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# Introduction

## Document Purpose

The Aggregated Feature Specification (AFS) specifies the concept of the Trailer Profile and Settings Feature and how it shall behave from customer down to Component level on an electrical platform.

PDF file also specifies the timing and milestones required by the Feature to be implemented.

This Aggregated Feature Specification is divided in 3 chapters

* Feature Document
* Function Specifications
* Feature Implementation Specification

Those chapters correspond to the 3 levels of the RE Information Model - Feature Level, Function Level, and Component Level (cross-ECU/platform view only). The AFS requirements are cascaded to the ECU Functional Specs on Component Level.

## Document Scope

The following Feature from the [Global Feature & Function List](https://www.vsemweb.ford.com:443/tc/launchapp?-attach=true&-s=226TCSession&-o=ZmZNi0JHx3NrTDAAAAAAAAAAAAA) and its deployment to the electrical architecture is described in this AFS:

* Trailer Settings and Profile feature is described in this AFS.
* < FD3\_CAN\_FNV2.5\_P708\_MY23\_v03a>
* < HS3\_CAN\_FNV2.5\_P708\_MY23\_v03a>

## Document Audience

The AFS is authored by Raul Rodriguez-Flores Feature Owner. All Stakeholders, i.e., all people who have a valid interest in the ECU behavior should read and, if possible, review the AFS. It needs to be guaranteed, that all stakeholders have access to the currently valid version of the AFS.

|  |  |  |  |
| --- | --- | --- | --- |
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### Stakeholder List

For the latest list of the Feature stakeholders and their roles & responsibilities refer to

|  |  |  |  |
| --- | --- | --- | --- |
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**#Hint:** Refer to [Ford RE Wiki – Stakeholder List](http://wiki.ford.com/display/RequirementsEngineering/Stakeholder+Analysis) on how to create a stakeholder list. The stakeholder list should be stored in VSEM in the pseudo folder “General Data Artifacts” of the corresponding feature / function / component.

### Target Vehicle Programs (initial)

Global (migration) integration plan drafted for this proposed feature.

|  |  |  |
| --- | --- | --- |
| **Program** | **Date** | **Note** |
| P708 | 2020/12/12 | UPV0 |

Table 2: Potential Program List

### Feature Prototype Plan

No prototype

Assess need for prototype

Prototype planned

## Feature Overview

### Conceptual Basis for Feature

The main concept of the feature is to configure and receive notifications by Sync for the trailer profiles and settings (such as Trailer Maintenance, Trailer Trip, etc.) for each trailer the user may own and saved in the Sync.

The user connects a trailer to the vehicle, gets into the vehicle, and turns on the ignition. Vehicle must be in Park for feature to activate. If the trailer connected was recently borrowed by a friend of the user, who used it for certain miles. The user goes into the sync settings to find the Trailer Settings and Profile, where he overrides the mileage of the trailer. As he overrides the mileage, a pop-up appears that a part of the trailer (ex: lug nuts) needs to be checked for any repairs.

This feature reminds the user for the maintenance of the parts of the trailer based on the mileage or time duration, the trailer has been used for, which helps the user to track and maintain them accordingly. This feature is **not** intended to replace the Trailer Owner’s Manual, the user must use the Maintenance information only as reference.

### Vision Statement

The feature envisions the user of the vehicle to:

* Be notified of any parts of the trailer connected that requires maintenance.
* Manually override the total mileage of the trailer.
* Check the Trailer maintenance “status” of the trailer connected.
* Toggle between multiple trailers (owned or borrowed).
* Add custom maintenance items (up to 5).
* Add Trailer profiles.

## Goals

|  |  |
| --- | --- |
| # | Minimum-Viable Product (MVP) Goals |
| 1 | This feature shall be merged with existing Trailer Profiles feature and therefore work within the Trailer Active Profiles and Trailer Settings and Profile menus with other relevant Trailer features framework. |
| 2 | User shall input and setup desired individual Trailer Settings and Profile items for a selected Trailer Profile. The user input consists of a “mileage and/or number of months” selection for each of the 13 defined maintenance items and 20 custom maintenance items. |
| 3 | The “mileage and/or number of months” selections are open to user for a custom selection (HMI shows open selections from 1 – 24 months and 1k – 24k miles). User have the option to track maintenance by mileage or/and time. |
| 4 | If Trailer Maintenance is due, user shall see a pop-up upon every 24hr at ignition on to remind the user of their due maintenance item. The maintenance due trigger is determined based on mileage accumulation or elapsed month, whichever comes first. |
| 5 | Users shall be able to view the status of the Trailer Settings and Profile items. |
| 6 | Users shall be able to modify the total Trailer Trip mileage, which may impact Trailer Maintenance items and pop-up warning displayed. |
| 7 | Users could view Trailer Trip Statuses in “Cluster Screen” along with the Touchscreen too. |
| 8 | Trailer Settings and Profile Feature will use all the existing CAN signals to support HMI functionality |
| 9 | The user will also have the ability to input up to 20 custom maintenance items with a custom “mileage and/or number of months” selection. |
| 10 | Trailer defined maintenance items have a predefined “mileage and time” intervals. The user will be able to customize them and save changes. |
|  |  |
|  |  |

|  |  |
| --- | --- |
| # | Out-of Scope Goals |
| 1 | Users could have access to the trailer profiles through Ford Pass. |
| 2 | Users could modify the trailer mileage through Ford Pass. |
| 3 | Users could set the mileage at which the warning pop-up (soon) mileage through Ford Pass. |
| 4 | Users shall be able to modify or delete each Trailer Maintenance item. |
| 5 | User shall be able to access the Trailer Maintenance Status on the IPC Screen |
| 6 | Addition of Drive Mode as part of Trailer Profile |
|  |  |

### Document Context

Refer to the [Ford RE Wiki](http://wiki.ford.com/display/RequirementsEngineering/Requirements+Engineering+for+SW+Enabled+Features) to get more information about the different Requirements Engineering (RE) templates (and how the AFS relates to those) and the overall RE approach for SW-enabled Features.

### Document Structure

The structure of this document is explained below:

**Section 1** – Introduction how to use this document including responsibilities and requisite documents. Explains the terminology. Gives a clarification of the definitions, concepts and abbreviations used in the document.

**Section 2** – Feature Document. Defines the Feature level requirements of the Feature realized by the system described in this specification

**Section 3** – Functional Architecture: Specifies the functional decomposition of the Feature.

**Section 4** – Function Specifications: Specifies the Logical Functions of the functional architecture of the Feature.

**Section 5** – Feature Implementation Specification: Specifies details of how the Feature / Logical Functions are deployed to the given electrical platform.

**Section 6** – List Open Concerns

**Section 7** Revision History.

**Section 8** – Appendix (Data Dictionary, etc.)

## 

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| Spec 1 | 23MY P708 Network Topology v7 | P708 Network Topology | V8 |
| Spec2 | P708\_UPV0\_\_MY23\_v03a | P708 Multiples Message List | V03A |
| Functional Specification | FS-MU5T-19J294-AB | CGEA 1.3 Integrated Trailer Module  (ITRM) | V1.7 |
| FuSa HARA | FFSD02 HARA Trailer Profile Settings V2 | Feature HARA | V2 |
| ConOps | ConOps\_Trailer Settings and Profile\_v0.10 | HMI Feature requirements | V0.10 |

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|  |  |
| Parked State | On automatic transmissions, the vehicle PRNDL is in “PARK” and for manual transmissions, the vehicle has the parking brake applied |
| Stationary State | The vehicle will be on Stationary State when the vehicle met the following:  Key Ignition Status is in RUN position  Transmission gear is in Park position  Battery Voltage percentage is above 75% of load |
|  |  |

|  |  |  |
| --- | --- | --- |
|  |  |  |
|  |  |  |
|  |  | Documents vehicle-level characteristics, using RQMTs and DVMs |
| BCM | Body Control Module | Feature Arbitrator |
| ITRM | Integrated Trailer Module | Module that delivers power to the trailer battery, turn lights and brake lights |
| ECG | Enhanced Central Gateway | Module that diverts CAN traffic through vehicle |
| TCU | Telematics Control Unit | Vehicle Modem that communicates with cloud / Ford Pass app |
| GSM | Gear Shift Module | Module that provide the Gear Shift position of the Transmission |
| APIM | Application Protocol Interface Module | SYNC user interface to vehicle |
| SCCM | Steering Column Control Module | Module that provide the steering wheel controls signals for the Notifications/Pop ups in the Cluster. |
| EOL | End of Line |  |
| CAN | Controller Area Network | Vehicle Communication Protocol |
| HS3 | High Speed 3 | High Speen CAN Network 3 |
| UI | User Interface | HMI interface to user |
| BT | Bluetooth | SYNC Applink – Bluetooth connection for Ford vehicles |

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# Feature SCOPING

The following feature from the [Global Feature & Function List](https://www.vsemweb.ford.com:443/tc/launchapp?-attach=true&-s=226TCSession&-o=ZmZNi0JHx3NrTDAAAAAAAAAAAAA) and its deployment to the electrical architecture

Trailer Settings and Profile feature described in this AFS

Document

# Feature Overview

### Feature Purpose and Description

The Trailer Settings and Profile Feature will allow the vehicle user to define and configure the Trailer Maintenance and Trailer Trip parameters for the multiple Trailers Profiles. Trailer Settings and Profile Feature HMI is divided in the functionalities previously stated.

1. Trailer Maintenance configuration. This section covers all the traceability for the trailer components maintenance/service. The Notifications/Pop ups triggered by this Function rely on the Months in Service (1-24) or Miles/Kilometers in Service (1,000-24,000). Trailer Maintenance configuration sequence is described as below:
   1. Maintenance Notifications. Enable notifications related to trailer maintenance. These notifications will be display while the trailer is active and the pre-conditions are meet.
   2. Active Trailer Status. Shows a summary of the maintenance status for the active trailer.
      * 1. Trailer Axle Maintenance. Axle Components Maintenance to be tracked are Wheel Bearings and Cups, Axle Seals, Springs and Suspension.
        2. Trailer Brakes Maintenance. Brakes Components Maintenance to be tracked are Brakes adjustments, Brake Linings, Hub and Drum Brakes, Hydraulic Brakes, Brake Lines, Trailer Brake Wiring, Trailer Magnets
        3. Trailer Wheel/Tire. Wheel/Tire components Maintenance to be tracked are Lug nuts and Wheel and Rims
        4. Trailer Wiring. Trailer Harness and connector maintenance to be tracked.
2. Trailer Trip configuration. This section covers the trailer mileage/kilometers traceability due the possibility that the vehicle customer may use a trailer on different vehicles. The main function allows the user to update / reset the Trailer Mileage/Kilometers on each one of the Trailer Profiles previously configured. Trailer Trip configuration sequence is described as below:
   1. Edit Trailer Distance. Shows a Numbers Keyboard to update the trailer distance.
   2. Reset Trailer Fuel Economy. Shows a Notification/Pop up to get the vehicle user confirmation for the Trailer Distance/Trailer Fuel Economy reset.

### Feature Variants

|  |  |  |
| --- | --- | --- |
| Variant Name | Variant Description | Remarks |
|  |  |  |

Table 6: Feature Variants

#### Regions & Markets

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Market /**  **Region**  Variant Name | **North America** | **South America** | **Europe** | **MiddleEast/Africa** | **Asia / Pacific** | **China** |
|  | *<Put “Optional” or “Mandatory” or some condition here>* |  |  |  |  |  |

### Input Requirements/Documents

|  |  |  |  |
| --- | --- | --- | --- |
| **Reference**  (Reference as listed in ch. “References”) | **Section/Requirement** | **Description** | **Derived Requirement**  (optional – reference to requirement in ch. “Feature Requirement”) |
| **Attribute Requirements** | | | |
|  |  |  |  |
|  |  |  |  |
| **Ford Engineering Standards** | | | |
|  |  |  |  |
|  |  |  |  |
| **Legal Regulations** | | | |
|  |  |  |  |
|  |  |  |  |
| **Industry Standards** | | | |
|  |  |  |  |
|  |  |  |  |
| **Other Sources** | | | |
| NATM | The Trailer Handbook | Trailer Maintenance and Inspection Schedules. | [https://www.trailersafetyweek.com/trailer-maintenance](https://clicktime.symantec.com/3CrsFPkxnzHqVCEmALCDKt57Vc?u=https%3A%2F%2Fwww.trailersafetyweek.com%2Ftrailer-maintenance) |
|  |  |  |  |

Table 7: Input Requirements/Documents

### Lessons Learned

Assumptions and constraints listed below are representative of current strategies and may be subject to change:

### Assumptions

* Trailer Settings and Profile feature will utilize existing hardware on the vehicle, no new hardware will be required.
* Trailer Settings and Profile feature will utilize existing CAN signals and Messages on the vehicle. No new/modified messages/signals will be required.
* Vehicle is at minimum FNV3 or later architecture.
* Vehicle has Ford factory/dealer installed trailer wiring, hitch and TRM / ITRM.
* When any selection/update button command form in vehicle HMI, the request shall be processed instantaneously.
* No Notification / Pop-ups will be displayed on the IPC at any time.
* Trailer Settings and Profile feature will be fully operative when the following preconditions are met: Vehicle transmission is on “Park” position + Key Ignition Status is in “RUN” position + Battery state of charge above 75%.

