active DTCs in ECU.
	  ○ Number of Inactive DTCs in ECU.
	  ○ Readiness information.
	  ○ Number of MIL-On DTCs and Previously MIL-On DTCs.
	• Trouble code for freeze frame data.
	• Freeze frame data.
	• Status of system monitoring tests.
	• All monitor Test Results.
	• Distance traveled while MIL is activated.
	• Number of warm-ups since DTC cleared.
	• Distance since DTCs cleared.
	• Minutes run by the engine while MIL is activated.
	• Time since DTCs cleared.
	• Other OEM specific “clearing/resetting” actions may also occur.

DM55	Clears all diagnostic information pertaining to Active Service Only DTCs. Inactive DTCs should be erased as well. The following items are affected: • Number of DTCs. • Trouble code for non-emission related freeze frame data. • Non-emissions related freeze frame data. • All non-emissions related monitor Test Results.

	• Other OEM specific “clearing/resetting” actions may also occur.
J1587 PID 195	Request counts be cleared for all DTCs/fault codes on the J1708/J1587 network.

13. DTC Types Screen

SAE or TMC have not defined icons for DTC types. Diesel Laptops created icons for each DTC type, however DDM also displays the J1939 DM type underneath the icon as well as an acronym to help with the interpretation. Since the technician may not be familiar with these icons or DM types, this screen was inserted. In J1587 and OBDII (J2012) there are only Active and Inactive (A/I). The following is a list of the J1939 DTC Types along with acronym and description.



J1939 DM Type	Acronym	Description
DM1	A	DM1 Active DTC
DM2	I	DM2 Previously Active DTC
DM6	EP	DM6 Emission-Related Pending DTC
DM12	EA	DM12 Emission-Related MIL-On DTC
DM23	EI	DM23 Emission-Related Previously MIL-On DTC
DM27	AP	DM27 All Pending DTC
DM28	PT	DM28 Emission-Related Permanent DTC
DM35	IFS	DM35 Immediate Fault Status
DM41	A,P	DM41 DTC-A, Pending
DM42	A,CA	DM42 DTC-A, Confirmed and Active
DM43	A,PA	DM43 DTC-A, Previously Active
DM44	B1,P	DM44 DTC-B1, Pending
DM45	B1,CA	DM45 DTC-B1, Confirmed and Active
DM46	B1,PA	DM46 DTC-B1, Previously Active
DM47	B2,P	DM47 DTC-B2, Pending
DM48	B2,CA	DM48 DTC-B2, Confirmed and Active
DM49	B2,PA	DM49 DTC-B2, Previously Active
DM50	C,P	DM50 DTC-C, Pending
DM51	C,CA	DM51 DTC-C, Confirmed and Active
DM52	C,PA	DM52 DTC-C, Previously Active
DM53	A,SO	DM53 Active Service Only DTC
DM54	I,SO	DM54 Previously Active Service Only DTC

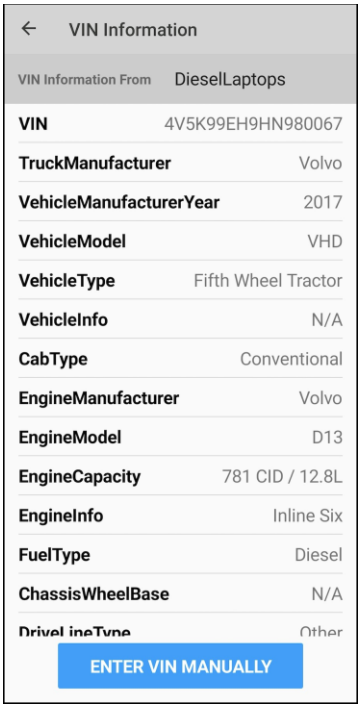
The following dialog box will be displayed, noting:

- J1939 has 22 different types of DTCs that are displayed.
    - Many of the J1939 DTC types (beyond Active/Inactive) are emissions-related, some legislated.
    - Some are part of the World-Wide Harmonization (WWH) effort between SAE and the International Standards Organization (ISO).

14. VIN Information Screen

The VIN Information screen displays information about the vehicle based on the VIN. There are three different sources for decoding VIN information in a dropdown box (in order of priority):

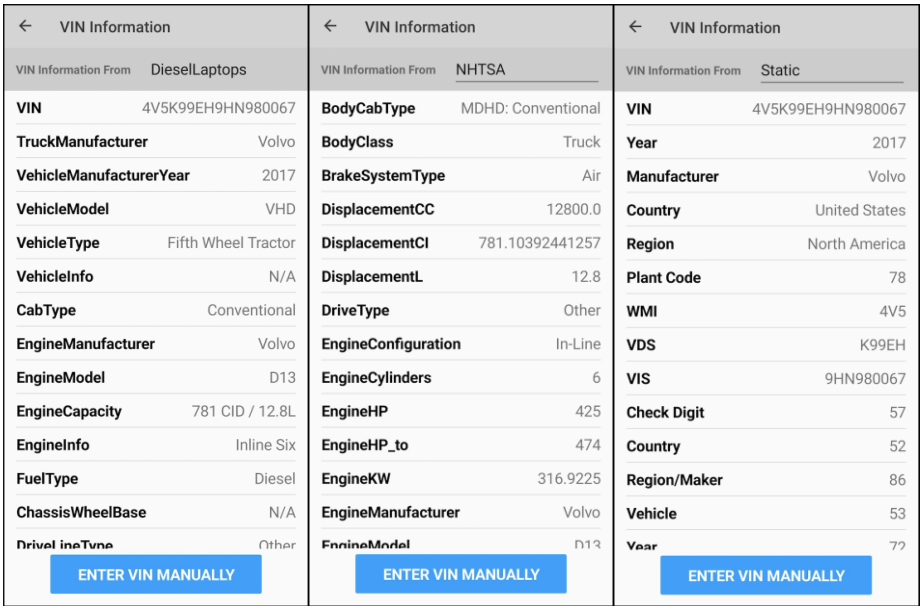
- Diesel Laptops VIN Server
    - Diesel Laptops has a VIN server that breaks the VIN into user-friendly information.



- NHTSA VIN Server
    - The NHTSA VIN server displays the most information about the vehicle. However, it is not as user friendly as the Diesel Laptops VIN Server.
- Statically Decoded VIN Information
    - This is the most basic information about a vehicle.

The user selects the source for VIN information from the combination box at the top of the screen.

Below are the images from the three VIN information sources for comparison.



15. The Components Screen

The components screen displays information about the individual ECMs that are on the vehicle.

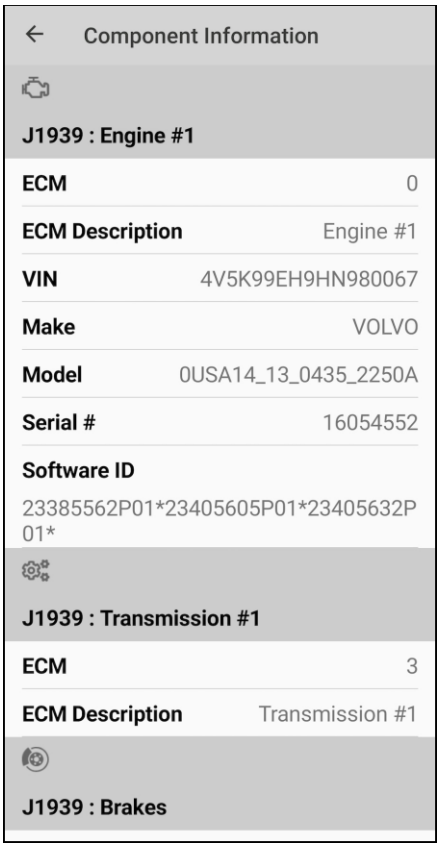
Note that it is common for some of the fields not to populate. Not all ECMs support component messages, however each ECM that is transmitting on the databus will appear in the list.

This list can assist in CAN bus debugging by showing if an ECM is transmitting. Here are the steps to try this:

1. Turn off vehicle.
2. Gets the DDM software ready to connect.
3. Turn on the vehicle.
4. Connect with DDM software, writes down the ECMs on the databus.
5. The user waits about 1 minute.
6. The user disconnects and connects again to see if an ECM dropped off the databus (CAN BUS OFF condition).

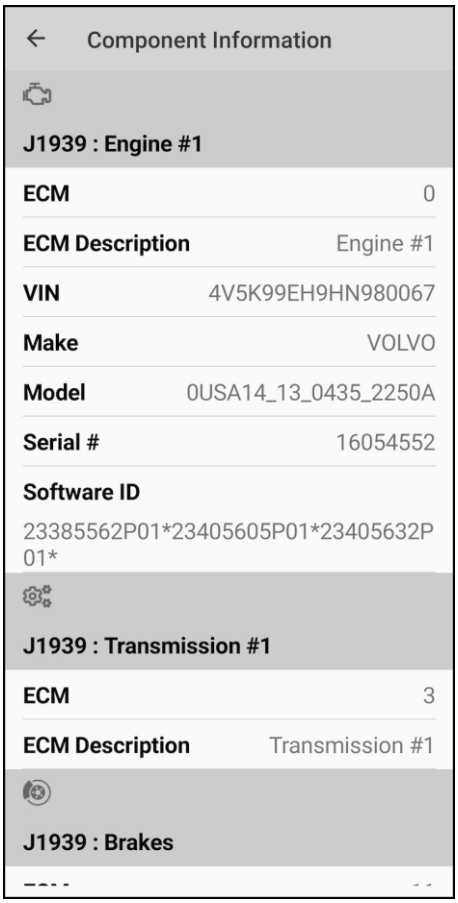
15.1. J1939 Component Information

This grid shows information about the vehicle and ECMs on the J1939 and J1587 networks.



