IUMPR User Documentation Help File

Table of Contents

1.0 Introduction

The IUMPR Data Collection Tool provides for the automated collection of data required by 13 CCR 1971.1 (l)(2.3.3), while producing a standardized report format for the submission of the data for review by California Air Resources Board (CARB) staff. One key feature of this process is the tracking for data collection as the test vehicle is driven to identify when the subject monitors have completed and incremented their respective numerators and denominators. The Data Collection Tool's automated collection of In Use Monitor Performance Ratios [IUMPR], test results, and quality checks provide for consistent reporting among the heavy-duty engine manufacturers.

The HD OBD IUMPR Data Collection Tool and process is memorialized in [draft] SAE J3162™. This help file links the software and its process back to SAE J3162. Thus, the software and process have been given an industry standard reference that will provide for clear communication among Engine Manufacturers and CARB staff. 13 CCR (l)(2.3.3) States:

> *(l)(2.3.3) The evaluation shall verify that the software used to track the numerator and denominator for purposes of determining in-use monitoring frequency correctly increments as required in section (d)(4).*

1.1 IUMPR Data Collection Tool Overview

The IUMPR Data Collection Tool is used for HD vehicles that comply with US EPA and CARB data communications regulations using the SAE J1939™ family of standards. The purpose of the tool is the collection and summary of vehicle telemetry for test results, monitor ratios, and monitor completion. The collected data and summaries are then automatically reported creating a standardized format for the submission of (l)(2.3.3) data to CARB.

The software consists of 4 principle functions. These functions may be run in sequence during each use of the software. But the functions are implemented so that they may be run in alternate orders that are best suited to the driving demonstration cycles planned for the monitor entry conditions of individual tests.

The last report contained in any tool output file to be provided to CARB shall be the report from Function E (Collect Test Results). The first report in any tool output file shall be the report from Function B (Generate Vehicle Data Plate).

Sequence of Steps

Selecting a Vehicle Adapter (Section 2.3)
The software can only be used with a TMC RP 1210C adapter. This feature presents the available adapters from which the user must select how he prefers to communicate with the vehicle.

Function A. Select/Create a Report File (Section 2.4) and Read Vehicle Information (Section 2.5)
The first principal step is to identify which file shall contain the collected data. If the file already contains data, Read Vehicle Information ensures that the same vehicle with the same VIN and CAL IDs is used to append data on the end of the file.

Function B. Generate Vehicle Data Plate (Section 2.6)
Before the vehicle is driven, the next overall step is to document the VIN, CAL IDs and Component IDs for the vehicle. Reuse of this function for data collection over multiple days allows the user to visually assess the status of the vehicle before it is driven. This report must be the first report in any submitted file.

Function C. Track Monitor Completion Status (Section 2.7)
This function is selected while the vehicle is driven to match the monitor entry conditions of individual tests. When all the tests for a particular monitor are completed, the status of the monitor will change from not complete to complete and the numerator and denominator will increment. The background for the monitor will then turn green. The monitor/test entry conditions are defined by the engine manufacturer and are not included in the tool as instructions to the user. See sections 1.3 and 1.4 for more information.

Function E. Collect Tests Results (Section 2.8)
When there is sufficient change in the monitor status, that is after the desired number of monitors are now highlighted in green. Collect test results queries and documents the test data (value, minimum and maximum) for all the tests supported by the engine manufacturer's HD OBD system. It also repeats the comparison if the resulting monitor status with the initial monitor status. This report must be the last report in any submitted file.

Alternate Sequence of Steps

1. Connect the communications adapter to the vehicle's diagnostic port and open the IUMPR tool.
2. Select the appropriate vehicle adapter from the dropdown.
3. Click "Select File" button to create or select an existing report file.
4. Click "Read Vehicle Info".
5. Click "Generate Vehicle Data Plate".
6. Click "Collect Test Results". All the test results will be incomplete. Following the completion of a function, an option exists to stay connected to the truck or not.
7. Click "Track Monitor Completion Status".
8. Drive the truck for the required operating cycles for the desired monitors to complete.
9. Click on "Stop Tracking Monitor Completion Status".
10. Click "Collect Test Results". All the test results for the completed monitors will show values and limits.
11. All the results are stored in a single log file with the *.iumpr extension.