## Feature Context

### Feature Context Diagram

**

Figure 1: Context Diagram

### List of Influences

|  |  |  |
| --- | --- | --- |
| **ID** | **External Entity** | **Influence Description** |
| I1 | User | *User requests to activate Trailer Settings and Profile Feature functions* |
| I2 | Host Vehicle HMI | *Host Vehicle HMI to interact with Trailer Settings and Profile* |
| I3 | Trailer Attached | *User plug in the Trailer Wiring to the vehicle* |
| I4 | Transmission | *Vehicle in Park position of user shift the Transmission to Park Position* |
| I5 | Key Ignition | *User turn the key to Run.* |
|  |  |  |

Table 8: List of Influences

## Feature Modeling

### Operation Modes and States

Figure 2: Feature Operation States and Modes

|  |  |  |
| --- | --- | --- |
| **State** | **Description** | **Requirements Reference** (optional) |
| S1 | Feature is Idle |  |
| S2 | Feature is available and in operation |  |
|  |  |  |

Table 9: Operation Modes

|  |  |  |  |
| --- | --- | --- | --- |
| **Transition ID** | **Description** | **Action** | **Requirements Reference** (optional) |
| <T1> | User Configure Trailer Maintenance and Trailer Trip Functions when the reconditions  are met. | <S1> to <S2> |  |
| <T2> | User Update/Reset Trailer Maintenance and Trailer Trip functions or preconditions not met | <S2> to <S1> |  |
| <T3> |  |  |  |
| <T4> |  |  |  |

Table 10: Transition between Operational States

### Use Cases

#### Use Case Diagram



#### Actors

|  |  |
| --- | --- |
| Actor | Description |
| User | Vehicle User can be Driver/Passenger who own/use the vehicle. |
| HMI | Human Machine Interface (Visual Screens, Notifications or Pop ups) |
| SYNC | Module provider for the HMI |
| IPC | Module provider for the Features status |

Table 11: List of Actors

#### Use Case Descriptions

* ###UC\_F\_Trailer Settings and Profile\_00001### User enter the Trailer Maintenance (Active Trailer Profile or Towing Menu).

|  |  |  |
| --- | --- | --- |
| **Purpose** |  | User enter the Trailer Maintenance Menu thru the Active Trailer Profile. |
| **Actors** |  | User / |
| **Precondition** |  | Vehicle has factory or dealer installed trailer wiring  Trailer is connected to the Vehicle  Trailer connected/attached signal must be present on HS3 CAN bus.  Vehicle battery is >= 75% state of charge with engine off  Ignition is ON or ACC  Vehicle is stationary or Gear Shift must be in Park Position  Time and Date are set up to date  Mileage message is available on the vehicle  An active Trailer Profile is currently selected |
|  |  |  |
| **Main Flow** | M1 | User Access the Towing Menu |
|  | M2 | User has the following options:   1. User select “Select Active Trailer” soft button.    1. Then user selects one of the Trailer Profiles created (not applicable to Default Trailer profile). (continue on M3) 2. User select “Maintenance Status” soft button. (continue on M4) |
|  | M3 | User selects one of the Trailer Profiles created (not applicable to Default Trailer profile). |
|  | M4 | User selects “Maintenance Status” soft button. |
|  | M5 | User shall enter to the “Trailer Maintenance” menu. |
|  |  |  |
| **Alternative Flow 1** | A1 | * User can change the Vehicle from the stationary position. * Feature shall hide the Trailer Maintenance Notification. * Notification/Pop up shall be displayed when the preconditions are complied. |
| **Alternative Flow 2** | A2 | * Trailer Tow harness may get disconnected. * Feature shall display the Trailer Maintenance Notifications/Pop ups |
|  |  |  |
| **Post-condition** |  | HMI Visual Notification/Pop up will be closed. |

* ###UC\_F\_Trailer Settings and Profile\_00002### User receives a disclaimer to specify the Feature limits and conditions.

|  |  |  |
| --- | --- | --- |
| **Purpose** |  | User should be notified of the limits and conditions for the Feature Functionality |
| **Actors** |  | User / |
| **Precondition** |  | Vehicle has factory or dealer installed trailer wiring  Trailer is connected to the Vehicle  Trailer connected/attached signal must be present on HS3 CAN bus.  Vehicle battery is >= 75% state of charge with engine off  Ignition is ON or ACC  Vehicle is stationary or Gear Shift must be in Park Position  Time and Date are set up to date  Mileage message is available on the vehicle  An active Trailer Profile is currently selected |
|  |  |  |
| **Main Flow** | M1 | When Trailer and Settings and Profile Feature Menu is selected, SYNC shall provide an HMI Disclaimer to the user to define capability and limits of the feature. |
|  | M2 | Disclaimer will appear under 2 conditions:   1. When the user makes the Trailer Maintenance configuration for the first time on each one of the created Profiles. 2. When the user reset the Trailer Maintenance configuration to the default/factory status. |
|  | M3 | Disclaimer shall provide the following information:   * Trailer Maintenance functionality will not replace the Trailer Owner Manual. * Trailer Maintenance functionality is limited by the vehicle user inputs. * The information provided by the feature is only for reference. |
|  | M4 | User shall acknowledge the disclaimer by selecting “Agree” soft button. |
| **Alternative Flow 1** | A1 | * User can change the Vehicle from the stationary position. * Feature shall hide the Trailer Maintenance Notification. * Notification/Pop up shall be displayed when the preconditions are complied. |
|  |  |  |
| **Alternative Flow 2** | A2 | * Trailer Tow harness may get disconnected. * Feature shall display the Trailer Maintenance Notifications/Pop ups |
|  |  |  |
| **Post-condition** |  | HMI Visual Notification/Pop up will be closed. |

* ###UC\_F\_Trailer Maintenance\_00003### User receives a Maintenance Notification.
* Notification for 1 item
* Notification for 2 or more items
* Notification for 1 or more items Maintenance due under the Navigation route set)

|  |  |  |
| --- | --- | --- |
| **Purpose** |  | User would like to be notified when my trailer needs maintenance via SYNC HMI |
| **Actors** |  | User / |
| **Precondition** |  | Vehicle has factory or dealer installed trailer wiring  Trailer is connected to the Vehicle  Trailer connected/attached signal must be present on HS3 CAN bus.  Vehicle battery is >= 75% state of charge with engine off  Ignition is ON or ACC  Vehicle is stationary or Gear Shift must be in Park Position  Time and Date are set up to date  Mileage message is available on the vehicle  An active Trailer Profile is currently selected |
|  |  |  |
| **Main Flow** | M1 | User will find the following Notification / Pop Ups scenarios:   * When A Trailer Maintenance interval has been reached * When a Navigation route is set on SYNC and 1 or more Trailer Maintenance items intervals due on the route. |
|  | M2 | User will find the following options:   1. If there are 2 or more notifications, the pop-up should group all the items into a single pop-up. (continue on M3 or M4 for Navigations Pop Ups) 2. If there is one Maintenance Item notification active. (continue on M5) |
|  | M3 | Notification / Pop Up shall display the following content:  [Header]Trailer Maintenance Reminder  [Subject] Several {Trailer Name} items need maintenance.  Continue M5 |
|  | M4 | Notification / Pop Up shall display the following content:  [Header]Trailer Maintenance Reminder  [Subject] Several {Trailer Name} items will need maintenance during this trip.  Continue M5 |
|  | M5 | User shall have the following options for 2 or more maintenance items:   * If User selects “View” HMI will be redirected to Active Trailer Items list menu * If User selects “Remind me later” Pop Up shall be closed but the reminder will not be cleared. |
|  | M6 | Notification / Pop-Up shall display the following content:  [Header]Trailer Maintenance Reminder  [Subject] The Maintenance on {maintenance list item} on {Trailer Name} is upcoming.  Continue M8 |
|  | M7 | Notification / Pop-up shall display the following content:  [Header]Trailer Maintenance Reminder  [Subject] The Maintenance on {maintenance list item} on {Trailer Name} will be due during this trip.  Continue M8 |
|  | M8 | User shall have the following options for one maintenance item:   * If User selects “View” HMI will be redirected to Active Trailer Items list menu * If User selects “Remind me later” Pop Up shall be closed but the reminder will not be cleared.   If User selects “Clear Reminder” Pop Up shall be closed and reminder will be dismissed. |
|  |  |  |
| **Alternative Flow 1** | A1 | * User can change the Vehicle from the stationary position. * Feature shall hide the Trailer Maintenance Notification. * Notification/Pop up shall be displayed again when the preconditions are complied. |
|  |  |  |
| **Alternative Flow 2** | A2 | * Trailer Tow harness may get disconnected. * Feature shall display the Trailer Maintenance Notifications/Pop ups |
|  |  |  |
| **Post-condition** |  | HMI Visual Notification/Pop up will be closed. |

* ###UC\_F\_Trailer Maintenance\_00004### User request access to Maintenance Notifications or to toggle between ON/OFF Notifications / Pop-ups.

|  |  |  |
| --- | --- | --- |
| **Purpose** |  | User request access to maintenance Notification option via SYNC HMI |
| **Actors** |  | User |
| **Precondition** |  | Vehicle has factory or dealer installed trailer wiring  Trailer is connected to the Vehicle  Trailer connected/attached signal must be present on HS3 CAN bus.  Vehicle battery is >= 75% state of charge with engine off  Ignition is ON or ACC  Vehicle is stationary or Gear Shift must be in Park Position  Time and Date are set up to date  Mileage message is available on the vehicle  An active Trailer Profile is currently selected |
|  |  |  |
| **Main Flow** | M1 | User request access to Trailer Maintenance items thru “Towing Menu” or “Select Active Trailer” menu. |
|  | M2 | User select Maintenance Notifications and Enable/Disable Maintenance Notifications option |
|  | M3 | User shall not be able to receive any Maintenance Notification. |
|  |  |  |
| **Alternative Flow 1** | A1 | User select the Maintenance Notifications Infobook Icon. User shall receive message with the following description “Enable Notifications related to the trailer maintenance. These notifications will be displayed while the trailer is active.” |
| **Alternative Flow 2** | A2 | * User can change the Vehicle from the stationary position. * Feature shall hide and Disable the Trailer Maintenance Menu. |
| **Alternative Flow 3** | A3 | * User request access to the Trailer Maintenance when the Default Trailer profiles has been selected. * Feature shall send a Notification/Pop up to notify the Trailer Maintenance Status is not available for the Default Trailer Profile. * Feature shall disable the Active Trailer Status component list. |
| **Alternative Flow 4** | A4 | * Trailer Tow harness may get disconnected. * Feature shall hide and Disable the Trailer Maintenance Menu. |
|  |  |  |
| **Post-condition** |  | HMI Visual Screen will be closed |

* ###UC\_F\_Trailer Maintenance\_00005### User selects access to Active Trailer Status or to view current mileage/date maintenance status.
* Summary of all the items.
* Each one of the Maintenance Items (Predefines and custom).

|  |  |  |
| --- | --- | --- |
| **Purpose** |  | User request to view current mileage/date status via SYNC HMI |
| **Actors** |  | User |
| **Precondition** |  | Vehicle has factory or dealer installed trailer wiring  Trailer is connected to the Vehicle  Trailer connected/attached signal must be present on HS3 CAN bus.  Vehicle battery is >= 75% state of charge with engine off  Ignition is ON or ACC  Vehicle is stationary or Gear Shift must be in Park Position  Time and Date are set up to date  Mileage message is available on the vehicle  An active Trailer Profile is currently selected |
|  |  |  |
| **Main Flow** | M1 | User access “Trailer Maintenance” menu under thru “Towing Menu” or “Select Active Trailer” menu. |
|  | M2 | User will have the following options:   * Select the Active Trailer Status Infobook Icon to see the summary of all maintenance items. (continue M3) * Open the Active Trailer Status items list and select the Infobook Icon for each one. (continue M4) |
|  | M3 | User will be able to see a summary of the Maintenance status for the active trailer |
|  | M4 | If the user clicks on the Pre-defined items Infobook the maintenance status will be shown only on the item selected as following:   * If user select the Infobook of a pre-defined item. User shall receive a Pop-Up with the following:   [Header] {Maintenance List Item}  [Subject] Recommended maintenance steps:  Item status (Mileage and/or Time)  If the User clicks on the Custom items Infobook the maintenance status will be shown only on the item selected as following:   * If user select the Infobook of a custom item. User shall receive a Pop-Up with the following:   Item status (Mileage and/or Time) |
|  |  |  |
| **Alternative Flow 1** | A1 | * User can change the Vehicle from the stationary position. * Feature shall hide and Disable the Trailer Maintenance Menu. |
| **Alternative Flow 2** | A2 | * User request access to the Trailer Maintenance when the Default Trailer profile has been selected. * Feature shall send a Notification/Pop up to notify the Trailer Maintenance Status is not available for the Default Trailer Profile. * Feature shall disable the Active Trailer Status component list. |
| **Alternative Flow 3** | A3 | * Trailer Tow harness may get disconnected. * Feature shall hide and Disable the Trailer Maintenance Menu. |
|  |  |  |
| **Post-condition** |  | HMI Visual Screen will be closed |

* ###UC\_F\_Trailer Maintenance\_00006### User request to reset all the current Maintenance items to Default Trailer Maintenance Schedule.

|  |  |  |
| --- | --- | --- |
| **Purpose** |  | User request to reset current mileage/date status for all trailer maintenance items via SYNC HMI |
| **Actors** |  | User |
| **Precondition** |  | Vehicle has factory or dealer installed trailer wiring  Trailer is connected to the Vehicle  Trailer connected/attached signal must be present on HS3 CAN bus.  Vehicle battery is >= 75% state of charge with engine off  Ignition is ON or ACC  Vehicle is stationary or Gear Shift must be in Park Position  Time and Date are set up to date  Mileage message is available on the vehicle  An active Trailer Profile is currently selected |
|  |  |  |
| **Main Flow** | M1 | User request access Trailer Maintenance items thru “Towing Menu” or “Select Active Trailer” menu. |
|  | M2 | User access Trailer Maintenance Menu and select the “Active Trailer Status” option. |
|  | M3 | User access “Active Trailer Status” menu and select Reset soft button. |
|  | M4 | User shall receive a Pop-Up with the following:  [Header] Reset Maintenance Notification  [Subject] Resetting the Maintenance Notifications will set all the notifications to the default intervals and delete all saved custom notifications.  Do you want to proceed? |
|  | M5 | User shall have two options to proceed.  When the user selects soft button [YES] SYNC shall set all items to default notification intervals and delete all custom maintenance items.  When the user selects soft button [NO] SYNC shall close the Pop-Up. |
|  |  |  |
| **Alternative Flow 1** | A1 | * User can change the Vehicle from the stationary position. * Feature shall hide and Disable the Trailer Maintenance Menu. |
| **Alternative Flow 2** | A2 | * User request access to the Trailer Maintenance when the Default Trailer profiles has been selected. * Feature shall send a Notification/Pop up to notify the Trailer Maintenance Status is not available for the Default Trailer Profile. * Feature shall disable the Active Trailer Status component list. |
| **Alternative Flow 3** | A3 | * Trailer Tow harness may get disconnected. * Feature shall hide and Disable the Trailer Maintenance Menu. |
|  |  |  |
| **Post-condition** |  | HMI Visual Screen will be closed |

* ###UC\_F\_Trailer Maintenance\_00007### User would like to setup the interval for a pre-defined trailer maintenance item.
* Allow simple selection or indication of default recommendation and configure the maintenance tracking (Miles in Service/Months since the item was created) according to the predefined intervals available.

|  |  |  |
| --- | --- | --- |
| **Purpose** |  | User would like to setup the interval for a pre-defined trailer maintenance item via SYNC HMI. |
| **Actors** |  | User |
| **Precondition** |  | Vehicle has factory or dealer installed trailer wiring  Trailer is connected to the Vehicle  Trailer connected/attached signal must be present on HS3 CAN bus.  Vehicle battery is >= 75% state of charge with engine off  Ignition is ON or ACC  Vehicle is stationary or Gear Shift must be in Park Position  Time and Date are set up to date  Mileage message is available on the vehicle  An active Trailer Profile is currently selected |
|  |  |  |
| **Main Flow** | M1 | User request access to “Trailer Maintenance” menu thru “Towing Menu” or “Select Active Trailer” menu. |
|  | M2 | User access Trailer Maintenance Menu and select the “Active Trailer Status” option. |
|  | M3 | User will see the Maintenance items list for the active trailer and select one of the items. |
|  | M4 | Use will have the following scenarios:   * User access the Maintenance Item selected and a screen with the two slides shall be displayed. One for Mileage (1000-24000 miles), and one for Time (1-24 months since the item configuration). Both options shall have a soft button to set the reminder OFF. * If the Maintenance Item threshold has been reached or the previous selected interval is overdue, the User shall receive a Maintenance Notification as following:   [Header] {Maintenance list Item} needs attention!  [Subject] The Maintenance on {maintenance list item} on {Trailer Name} is overdue by {xx days / yy miles/kilometers}.  Recommended maintenance steps: |
|  | M5 | Maintenance Notification shall provide the following options:   * Remind me later soft button will close the pop up but not clear the reminder (Change the HMI to close the Pop-up) * Clear Reminder will clear the reminder |
| **Alternative Flow 1** | A1 | User shall be able to consult the Maintenance status on a short description below each one of the Maintenance Items. The status will be described as following:  [Item Name] Maintenance Item  [Item Status] Upcoming maintenance in the next (yy miles /xx days) |
| **Alternative Flow 2** | A2 | * User can change the Vehicle from the stationary position. * Feature shall hide and Disable the Trailer Maintenance Menu. |
| **Alternative Flow 4** | A4 | * User request access to the Trailer Maintenance when the Default Trailer profiles has been selected. * Feature shall send a Notification/Pop up to notify the Trailer Maintenance Status is not available for the Default Trailer Profile. * Feature shall disable the Active Trailer Status component list. |
| **Alternative Flow 5** | A5 | * Trailer Tow harness may get disconnected. * Feature shall hide and Disable the Trailer Maintenance Menu. |
|  |  |  |
| **Post-condition** |  | HMI Visual Screen will be closed |