The following are a description of the fields in the J1939 portion of the grid:

Field	Field Description
ECM	The source address of the component.
ECM Description	The description of the source address (i.e. Engine #1).
VIN	Vehicle Identification Number.
Make	The 5-digit TMC VMRS code for the manufacturer.
Model	Model information for the ECM.
Serial #	Serial Number for the ECM.
Unit #	Unit Number for the ECM (rarely populated).
Software ID	Software version information for the ECM.
ECM Part #	The ECM part number for the ECM.
ECM Serial #	Serial number for the ECM.
ECM Location	Location of the ECM (rarely populated).
ECM Type	J1939 Type of the ECM (rarely populated)

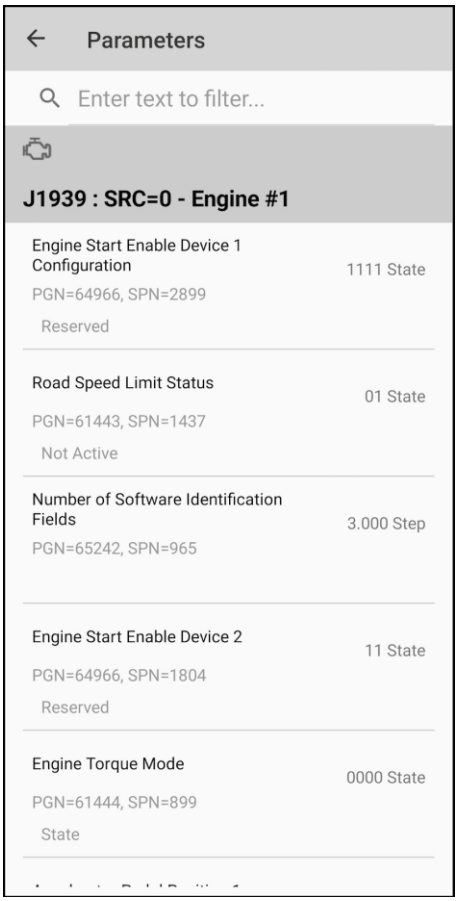


The following are a description of the fields in the J1587 portion of the grid:

Field	Field Description
MID	The MID (source address) of the component.
MID Description	The description of the MID (i.e. Engine #1).
VIN	Vehicle Identification Number.
Make	The 5-digit TMC VMRS code for the manufacturer.
Model	Model information for the ECM.
Serial #	Serial Number for the ECM.
Unit #	Unit Number for the ECM (rarely populated).
Software ID	Software version information for the ECM.

16. Parameters Screen

The parameters screen can display over 17,000 J1939 PGN/SPN combinations as well as over 300 J1708/J1587 PIDs. These parameters can be numeric values (temps, pressures), ASCII values such as Make/Model, and binary values such as “Cruise Control is Not Engaged”.



16.1. J1939 Parameters Grid

In the J1939 grid, parameters are sorted first by SRC address, then PGN, then SPN. The data set becomes very wide, so clicking on the column header will allow the end-user to hide columns. The following are a description of the fields in the grid:

Field	Field Description
SRC	The source address of the ECM sending the parameter.
SRC Description	The description of the source address (i.e. Engine #1).
PGN	The J1939 Parameter Group Number (PGN). A PGN can hold many Suspect Parameter Numbers (SPNs).
PGN Description	The description of the J1939 PGN.
SPN	The Suspect Parameter Number (SPN). This is “the parameter” being displayed.
SPN Description	The description of the SPN.
Metric Value	The value in metric of the parameter.
Metric Units	The units in metric of the parameter.
English Value	The value in English of the parameter.
English Units	The units in English of the parameter.
ASCII/Binary Value	If a parameter is ASCII or binary in nature, this will be the decoded text of the parameter.

16.2. J1587 Parameters Grid

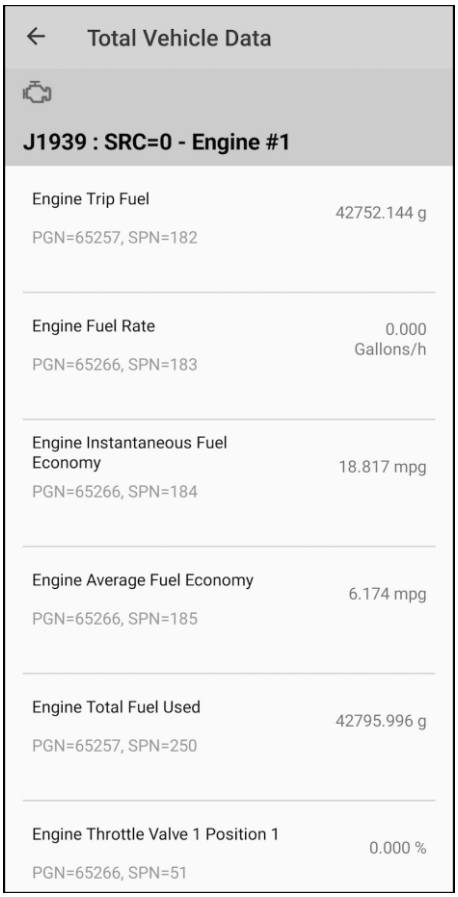
In the J1587 grid, parameters are sorted first by MID, then PID. The data set becomes very wide, so clicking on the column header will allow the end-user to hide columns. The following are a description of the fields in the grid:

Field	Field Description
MID	The MID (source address) of the ECM sending the parameter.
MID Description	The description of the MID (i.e. Engine #1).
PID	The J1587 Parameter Identifier (PID).
PID Name	The description of the J1587 PID.

Sub PID	Sometimes a PID has multiple parameters in it (i.e. J1939 PGN with 10 SPNs - this is the equivalent).
Sub PID Description	The description of the Sub PID.
Metric Value	The value in metric of the parameter.
Metric Units	The units in metric of the parameter.
English Value	The value in English of the parameter.
English Units	The units in English of the parameter.
ASCII/Binary Value	If a parameter is ASCII or binary in nature, this will be the decoded text of the parameter.

17. Total Vehicle Data Screen

The **Total Vehicle Data** screen is a subset of the **Parameters Screen**. It is focused only on J1939 PGN/SPNs and J1587 PIDs tracking total vehicle data such as Odometer (sometimes referred to as "Vehicle Distance" or "High Resolution Vehicle Distance"), Total Fuel Used, etc.



17.1. J1939 Parameters Grid

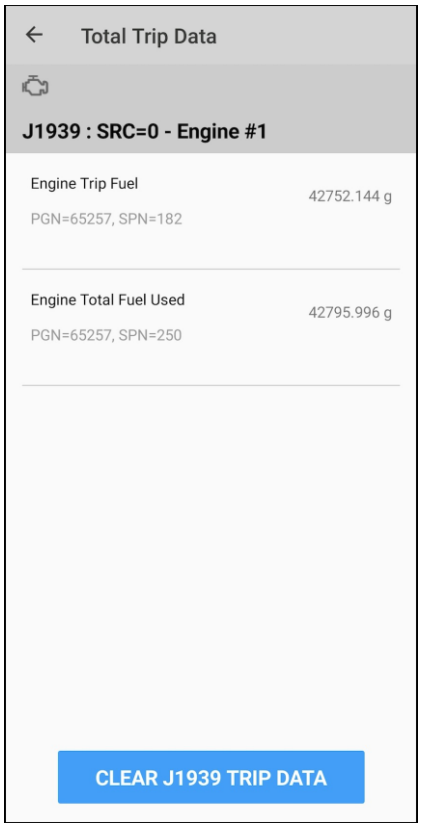
For information on the field definitions, see the section **J1939 Parameters Grid**.

17.2. J1587 Parameters Grid

For information on the field definitions, see the section **J1587 Parameters Grid**.

18. Total Trip Data Screen

The **Total Trip Data** screen is a subset of the **Parameters Screen**. It is focused only on J1939 PGN/SPNs and J1587 PIDs tracking trip data such as Trip Odometer (sometimes referred to as "Vehicle Distance" or "High Resolution Vehicle Distance"), Total Trip Fuel Used, Total Trip Fuel Economy, etc.



18.1. J1939 Parameters Grid

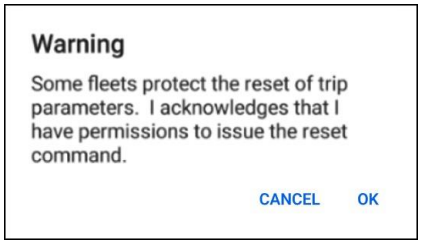
For information on the field definitions, see the section **J1939 Parameters Grid**.