Section 2 provides a step by step instruction on the use of these functions. The balance of section 1 describes hardware and software requirements, vehicle preparation and data collection notes. Please note

that the tool clears HD OBD emissions faults using DM11 every time a new file is created. Key On Engine Off operation is strongly recommended for the Vehicle Data Plate which provides the clear faults query before data is collected. Incomplete clearing of data in response to the DM11 command will likely render the test results unacceptable for submission to CARB.

1.2 Hardware and Software Required

The tool is designed for use on Windows 7 - Windows 10 PCs with ATA/TMC RP 1210C Adapters for datalink communications of SAE J1939 messages. The application software is self-contained; no additional runtime libraries are required. Use on PCs with less than 512MB of RAM is not recommended. The PC's local file system or directly connected flash drive is intended to be used. Note, files created by the tool with the .iumpr file extension contain 8-bit ASCII data. These files may be viewed using common PC utility programs by selecting "Open with". CAN data is logged in the operating systems %TEMP% directory. Commonly this is %userprofile%\AppData\Local\Temp". These logs can be useful in problem root cause analysis. The operating system will reclaim this disk space, when space is needed. The operating systems disk cleanup utility will remove these files.

1.3 Vehicle Preparation Notes

Vehicles that are used for data collection must be fault free with no pending diagnostics codes. The MIL shall be off. Inspection of the engine's condition using the engine manufacturer's service tool is recommended. This inspection may also clear emissions related and non-emissions related faults before launching the application. The engine manufacturer's service tool shall not be used in parallel with the application.

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1.4 Data Collection Notes

The successful completion of data collection depends on a thorough understanding of the manufacturer's monitor entry conditions and ARB regulations for incrementing numerators and denominators as defined in 13 CCR 1971.1 (d). Operating cycles must be a minimum of ten minutes in length where the engine speed exceeds 1150 RPM for five minutes. 13 CCR 1971.1 (d)(4.3.2)(G) also defines an 800 minute denominator for NMHC catalyst infrequent regeneration, and (H) requires 10 seconds of commanded regeneration.

> *13 CCR 1971.1 (d)(4.3.2)(H) For 2013 and subsequent model year engines, in addition to the requirements of section (d)(4.3.2)(B) above, the denominator(s) for the following monitors shall be incremented if and only if a regeneration event is commanded for a time greater than or equal to 10 seconds:*
>
> *(i) Diesel NMHC converting catalyst other aftertreatment assistance functions (sections (e)(5.2.3)(A) and (C))*
> *(ii) PM filter incomplete regeneration (section (e)(8.2.3)).*

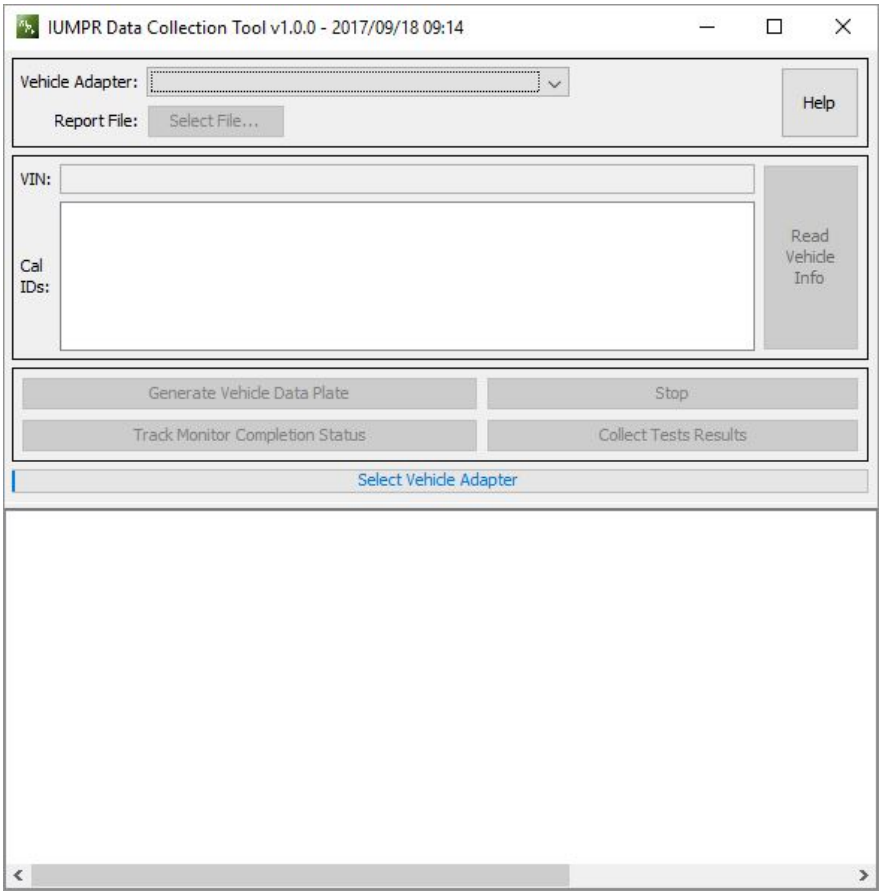
Data collection on a given vehicle may not work due to missing responses when Source Address 249 is used by other equipment on the vehicle that pretend to be a service tool -- Devices are not required to process multiple requests in parallel. Data collection may also be disrupted when devices on the vehicle do not adhere to message protocols described in the SAE J1939 recommended practices. Finally, vehicles with very