* ###UC\_F\_Trailer Maintenance\_00008### User would like to setup a custom trailer maintenance item (up to 20 maximum). User can input custom name (20 char max?). Allow for custom interval selection and configure the maintenance tracking (Miles/Months in service) according to the predefined intervals available.

|  |  |  |
| --- | --- | --- |
| **Purpose** |  | User would like to setup a custom trailer maintenance item (up to 5 maximum) via SYNC HMI |
| **Actors** |  | User |
| **Precondition** |  | Vehicle has factory or dealer installed trailer wiring  Trailer is connected to the Vehicle  Trailer connected/attached signal must be present on HS3 CAN bus.  Vehicle battery is >= 75% state of charge with engine off  Ignition is ON or ACC  Vehicle is stationary or Gear Shift must be in Park Position  Time and Date are set up to date  Mileage message is available on the vehicle  An active Trailer Profile is currently selected |
|  |  |  |
| **Main Flow** | M1 | User request access to “Trailer Maintenance” menu thru “Towing Menu” or “Select Active Trailer” menu. |
|  | M2 | User access Trailer Maintenance Menu and select the Active Trailer Status option |
|  | M3 | User select one of the items shown in the “Active Trailer Status” menu. |
|  | M4 | User shall be able to create up to 5 custom Trailer Maintenance components by selecting “Add new maintenance item” soft button. |
|  | M5 | User shall have access to a Keyboard in order to be able to use up to 20 characters to label the component. Once the trailer item being labeled user must select “Enter” soft buttons. |
|  | M6 | User access the custom Item configuration created and a screen with the available intervals shall be displayed. (Mileage, Time or Reminder OFF) |
|  | M7 | User shall select “Save” to complete the custom Item configuration. |
|  |  |  |
| **Alternative Flow 1** | A1 | * User can change the Vehicle from the stationary position. * Feature shall hide and Disable the Trailer Maintenance Menu. |
| **Alternative Flow 2** | A2 | * User request access to the Trailer Maintenance when the Default Trailer profiles has been selected. * Feature shall send a Notification/Pop up to notify the Trailer Maintenance Status is not available for the Default Trailer Profile. * Feature shall disable the Active Trailer Status component list. |
| **Alternative Flow 3** | A3 | * Trailer Tow harness may get disconnected. * Feature shall hide and Disable the Trailer Maintenance Menu. |
|  |  |  |
| **Post-condition** |  | HMI Visual Screen will be closed |

* ###UC\_F\_Trailer Trip\_00001### User would like to set the Trailer Distance on the Active Trailer Profile. Allow user to update the trailer mileage on an already created Profile (BEV or Not BEV vehicles)

|  |  |  |
| --- | --- | --- |
| **Purpose** |  | User would like to set the Trailer Distance on (2 or more) Trailer Profiles via SYNC HMI |
| **Actors** |  | User |
| **Precondition** |  | Vehicle has factory or dealer installed trailer wiring  Trailer is connected to the Vehicle  Trailer connected/attached signal must be present on HS3 CAN bus.  Vehicle battery is >= 75% state of charge with engine off  Ignition is ON or ACC  Vehicle is stationary or Gear Shift must be in Park Position  Time and Date are set up to date  Mileage message is available on the vehicle  An active Trailer Profile is currently selected |
|  |  |  |
| **Main Flow** | M1 | User shall select “Select Active Trailer” option under Towing Main Menu. |
|  | M2 | User select “Trailer Trip” and then select the Edit Trailer Distance option (BEV and Non BEV Vehicle) |
|  | M3 | User type the updated Trailer Mileage on the Numbers Keyboard and click Enter to rewrite parameter. |
|  |  |  |
| **Alternative Flow 1** | A1 | * User can change the Vehicle from the stationary position. * Feature shall hide and Disable the Trailer Trip Menu. |
| **Alternative Flow 2** | A2 | * User request access to the Trailer Trip when the Default Trailer profiles has been selected. * Feature shall send a Notification/Pop up to notify the Trailer Trip Status is not available for the Default Trailer Profile. * Feature shall disable the Trailer Trip component list. |
| **Alternative Flow 3** | A3 | * Trailer Tow harness may get disconnected. * Feature shall hide and Disable the Trailer Trip Menu. |
|  |  |  |
| **Post-condition** |  | HMI Visual Screen shall return to the previous Trailer Trip screen |

* ###UC\_F\_Trailer Trip\_00002### User would like to reset the Trailer Distance on the Active Trailer Profile. Allow user to reset the trailer mileage on an already created Trailer Profile (BEV or Not BEV vehicles)

|  |  |  |
| --- | --- | --- |
| **Purpose** |  | User would like to reset the Trailer Distance on (2 or more) Trailer Profiles via SYNC HMI |
| **Actors** |  | User |
| **Precondition** |  | Vehicle has factory or dealer installed trailer wiring  Trailer is connected to the Vehicle  Trailer connected/attached signal must be present on HS3 CAN bus.  Vehicle battery is >= 75% state of charge with engine off  Ignition is ON or ACC  Vehicle is stationary or Gear Shift must be in Park Position  Time and Date are set up to date  Mileage message is available on the vehicle  An active Trailer Profile is currently selected |
|  |  |  |
| **Main Flow** | M1 | User shall select “Select Active Trailer” option under Towing Main Menu. |
|  | M2 | User select “Trailer Trip” and then select the Edit Trailer Distance option (BEV and Non BEV Vehicle) |
|  | M3 | User access Edit Trailer Distance Menu and click on Reset Soft Button. |
|  | M4 | User shall receive a Notification/Pop Up to confirm the reset command. |
|  | M5 | User shall click on “YES” option to reset to 0 the Edit Trailer Distance or “NO” to close the Notification / Pop Up |
| **Alternative Flow 2** | A2 | * User can change the Vehicle from the stationary position. * Feature shall hide and Disable the Trailer Trip Menu. |
| **Alternative Flow 3** | A3 | * User request access to the Trailer Trip when the Default Trailer profiles has been selected. * Feature shall send a Notification/Pop up to notify the Trailer Trip Status is not available for the Default Trailer Profile. * Feature shall disable the Trailer Trip component list. |
| **Alternative Flow 4** | A4 | * Trailer Tow harness may get disconnected. * Feature shall hide and Disable the Trailer Trip Menu. |
|  |  |  |
| **Post-condition** |  | HMI Visual Screen shall return to the previous Trailer Trip screen |

* ###UC\_F\_Trailer Trip\_00003### User would like to reset the Trailer Fuel Economy on the Active Trailer Profile. Allow user to reset the trailer mileage on an already created Trailer Profile (BEV or Not BEV vehicles)

|  |  |  |
| --- | --- | --- |
| **Purpose** |  | User would like to reset the Trailer Fuel Economy on (2 or more) Trailer Profiles via SYNC HMI |
| **Actors** |  | User |
| **Precondition** |  | Vehicle has factory or dealer installed trailer wiring  Trailer is connected to the Vehicle  Trailer connected/attached signal must be present on HS3 CAN bus.  Vehicle battery is >= 75% state of charge with engine off  Ignition is ON or ACC  Vehicle is stationary or Gear Shift must be in Park Position  Time and Date are set up to date  Mileage message is available on the vehicle  An active Trailer Profile is currently selected |
|  |  |  |
| **Main Flow** | M1 | User shall select “Select Active Trailer” option under Towing Main Menu. |
|  | M2 | User select “Trailer Trip” and then select the Reset Trailer Fuel Economy option (Non BEV Vehicle) or Reset Trailer Range per Full Charge (BEV Vehicle) |
|  | M4 | User shall receive a Notification/Pop Up to confirm the reset command. |
|  | M5 | User shall click on “YES” option to reset to 0 the Trailer Fuel Economy option (Non BEV Vehicle)/Trailer Range per Full Charge (BEV Vehicle) or “NO” to close the Notification / Pop Up |
|  |  |  |
| **Alternative Flow 2** | A2 | * User can change the Vehicle from the stationary position. * Feature shall hide and Disable the Trailer Trip Menu. |
| **Alternative Flow 3** | A3 | * User request access to the Trailer Trip when the Default Trailer profiles has been selected. * Feature shall send a Notification/Pop up to notify the Trailer Trip Status is not available for the Default Trailer Profile. * Feature shall disable the Trailer Trip component list. |
| **Alternative Flow 4** | A4 | * Trailer Tow harness may get disconnected. * Feature shall hide and Disable the Trailer Trip Menu. |
|  |  |  |
| **Post-condition** |  | HMI Visual Screen shall return to the previous Trailer Trip screen |

* ###UC\_F\_Trailer Trip\_00004### User would like to reset Trailer Distance and Trailer Fuel Economy on the Active Trailer Profile. Allow user to reset the trailer mileage on an already created Trailer Profile (BEV or Not BEV vehicles)

|  |  |  |
| --- | --- | --- |
| **Purpose** |  | User would like to reset the Trailer Distance and Trailer Fuel Economy on (2 or more) Trailer Profiles via SYNC HMI |
| **Actors** |  | User |
| **Precondition** |  | Vehicle has factory or dealer installed trailer wiring  Trailer is connected to the Vehicle  Trailer connected/attached signal must be present on HS3 CAN bus.  Vehicle battery is >= 75% state of charge with engine off  Ignition is ON or ACC  Vehicle is stationary or Gear Shift must be in Park Position  Time and Date are set up to date  Mileage message is available on the vehicle  An active Trailer Profile is currently selected |
|  |  |  |
| **Main Flow** | M1 | User shall select “Select Active Trailer” option under Towing Main Menu. |
|  | M2 | User select “Trailer Trip” and then click on Reset All soft Button |
|  | M4 | User shall receive a Notification/Pop Up to confirm the reset command. |
|  | M5 | User shall click on “YES” option to reset to 0 the Trailer Fuel Economy option (Non BEV Vehicle)/Trailer Range per Full Charge (BEV Vehicle) and Trailer Distance mileage or “NO” to close the Notification / Pop Up |
| **Alternative Flow 2** | A2 | * User can change the Vehicle from the stationary position. * Feature shall hide and Disable the Trailer Trip Menu. |
| **Alternative Flow 3** | A3 | * User request access to the Trailer Trip when the Default Trailer profiles has been selected. * Feature shall send a Notification/Pop up to notify the Trailer Trip Status is not available for the Default Trailer Profile. * Feature shall disable the Trailer Trip component list. |
| **Alternative Flow 4** | A4 | * Trailer Tow harness may get disconnected. * Feature shall hide and Disable the Trailer Trip Menu. |
|  |  |  |
| **Post-condition** |  | HMI Visual Screen shall return to the previous Trailer Trip screen |

* ###UC\_F\_Trailer Trip\_00005### User would like to see the Trailer Distance and Trailer Fuel Economy status on the Active Trailer Selected. (BEV or Not BEV vehicles)

|  |  |  |
| --- | --- | --- |
| **Purpose** |  | User would like to reset the Trailer Distance and Trailer Fuel Economy on (2 or more) Trailer Profiles via SYNC HMI |
| **Actors** |  | User |
| **Precondition** |  | Vehicle has factory or dealer installed trailer wiring  Trailer is connected to the Vehicle  Trailer connected/attached signal must be present on HS3 CAN bus.  Vehicle battery is >= 75% state of charge with engine off  Ignition is ON or ACC  Vehicle is stationary or Gear Shift must be in Park Position  Time and Date are set up to date  Mileage message is available on the vehicle  An active Trailer Profile is currently selected |
|  |  |  |
| **Main Flow** | M1 | User shall select “Select Active Trailer” option under Towing Main Menu. |
|  | M2 | The user will have the following options depending if the vehicle is BEV or not:  BEV Vehicle   * Edit Trailer Distance {Current Trailer Distance} {units} * Reset Trailer Range per Full Charge {Current Range per Full Charge} {units}   Not BEV Vehicle   * Edit Trailer Distance {Current Trailer Distance} {units} * Reset Trailer Fuel Economy {Current Trailer Fuel Economy}{units} |
|  |  |  |
|  |  |  |
| **Alternative Flow 2** | A2 | * User can change the Vehicle from the stationary position. * Feature shall hide and Disable the Trailer Trip Menu. |
| **Alternative Flow 3** | A3 | * User request access to the Trailer Trip when the Default Trailer profiles has been selected. * Feature shall send a Notification/Pop up to notify the Trailer Trip Status is not available for the Default Trailer Profile. * Feature shall disable the Trailer Trip component list. |
| **Alternative Flow 4** | A4 | * Trailer Tow harness may get disconnected. * Feature shall hide and Disable the Trailer Trip Menu. |
|  |  |  |
| **Post-condition** |  | HMI Visual Screen shall return to the previous Trailer Trip screen |

### Driving Scenarios

NA

### Decision Tables

NA

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Input 1** | **Input 2** | **Input 3** | **Input 4** | **Output** |
| Value I1 | Value I2 |  |  | Value O1 |
|  |  |  |  |  |

## Feature Requirements

### Functional Requirements

###R\_F\_Trailer Settings and Profiles\_00001### Feature Enable

Trailer Settings and Profile feature shall enable the user to configure the Trailer Maintenance and Trailer Trip functions when the following preconditions are met.

* Vehicle has factory or dealer installed trailer wiring
* Trailer is connected to the Vehicle
* Trailer connected/attached signal must be present.
* Vehicle battery is >= 75% state of charge with engine off
* Ignition is ON or ACC
* Vehicle is stationary or Gear Shift must be in Park Position
* Time and Date are set up to date
* Mileage message is available on the vehicle
* An active Trailer Profile is currently selected

###R\_F\_Trailer Settings and Profiles\_00002### Feature Disclaimer

When the Feature is selected and preconditions are met, Trailer Settings and Profile Feature shall provide a disclaimer to define the capabilities and limits.