18.2. J1587 Parameters Grid

For information on the field definitions, see the section **J1587 Parameters Grid**.

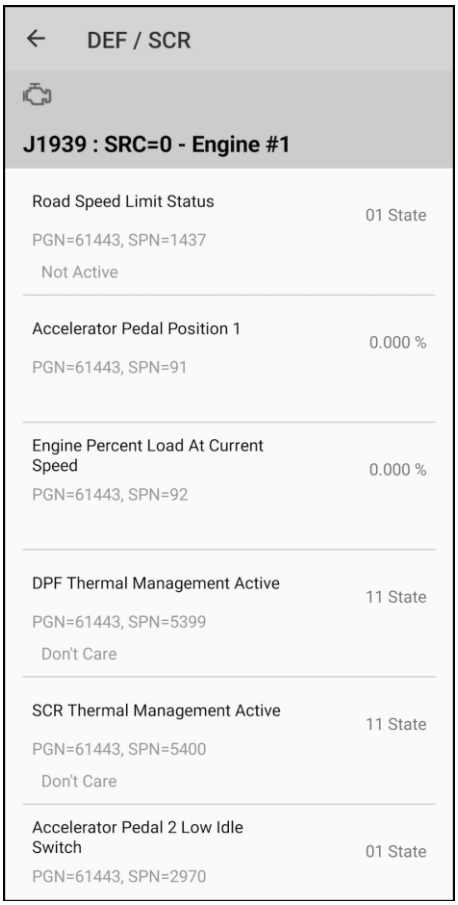
18.3. Clear J1939 Trip Data Button

Pressing the **Clear J1939 Trip Data Button** is for resetting J1939 "trip" parameters. Since this reset message is not supported by all ECMs that are monitoring trip data, or the command may be denied (requiring special password access or an OEM application), trip parameters may not be reset. Since some fleets do not allow all personnel to reset trip parameters, so the following dialog will appear. If you have permission, pressing OK will request that the trip parameters be reset.



19. DEF/SCR Data Screen

The **DEF/SCR Data** screen is a subset of the **Parameters Screen**. It is focused only on J1939 PGN/SPNs and J1587 PIDs tracking DEF, SCR, and other emissions-limiting-systems related parameters.



19.1. J1939 Parameters Grid

For information on the field definitions, see the section **J1939 Parameters Grid**.

19.2. J1587 Parameters Grid

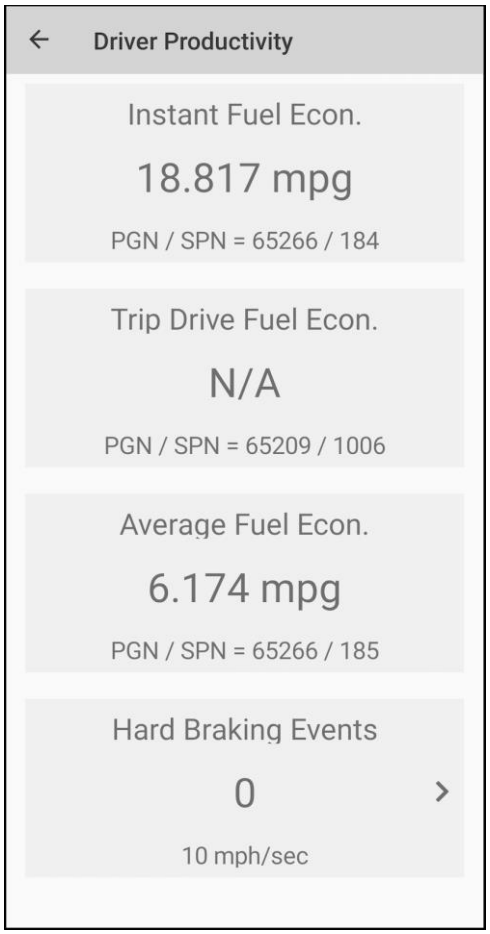
For information on the field definitions, see the section **J1587 Parameters Grid**.

20. Driver Productivity Screen

Note: The driver should be aware of the dangers of distracted driving. Diesel Laptops, LLC shall not be held liable for incidents occurring during the use of this program.

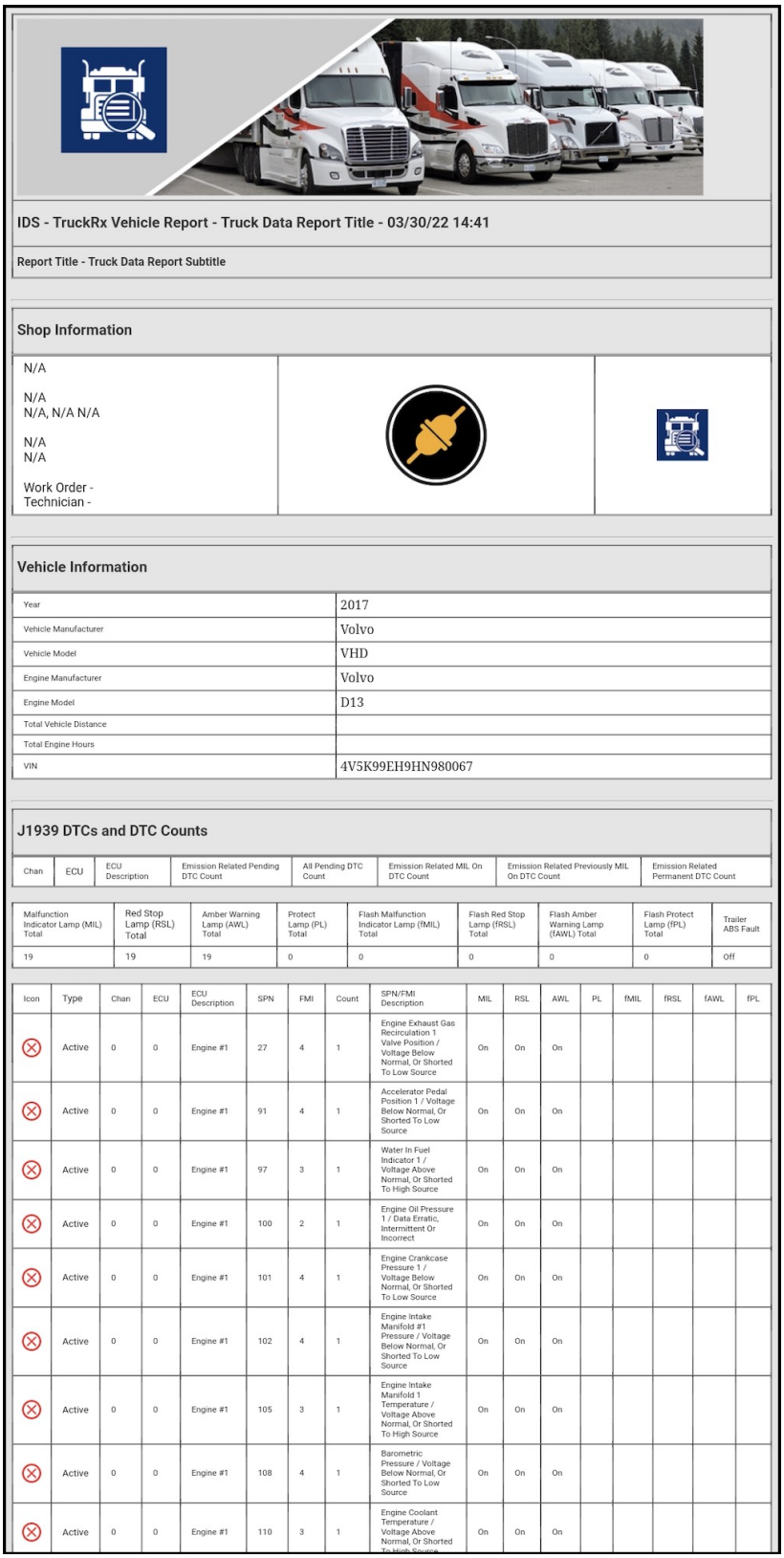
This screen is made exclusively for the driver. It monitors the following parameters that drivers like to see:

- Instantaneous Fuel Economy
- Trip Fuel Economy (Trip Drive Fuel Economy)
- Average Fuel Economy (Vehicle Average Fuel Economy)
- Hard Braking Events (Monitored by the MVDA)
    - To reset hard braking events and the threshold for a hard brake event, press the ">" button. This will pull up a dialog box confirmation that the user wants to reset the count of hard braking events.



21. Reporting Screen

The reporting screen allows the user to save the information obtained during a vehicle scan in an HTML file for viewing, printing, emailing, or for historic purposes. There are three sub-screens, each described below.