high bus loading may exceed the capacity of the adapter, causing messages to become lost.

2.0 IUMPR Software Operation

2.1 Program Initiation

Users should navigate to the location of the executable IUMPR Data Collection Tool or shortcut and double-click the file icon to launch the application. Upon launch, the main screen is presented. The main screen will be used to select the vehicle communications adapter, select an existing report file or create a new report file, and control the data collection operation of the tool.



IUMPR Main Screen

2.2 User Interface Screen Components

The title bar displays the Data Collection Tool version information.

Version Information

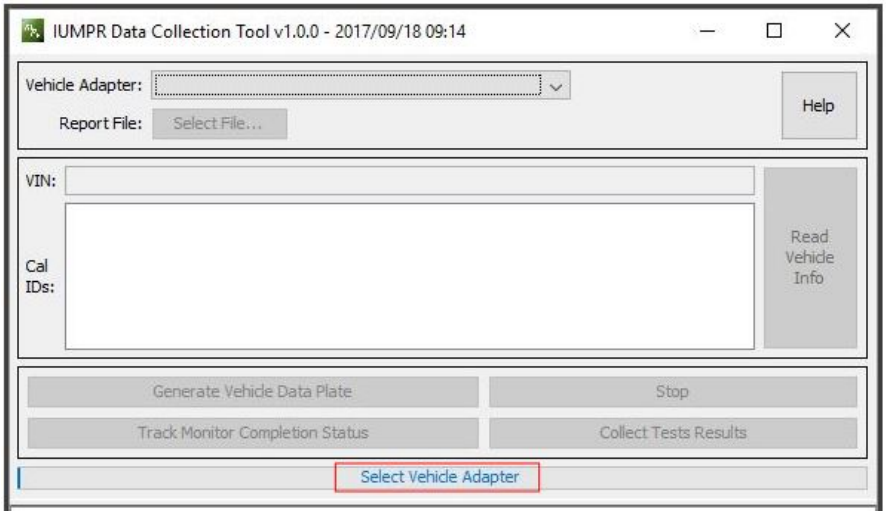
The top section of the window initiates the selection of the ATA/TMC RP1210C Vehicle Adapter, the selection of the Report File, and provides the "Help" button.

Below the Report File selector is the Vehicle Information section where the VIN and Cal IDs read from the vehicle are displayed when the "Read Vehicle Information" button is pushed. The "Read Vehicle Information" button is found on the right side of this section.

Below the Vehicle Information section is the Report Control section containing the four buttons the user will use to control the data collection process. Below the four report control buttons is the progress bar. In the progress bar, the tool displays cues for the user on next steps in the data collection process as well as status information on data collection activity.

Below the progress bar is the Report Logger area of the main screen. The Report Logger provides a live preview of the report generated to that point. The Report Logger scrolls so that the most recent information is continuously shown to the user. There is a scroll bar allowing the user to return to an earlier point in the report. The user cannot edit the report in the Report Logger pane but data may be selected and copied to the clipboard by highlighting the desired text and pressing <Ctrl> C.