###R\_F\_Trailer Settings and Profiles\_00003### Feature Disclaimer Recurrence

Trailer Settings and Profile Feature disclaimer shall be present when a Trailer Profile is being configure for the first time or after a Trailer Profile has been reset to the Factory Values.

###R\_F\_Trailer Settings and Profiles\_00004### Feature Disclaimer Content

When Trailer Maintenance Disclaimer is displayer, Trailer Settings and Profile Feature disclaimer shall cover the following statements:

* Trailer Maintenance feature is not replacing the Trailer Owner Manual
* Information displayed by the feature shall be taken as reference only
* All the Notifications and Pop-Ups are displayed based on the user configuration.

###R\_F\_Trailer Settings and Profiles\_00005### Feature Operation

When the Trailer connection/attachment to the vehicle and the preconditions are met, Trailer Settings and Profile Feature shall provide the following functionality:

1. Trailer Maintenance and Trailer Trip HMI Menus became enabled/available.
2. Trailer Maintenance Notifications/Pop Ups shall be present in the Center Console Display.
3. Trailer Maintenance and Trailer Trip status shall be available on the Cluster.

###R\_F\_Trailer Settings and Profiles\_00006### Feature precondition violation

When the Trailer connection/attachment to the vehicle and the preconditions are not met, Trailer Settings and Profile Feature shall disable all the Feature functionality until the preconditions are met again.

###R\_F\_Trailer Settings and Profiles\_00007### Trailer Maintenance Configuration

When Trailer Maintenance function is selected the user shall be allowed to provide the following Trailer components maintenance traceability (Mileage/Months since the Maintenance was configured):

1. Trailer Axle Maintenance components.

- Wheel Bearings and Cups

- Axle Seals

- Springs

- Suspension

1. Trailer Brake Maintenance components.

- Break Adjustment

- Brake Linings

- Hubs and Drum Brakes

- Hydraulic Brakes

- Brake Lines

- Trailer Brake Wiring

- Trailer Brake Magnets.

1. Trailer Wheel and Tire Maintenance components.

- Lug Nuts

- Wheels and Rims

###R\_F\_Trailer Settings and Profiles\_00008### Trailer Maintenance Interval Configuration

When the user starts/update the Maintenance configuration, the user shall be able to customize the time and/or mileage maintenance intervals. (1k-24k Miles / 1-24 Months)

###R\_F\_Trailer Settings and Profiles\_00009### Trailer Maintenance Interval Steps

When the user starts/update the Maintenance configuration, the user shall be able to customize the time interval by 1 month and/or mileage interval by 1000 miles increments.

###R\_F\_Trailer Settings and Profiles\_00010### Trailer Maintenance Interval Turn off

When the Trailer Maintenance is being configured, the user shall be able to turn off time or mileage and keep the maintenance tracking with the remaining active criteria (time/mileage).

###R\_F\_Trailer Settings and Profiles\_00011### Trailer Maintenance Items disabled

When the user is not using one of the predefined maintenance items, the items can be turned off and they will change their position to the bottom of the Maintenance item list.

###R\_F\_Trailer Settings and Profiles\_00012### Trailer Maintenance Configuration Profile Store

When the vehicle user modifies or updates maintenance items, APIM shall store the last updates performed to the Maintenance items configuration.

###R\_F\_Trailer Settings and Profiles\_00013### Trailer Maintenance Axle Components

When Trailer Axle components are selected the maintenance components shall be set as the default threshold as the following diagram.

Axle Components

12,000 Miles / 12 Months

Wheel Bearings and Cups

Axle Seals

Springs

Suspension

###R\_F\_Trailer Settings and Profiles\_00014### Trailer Maintenance Brake Components

When Trailer Brake components are selected the maintenance components shall be set as the default threshold as the following diagram.

Brake Components

6,000 Miles / 6 Months

9,000 Miles / 9 Months

Brake Adjustment

Brake Linings

Hubs and Drum Brakes

Hydraulic Brakes

12,000 Miles / 12 Months

Brake Lines

Trailer Brake Wiring

Trailer Brake Magnets

###R\_F\_Trailer Settings and Profiles\_00015### Trailer Maintenance Wheels and Tire Components

When Trailer Wheel and Rims components are selected the maintenance components shall be set as the default threshold as the following diagram.

3,000 Miles / 3Months

Wheel / Tire

Components

Lug Nuts

12,000 Miles

/ 12 Months

Wheels / Rims

###R\_F\_Trailer Settings and Profiles\_00016### Trailer Maintenance Wiring / Harness Components

When Trailer Wiring / Harness components are selected the maintenance components shall be set as the default threshold as the following diagram.

3,000 Miles / 3Months

Wiring/Harness

Components

Trailer Connector / Harness

###R\_F\_Trailer Settings and Profiles\_00017### Trailer Maintenance recommended maintenance steps

When a Trailer Maintenance pre-defined Item has reached the mileage or/and Time due interval, the HMI shall provide the maintenance recommended steps.

|  |  |  |
| --- | --- | --- |
| **Item** | | **Inspection recommended** |
| 1 | Lug Nuts | Tighten to specified torque value |
| 2 | Brake Adjustment | Adjust to proper operating clearance |
| 3 | Brake Linings | Inspect for wear or contamination |
| 4 | Hub & Drum Brakes | Inspect for abnormal wear or scoring |
| 5 | Brake Lines | Check for cracks, leaks and kinks |
| 6 | Wheel Bearings and Cups | Inspect for corrosion or wear. Clean and repack |
| 7 | Axle Seals | Inspect for leakage. Replace if removed. |
| 8 | Trailer Brake Wiring | Inspect wiring for bare spots, fray, etc. |
| 9 | Wheels/Rim | Check for cracks, dents or corrosion |
| 10 | Hydraulic brakes | Bleed brakes and change brake fluid |
| 11 | Springs | Check for broken or flattened springs |
| 12 | Suspension | Check for worn or loose fasteners and shackle link wear |
| 13 | Trailer Brake Magnets | Check for wear and replace if surface is grooved or copper windings are exposed |
| 14 | Trailer Wiring Connector | Check for dirt or rust and clean the connector pins |

###R\_F\_Trailer Settings and Profiles\_00018### Trailer Maintenance Custom Components

When Trailer Maintenance function is selected, the User shall be able to input up to 19 Custom components and configure the maintenance tracking (Miles/Months in service) according to the predefined intervals available.

###R\_F\_Trailer Settings and Profiles\_00019### Trailer Maintenance Custom Components Configuration

When the User inputs a Custom component, Trailer Maintenance Menu shall allow to use 20 characters to label/define the component.

###R\_F\_Trailer Settings and Profiles\_00020### Trailer Maintenance for Default Trailer

When the User selects as the active Trailer Profile is Default Trailer, all Trailer Maintenance Menus should be disabled for any configuration.

###R\_F\_Trailer Settings and Profiles\_00021### Trailer Maintenance Notifications/Pop Ups

When the Trailer Maintenance functionality enables HMI Notification/Pop Ups on the Central Console Display, the user shall be allowed to select “VIEW” to open the remainder details or “CLEAR REMINDER” to dismiss/clear the reminder.

###R\_F\_Trailer Settings and Profiles\_00022### Trailer Maintenance Notifications/Pop Ups threshold.

When the Trailer Maintenance Notification threshold [350 miles or 7 days are left on the maintenance countdown ] is reached and the preconditions are met, the HMI shall display the Notifications/Pop Ups on the SYNC display.

###R\_F\_Trailer Settings and Profiles\_00023### Trailer Trip Configuration

When Trailer Trip function is selected the user shall be allowed to update/reset the Trailer Distance and Trailer Fuel Economy options.

* Update Trailer Distance and Trailer Fuel Economy separately.
* Reset Trailer Distance and Trailer Fuel Economy together.

###R\_F\_Trailer Settings and Profiles\_00024### Trailer Distance Update

When Trailer Distance option is selected the user shall be able to input the updated the Trailer Distance value.

###R\_F\_Trailer Settings and Profiles\_00025### Trailer Distance Reset

When Reset Edit Trailer Distance option is selected the user shall receive an HMI Notification/Pop up to confirm reset to 0 the Trailer Distance.

###R\_F\_Trailer Settings and Profiles\_00026### Trailer Fuel Economy Reset

When Reset Trailer Fuel Economy option is selected the user shall confirm the HMI Notification/Pop up to confirm reset to 0 the Trailer Fuel Economy.

###R\_F\_Trailer Settings and Profiles\_00027### Trailer Trip Status

When the trailer trip status has an update (mileage/fuel economy), SYNC shall send the updated status information to the cluster in order to update the HMI.

###R\_F\_Trailer Settings and Profiles\_00028### Trailer Maintenance First Notification

When the trailer maintenance item status reaches the values on table below before the deadline, SYNC shall send a Pop-Up/Notification to the user with the time or mileage remaining for the next maintenance.

|  |  |  |
| --- | --- | --- |
|  | Trigger 1st Notification  [Miles before maintenance due] | Trigger 1st Notification  [days before maintenance due] |
| Active Trailer Profile | | |
| Wheel bearings and cups | 350 | 7 |
| Axel seals |
| Springs |
| Suspension |
| Brake Adjustment |
| Brake lining |
| Hub and Drum brakes |
| Brake lines |
| Trailer Brake wiring |
| Hydraulic brakes |
| Trailer Brake magnets |
| Lug nuts |
| Wheel/rim |
| custom items 1-20\* |

###R\_F\_Trailer Settings and Profiles\_00029### Trailer Maintenance Second Notification

When the trailer maintenance item status reaches the values on table below before the deadline, SYNC shall send a Pop-Up/Notification to the user with the time or mileage remaining for the next maintenance.

|  |  |  |
| --- | --- | --- |
|  | Trigger 2nd Notification  [Miles maintenance reached] | Trigger 2nd Notification  [days maintenance reached] |
| Active Trailer Profile | | |
| Wheel bearings and cups | Trailer current mileage countdown  =  Trailer Maintenance Miles | Trailer current Month countdown  =  Trailer Maintenance Time |
| Axel seals |
| Springs |
| Suspension |
| Brake Adjustment |
| Brake lining |
| Hub and Drum brakes |
| Brake lines |
| Trailer Brake wiring |
| Hydraulic brakes |
| Trailer Brake magnets |
| Lug nuts |
| Wheel/rim |
| custom item 1-20\* |

###R\_F\_Trailer Settings and Profiles\_00030### Trailer Maintenance Overdue Notification

When one or more trailer maintenance items have overdue the Trailer Maintenance Time or Mileage interval configured, the user shall receive an Overdue Maintenance Notification / Pop-Up on the first key ignition cycle with a 24hr spacing period.

### Nonfunctional Requirements

#### Security

#### Reliability

### HMI Requirements

This Feature provides an HMI interface to the user on the SYNC display and IPC which describes the functionality and provides the user the Feature Functions to configure (Trailer Maintenance/Trailer Trip). All the HMI requirements are described on ConOps\_Trailer Settings and Profile\_v0.08 or newer.

### Other Requirements

#### Manufacturing Requirements

#### Service Requirements

##### Cloud Connectivity Data Analytics Requirements

#### After Sales Requirements

#### Process requirements

**#Hint**: Requirements in this section are relevant for the development process of the feature, e.g. ISO26262 compliance.

## Functional Safety

The Trailer Settings and Profiles feature requires Functional Safety to perform a safety analysis on the feature. The analysis encompasses 7 unique system behaviors, of which, have all been analyzed. From the Hazard Analysis and Risk Assessment Functional Safety work product it was determined that the Trailer Settings and Profiles is a low risk feature with a QM rating.

### System Behaviors for HARA

|  |  |  |
| --- | --- | --- |
| ID | Name | Description |
| **F\_Trailer Settings and Profiles\_SB0001** | Check Connected Trailer Maintenance Status | Feature becomes enabled when there is a trailer attached to the vehicle. |
| **F\_Trailer Settings and Profiles\_SB0002** | Display Trailer Profile and Settings | Customer can view the current attached trailer profile and the settings (maintenance items) that correspond to that trailer profile. |
| **F\_Trailer Settings and Profiles\_SB0003** | Detected Trailer Profile Selection Notification | Customer can view the maintenance notification preferences for a trailer profile. |
| **F\_Trailer Settings and Profiles\_SB0004** | Notification of Trailer Maintenance Required | Notification sent to the HMI notifying the user when trailer maintenance is required. |
| **F\_Trailer Settings and Profiles\_SB0005** | Save Custom Maintenance Item | Customer can save up to 4 custom maintenance items. |
| **F\_Trailer Settings and Profiles\_SB0006** | Save Trailer Profile and Settings | Customer can save the trailer profile and settings (maintenance items). |
| **F\_Trailer Settings and Profiles\_SB0007** | Track Trailer Mileage | Feature tracks mileage of connected trailer. |

Table 12: System Behaviors for HARA

### Safety Assumptions

There are no Safety Assumptions for this feature.

|  |  |  |
| --- | --- | --- |
| ID | Assumption | |
| **1** | **Name** | Vehicle Stationary / In Park |
| **Description** | Precondition to use the feature, the vehicle must be stationary or in park position, otherwise feature is inaccessible. |
| **Purpose** | To call attention to the vehicle and transmission state to access this feature. |
| **Category** | Controllability |
| **Related FSR IDs** | A01 |
| **2** | **Name** | Operator's Responsibility |
| **Description** | The operator is responsible for following preventative maintenance procedures, laws and best practices for vehicle and trailer operation regardless of function of the feature to prevent equipment failure due to normal wear and tear. |
| **Purpose** | To relay that this feature is not a replacement for the trailer maintenance manual. |
| **Category** | Controllability |
| **Related FSR IDs** | A02 |

Table 13: Functional Safety Assumptions

### Safety Goals

There are no Safety Goals for this feature.

### Functional Safety Requirements

Functional Safety Requirements (FSRs) are not applicable for this feature.

## Cybersecurity

**#Classification**: Cybersecurity only – Otherwise remove substructure and state “not applicable”.

### Security Goals

**#Classification**: Cybersecurity only

**#Hint:** The list of Cybersecurity Goals are an output of the Threat Model. The CAL attribute is not used yet.

**#Link:** [Alignment with Cybersecurity](http://wiki.ford.com/display/RequirementsEngineering/Alignment+with+Cybersecurity) – RE Wiki

|  |  |  |
| --- | --- | --- |
| ID | Goal | |
|  | **Goal Name** |  |
| **Description** |  |
| **CAL** |  |
| **Related CSR IDs** |  |
|  | **Goal Name** |  |
| **Description** |  |
| **CAL** |  |
| **Related CSR IDs** |  |
|  | **Goal Name** |  |
| **Description** |  |
| **CAL** |  |
| **Related CSR IDs** |  |

Table 16: Cybersecurity Goals

### Cybersecurity Requirements

No Applicable

# Functional Architecture

## Description

This Functional Architecture Diagram shows the signals and messages transit between the modules to enable Trailer Settings and Profile Feature.

* Signals.

BCM, PCM, ITRM provide the pre-condition signals to enable the feature functionality through the FNV3 Architecture.

* TP Messages.

IPC receive Feature information from APIM and display the Trailer Trip Status in the Cluster IOD.