IDS - TruckRx Vehicle Report - Truck Data Report Title - 03/30/22 14:41

Report Title - Truck Data Report Subtitle

Shop Information

N/A

N/A
N/A, N/A N/A

N/A
N/A

Work Order -
Technician -

Vehicle Information

Year	2017
Vehicle Manufacturer	Volvo
Vehicle Model	VHD
Engine Manufacturer	Volvo
Engine Model	D13
Total Vehicle Distance	
Total Engine Hours	
VIN	4V5K99EH9HN980067

J1939 DTCs and DTC Counts

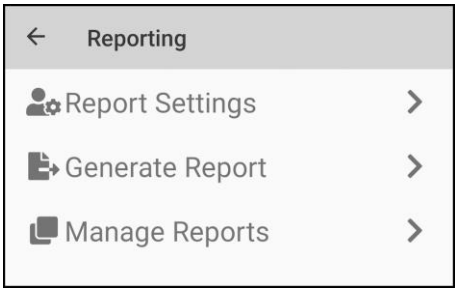
Chan	ECU	ECU Description	Emission Related Pending DTC Count	All Pending DTC Count	Emission Related MIL On DTC Count	Emission Related Previously MIL On DTC Count	Emission Related Permanent DTC Count

Malfunction Indicator Lamp (MIL) Total	Red Stop Lamp (RSL) Total	Amber Warning Lamp (AWL) Total	Protect Lamp (PL) Total	Flash Malfunction Indicator Lamp (fMIL) Total	Flash Red Stop Lamp (fRSL) Total	Flash Amber Warning Lamp (fAWL) Total	Flash Protect Lamp (fPL) Total	Trailer ABS Fault
19	19	19	0	0	0	0	0	Off

Icon	Type	Chan	ECU	ECU Description	SPN	FMI	Count	SPN/FMI Description	MIL	RSL	AWL	PL	fMIL	fRSL	fAWL	fPL
⊗	Active	0	0	Engine #1	27	4	1	Engine Exhaust Gas Recirculation 1 Valve Position / Voltage Below Normal, Or Shorted To Low Source	On	On	On					
⊗	Active	0	0	Engine #1	91	4	1	Accelerator Pedal Position 1 / Voltage Below Normal, Or Shorted To Low Source	On	On	On					
⊗	Active	0	0	Engine #1	97	3	1	Water In Fuel Indicator 1 / Voltage Above Normal, Or Shorted To High Source	On	On	On					
⊗	Active	0	0	Engine #1	100	2	1	Engine Oil Pressure 1 / Data Erratic, Intermittent Or Incorrect	On	On	On					
⊗	Active	0	0	Engine #1	101	4	1	Engine Crankcase Pressure 1 / Voltage Below Normal, Or Shorted To Low Source	On	On	On					
⊗	Active	0	0	Engine #1	102	4	1	Engine Intake Manifold #1 Pressure / Voltage Below Normal, Or Shorted To Low Source	On	On	On					
⊗	Active	0	0	Engine #1	105	3	1	Engine Intake Manifold 1 Temperature / Voltage Above Normal, Or Shorted To High Source	On	On	On					
⊗	Active	0	0	Engine #1	108	4	1	Barometric Pressure / Voltage Below Normal, Or Shorted To Low Source	On	On	On					
⊗	Active	0	0	Engine #1	110	3	1	Engine Coolant Temperature / Voltage Above Normal, Or Shorted To High Source	On	On	On					

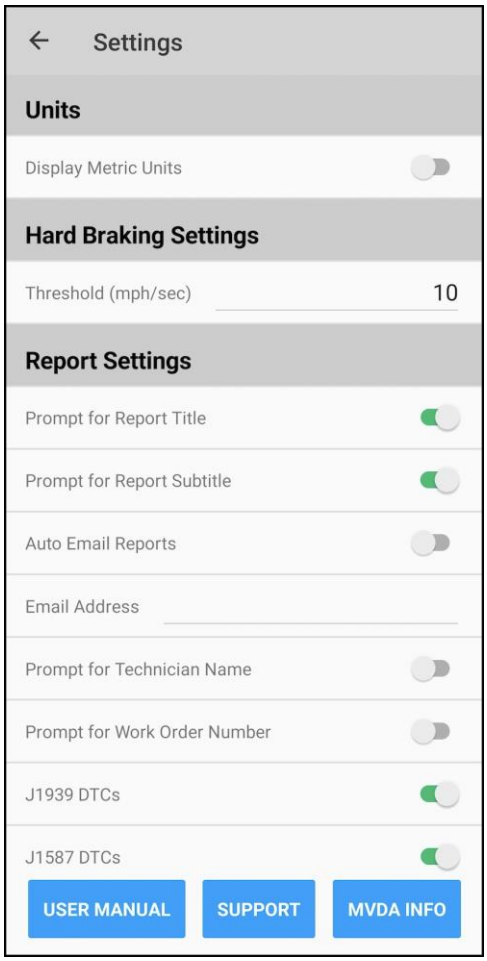
An Example Truck Data Report

21.1. Main Screen



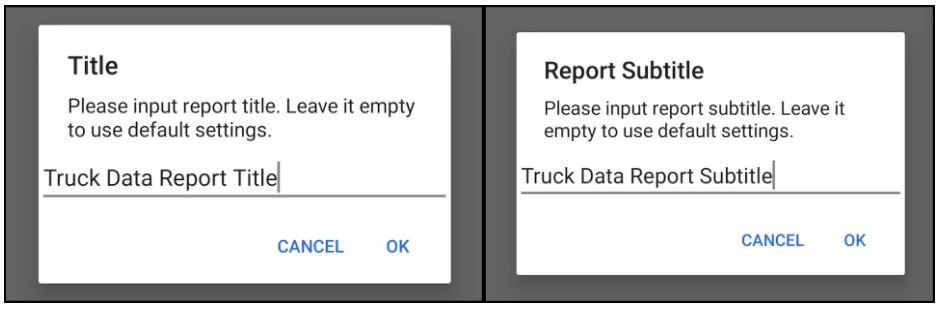
21.2. Report Settings

Report Settings takes the user to the report section of the Settings Screen. The user can set the default report title and subtitle as well as turn on/off various sections of the report.

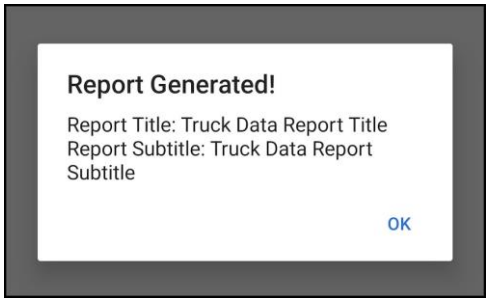


21.3. Generate Report

The user has the option to set the title and subtitle (for easier tracking) of the report. Some fleets like to see “Door Number”, “Unit Number” or other information in these fields. The user is prompted for both before the report is generated. The defaults for these can be set in the reporting part of the Settings Screen.



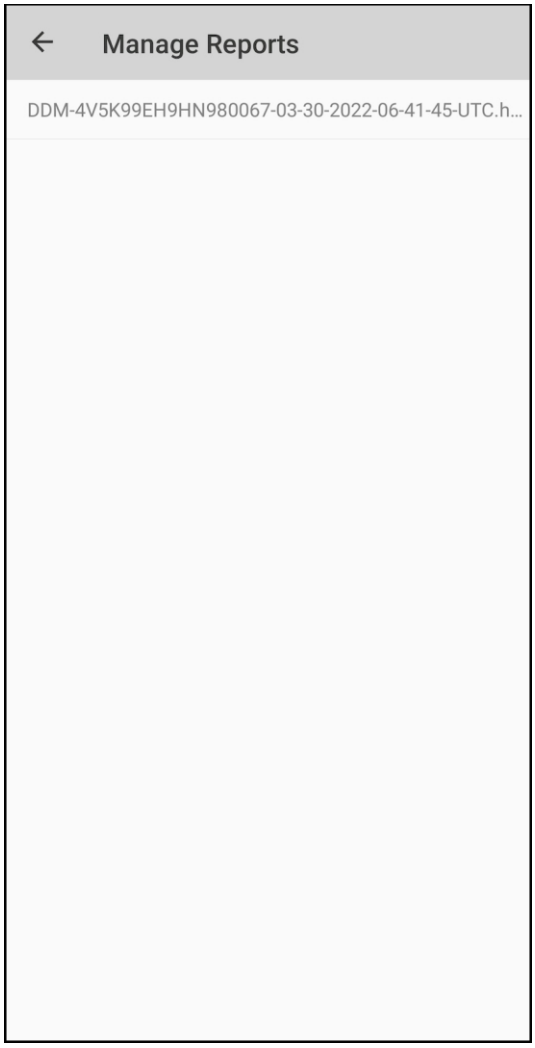
After the subtitle is entered, in about a minute a report will be generated, and then the following screen will appear.



The report is now on the hard drive. It can be accessed using the Manage Reports screen.

21.4. Manage Reports

By going to the Manage Reports sub-menu, you will see a list of all the reports. The example below just shows two.