Upon startup, "Select Vehicle Adapter" is displayed in the progress bar.



Select Vehicle Adapter

2.3 Selecting a Vehicle Adapter

The user must select a vehicle communications adapter before any other actions are possible. The Select Vehicle Adapter drop down list guides the selection of an installed communications adapter that will be used for J1939 datalink communications with the engine. This list will be populated with all of the TMC RP1210C adapters installed on the computer. The user may pick one adapter from the drop down list. If there are no vehicle adapters installed, the user will need to install them and restart the application. Upon successfully selecting a vehicle adapter, "Select Report File" is displayed in the progress bar and the user

can then select or create a report file. Once report generation has begun, the Select Vehicle Adapter control is disabled until the report generation has completed.

Follow the adapter manufacturer's recommendations for connecting the adapter to the PC and to the vehicle. Adapters are often recommended to be connected to the PC and the vehicle's diagnostic connector before the ignition key is turned on. Only the adapter to be used by the data collection tool software should be connected to the vehicle's J1939-13 connecter while the application software is in use.

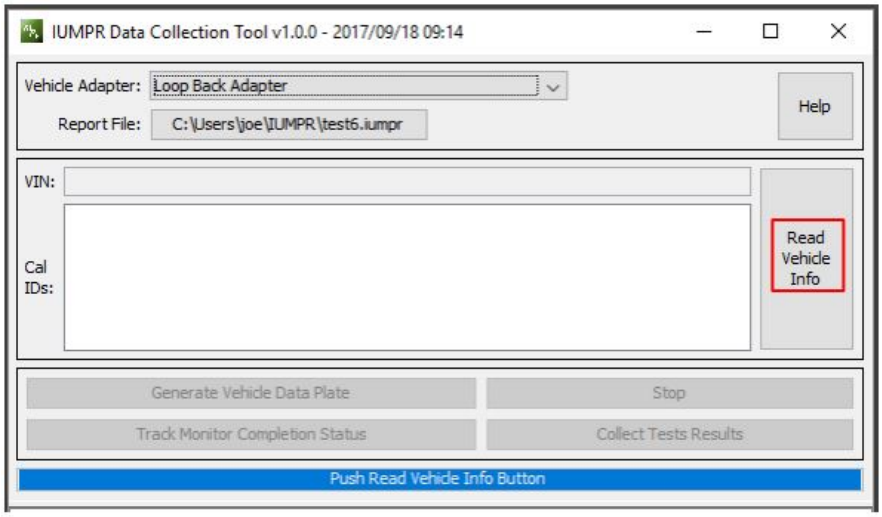
2.4 Selecting/Creating a Report File

After a vehicle adapter has been selected, the user can select or create a report file. Pushing the "Select File..." button will open a standard Windows file selection dialog box. The file chooser dialog will allow the user to navigate to the desired report file directory. The user will be able to choose any file location, whether it is local to the computer or a connected network drive. The user may type the name of the file to be used, (The tool creates a new file if filename entered does not exist) or select an existing file displayed in the file selection dialog box. If the specified filename (new file) does not have the extension ".iumpr," it will be added to the filename by the application. If the user chooses the wrong file, they are able to cancel their selection and no file will be selected. After they have chosen a file this control will display the path and filename.

If the user would like to extend previously saved data, they must select an existing file. Selections of existing files are validated to ensure their suitability for use. If the previous VIN and Calibration Information found in the file are inconsistent within the selected file, the user cannot proceed with that file. Time Stamps in an existing report file must also monotonically increase. (Subsequent time stamps must increase or match preceding time stamp.) If the file is not suitable for use, the user must choose a different report file or close the application. Report files are stored in plaintext format allowing a user to examine contents for VIN, calibration data, time stamp data, etc.

If there is a problem reading the file or the application cannot write to the file, a pop up will be presented and the user will be required to choose a different report file or close the application. After successfully selecting a report file, "Push Read Vehicle Info Button" is displayed in the progress bar. Once report generation has begun, the select file control will be disabled until report generation has completed.