Figure 4: Functional Architecture

## Function List

|  |  |  |  |
| --- | --- | --- | --- |
| Function Name | Description | Link to Function Spec | Comments |
| Receive Ignition Status Signal | Ignition status determination for feature pre-condition assessment  Signal = RUN | N/A | Existing function |
| Receive Taillight Status Signal | Taillight status determination for feature pre-condition assessment  Signal = Trailer Lamp Connected | N/A | Existing function |
| Receive Battery State of Charge Signal | Vehicle battery state of charge determination for feature pre-condition assessment  Signal = Supported | N/A | Existing function |
| Receive Transmission gear position signal | Vehicle stationary status determination for feature pre-condition assessment  Signal = Park Position |  | Existing function |
| Show Pre-condition Status | Displays pre-condition status on UI if pre-conditions are not met |  | New function |
| Trailer Settings and Profile Feature Request | Send user request to configure/update Trailer Settings and Profile function. | 3.4.1 | New Function |
| Trailer Maintenance HMI Displayed by SYNC | SYNC Enable the configuration/update of the Trailer Maintenance Items. | 3.4.1 | New Function |
| Trailer Trip HMI Displayed by SYNC | SYNC Enable the Update/ reset of the Trailer Trip Items. | 3.4.1 | Existing Function |
| Calculate Trailer Trip Parameters Status | Trailer Distance and Trailer Fuel Economy Status Displayed. | 3.4.1 | Existing Function |
| Forward Trailer Trip Parameters Status | Trailer Distance and Trailer Fuel Economy Status Displayed. | 3.4.1 | Existing Function |
| Trailer Trip Parameters Status Displayed by IPC | Trailer Distance and Trailer Fuel Economy Status Displayed. | 3.4.1 | Existing Function |
|  |  |  |  |

Table 17: List of Logical Functions

## Signal List

### HS3 signals

APIM

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Msg Id** | **Description** | **Length** | **StartBit** | **Detailed Meaning** | **Units** | **Minimum** | **Maximum** | **Transmitters** | **Signal Receivers** | **Send Type** | **GenSigStartValue (Init)** |
| 0x91 | MFD\_DateTime | 64 (48 used) |  |  |  |  |  | APIM | IPC | Event |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  | MFD\_Year | 8 | 0 |  | year | 2000 (0x0) | 2254 (0xFE) | APIM | IPC | No Send Type | 0 (2000) |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  | MFD\_Month | 8 | 8 |  | month | 0 (0x0) | 12 (0xC) | APIM | IPC | No Send Type | 0 (0) |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  | MFD\_Day | 8 | 16 |  | day | 0 (0x0) | 31 (0x1F) | APIM | IPC | No Send Type | 0 (0) |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  | MFD\_Hour | 8 | 24 |  | hour | 0 (0x0) | 23 (0x17) | APIM | IPC | No Send Type | 0 (0) |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  | MFD\_Second | 8 | 32 |  | second | 0 (0x0) | 59 (0x3B) | APIM | IPC | OnChange | 0 (0) |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  | MFD\_Minute | 8 | 40 |  | minute | 0 (0x0) | 59 (0x3B) | APIM | IPC | No Send Type | 0 (0) |
|  |  |  |  |  |  |  |  |  |  |  |  |

ITRM-TRM

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Msg Id** | **Description** | **Length** | **StartBit** | **Detailed Meaning** | **State Encoded** | **Minimum** | **Maximum** | **Transmitters** | **Signal Receivers** | **Send Type** | **GenSigStartValue (Init)** |
| **0x443** | **TrailerInfo\_HS2** | **64 (23 used)** |  |  |  |  |  | **TRM\_ITRM** | **GWM SCCM** | **Event Periodic** |  |
|  | **TrlrLampCnnct\_B\_Actl** | **1** | **0** |  |  | **0 (0x0)** | **1 (0x1)** | **TRM\_ITRM** | **GWM SCCM** | **No Send Type** | **0 (0)** |
|  |  |  |  | **No** | **0x0** |  |  |  |  |  |  |
|  |  |  |  | **Yes** | **0x1** |  |  |  |  |  |  |

### FD1 Signals

BCM

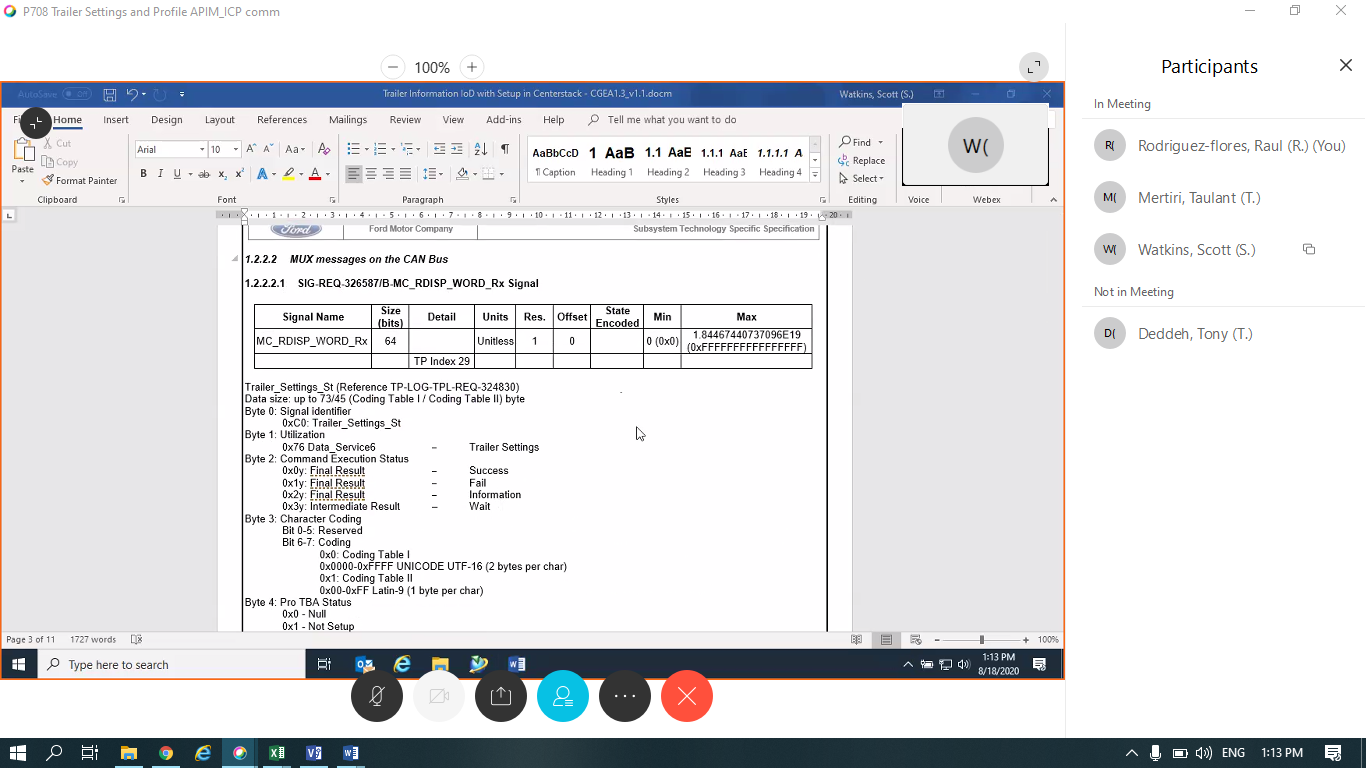
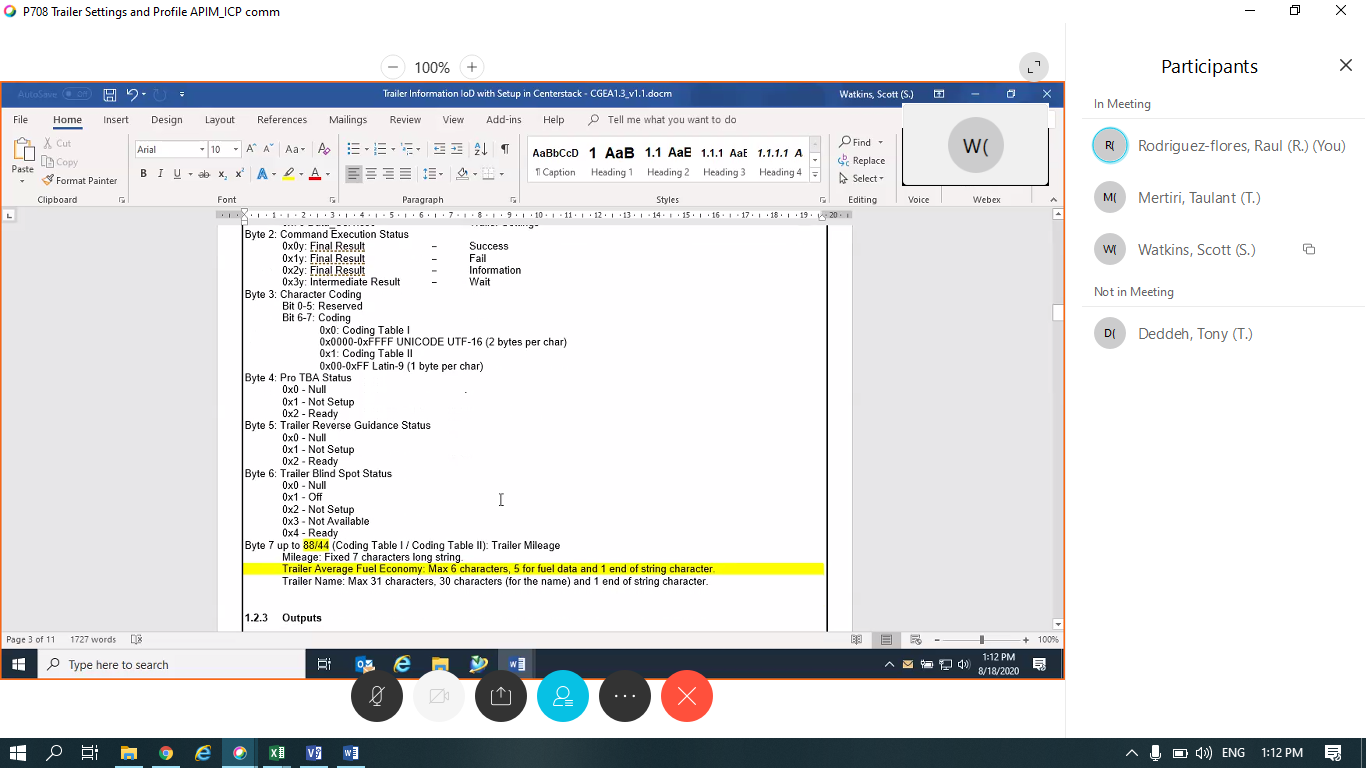
|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Msg Id** | **Description** | **Length** | **StartBit** | **Detailed Meaning** | **State Encoded** | **Minimum** | **Maximum** | **Transmitters** | **Signal Receivers** | **Send Type** | **GenSigStartValue (Init)** |
| **0x43C** | **Battery\_Mgmt\_3** | **64 (57 used)** |  |  |  |  |  | **BCM** |  | **Fixed Periodic** |  |
|  | **BSBattSOC** | **7** | **17** |  |  | **0 (0x0)** | **127 (0x7F)** | **BCM** | **ECM DIESEL GWM PCM TCM\_DSL** | **No Send Type** | **0 (0)** |
|  |  |  |  | **%** |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **0x3B3** | **BodyInfo\_3** | **64 (64 used)** |  |  |  |  |  |  |  |  | **BCM** |  | **Event Periodic** |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | **Ignition\_Status** | **4** | **0** |  | **SED** | **1** | **0** |  | **0 (0x0)** | **15 (0xF)** | **BCM** | **GWM PCM** | **OnChange** |
|  |  |  |  | **Unknown** |  |  |  | **0x0** |  |  |  |  |  |
|  |  |  |  | **Off** |  |  |  | **0x1** |  |  |  |  |  |
|  |  |  |  | **Accessory** |  |  |  | **0x2** |  |  |  |  |  |
|  |  |  |  | **Run** |  |  |  | **0x4** |  |  |  |  |  |
|  |  |  |  | **Start** |  |  |  | **0x8** |  |  |  |  |  |
|  |  |  |  | **Invalid** |  |  |  | **0xF** |  |  |  |  |  |

PCM

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Msg Id** | **Description** | **Length** | **StartBit** | **Detailed Meaning** | **State Encoded** | | **Minimum** | **Maximum** | **Transmitters** | **Signal Receivers** | **Send Type** | **GenSigStartValue (Init)** |
| **0x230** | **TransGearData** | **64 (52 used)** |  |  | |  |  |  | **PCM TCM\_DSL** |  | **Fixed Periodic** |  | |
|  | **GearLvrPos\_D\_Actl** | **4** | **11** |  | |  | **0 (0x0)** | **15 (0xF)** | **PCM TCM\_DSL** | **BCM ECM\_DIESEL GWM** | **No Send Type** | **14 (14)** | |
|  |  |  |  | **Park** | | **0x0** |  |  |  |  |  |  | |
|  |  |  |  | **Reverse** | | **0x1** |  |  |  |  |  |  | |
|  |  |  |  | **Neutral** | | **0x2** |  |  |  |  |  |  | |
|  |  |  |  | **Drive** | | **0x3** |  |  |  |  |  |  | |
|  |  |  |  | **Sport\_DriveSport** | | **0x4** |  |  |  |  |  |  | |
|  |  |  |  | **Low** | | **0x5** |  |  |  |  |  |  | |
|  |  |  |  | **first** | | **0x6** |  |  |  |  |  |  | |
|  |  |  |  | **second** | | **0x7** |  |  |  |  |  |  | |
|  |  |  |  | **third** | | **0x8** |  |  |  |  |  |  | |
|  |  |  |  | **fourth** | | **0x9** |  |  |  |  |  |  | |
|  |  |  |  | **fifth** | | **0xA** |  |  |  |  |  |  | |
|  |  |  |  | **sixth** | | **0xB** |  |  |  |  |  |  | |
|  |  |  |  | **Undefined\_Treat\_as\_Fault** | | **0xC** |  |  |  |  |  |  | |
|  |  |  |  | **Undefined\_Treat\_as\_\_Fault** | | **0xD** |  |  |  |  |  |  | |
|  |  |  |  | **Unknown\_Position** | | **0xE** |  |  |  |  |  |  | |
|  |  |  |  | **Fault** | | **0xF** |  |  |  |  |  |  | |

### Message ID 2AC goes thru CAN HS3



# Function Specifications

## Logical Functions

## Trailer Maintenance User Request

#### Description

This function allows the user to make a selection using In-vehicle HMI to track the Trailer Maintenance parameters for all the Trailer Profiles Created. The user can select one Trailer Profile at a time and keep it as the Active Trailer Profile.

The Active Trailer Profile will be the only Profile with full Trailer Maintenance functionality in order to be Configured/Updated/Reset while the Features pre-conditions are met (Transmission gear in park position, Key Ignition Status on RUN position, Battery State of Charge > 75% and Trailer connected to vehicle).