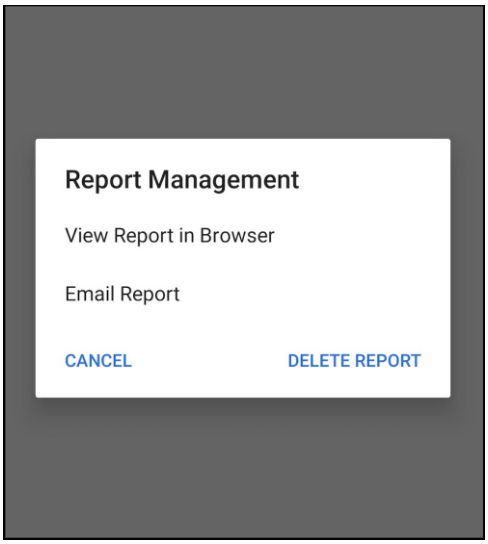
The report file names are broken down in a way to easily see when they were created. See below:

DXP-	Format is Diesel Laptops Diesel Explorer.
XXXXXXX-	VIN
MM-	Month
DD-	Day
YYYY	Year
HH-	Hour (24-hour format) – UTC Time
MM-	Minute (24-hour format) – UTC Time

SS-	Second (24-hour format) – UTC Time
UTC	Reports are based on universal time coordinates (UTC).
.html	The reports are in HTML format for easy viewing in a web browser.

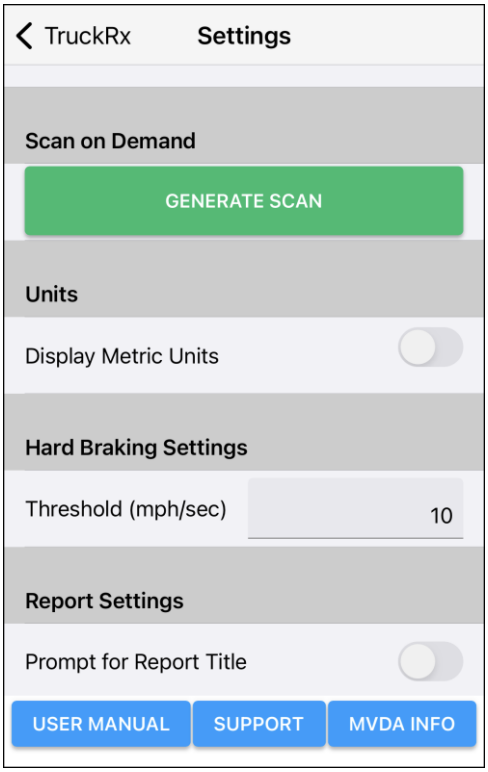
When the user taps on a filename, they will be presented with the following dialog box titled ***Report Management***. From here, the user can:

- Delete the report if it is no longer needed.
- View the report in their currently selected web browser.
- Email the report to an email recipient using the default email client.
    - Many printers now have email addresses, so this makes it easy to print reports.



22. Settings Screen

The Settings screen allows the user to change various options within the program.



22.1. Units

- Display Metric Units
  - The program defaults to displaying English/Colonial units. Turn this on to display units in Metric.

22.2. Hard Braking Settings

- Threshold (mph/sec)
  - Set the desired parameters for reporting hard braking.

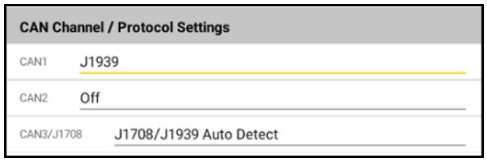
22.3. Report Settings

- Set the default report title and subtitle.
- Individual Report Sections (i.e. J1939 DTCs, J1587 DTCs, J2012 DTCs, Freeze Frames, …)
  - Turns on or off the inclusion of that section in the generated report.

22.4. CAN Channel / Protocol Settings

These settings allow the user to select which channel J1939 data is on if J1939 is not on CAN1. An example would be a Volvo 2013 or newer with an OBDII-to-9-pin adapter.

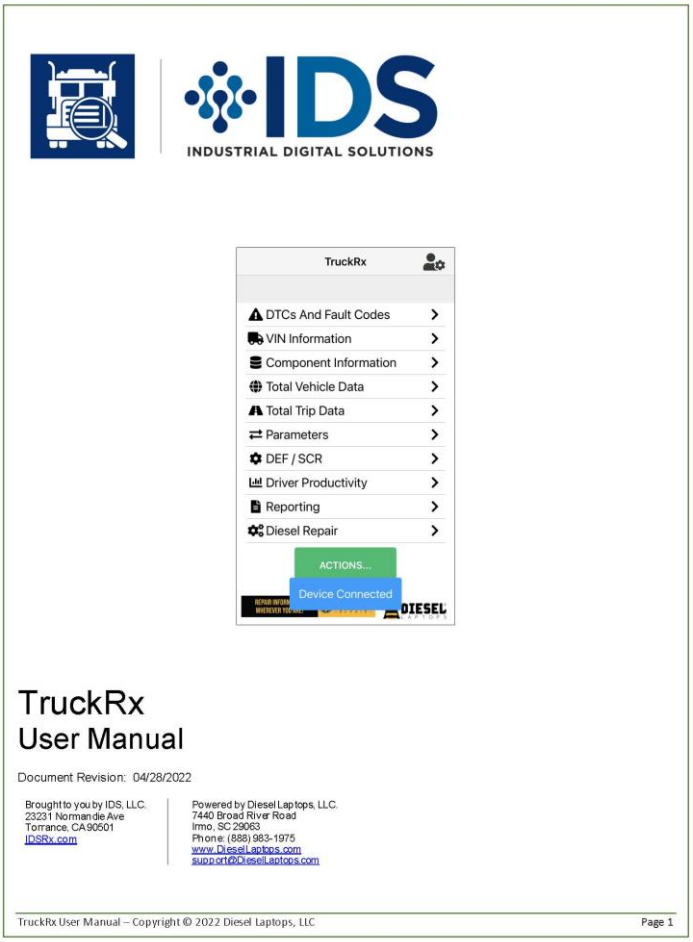
NOTE: Changes to channel protocol settings will take effect only when a new connection is established. If the application is connected to the MVDA when settings are changed, it must be disconnected and reconnected.



- CAN1
  - Options can be J1939 or Off
- CAN2
  - Options can be J1939 or Off
- CAN3
  - Options can be “J1708/J1939 Auto Detect” or Off. The MVDA automatically detects CAN3 as being J1708/J1587 or CAN-based.

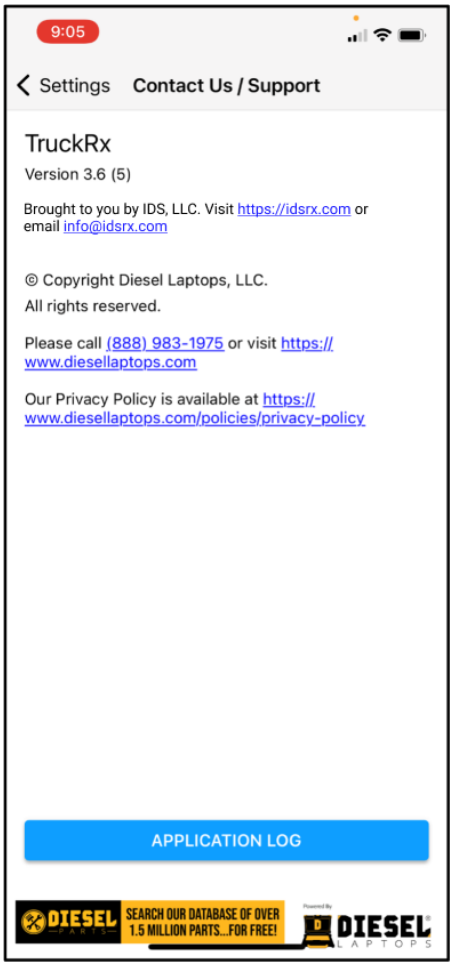
22.5. User Manual

Brings up the user manual for the program, this file.



22.6. Contact Us/Support

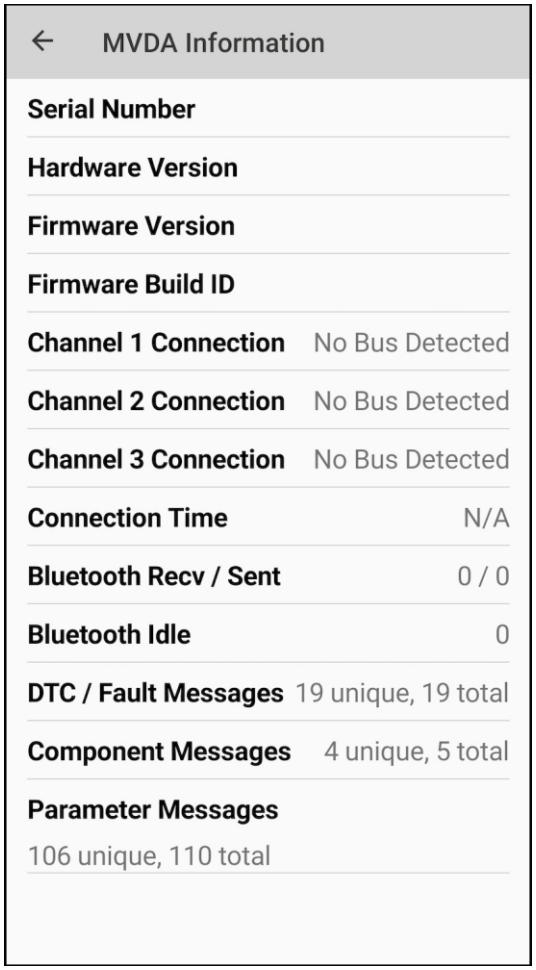
This button brings up the telephone number and website for support at DieselLaptops.com.