2.5 Reading Vehicle Information



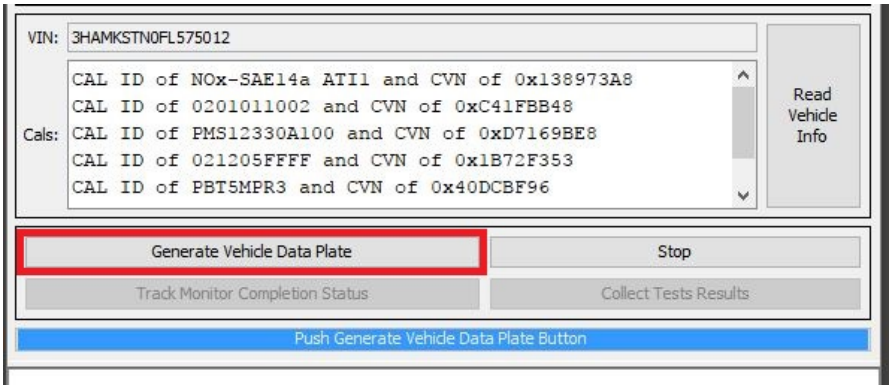
Read Vehicle Info Button

After a vehicle adapter has been selected and a valid report file specified, the "Read Vehicle Info" button is enabled, allowing the user to read VIN, Calibrations, and Time Since Code Clear information from the vehicle. VIN and Engine Calibrations information will be displayed in the "VIN:" and "Cal ID" areas respectively. If an existing report file has been selected, VIN, Calibrations, and Time Since Code Clear from the vehicle will be checked against the corresponding information in the selected report file. Additionally, the last Time Since Code Clear in the file will be checked against the current Time Since Code Clear from the vehicle. If the Time Since Code Clear was reset or there is a gap of more than 60 minutes, a warning message will be displayed, but the user will be allowed to continue using this report file.

If the VIN or Calibrations do not match, a warning will be displayed to the user and they will be required to choose a different vehicle or report file to continue. After choosing a new report file or different vehicle, the application will require the user to read the vehicle information again before proceeding.

Once it has been determined that the vehicle information matches a valid report file, the user will be able to generate the Vehicle Data Plate. The "Generate Vehicle Data Plate" button will be enabled and the application will display "Push Generate Vehicle Data Plate Button" in the progress bar. If for any reason, the user does not want to continue with the selected adapter, report file, or vehicle, these can be changed prior to pushing the "Generate Vehicle Data Plate" button.

2.6 Generating Vehicle Data Plate



Generate Vehicle Data Plate Button

After the vehicle information has been read and it has been determined that the report file matches the connected vehicle, the user may Generate the Vehicle Data Plate by pushing the "Generate Vehicle Data Plate" button. The Tool will query the vehicle and return information to the Report Logger area at the bottom of the main screen. The information appearing in the Report Logger area will also be appended to the report file.

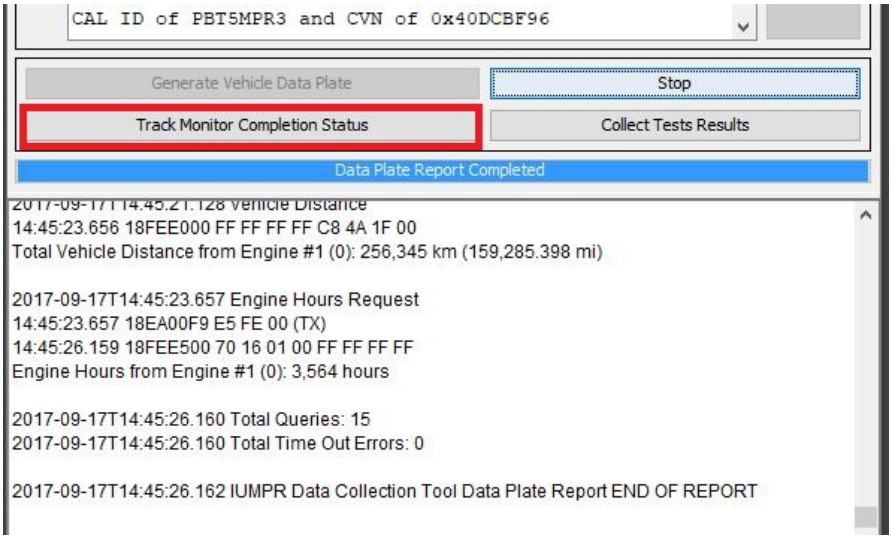
Important: During the vehicle data plate generation, if a new file is being used, the Diagnostic Trouble Codes (DTCs) will be cleared, using the SAE J1939-73 DM11 query. Many manufacturers only honor a DM11 query when the engine isn't running. If a running engine is observed, a warning dialogue will open cautioning the user to stop the engine and turn the key back on, before continuing with the data plate generation. Also, for new or existing files, the emission related DTCs will be read. If there are DTCs present, a warning dialog will be presented to the user. The user then has the choice to continue using the tool or end the program by pushing the "Stop"" button.