#### Assumptions

Assumptions and Constrains listed below:

**Assumptions**

1. APIM will serve as the feature arbitrator.
2. High Speed and Medium Speed CAN interfaces between the modules are already implemented
3. Battery status and SOC monitoring function is already implemented on the power supply module
4. 12V primary battery supported/not and transmission status monitoring functions are already implemented on the PCM/ECM/TCM
5. Vehicle Speed monitoring function is already implemented on the ABS and PCM/ECM/TCM
6. HMI has already a way to read and process the user inputs
7. This Feature will provide suggested/recommended Trailer maintenance steps and intervals, but It will not replace the Trailer Owner Manual.

**Constraints**

1. Vehicle user trailer information inputs determine the accuracy of the Feature functions.
2. Sync Notification hierarchy determine when the Feature Notifications are shown.
3. SYNC/APIM software versions
4. Applicable for vehicles equipped with automatic transmission and manual transmissions with electric park brake
5. Capability of modules to implement the function
6. Memory of the modules
7. Bandwidth of the buses
8. Netcomm regulations for CAN interfaces
9. Existing messages on the vehicle network.
10. HMI structure design
11. Display capability of the HMI screen
12. Vehicle battery usage by other features

**Dependencies**

1. Implementation depends on vehicle electrical architecture.
2. Configuration of the modules
3. Customer usage and maintenance
4. Vehicle architecture must be at least FNV3
5. Vehicles with at least SYNC 4.0 shall have this feature
6. BCM version must be at least BCM Gen 1 M
7. Battery type- AGM battery, 12V

### Function Scope



Figure 5: Context Diagram of Function Trailer Maintenance User Request

### Function Interfaces

#### Logical Inputs

###LSG\_Trailer Settings and Profiles\_00001### Trailer Module Precondition

When user selects Trailer Settings and Profile using in-vehicle, this logical signal notifies if the trailer connection precondition is met.

|  |  |  |
| --- | --- | --- |
| **Signal Name** | **Signal Value** | **Description** |
| Trailer Connected | [0] TrlrLampCnnct\_B\_Actl | Indicates if a trailer is connected on the trailer lamp circuit. |

|  |  |  |
| --- | --- | --- |
| Data Type | Init Value | Default Value  (missing signal) |
| 0x0 - Null (Defaulted)  0x1 – Yes (Connected) | 0x0 = Null (Defaulted) | 0x0 = Null (Defaulted) |

|  |  |  |
| --- | --- | --- |
| Transmit Model | Send Type | E2E Latency |
| HS3 CAN | Event Periodic |  |

###LSG\_Trailer Settings and Profile\_00002### Powertrain Control Module Precondition

When user selects Trailer Settings and Profile using in-vehicle, this logical signal notifies if the transmission gear position precondition is met.

|  |  |  |
| --- | --- | --- |
| **Signal Name** | **Signal Value** | **Description** |
| Shifter Position | [11] GearLvrPos\_D\_Actl | Indicates if the Transmission changes or stay on specific position. |

|  |  |  |
| --- | --- | --- |
| Data Type | Init Value | Default Value  (missing signal) |
| 0x0 - Park  0x1 – Reverse  0x2 - Neutral  0x3 – Drive  0x4 - Sport\_DriveSport  0x5 - Low  0x6 – First  0x7 - Second  0x8 - Third  0x9 - Fourth  0xA - Fifth  0xB - Sixth  0xC - Undefined\_Treat\_as\_Fault  0xD - Undefined\_Treat\_as\_Fault  0xE – Unknown\_Position  0xF - Fault | 0x0 = Park (Defaulted) | 0x0 = Park (Defaulted) |

|  |  |  |
| --- | --- | --- |
| Transmit Model | Send Type | E2E Latency |
| FD1 CAN | Fixed Periodic |  |

###LSG\_Trailer Settings and Profile\_00003### Powertrain Control Module Precondition

When user selects Trailer Settings and Profile using in-vehicle, this logical signal notifies if the operating battery precondition is met.

|  |  |  |
| --- | --- | --- |
| **Signal Name** | **Signal Value** | **Description** |
| Battery SOC | [7] BSBattSOC | Indicates if the battery operation range supports the functionality. |

|  |  |  |
| --- | --- | --- |
| Data Type | Init Value | Default Value  (missing signal) |
| 0x0 – 0  0x7F – 127 | 0x0 = 0 |  |

|  |  |  |
| --- | --- | --- |
| Transmit Model | Send Type | E2E Latency |
| FD1 CAN | Fixed Periodic |  |

###LSG\_Trailer Settings and Profile\_00004### Body Control Module Precondition

When user selects Trailer Settings and Profile using in-vehicle, this logical signal notifies if the Key Ignition Status precondition is met.

|  |  |  |
| --- | --- | --- |
| **Signal Name** | **Signal Value** | **Description** |
| Ignition Status | [0] Ignition\_Status | Indicates if the Key Ignition Status Position. |

|  |  |  |
| --- | --- | --- |
| Data Type | Init Value | Default Value  (missing signal) |
| 0x0 – Unknown  0x1 – Off  0x2 - Accessory  0x4 – Run  0x8 – Start  0xF – Invalid | 0x0 = Unknown (Defaulted) | 0x0 = Unknown (Defaulted) |

|  |  |  |
| --- | --- | --- |
| Transmit Model | Send Type | E2E Latency |
| FD1 CAN | Event Periodic |  |

#### Logical Outputs

###LSG\_Trailer Settings and Profile\_00001### Date/Time

When user selects Trailer Settings and Profile using in-vehicle, this logical signal is used to calculate the Time Maintenance parameters.

|  |  |  |
| --- | --- | --- |
| **Signal Name** | **Signal Value** | **Description** |
| Year | [0] MFD\_Year | Indicates the current year. |

|  |  |  |
| --- | --- | --- |
| Data Type | Init Value | Default Value  (missing signal) |
| 0x0 – 2000  0xFE – 2254 | 0x0 = 2000 | 0x0 = 2000 |

|  |  |  |
| --- | --- | --- |
| Transmit Model | Send Type | E2E Latency |
| HS3 CAN | Event |  |

###LSG\_Trailer Settings and Profile\_00001### Date/Time

When user selects Trailer Settings and Profile using in-vehicle, this logical signal is used to calculate the Time Maintenance parameters.

|  |  |  |
| --- | --- | --- |
| **Signal Name** | **Signal Value** | **Description** |
| Month | [8] MFD\_Month | Indicates the current month. |

|  |  |  |
| --- | --- | --- |
| Data Type | Init Value | Default Value  (missing signal) |
| 0x0 – 0  0xC – 12 | 0x0 = 0 | 0x0 = 0 |

|  |  |  |
| --- | --- | --- |
| Transmit Model | Send Type | E2E Latency |
| HS3 CAN | Event |  |

###LSG\_Trailer Settings and Profile\_00001### Date/Time

When user selects Trailer Settings and Profile using in-vehicle, this logical signal is used to calculate the Time Maintenance parameters.

|  |  |  |
| --- | --- | --- |
| **Signal Name** | **Signal Value** | **Description** |
| Day | [16] MFD\_Day | Indicates the current day. |

|  |  |  |
| --- | --- | --- |
| Data Type | Init Value | Default Value  (missing signal) |
| 0x0 – 0  0x1F – 31 | 0x0 = 0 | 0x0 = 0 |

|  |  |  |
| --- | --- | --- |
| Transmit Model | Send Type | E2E Latency |
| HS3 CAN | Event |  |

#### Logical Parameters

|  |  |
| --- | --- |
| **Parameter Name** | **Description** |
| Item#\_MaintConfigDate | Maintenance Items Configuration Date |
| Item#\_MaintDueDate | Maintenance Items Due Date |
| Item#\_TimeCountdown | Maintenance Items Time Countdown |
| Item#\_MaintConfigOdometer | Maintenance Items Odometer Configuration |
| Item#\_MaintOdometerDue | Maintenance Items Odometer Due |
| Item#\_OdometerCountdown | Maintenance Items Odometer Countdown |

### Function Modeling

#### Use Cases

* ###UC\_fn\_Trailer Maintenance\_00001### User enter the Trailer Maintenance (Active Trailer Profile).

|  |  |  |
| --- | --- | --- |
| **Purpose** |  | User enter the Trailer Maintenance Menu |
| **Actors** |  | User / SYNC |
| **Precondition** |  | Trailer connected/attached signal must be present on HS3 CAN bus.  Vehicle battery is >= 75% state of charge with engine off  Ignition is ON or ACC  Vehicle is stationary or Gear Shift must be in Park Position |
|  |  |  |
| **Main Flow** | M1 | User Access the Towing Menu |
|  | M2 | User has the following options:   1. User select “Select Active Trailer” soft button.    1. Then user selects one of the Trailer Profiles created (not applicable to Default Trailer profile). (continue on M3) 2. User select “Maintenance Status” soft button. (continue on M4) |
|  | M3 | User selects one of the Trailer Profiles created (not applicable to Default Trailer profile). |
|  | M4 | User selects “Maintenance Status” soft button. |
|  | M5 | User shall enter to the “Trailer Maintenance” menu. |
|  |  |  |
| **Alternative Flow 1** | A1 | * User can change the Vehicle from the stationary position. * Feature shall hide the Trailer Maintenance Notification. * Notification/Pop up shall be displayed when the preconditions are complied. |
|  |  |  |
| **Post-condition** |  | Trailer Maintenance HMI will be fully operational. |

#### State Charts / Activity Diagrams / Sequence Diagrams / Decision Tables

**

Figure 6: State Machine of Function Trailer Maintenance User Access request



Figure 7: Activity Diagram of Function “Trailer Maintenance User request”



Figure 8: Sequence Diagram of Function “Trailer Maintenance Logical Function”

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Input Signal 1** | **Input Signal 2** | **Input Signal 3** | **Input Signal 4** | **Output Signal** |
| Value I1 | Value I2 |  |  | Value O1 |
|  |  |  |  |  |

Table 19: Decision Table of Function “Trailer Maintenance Logical Function”

### Function Requirements

###R\_FNC\_Trailer Maintenance\_00001### User request access to Trailer Maintenance

Upon user request access to the Trailer Maintenance in-vehicle, the function shall verify pre-conditions are met.

Ignition\_status = (0x4) RUN or (0x2) ACC

GearLvrPos\_D\_Actl = (0x0) Park

BSBattSOC > (0x59) 75%

TrlrLampCnnct\_B\_Actl = (0x1) Yes

###R\_FNC\_Trailer Maintenance\_00002### User request access to Trailer Maintenance

When the pre-conditions are meet, Sync shall enable all the Trailer Maintenance functionality.

#### Functional Requirements

###R\_FNC\_Trailer Maintenance\_00003### User request access to Trailer Maintenance

When the pre-conditions are not meet after at any time while the user is navigating on Trailer Maintenance function, Sync shall disable all the Trailer Maintenance functionality and provide a Notification of the preconditions faulted.

###R\_FNC\_Trailer Maintenance\_00004### Pre-defined Maintenance Items Configuration Date

When the user access the Active Trailer Status and accept the Maintenance Disclaimer, APIM shall store the current MFD\_Year, MFD\_Month, MFD\_Day values of MFD\_DateTime message as the Maintenance Items Configuration Date <Item#\_MaintConfigDate> for the pre-defined items.

###R\_FNC\_Trailer Maintenance\_00005### Custom Maintenance Items Configuration Date

When a new maintenance item is included in the Maintenance Items list, APIM shall store the current MFD\_Year, MFD\_Month, MFD\_Day values of MFD\_DateTime message as the New Maintenance Item Configuration Date <Item#\_MaintConfigDate>.

###R\_FNC\_Trailer Maintenance\_00006### Pre-defined Maintenance Items Configuration Date Reset

When the user reset the Active Trailer Status, APIM shall erase current value of the pre-defined Maintenance Items Configuration Date <Item#\_MaintConfigDate> and display the Maintenance Disclaimer.

###R\_FNC\_Trailer Maintenance\_00007### Custom Maintenance Items Configuration Reset

When the user reset the Active Trailer Status, APIM shall erase all the Custom Maintenance Items.

###R\_FNC\_Trailer Maintenance\_00008### Item Maintenance Due Date

When a Pre-defined/Custom Maintenance item is configured with a date interval, APIM shall calculate and store the Maintenance due date <Item#\_MaintDueDate> by adding the Maintenance Item Configuration Date <Item#\_MaintConfigDate> with the Maintenance Time interval selected.

###R\_FNC\_Trailer Maintenance\_00009### Item Maintenance Time Countdown

When an Active Trailer Profile is select, APIM shall calculate all the Maintenance Items Time Countdown <Item#\_TimeCountdown> comparing the current Maintenance Due Date <Item#\_MaintDueDate> and the current values of MFD\_DateTime,

###R\_FNC\_Trailer Maintenance\_00010### Item Maintenance Due Date Update

When the user updates a Pre-defined/Custom Maintenance item time interval before the current due date is reached, APIM shall calculate and store the new Maintenance due date <Item#\_MaintDueDate> by adding the Maintenance Item Configuration Date <Item#\_MaintConfigDate> with the new Maintenance Time interval selected.

###R\_FNC\_Trailer Maintenance\_00011### Item Maintenance Due Date Invalid Update

Sync shall display an Invalid Selection Pop Up, when the updated Maintenance Due Date <Item#\_MaintDueDate> compared against the current maintenance Odometer Countdown <Item#\_TimeCountdown> gives a value lower than 0 days.

###R\_FNC\_Trailer Maintenance\_00012### Item Maintenance Configuration Date Update

When a Pre-defined/Custom Maintenance Item Date Interval is update after the current due date is reach, APIM shall overwrite the Maintenance Item Configuration Date <Item#\_MaintConfigDate> with the current Maintenance Due Date <Item#\_MaintDueDate> and recalculate the new Maintenance Due Date <Item#\_MaintDueDate> with updated interval selected.

###R\_FNC\_Trailer Maintenance\_00013### 7 days or less Maintenance Reminder

When the difference between Item Time Countdown <Item#\_TimeCountdown> and the Maintenance Due Date stored <Item#\_MaintDueDate> is between 1 to 7 days for one or more Maintenance Items, the system shall display an Item Maintenance Reminder for the upcoming Maintenance items.

###R\_FNC\_Trailer Maintenance\_00014### Item Maintenance Notification Snooze

When user select “Remind me later” for the 7 days or less Maintenance Reminder, Sync shall display the next Maintenance Reminder until the Item Time Countdown <Item#\_TimeCountdown> reaches 0 days.

###R\_FNC\_Trailer Maintenance\_00015### Due date Maintenance Reminder

When the difference between Item Time Countdown <Item#\_TimeCountdown> and the Maintenance Due Date stored <Item#\_MaintDueDate> is equal to 0 days for one or more Maintenance Items, the system shall display a Due Date Maintenance Reminder.

###R\_FNC\_Trailer Maintenance\_00016### Item Maintenance Date Overdue

When the APIM current MDF\_DateTime values are greater than <Item#\_MaintDueDate>, the system shall display an Item Maintenance Overdue Notification every 24hr until the reminder become cleared.