22.7. MVDA INFO Button

This button brings up a screen with information about the Mini-VDA unit. This screen is mainly for Diesel Laptops' Technical Support department for debugging purposes (i.e. ***Hardware Version/Firmware Version/Serial Number***).

There are a couple of areas of interest to the end-user. These are the "***Channel 1-3 Connection***" items. They display if there was a CAN connection detected (and baud rate) and whether the CAN3 channel is CAN-based or J1708/J1587 (both allowed protocols on the J1939-13 diagnostic connector CAN3 connection).


MVDA Information
Serial Number
Hardware Version
Firmware Version
Firmware Build ID
Channel 1 Connection No Bus Detected
Channel 2 Connection No Bus Detected
Channel 3 Connection No Bus Detected
Connection Time N/A
Bluetooth Recv / Sent 0 / 0
Bluetooth Idle 0
DTC / Fault Messages 19 unique, 19 total
Component Messages 4 unique, 5 total
Parameter Messages
106 unique, 110 total

23. MVDA Status Indicator LEDs

The MVDA is equipped with a multi-color LED that is visible from the top, near the outside edge.

The following colors and patterns are used to indicate the status of the device:

LED Color/Pattern	Description
Solid Red	Device is powering up.
Blinking Red	Running bus detection and CAN autobaud routine.
Alternating Blue/Red	Device is not setup / has been reset to factory condition (ready to set password).
Solid Green	Device is running, no mobile device is connected.
Slow Blinking Green	Device is running, a mobile device is connected using Bluetooth.
Fast Blinking Orange	Firmware update is in process.

24. Appendix A. Connectors, Pinouts, Protocols, Baud Rates, and Channels

24.1. Introduction

In the 1970's when automobiles added Electronic Control Modules (ECMs), their vehicle networks began with simple protocols and a single channel for that protocol. When Controller Area Network (CAN) was introduced in the late 1980's, most vehicles started with a single CAN channel (powertrain control). The CAN protocol has allowed OEMs and component suppliers to add features and automation that were not possible with the older/slower protocols.

It is common for a vehicle to have 5 or more CAN channels/networks!
Some OEMs have brought 2 or 3 of the CAN channels/networks to the diagnostic connector.

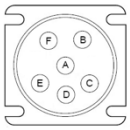
Before we introduce the common connectors, it is good to know that the connectors, pinouts on those connectors, and diagnostic protocols on on-highway vehicles are controlled by "emissions-related" legislation (Environmental Protection Agency – EPA, and California Air Resources Board – CARB). These regulations allow ONLY the SAE J1939/13 9-pin Deutsch connector (common on MD/HD vehicles) and the SAE J1962/OBDII connector (commonly found on light-duty/medium-duty vehicles) noting:

Emissions regulations stipulate only where the pins for the 1st CAN channel (CAN1) will be, and if the protocol on CAN1 will be J1939 (9-pin Deutsch) or ISO15765 (OBDII/J1962). These are the only two legislated protocols and connectors since 2008 (OBDII) and 2016 (9-pin Deutsch).

SAE has defined 3 CAN channels on both emissions-regulated connectors. Some OEMs use the non-regulated pins for other protocols and other CAN channels. Please refer to the service literature for the vehicle you are diagnosing to determine what pins and protocols are being used and which CAN channels are active.

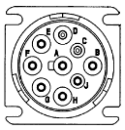
24.2. The 6-pin Deutsch Connector (Not Legislated)

The 6-pin Deutsch connector is mostly associated with older HD vehicles and J1708 is the only protocol.

<table>
<tr><td>Connector
(Grey)</td><td> 
</td></tr>
<tr><td>Pinouts</td><td>
<table>
<tr><th>Pin #</th><th>Function</th></tr>
<tr><td>A</td><td>J1708 High</td></tr>
<tr><td>B</td><td>J1708 Low</td></tr>
<tr><td>C</td><td>Battery Plus (+V), Fused at 10 Amp (unconditioned, unswitched)</td></tr>
<tr><td>D</td><td>OEM Specific</td></tr>
<tr><td>E</td><td>Battery Minus (Ground)</td></tr>
<tr><td>F</td><td>OEM Specific</td></tr>
</table>
</td></tr>
<tr><td>Non-CAN Protocols</td><td>❖ J1708</td></tr>
<tr><td>CAN Protocols</td><td>❖ None</td></tr>
</table>

24.3. The 9-pin Deutsch Connector Type I (Not Legislated)

The 9-pin Deutsch Type I connector is associated with HD vehicles before the 2016 mandate of the J1939 Type II.

Connector (Black, Grey)	

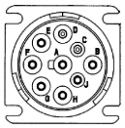
Pin	J1939 Standard	FTL Cascadia	PACCAR <=2009
A	Ground	Ground	Ground
B	Power	Power	Power
C	CAN1, J1939+	CAN1, J1939+	CAN1, J1939+
D	CAN1, J1939-	CAN1, J1939-	CAN1, J1939-
E	CAN1, J1939 Shield	CAN1, J1939 Shield	CAN1, J1939 Shield
F	J1708/J1587+	J1708/J1587+	J1708/J1587+
G	J1708/J1587-	J1708/J1587-	J1708/J1587-
H	OEM Specific	CAN2+	Spare
J	OEM Specific	CAN2-	ISO9141 K-Line

Pin	PACCAR 2010+	NAVISTAR	CNH
A	Ground	Ground	Ground
B	Power	Power	Power
C	CAN1, J1939+	CAN1, J1939+	CAN1, J1939+
D	CAN1, J1939-	CAN1, J1939-	CAN1, J1939-
E	CAN1, J1939 Shield	CAN1, J1939 Shield	ISO9141 K-Line
F	J1708/J1587+	J1708/J1587+	Spare
G	J1708/J1587-	J1708/J1587-	Spare
H	CAN2+	Spare	CAN2+
J	CAN2-	ISO9141 K-Line	CAN2-

Non-CAN Protocols	❖ J1708
CAN Protocols	❖ J1939, CAN, ISO15765
CAN Channels	❖ CAN1, CAN2
CAN Baud Rates	❖ 250, 500

24.4. The 9-pin Deutsch Connector Type II (Legislated)

The 9-pin Deutsch Type II (lime green) connector was mandated in HD vehicles in 2016, however some OEMs like Volvo decided to use the J1962/OBDII connector (covered later).

Connector (Lime Green)	

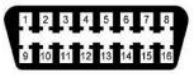
Pin	J1939 Standard	PACCAR 2016+	NAVISTAR
A	Ground	Ground	Ground
B	Power	Power	Power
C	CAN1, J1939+	CAN1, J1939+	CAN1, J1939+
D	CAN1, J1939-	CAN1, J1939-	CAN1, J1939-
E	CAN1, J1939 Shield	CAN1, J1939 Shield	CAN1, J1939 Shield
F	J1708/J1587+ or CAN3+	CAN3+	J1708/J1587+
G	J1708/J1587- or CAN3-	CAN3-	J1708/J1587-
H	OEM Specific	CAN2+	CAN2+
J	OEM Specific	CAN2-	CAN2-

Non-CAN Protocols	❖ J1708
CAN Protocols	❖ J1939, CAN, ISO15765
CAN Channels	❖ CAN1, CAN2, CAN3
CAN Baud Rates	❖ 250, 500

24.5. The J1962/OBDII Connector (Legislated)

The SAE J1962 connector is commonly referred to as the “OBD 2” (OBDII) connector. It is found in automobiles, some medium-duty vehicles, and in Volvo/Mack trucks (with Volvo/Mack engines) starting in 2013.

Note that the Volvo 2013+ (column 2) and GMC/Isuzu (column 3) connectors require specialized VDA cabling to use their diagnostic software. See your VDA user manual.