Status information on the data collection process and work in progress is provided in the progress bar just

above the Report Logger area. At any time during the vehicle data plate generation, the user may press the "Stop" button. If the "Stop" button is pressed, the data plate generation will stop and a message will be recorded to the file indicating the operation was stopped. The user will be able to press the "Generate Vehicle Data Plate" button again but will be unable to select a different adapter or report file. Until the vehicle data plate has been successfully generated the user will not be able to proceed to any other function.

The application indicates the successful completion of Vehicle Data Plate generation by showing "Data Plate Report Completed" on the progress bar and enabling the "Track Monitor Completion Status" and "Collect Tests Results" buttons. After the vehicle data plate has been generated, the user will not be able to generate additional data plates, select a different adapter or report file, or read information from the vehicle until the application has been restarted.

2.7 Tracking Monitor Completion Status



Track Monitor Completion Status Button

After the Vehicle Data Plate has been generated, the user may track the monitor completion status by pressing the "Track Monitor Completion Status" button. Pressing this button will open a Status View as a separate window showing the Performance Ratios and Supported Monitors. While executing the Tracking Monitor Completion Status function, the application will compare current DM20 monitor data to the DM20 monitor Baseline data from the first Vehicle Data Plate in the report file. The current data will be updated periodically until the "Stop" button is pressed.

Monitor Completion Status tracking will continue indefinitely while the vehicle continues to communicate, or until the user presses "Stop Tracking Monitor Completion Status" button on the Status View window or the "Stop" button on the main screen. The Status View window can only be closed by pressing the "Stop" button (on main screen) or the "Stop Tracking Monitor Completion Status" button (on Status View window).

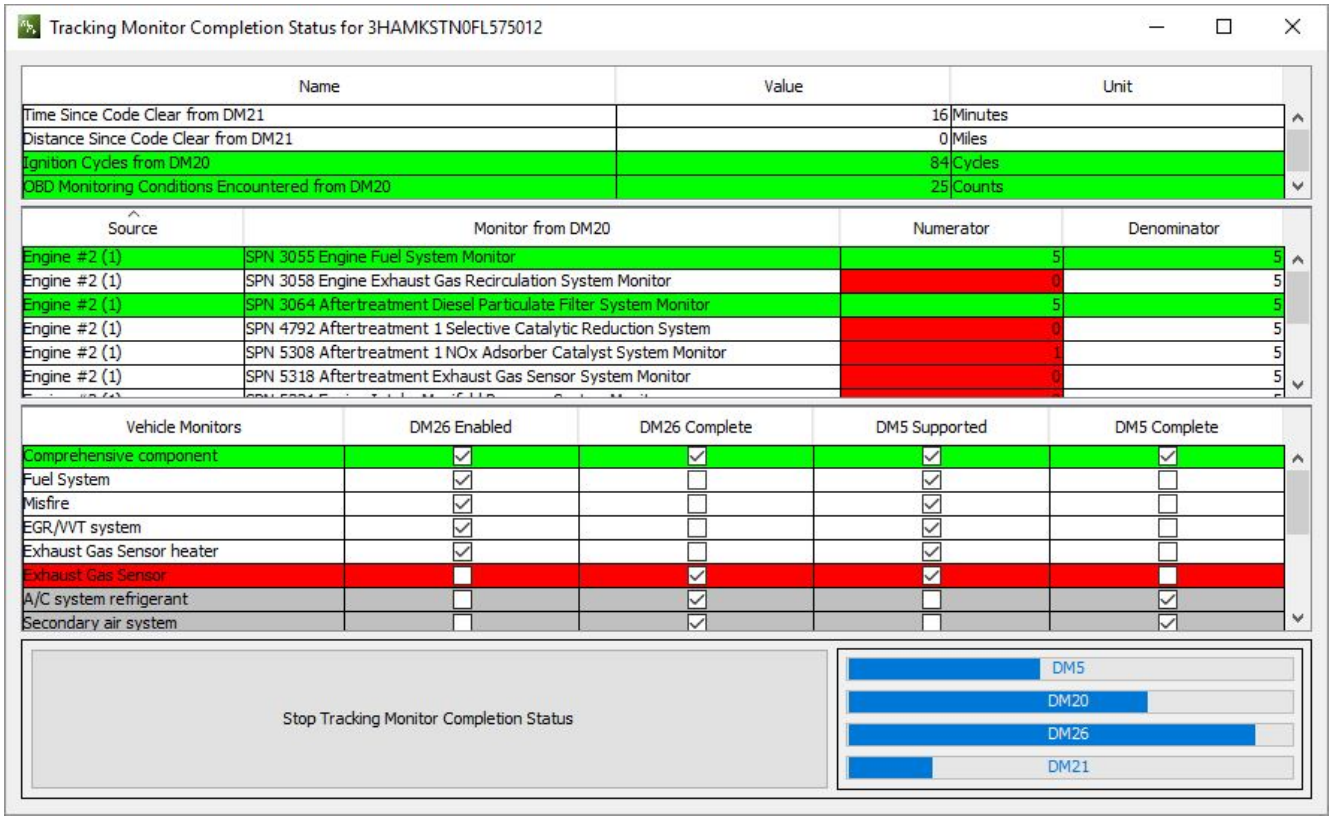
It's important to note the different actions produced by these two different stop buttons. Pressing the "Stop" button on the main screen *will interrupt the operation immediately without completing the Track Monitor Completion Status function*. Pressing the "Stop Tracking Monitor Completion Status" button on the Status View will close the Status View and return the user to the main screen. The application will read additional information from the vehicle to complete the Tracking Monitor Completion Status function and append the results to the report file and Report Logger (DM21 Time Since Code Cleared, Vehicle Distance, and Engine Hours).