###R\_FNC\_Trailer Maintenance\_00017### Item Maintenance Overdue Notification Clear

When the User select “Clear Reminder” Notification option or update the Maintenance Due Date <Item#\_MaintDueDate>, the system shall display an Item Maintenance Overdue Notification every 24hr.

###R\_FNC\_Trailer Maintenance\_00018### Pre-defined Maintenance Items Odometer Configuration

When the user access the Active Trailer Status and accept the Maintenance Disclaimer, APIM shall store the current Trailer Distance value form Trailer Trip function as the Maintenance Items Odometer Configuration <Item#\_MaintConfigOdometer> for the pre-defined items.

###R\_FNC\_Trailer Maintenance\_00019### Custom Maintenance Items Configuration Odometer

When a new maintenance item is included in the Maintenance Items list, Sync shall store the current Trailer Distance value form Trailer Trip function as the Maintenance Item Odometer Configuration <Item#\_MaintConfigOdometer> for the new item.

###R\_FNC\_Trailer Maintenance\_00020### Pre-defined Maintenance Items Configuration Odometer Reset

When the user reset the Active Trailer Status, Sync shall erase current value of the pre-defined Maintenance Items Odometer Configuration <Item#\_MaintConfigOdometer> and display the Maintenance Disclaimer.

###R\_FNC\_Trailer Maintenance\_00021### Item Maintenance Odometer Due

When a Pre-defined/Custom Maintenance item is configure with a distance interval, APIM shall calculate and store the Maintenance Odometer Due <Item#\_MaintOdometerDue> by adding the Maintenance Item Odometer Configuration <Item#\_MaintConfigOdometer> with the Maintenance Distance interval selected.

###R\_FNC\_Trailer Maintenance\_00022### Item Maintenance Odometer Countdown

When an Active Trailer Profile is select, APIM shall calculate all the Maintenance Items Odometer Countdown <Item#\_OdometerCountdown> comparing the current Maintenance Odometer Due <Item#\_MaintOdometerDue> and the current Trailer Distance value in Trailer Trip function.

###R\_FNC\_Trailer Maintenance\_00023### Item Maintenance Odometer Due Update

When the user update a Pre-defined/Custom Maintenance item distance interval before the current odometer due is reached, APIM shall calculate and store the new Maintenance Odometer due <Item#\_MaintOdometerDue> by adding the Maintenance Item Odometer Configuration <Item#\_MaintConfigOdometer> with the new Maintenance distance interval selected.

###R\_FNC\_Trailer Maintenance\_00024### Item Maintenance Odometer Due Invalid Update

Sync shall display an Invalid Selection Pop Up, when the updated Maintenance Odometer Due <Item#\_MaintOdometerDue> compared against the current maintenance Odometer Countdown <Item#\_OdometerCountdown> gives a value lower than 0 miles.

###R\_FNC\_Trailer Maintenance\_00025### Item Maintenance Odometer Configuration Update

When the user updates a Pre-defined/Custom Maintenance Item Distance Interval after the current Odometer Due is reached, APIM shall overwrite the Maintenance Item Odometer Configuration <Item#\_MaintConfigOdometer> with the current Maintenance Due Date <Item#\_MaintDueDate> and recalculate the new Maintenance Due Date <Item#\_MaintDueDate> with updated interval selected.

###R\_FNC\_Trailer Maintenance\_00026### 350 Miles or less Maintenance Reminder

When the difference between Item Odometer Countdown <Item#\_OdometerCountdown> and the Maintenance Odometer Due stored <Item#\_MaintDueDate> is between 1 to 350 miles for one or more Maintenance Items, the system shall display an Item Maintenance Reminder for the upcoming Maintenance items.

###R\_FNC\_Trailer Maintenance\_00027### Item Maintenance Notification Snooze

When user select “Remind me later” for the 350 miles or less Maintenance Reminder, Sync shall display the next Maintenance Reminder until the Item Odometer Countdown <Item#\_OdometerCountdown> reaches 0 miles.

###R\_FNC\_Trailer Maintenance\_00028### Maintenance Odometer Due Reminder

When the difference between Item Odometer Countdown <Item#\_OdometerCountdown> and the Maintenance Odometer Due stored <Item#\_MaintOdometerDue> is equal to 0 miles for one or more Maintenance Items, the system shall display an Odometer Due Maintenance Reminder.

###R\_FNC\_Trailer Maintenance\_00029### Item Maintenance Odometer Overdue

When the APIM current Trailer Distance value is greater than <Item#\_MaintOdometerDue>, the system shall display an Item Maintenance Overdue Notification every 24hr until the reminder become cleared.

###R\_FNC\_Trailer Maintenance\_00030### Item Maintenance Overdue Notification Clear

When the User select “Clear Reminder” Notification option or update the Maintenance Odometer Due <Item#\_MaintOdometerDue>, the system shall display an Item Maintenance Overdue Notification every 24hr.

## Trailer Trip User Request

#### Description

This function allows the user to make a selection using In-vehicle HMI to track the Trailer Trip parameters for all the Trailer Profiles Created. The user can select one Trailer Profile at a time and keep it as the Active Trailer Profile.

The Active Trailer Profile will be the only Profile with full Trailer Trip functionality in order to be Configured/Updated/Reset while the Features pre-conditions are met (Transmission gear in park position, Key Ignition Status on RUN position, Battery State of Charge > 75% and Trailer connected to vehicle).

#### Assumptions

Assumptions and Constrains listed below:

**Assumptions**

1. APIM will serve as the feature arbitrator.
2. High Speed and Medium Speed CAN interfaces between the modules are already implemented
3. Battery status and SOC monitoring function is already implemented on the power supply module
4. 12V primary battery supported/not and transmission status monitoring functions are already implemented on the PCM/ECM/TCM
5. Vehicle Speed monitoring function is already implemented on the ABS and PCM/ECM/TCM
6. HMI has already a way to read and process the user inputs
7. This Feature will provide suggested/recommended Trailer maintenance steps and intervals, but It will not replace the Trailer Owner Manual.
8. This Feature will provide Trailer Mileage and Trailer Fuel Economy only for the Active Trailer Selected.

**Constraints**

1. Vehicle User trailer information inputs determine the accuracy of the Feature functions.
2. Sync Notification hierarchy determine when the Feature Notifications are shown.
3. SYNC/APIM software versions
4. Applicable for vehicles equipped with automatic transmission and manual transmissions with electric park brake
5. Capability of modules to implement the function
6. Memory of the modules
7. Bandwidth of the buses
8. Netcomm regulations for CAN interfaces
9. Existing messages on the vehicle network.
10. HMI structure design
11. Display capability of the HMI screen
12. Vehicle battery usage by other features

**Dependencies**

1. Implementation depends on vehicle electrical architecture.
2. Configuration of the modules
3. Customer usage and maintenance
4. Vehicle architecture must be at least FNV3
5. Vehicles with at least SYNC 4.0 shall have this feature
6. BCM version must be at least BCM Gen 1 M
7. Battery type- AGM battery, 12V

### Function Scope



Figure 6: Context Diagram of Function Trailer Trip User Request

### Function Interfaces

#### Logical Inputs

###LSG\_Trailer Settings and Profiles\_00001### Trailer Module Precondition

When user selects Trailer Settings and Profile using in-vehicle, this logical signal notifies if the trailer connection precondition is met.

|  |  |  |
| --- | --- | --- |
| **Signal Name** | **Signal Value** | **Description** |
| Trailer Connected | [0] TrlrLampCnnct\_B\_Actl | Indicates if a trailer is connected on the trailer lamp circuit. |

|  |  |  |
| --- | --- | --- |
| Data Type | Init Value | Default Value  (missing signal) |
| 0x0 - Null (Defaulted)  0x1 – Yes (Connected) | 0x0 = Null (Defaulted) | 0x0 = Null (Defaulted) |

|  |  |  |
| --- | --- | --- |
| Transmit Model | Send Type | E2E Latency |
| HS3 CAN | Event Periodic |  |

###LSG\_Trailer Settings and Profile\_00002### Powertrain Control Module Precondition

When user selects Trailer Settings and Profile using in-vehicle, this logical signal notifies if the transmission gear position precondition is met.

|  |  |  |
| --- | --- | --- |
| **Signal Name** | **Signal Value** | **Description** |
| Shifter Position | [11] GearLvrPos\_D\_Actl | Indicates if the Transmission changes or stay on specific position. |

|  |  |  |
| --- | --- | --- |
| Data Type | Init Value | Default Value  (missing signal) |
| 0x0 - Park  0x1 – Reverse  0x2 - Neutral  0x3 – Drive  0x4 - Sport\_DriveSport  0x5 - Low  0x6 – First  0x7 - Second  0x8 - Third  0x9 - Fourth  0xA - Fifth  0xB - Sixth  0xC - Undefined\_Treat\_as\_Fault  0xD - Undefined\_Treat\_as\_Fault  0xE – Unknown\_Position  0xF - Fault | 0x0 = Park (Defaulted) | 0x0 = Park (Defaulted) |

|  |  |  |
| --- | --- | --- |
| Transmit Model | Send Type | E2E Latency |
| FD1 CAN | Fixed Periodic |  |

###LSG\_Trailer Settings and Profile\_00003### Powertrain Control Module Precondition

When user selects Trailer Settings and Profile using in-vehicle, this logical signal notifies if the operating battery precondition is met.

|  |  |  |
| --- | --- | --- |
| **Signal Name** | **Signal Value** | **Description** |
| Battery SOC | [7] BSBattSOC | Indicates if the battery operation range supports the functionality. |

|  |  |  |
| --- | --- | --- |
| Data Type | Init Value | Default Value  (missing signal) |
| 0x0 – 0  0x7F – 127 | 0x0 = 0 |  |

|  |  |  |
| --- | --- | --- |
| Transmit Model | Send Type | E2E Latency |
| FD1 CAN | Fixed Periodic |  |

###LSG\_Trailer Settings and Profile\_00004### Body Control Module Precondition

When user selects Trailer Settings and Profile using in-vehicle, this logical signal notifies if the Key Ignition Status precondition is met.

|  |  |  |
| --- | --- | --- |
| **Signal Name** | **Signal Value** | **Description** |
| Ignition Status | [0] Ignition\_Status | Indicates if the Key Ignition Status Position. |

|  |  |  |
| --- | --- | --- |
| Data Type | Init Value | Default Value  (missing signal) |
| 0x0 – Unknown  0x1 – Off  0x2 - Accessory  0x4 – Run  0x8 – Start  0xF – Invalid | 0x0 = Unknown (Defaulted) | 0x0 = Unknown (Defaulted) |

|  |  |  |
| --- | --- | --- |
| Transmit Model | Send Type | E2E Latency |
| FD1 CAN | Event Periodic |  |

#### Logical Outputs

###LSG\_Trailer Settings and Profiles\_00001###SYNC Trailer Trip Functionality Status

When user selects Trailer Settings and Profile using in-vehicle, this logical signal shares the Trailer Trip functions status to the Output Interfaces.

|  |  |  |
| --- | --- | --- |
| **Signal Name** | **Signal Value** | **Description** |
| MC\_RDISP\_WORD\_Rx | [7] Trailer Mileage | Indicates the Trailer Mileage and Fuel Economy statuses. |

|  |  |  |
| --- | --- | --- |
| Data Type | Init Value | Default Value  (missing signal) |
| [7 up to 88]  Mileage  Trailer Fuel Economy  Trailer Name | 0x0 = Null (Defaulted) | 0x0 = Null (Defaulted) |

|  |  |  |
| --- | --- | --- |
| Transmit Model | Send Type | E2E Latency |
| Transport Protocol | Event Periodic |  |

#### Logical Parameters

|  |  |
| --- | --- |
| **Parameter Name** | **Description** |
|  |  |
|  |  |
|  |  |

### Function Modeling

#### Use Cases

* ###UC\_fn\_Trailer Maintenance\_00001### User enter the Trailer Maintenance (Active Trailer Profile or Towing Menu).

|  |  |  |
| --- | --- | --- |
| **Purpose** |  | User enter the Trailer Maintenance Menu |
| **Actors** |  | User / SYNC |
| **Precondition** |  | Trailer connected/attached signal must be present on HS3 CAN bus.  Vehicle battery is >= 75% state of charge with engine off  Ignition is ON or ACC  Vehicle is stationary or Gear Shift must be in Park Position |
|  |  |  |
| **Main Flow** | M1 | User shall select “Select Active Trailer” option under Towing Main Menu. |
|  | M2 | 1. User select “Trailer Trip”. 2. Depending if it is a BEV or Non BEV Vehicle the Options may vary. |
|  | M3 | Edit Trailer Distance option (BEV and Non BEV Vehicle)  Reset Trailer Fuel Economy option (Non BEV Vehicle) or Reset Trailer Range per Full Charge (BEV Vehicle) |
|  |  |  |
| **Alternative Flow 1** | A1 | * User can change the Vehicle from the stationary position. * Feature shall hide the Trailer Maintenance Notification. * Notification/Pop up shall be displayed when the preconditions are complied. |
|  |  |  |
| **Post-condition** |  | Trailer Trip HMI will be fully operational. |

#### State Charts / Activity Diagrams / Sequence Diagrams / Decision Tables

**

Figure 6: State Machine of Function Trailer Maintenance User Access request



Figure 7: Activity Diagram of Function “MyLogicalFunction1”



Figure 8: Sequence Diagram of Function “Trailer Trip LogicalFunction”

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Input Signal 1** | **Input Signal 2** | **Input Signal 3** | **Input Signal 4** | **Output Signal** |
| Value I1 | Value I2 |  |  | Value O1 |
|  |  |  |  |  |

Table 19: Decision Table of Function “Trailer Trip Logical Function”

### Function Requirements

###R\_FNC\_Trailer Trip\_00001### User request access to Trailer Trip

Upon user request access to the Trailer Trip in-vehicle, the function shall verify pre-conditions are met.

Ignition\_status = (0x4) RUN or (0x2) ACC

GearLvrPos\_D\_Actl = (0x0) Park

ElPw\_D\_Stat = (0x1) Supported

TrlrLampCnnct\_B\_Actl = (0x1) Yes

###R\_FNC\_Trailer Trip\_00002### User request access to Trailer Trip

When the pre-conditions are meet, Sync shall enable all the Trailer Trip functionality.

#### Functional Requirements

###R\_FNC\_Trailer Trip\_00001### User request access to Trailer Trip

When the pre-conditions are not meet after at any time while the user is navigating on Trailer Maintenance function, Sync shall disable all the Trailer Maintenance functionality and provide a Notification of the preconditions faulted.

###R\_FNC\_Trailer Trip\_00002### Trailer Distance Value Calculation for BEV and Non BEV vehicles

When the user select an Active Trailer Status, Sync shall activate and display the Trailer Distance value.

###R\_FNC\_Trailer Trip\_00003### Trailer Fuel Economy Value Calculation for Non BEV vehicles

When the user select an Active Trailer Status, Sync shall activate and display the Trailer Distance value.