Connector (Black)	

Pin	J1962/OBDII Standard	Volvo 2013+ (Volvo Engine)	GMC Topkick/Kodiak, Isuzu F-Series
1			
2	J1850VPW+ / J1850PWM +		J1850 VPW+
3	CAN2+	CAN2/J1939+	
4	Chassis Ground		Ground
5	Signal Ground	Ground	Signal Ground
6	CAN1/ISO15765+	CAN1/ISO15765+	GMLAN+
7	ISO9141/ISO14230 K-Line		J1708/J1587+
8			
9			
10	J1850VPW- / J1850PWM-		
11	CAN2-	CAN2/J1939-	
12	CAN3+	J1708/J1587+	
13	CAN3-	J1708/J1587-	
14	CAN1/ISO15765-	CAN1/ISO15765-	GMLAN-
15	ISO9141/ISO14230 K-Line		J1708/J1587+
16	Power	Power	Power

Non-CAN Protocols	❖ J1708, J1850VPW, J1850PWM, ISO9141, ISO14230
CAN Protocols	❖ ISO15765, CAN, J1939
CAN Channels	❖ CAN1, CAN2, CAN3
CAN Baud Rates	❖ 250, 500

25. Appendix B. Considerations for Volvo/Mack 2013 and Newer Vehicles

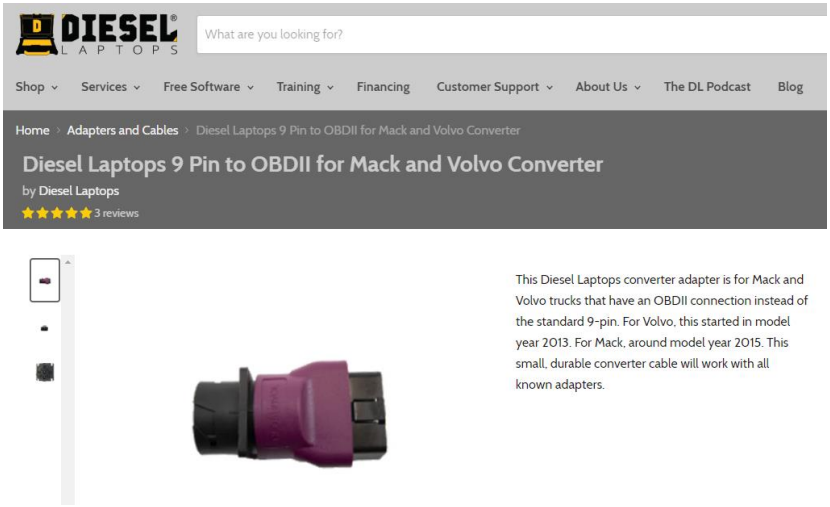
This section is applicable to 2013 and newer Volvo/Mack chassis that have Volvo/Mack engines and an OBDII diagnostic connector. This section does not apply to a Volvo/Mack chassis with a Cummins engine (9-pin Deutsch).

Starting in model year 2013, Volvo/Mack introduced a proprietary variant of the OBDII/J1962 diagnostic connector for a Volvo/Mack chassis with a Volvo/Mack engine. It is different in several ways than the SAE standard J1962/OBDII connector commonly seen in automobiles. It contains two separate CAN channels as well as J1708, noting:

- CAN1 is using the ISO15765 protocol and OBDII legislated messaging. It is on CAN1 pins (6, 14).
- CAN2 contains the J1939 protocol on J1962 CAN2 pins (3, 11).
- The J1708/J1587 protocol is on what is defined in J1962 as the CAN3 pins (12, 13).

The complete pinouts of this connector are described in the J1962 connector section above.

To connect the MVDA to this connector you will need the following adapter. It can be ordered from Diesel Laptops.



https://www.diesellaptops.com/collections/adapters-and-cables/products/diesel-laptops-9-pin-to-obdii-for-mack-and-volvo-converter

26. Appendix C. DDM and CAT Equipment

This section deals with CAT equipment and whether the MVDA and DDM will work on that equipment.

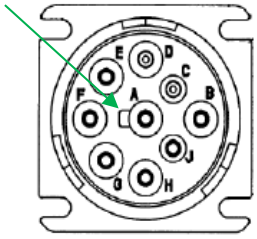
- DDM works on all CAT equipment that use the J1939 and/or J1708/J1587 (ATA) protocols.

DDM will not work on CAT engines and equipment using only the proprietary CAT Data Link (CDL) protocol.

The top illustration below shows the SAE standard J1939 connector (Type I, Type II) in contrast to the CAT Proprietary Connector below. If the vehicle or equipment with the CAT engine uses either one of these connectors, DDM will work.

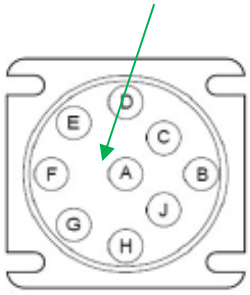
- Note the "A pin" of the standard connector has a key (arrow), whereas the CAT connector does not.
- Note that the Ground/Power pins on the CAT connector are reversed compared to the SAE standard. Cutting the "A" pin "key" off the standard J1939 cable will not allow it to work because the J1708/J1587/ATA protocol and the J1939 protocol are on different pins as well as power and ground being reversed.

Pin	J1939 Type I	J1939 Type II
A	Ground	Ground
B	Power	Power
C	CAN1/J1939 Hi	CAN1/J1939 Hi
D	CAN1/J1939 Lo	CAN1/J1939 Lo
E	CAN1/J1939 Shield	CAN1/J1939 Shield
F	J1708/J1587/ATA Hi	J1708 or CAN3 Hi
G	J1708/J1587/ATA Lo	J1708 or CAN3 Lo
H	OEM Specific	OEM Specific or CAN2 Hi
J	OEM Specific	OEM Specific or CAN2 Lo



J1939 Standard
Type I or Type II

Pin	CAT Proprietary Connector
A	Power
B	Ground
C	CAN1 Shield
D	CAT Data Link (CDL) Hi
E	CAT Data Link (CDL) Lo
F	CAN1/J1939 Lo
G	CAN1/J1939 Hi
H	J1708/J1587/ATA Lo
J	J1708/J1587/ATA Hi



CAT Proprietary Connector

If you have the CAT Proprietary Connector and A/B (Power/Ground) and D/E (CDL) are populated, DDM will not work.

If A/B (Power/Ground) pins and F/G (J1939) or H/J (J1708/J1587/ATA) are populated, you can use the MVDA with DDM software, noting you will need a special adapter. Contact Diesel Laptops for this adapter.

27. Appendix D. CAN Bus Troubleshooting - Overview

The CAN data bus has been around since the 1980's and is used in many devices from factory floor robots to on-highway vehicles. DDM provides a good triage for CAN databus failures; however, there are times that the technician needs to diagnose the physical CAN databus. This chapter discusses the most common causes of CAN bus failure.

27.1. Moisture Intrusion

It is common for heavy-duty vehicles to be driven over a million miles and to operate in different climates. These vehicles not only experience water and mud, but they often encounter snow/ice/slush-covered roads mixed with salt or potassium chloride (melting agents that are corrosive to metal). Water intrusion and "water wicking" is a big issue and corrosion can occur when water wicks into a connector. Corrosion can create shorts and open circuits.

27.2. Mechanical Vibration

Moisture intrusion is probably the most common cause of data bus failures. However, since heavy-duty vehicles are driven far longer than automobiles, other factors contribute to data bus failures, such as long-term vibration. Manufacturers do their best to design robust wiring harnesses and place those harnesses, sensors, and ECMs in locations where moisture does not intrude and vibration (wire chafing) is minimized.

> *A large OEM once noted a CAN bus failure where water wicked through a nick in a wiring harness, corroded the wire, and extended vibration of the equipment caused the wire to break inside the insulation. It took them many hours to diagnose the failure and it was only discovered when they brought out their Volt/Ohm meter (VOM) and started checking for continuity and resistances.*

27.3. Aftermarket ECM Installations (i.e. Telematics/ELD) - Termination Resistors

A properly terminated CAN network has two 120 Ohm termination resistors at the logical ends of the network (see Figure 12.1 below). Somehow technicians installing aftermarket ECMs such as Telematics platforms and Electronic Logging Devices (ELD) have gotten used to going behind the diagnostic connector (behind the dashboard) and butt-splicing or Scotch-Locking into the power, ground, and J1939 data bus lines. Many installers have inadvertently added an unnecessary terminating resistor (see Figure 12.2 below). If the vehicle started throwing databus-related fault codes after a Telematics or ELD installation, then this may be the cause.

- It is not a good practice to connect to the J1939 network behind the dashboard, especially with connectors that depend on piercing the insulation of a wire to make electrical contact. Connectors that pierce the insulation provide an area for moisture intrusion, wicking, and corrosion.

- Note that most OEMs are providing an option for a TMC RP1226 ***"Vehicle Accessory Connector (Telematics Connector)"*** wiring harness. This connector harness was developed by TMC and adopted by OEMs to help combat the issues surrounding 3rd party Telematics and ELD installations.

27.4. A Properly Terminated CAN Data Bus

The following figure shows a properly configured and terminated CAN data bus.