If the vehicle stops providing engine speed, DM5, DM20, or DM26 responses the operation will end. (More details are provided in the "Communications Status" section below.) If this happens, the results will be summarized and the Status View will be closed.

Once the Status View has been closed, users are returned to the main screen. The progress bar will display "Data Monitor Log Completed". At this point users have the option of continuing to track monitors (by hitting the "Track Monitor Completion Status" button), collecting test results (by hitting the "Collect Tests Results" button), or exiting the application (by hitting the "Stop" button and pressing the "X" in upper right corner of the title bar of the main screen).

Status View for Tracking Monitor Completion Status

The Status View window is opened while the tool is tracking monitor completion status to provide useful information about the monitor tracking progress. It is composed of an "Information Table," a "Performance Ratio Table," "Supported Monitors Table," a "Stop Tracking Monitor Completion Status Button," and "Communications Status" section. The three tables show the DM21, DM20, DM5, and DM26 information: The Information Table, the Performance Ratio Table, and the Supported Monitors Table. As information changes, the changed information will be highlighted in green. The tables can be independently resized or scrolled. Additionally, the view can be resized up to the size of the computer screen.



Status View Window for Tracking Monitor Completion Status

Information Table (Name — Value — Unit)

The Information Table at the top shows the Time and Distance since DTCs were cleared information from DM21 packets. It also displays the number of Ignition Cycles and OBD Monitoring Conditions Encountered from DM20 packets. If a value changes from the beginning of the session, the entire row containing the changed value will be highlighted.

The user can sort the table by clicking on the column headings.

Performance Ratio Table (Source — Monitor from DM20 — Numerator — Denominator)

While executing the Tracking Monitor Completion Status function, the application will display the current Performance Ratios from the DM20 packets and compare current DM20 monitor data to the DM20 monitor Baseline data from the first Vehicle Data Plate in the report file. This information is displayed in the Performance Ratio Table of the Status View.

Field background colors indicate a Numerator change relative to the Baseline data (first Vehicle Data Plate Report of the data file). If a Numerator has incremented since the initial values were read when the first data plate was generated, the changed Numerator will be highlighted green. If a increased to a Numerator is observed while the application is executing the Tracking Monitor Completion Status function IN THIS SESSION, the entire row will be highlighted in green. In the event a Numerator or Denominator decrement, they will be highlighted red.