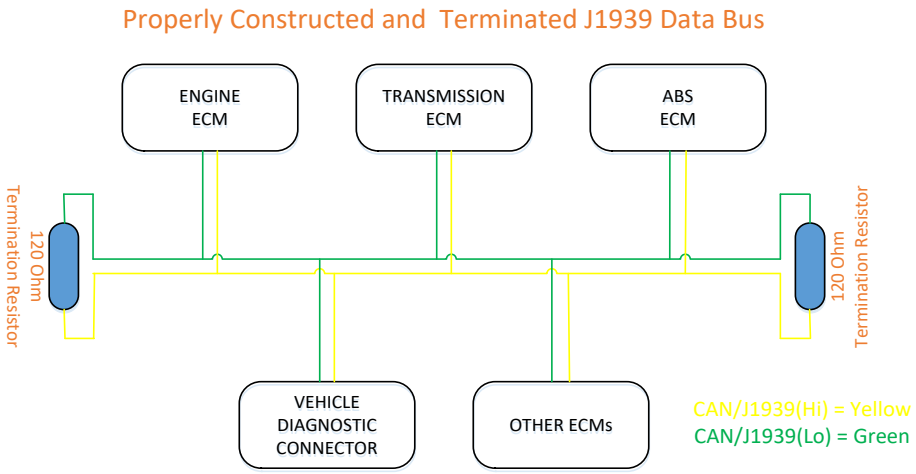
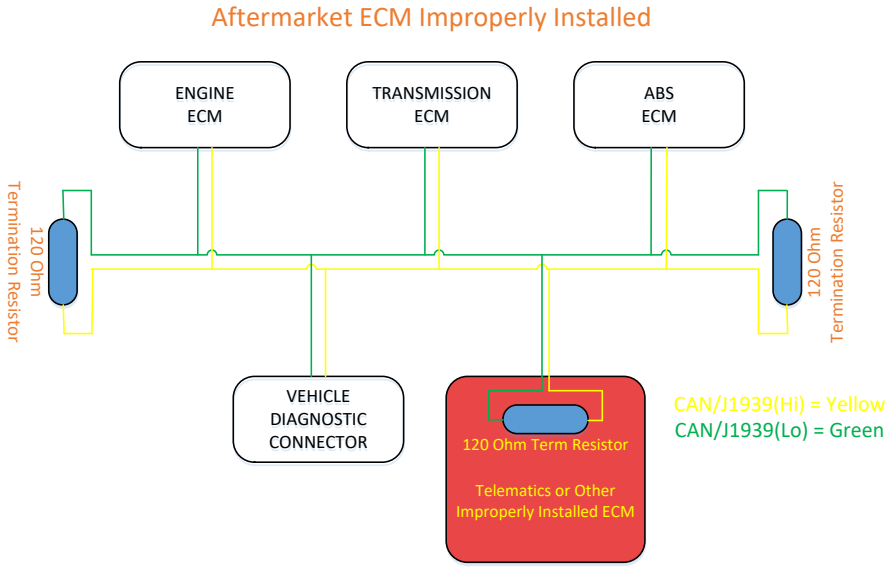


Figure 12.1 Properly Terminated CAN Data Bus

27.5. An Improperly Terminated CAN Data Bus

The following figure shows an improperly configured and terminated CAN data bus. This is most likely due to an aftermarket Telematics or ELD installation.



27.1. CAN Bus Troubleshooting – Troubleshooting Software for Windows

There are several very good Windows-based troubleshooting applications that can help determine if communications can be established with the vehicle and to figure out what CAN channels and protocols exist on that vehicle. This is the first line of troubleshooting since it covers the simplest aspects of connection problem:

- ❖ The ignition switch is in the off position.
- ❖ Selecting the wrong CAN channel.
- ❖ Selecting the wrong protocol (i.e. J1708 on a CAN-only vehicle).

There are three recommended tools for quick, Windows-based troubleshooting:

- Diesel Laptops – Diesel Laptops Validation Tool (DVT).
  - This is a free application that is completely RP1210 and J2534 compliant and works for light-duty through heavy-duty vehicles using any RP1210 or J2534 compliant VDA device. This can be downloaded from the Diesel Laptops website www.diesellaptops.com.
  - **This tool has more features and is easier to use than the other free troubleshooting tools.**
- Dearborn Group – Adapter Validation Tool (AVT).
  - This application is installed with any of the Dearborn Protocol Adapters (DPA).
  - This is a free application that is completely RP1210 and J2534 compliant and works for light-duty through heavy-duty vehicles using any RP1210 or J2534 compliant VDA device. This can be downloaded from the Dearborn Group (DG Technologies) website www.dgtech.com.
- Drew Technologies – VDA Validation Tool (VVT).
  - This application is also installed along with the Diesel Laptops' DieselLink VDA as well as the Drew Technologies DrewLinQ adapter.
  - This is a free application that is only RP1210 compliant and works only for medium/heavy-duty vehicles using any RP1210 compliant VDA device. This can be downloaded from the Drew Technologies website www.drewtech.com.
- NEXIQ – Device Tester
  - This application is not RP1210 compliant and is only for use with NEXIQ adapters. It is not recommended for generic troubleshooting.
  - The other applications allow the user to test other brands of VDAs in the event they think that the VDA they have may be damaged or broken.

Each of these applications has a user manual that will help you through the first level of troubleshooting which is to establish some level of communications with the vehicle. If the application you were using for this step indicates further diagnosis of the vehicle (electrical troubleshooting) is needed, please follow the steps in the next chapter.

28. Appendix E. CAN Bus Troubleshooting – Physical Troubleshooting

These next steps require the use of a Volt/Ohm meter (VOM).

The typical pinouts for the J1939 connectors and the OBDII connector are listed in a previous chapter of this user manual. If you are connecting to a different connector, refer to the manufacturer's as-built drawing to locate the CAN channels.

28.1. Step 1 - Proper Termination Resistance

1. Remove the positive battery lead from the battery. This step cannot be omitted.
2. With the VOM set to read resistance (Ohms setting), place one lead on the CAN_Hi terminal and the other lead on the CAN_Lo terminal.
3. Note the value and compare to the table below.

Value	Issue	Next Step, Resolution
54 - 66 Ohms	• No issue.	Go to Step 2.
> 120 Ohms	• Possibly an open circuit. • Possibly missing a terminating resistor.	Install a terminating resistor at the logical end of the network. See manufacturer literature for proper terminating resistor placement and other troubleshooting documentation.
< 44 Ohms	• Possibly more than 2 terminating resistors. • Possibly wires shorted together in harness.	Locate and remove extra terminating resistors. See manufacturer literature for proper terminating resistor placement and other troubleshooting documentation.

28.2. Step 2 - Shorts to Ground

1. Remove the positive battery lead from the battery. This step cannot be omitted.
2. With the VOM set to read resistance (Ohms setting), place one lead on the CAN_Hi terminal and the other lead on the Ground terminal. Note the value.
3. With the VOM set to read resistance (Ohms setting), place one lead on the CAN_Lo terminal and the other lead on the Ground. Note the value.
4. Compare each value to the table below.

Value	Issue	Next Step, Resolution
> 10k Ohms	• No issue.	Go to Step 3.
< 10k Ohms	• Wire is shorted to ground.	Repair or replace the wire or wiring harness. See manufacturer literature for proper terminating resistor placement and other troubleshooting documentation.

28.3. Step 3 – Proper CAN Voltage

1. Replace the positive battery lead.
2. Power up the vehicle and place the ignition switch in the on/accessory position.
3. With the VOM set to read DC Voltage, place one lead on the CAN_Hi terminal and the other lead on the Ground terminal. Note the value.
4. With the VOM set to read DC Voltage, place one lead on the CAN_Lo terminal and the other lead on the Ground terminal. Note the value.
5. Compare each value to the table below.

Value	Issue	Next Step, Resolution
2 - 4 Volts	• No issue.	Try connecting to the vehicle through a VDA and software. If software does not work, contact Diesel Laptops.
< 2 Volts	• Possibly one or more faulty CAN transceivers.	Go to Step 4 or refer to manufacturer documentation.
> 4 Volts	• Possibly one or more faulty CAN transceivers.	Go to Step 4 or refer to manufacturer documentation.

28.4. Step 4 - CAN Transceiver Testing

Electrical damage to one or both CAN transceiver circuits may increase the leakage current in the circuit. To measure current leakage through CAN circuits you will be required to remove the ECMs from the vehicle and you will need the manufacturers pin-out diagrams to locate the CAN_Hi, CAN_Lo, and Ground pins for that ECM.

1. Remove the positive battery lead from the battery. This step cannot be omitted.
2. Disconnect the ECM wiring harnesses and remove the ECM from the vehicle.
3. With the VOM set to read resistance (Ohms setting), place one lead on the CAN_Hi terminal and the other lead on the CAN_Ground terminal. Note the value.
4. With the VOM set to read resistance (Ohms setting), place one lead on the CAN_Lo terminal and the other lead on the CAN_Ground pin. Note the value.
5. Compare both values to the table below.

Value	Issue	Next Step, Resolution
1 - 4 Mega Ohms	• No issue.	Try connecting to the vehicle through a VDA and software. If software does not work, contact Diesel Laptops.
< 1 Mega Ohms	• Faulty CAN transceivers.	Contact manufacturer about either replacement or repairing of the ECM.

29. Appendix E. Technical Support

29.1. Technical Support

Technical support hours can be found at http://support.diesellaptops.com.

Diesel Laptops welcomes any opportunity to serve a customer, do not hesitate to call us with an issue!

Diesel Laptops Technical Support

Phone: (888) 983-1975 Option 2
E-mail: support@DieselLaptops.com