The user can sort the table by clicking on the column headings. By default, the column will sort ratios by source, then by ratio name.

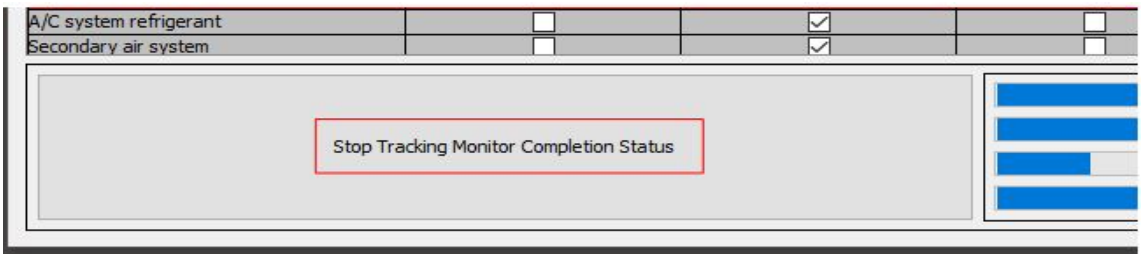
Supported Monitors Table (Vehicle Monitors — Trip Status (DM26) — Overall Status (DM5))

The Supported Monitors Table (DM26/DM5) shows the composite vehicle monitors status. It shows the Trip Status from DM26 packets, and the Overall Status from DM5 packets. Monitors that are disabled or not supported or monitored are highlighted grey. Monitors that are not complete will be the background color. Monitors that are complete are highlighted green. In the event that the Overall Status for a Monitor is supported and not complete but the Trip Status is disabled, the row will be highlighted red.

Communication Status (bottom right)

The lower right section of the Status View displays the communication status of the DM5, DM20, DM26, and DM21 packets. When a message is received, the value in the progress bar of the appropriate message is set to the maximum value. As time passes without receiving a message the value will decay. If the value reaches the minimum, "Timeout" will be displayed indicating that communications has failed. (If this occurs, user should check for loose adapter cable or vehicle off condition.) When a message is received, the value will return to the maximum and the process will continue. A communication status check is done every 10 seconds. For DM5 requests the application will try three times. Engine speed is checked every 300 ms. If there is no response for either, the data collection will abort.

Stop Tracking Monitor Completion Status Button (bottom left)



Stop Button

The "Stop Tracking Monitor Completion Status" button should be used to end the tracking process. After pressing this button, the application will display the progress through the final steps of the Tracking Monitor Completion Status function in the progress bar and Report Logger of the main screen (DM21 Time Since Code Cleared, Vehicle Distance, and Engine Hours). And, the process will gather the remaining information and summarize the differences in the ratios and monitors. The "Stop Tracking Monitor Completion Status" button will also close the Status View.

Once the Status View has been closed, users are returned to the main screen. The progress bar says "Data Monitor Log Completed." Here they have the option of continuing to track monitors (by hitting the "Track Monitor Completion Status" button), collecting test results (by hitting the "Collect Tests Results" button), or exiting the application (by hitting the "Stop" button and pressing the "X" in upper right corner of the title bar) from the main screen.

2.8 Collect Tests Results

Once the Vehicle Data Plate has been generated, the user may collect the tests results by pressing the "Collect Tests Results" button. This process will query the vehicle with a DM24 message to determine which SPNs support tests results. For those supported SPNs, a DM7 will be sent. The results will be written to the report file and Report Logger area. Work in progress and status information on the Collect Test Results process is provided in the progress bar just above the Report Logger. When the process is complete, the application will display "Data Collection Log Completed" in the progress bar and an END OF REPORT banner will be written to the Report Logger area and report file.

At any time during the Collect Test Results process, the user may press the "Stop" button. Pressing the "Stop" button will stop the process and cause a data collection log stopped message to be recorded to the Report Logger area and report file.

2.9 Closing the Application

Close the application by pressing the "X" in upper right corner of the title bar of the main screen. If a report file has been selected, a message will be written to the file indicating when the application was closed.

3.0 About

Author

This software was developed for the Equipment & Tool Institute by Solid Design, Inc.

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