###R\_FNC\_Trailer Trip\_00004### Trailer Range per Fuel Charge Value Calculation for BEV vehicles

When the user select an Active Trailer Status, Sync shall activate and display the Trailer Distance value.

###R\_FNC\_Trailer Trip\_00005### Trailer Range per Fuel Charge Value Calculation for BEV vehicles

When the user select an Active Trailer Status, Sync shall activate and display the Trailer Distance value.

###R\_FNC\_Trailer Trip\_00006### Trailer Distance Updated Value

When the user select enter the new Distance value for the Active Trailer Profile, Sync shall forward the updated value to Trailer Maintenance Items.

## HMI Function “Trailer Maintenance”

### Function Overview

#### Description

This function provides an HMI interface to the user on the SYNC display and describe Trailer Maintenance functionality and provides the user a method to configure the Trailer Maintenance Items.

#### Variants

Not Applicable.

|  |  |  |
| --- | --- | --- |
| Variant Name | Variant Description | Variant Condition (optional) |
|  |  |  |

#### Assumptions

**Assumptions**

1. APIM will serve as the HMI arbitrator.
2. Trailer Trip Distance information will be used to calculate the Trailer Maintenance Notifications.
3. HMI has already a way to read and process the user inputs
4. This Feature will provide suggested/recommended Trailer maintenance steps and intervals, but It will not replace the Trailer Owner Manual.

**Constraints**

1. Vehicle user trailer information inputs determine the accuracy of the Feature functions.
2. Sync Notification hierarchy determine when the Feature Notifications are shown.
3. HMI structure design
4. Display capability of the HMI screen

### Function Scope

Figure 9: Context Diagram of HMI Function 1

### Function Interfaces

All the Function Interfaces are between Sync Module and Sync Display.

#### Logical Inputs

|  |  |
| --- | --- |
| **Signal Name** | **Description** |
| TrailerInfo\_HS3  TrlrLampCnnct\_B\_Actl = YES | Trailer Light connected signal to determine the Trailer is connected to the vehicle. |
| BodyInfo\_3\_HS2  Ignition\_Status = RUN | Key Ignition Status signal to determine if the vehicle is in run position |
| Battery\_Mgmt  BSBattSOC > 75% | Battery State of Charge to determine if the feature functionality can be supported |
| TransGearData  GearLvrPos\_D\_Actl = Park | Transmission gear signal to determine the vehicle is on Park position. |

#### Logical Outputs

|  |  |
| --- | --- |
| **Signal Name** | **Description** |
|  |  |
|  |  |

#### Logical Parameters

|  |  |
| --- | --- |
| **Parameter Name** | **Description** |
| <(Mandatory) Word reference to the “Logical Parameters” name bookmark in the Data Dictionary> | <(Optional) Word reference to the “Logical Parameters” description bookmark in the Data Dictionary> |
|  |  |

### Function Modeling

#### Use Case(s)

###R\_FNC\_Trailer Settings and Profile\_00001### Preconditions met

Upon user selection of Trailer Maintenance or Trailer Trip menu in-vehicle HMI, the function shall verify preconditions are met.

###R\_FNC\_Trailer Settings and Profile\_00002### Preconditions not met

When the Preconditions are not met, SYNC display shall send a Pop-Up/Notification in vehicle HMI as following:

[Header] Trailer Maintenance menu not available

[Subject] -Verify if the Trailer is attached to the vehicle.

-Verify the shifter is on Park position.

-Battery state of charge is below 75%.

### Function Requirements

#### Functional Requirements

###R\_FNC\_Trailer Settings and Profile\_00003### Vehicle not stationary (automatic transmission ONLY)

When Vehicle\_Speed is more than 4 KPH and/or GearLvrPos\_D\_Actl != 0x0 (PARK), the Feature Settings and Profile precondition is met.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Requirement ID: ###R\_FNC\_Trailer Light Check\_00051###** | | | | | | |
| **Rationale** | | | | | | |
| <Put any rationale here> | | | | | | |
| **Acceptance Criteria** | | | | | | **V&V Method** |
| <Put any acceptance criteria here> | | | | | | <TestCase trace link> |
| **Notes** | | | | | | |
| <Put any notes here> | | | | | | |
| **Type** | | Choose an item. | | **Source** | <Put any source here, which is not a requirement reference> | |
| **Priority** | | Choose an item. | | **Source Req.** | <Put any parent requirement trace link here> | |
| **Status** | | Choose an item. | | **Owner** |  | |
| **Change Log** | | | | | | |
| **Version** | **Date** | **Author** | **Change** | | | |
| 1 |  |  | Initial version | | | |
| **Requirement ID: ###R\_FNC\_Trailer Light Check\_00052###** | | | | | | |
| **Rationale** | | | | | | |
| <Put any rationale here> | | | | | | |
| **Acceptance Criteria** | | | | | | **V&V Method** |
| <Put any acceptance criteria here> | | | | | | <TestCase trace link> |
| **Notes** | | | | | | |
| <Put any notes here> | | | | | | |
| **Type** | | Choose an item. | | **Source** | <Put any source here, which is not a requirement reference> | |
| **Priority** | | Choose an item. | | **Source Req.** | <Put any parent requirement trace link here> | |
| **Status** | | Choose an item. | | **Owner** |  | |
| **Change Log** | | | | | | |
| **Version** | **Date** | **Author** | **Change** | | | |
| 1 |  |  | Initial version | | | |

###R\_FNC\_Trailer Settings and Profile\_00004### Vehicle is stationary (automatic transmission ONLY)

When Vehicle\_Speed is less than or equal to 4 KPH and ElPw\_D\_Stat= 0x1 (Supported), the Feature Settings and Profile precondition is met.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Requirement ID: ###R\_FNC\_Trailer Light Check\_00053###** | | | | | | |
| **Rationale** | | | | | | |
| <Put any rationale here> | | | | | | |
| **Acceptance Criteria** | | | | | | **V&V Method** |
| <Put any acceptance criteria here> | | | | | | <TestCase trace link> |
| **Notes** | | | | | | |
| <Put any notes here> | | | | | | |
| **Type** | | Choose an item. | | **Source** | <Put any source here, which is not a requirement reference> | |
| **Priority** | | Choose an item. | | **Source Req.** | <Put any parent requirement trace link here> | |
| **Status** | | Choose an item. | | **Owner** |  | |
| **Change Log** | | | | | | |
| **Version** | **Date** | **Author** | **Change** | | | |
| 1 |  |  | Initial version | | | |

###R\_FNC\_Trailer Settings and Profile\_00005### Vehicle is stationary (manual transmission ONLY)

When Vehicle\_Speed is less than or equal to 4 KPH and Ignition\_Status = 0x4 (RUN), the Feature Settings and Profile precondition is met.

###R\_FNC\_Trailer Settings and Profile\_00006### Trailer Maintenance items Mileage/Kilometers Countdown

When the Trailer Maintenance functionality became active, Trailer Maintenance items shall update the Maintenance items countdown (Mileage) with the Trailer Trip information (Trailer Distance value).

###R\_FNC\_Trailer Settings and Profile\_00007### Trailer Maintenance items Time Tracking

When the Trailer Maintenance functionality became active, Trailer Maintenance items shall update the Maintenance items countdown (Mileage) with the Trailer items configuration date (First Time Trailer items configured).

###R\_FNC\_Trailer Settings and Profile\_00008### Trailer Maintenance Menu access

When the user tries to enter the Trailer Maintenance Menu, the user shall have access the function by the Towing Menu or by the Active Trailer Profile.

###R\_FNC\_Trailer Settings and Profile\_00009### Trailer Maintenance Menu Notifications

When the user access the Trailer Maintenance Menu, the user shall see the option of Turning off the Maintenance Notifications. (Enable / Disable softbutton)



Fig 5.4.5.1. HMI Proposal just for reference

###R\_FNC\_Trailer Settings and Profile\_00010### Trailer Maintenance Menu Active Trailer Status

When the user access the Trailer Maintenance Menu, the user shall see the option to open the “Active Trailer Status” (Active Trailer Maintenance Profile).



Fig 5.4.5.2. HMI Proposal just for reference

###R\_FNC\_Trailer Settings and Profile\_00011### Trailer Maintenance “Active Trailer Status” Menu

When the user access the “Active Trailer Status” Menu, the user shall see the following HMI:

-Trailer Name

-Reset Button

-14 Predefined Maintenance Item list

-Back Menu Button

-Maintenance Icon

-Maintenance Item Infobooks

-Scroll Up/Down bar



Fig 5.4.5.3. HMI Proposal just for reference

###R\_FNC\_Trailer Settings and Profile\_00012### Trailer Maintenance “Active Trailer Status” Menu

When the user wants to configure a Custom Maintenance Items” option, the user shall see the following HMI:

-Trailer Maintenance Item (If one or more had been configured)

-Add new maintenance item

-Key Board (Type Custom Maintenance Item)

-Back soft button



Figure 5.4.5.4 HMI Proposal just for reference

###R\_FNC\_Trailer Settings and Profile\_00013### Trailer Maintenance “Active Trailer Status” Disclaimer

When the user configures for the first time Maintenance Items or after a Maintenance Notifications reset, the user shall see the following HMI Disclaimer:

-The system is designed to be an aid and does not relieve you of your responsibility to follow the trailer manufacturers recommended maintenance intervals.  You are responsible for inputting maintenance intervals consistent with the trailer manufacturer.   Failure to follow these instructions could result in the loss of vehicle control, personal injury or death.



Figure 5.4.5.5 HMI Proposal just for reference

###R\_FNC\_Trailer Settings and Profile\_00014### Trailer Maintenance overdue Notifications

When the user selects one Maintenance Item which interval is overdue, the user shall see the following HMI Notification:

[Header] {Maintenance List Item} needs attention!

[Content] The maintenance on {maintenance list item} on {Trailer Name} is overdue by {xx days / yy {miles / kilometers}}.

Recommended maintenance steps:

1….

2….

3….



Figure 5.4.5.6 HMI Proposal just for reference

If the user selects Clear Reminder the following screen will be shown:

[Header] {Maintenance List Item} reminder cleared



Figure 5.4.5.6 HMI Proposal just for reference

###R\_FNC\_Trailer Settings and Profile\_00015### Single Item Maintenance reminder

When one of the Trailer Maintenance Items countdown reach the maintenance interval configured, the user shall see the following HMI Notification:

[Header] Trailer Maintenance Reminder

[Content] The maintenance on {maintenance list item} on {Trailer Name} is overdue.



Figure 5.4.5.7 HMI Proposal just for reference

###R\_FNC\_Trailer Settings and Profile\_00016### Multiple Items Maintenance reminder

When one of the Trailer Maintenance Items countdown reach the maintenance interval configured, the user shall see the following HMI Notification:

[Header] Trailer Maintenance Reminder

[Content] Several {Trailer Name} items need Maintenance.



Figure 5.4.5.8 HMI Proposal just for reference

###R\_FNC\_Trailer Settings and Profile\_00017### Reset Maintenance Notification

When the user selects the Maintenance Notifications Reset button, the user shall see the following HMI Notification:

[Header] Reset Maintenance Reminder

[Content] Resetting the Maintenance Notifications will set all the notifications to the default intervals and delete all saved custom notifications.

Do you want to proceed?



Figure 5.4.5.9 HMI Proposal just for reference

###R\_FNC\_Trailer Settings and Profile\_00018### Maintenance Item Infobook HMI

When the user selects a pre-defined Maintenance item Infobook, the user shall see the following HMI Notification:

[Header] {Maintenance list item}

[Content] Recommended maintenance steps:

1….

2….

3….



Figure 5.4.5.10 HMI Proposal just for reference

###R\_FNC\_Trailer Settings and Profile\_00019### Maintenance Item Infobook HMI

When the user wants to configure the Maintenance interval of an item, the user shall see the following HMI Notification:

[Header] {Trailer Maintenance Item}

[Content] Time and/or mileage interval selection. Time and Mileage On/Off buttons.

-Back soft button

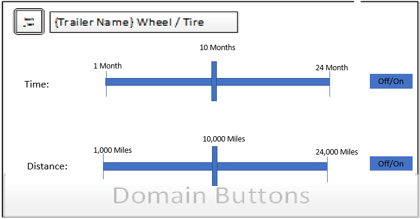


Figure 5.4.5.11 HMI Proposal just for reference

###R\_FNC\_Trailer Settings and Profile\_00019### Maintenance Invalid Update

When the user updates the Item Maintenance Interval with an invalid value and the updated Maintenance Odometer Countdown <Item#\_OdometerCountdown> gives a value lower than 0 miles, Sync shall provide the following HMI Notification:

[Header] {Invalid Maintenance Interval Selected}

[Content] The Interval selected will set the Maintenance Item as overdue.

#### Non-Functional Requirements

No applicable for this Feature

#### Functional Safety Requirements

No applicable for this Feature

## HMI Function “Trailer Trip”

**#Classification**: Optional (Remove section, if not used)

***#Hint:*** *HMI functions shall be defined in close cooperation between Function Owner and HMI team. There are currently 2 approaches in the HMI team for the specification of GUIs:*

*1. Visio Wallpapers with textual behavior descriptions*

*2. An executable model according to the Model-View-Control approach.*

*Both approaches can be used with this specification. The QPIP approach separates the feature logic from the HMI logic. The HMI logic (either the Controller / View part of the MVC approach or the Visio Wallpaper centered logic) is encapsulated in a separate HMI Function. The internal structure of the HMI Function section slightly differs from the section for normal Logical Functions. The use of HMI functions is explained at.*

### Function Overview

#### Description

This function provides an HMI interface to the user on the SYNC display which describes the Trailer Trip functionality and provides the user a method to configure the Trailer Trip parameters.

#### Variants

Not Applicable.

|  |  |  |
| --- | --- | --- |
| Variant Name | Variant Description | Variant Condition (optional) |
|  |  |  |

#### Input Requirements/Documents

**#Hint:** *The table below helps the function owner to collect relevant input* (requirements, documents, mails, models, …) *while writing the spec. When finalizing the spec, the function owner should check, if all inputs have been properly considered by derived/outgoing requirements* in chapter “*Function Requirements*”.

Note: It is not required to list each input requirement individually in this table, referencing the input document is enough (if relevant document section is indicated).

|  |  |  |  |
| --- | --- | --- | --- |
| **Reference**  (Reference as listed in ch. ” ”References”) | **Section/Requirement** | **Description** | **Derived Requirement**  (optional – reference to requirement in ch. “Function Requirements”) |
| **Feature Requirements** | | | |
|  | <Example:  id + title of relevant Feature Docs> | <Example: “Requirements of Feature …”> | <Note: If you reference a requirement in this column, that requirement should have a trace link in its [“Source”/”Source Req.” attribute](http://wiki.ford.com/display/RequirementsEngineering/Requirements+Attributes) field pointing back to the input requirement (or to a requirement inside the input document) given in this table row> |
|  |  |  |  |
| **Ford Engineering Standards** | | | |
|  | <Example: some SDS (requirement)> |  |  |
|  |  |  |  |
| **Legal Regulations** | | | |
|  | <Example: some excerpt from ECE or FMVSS> |  |  |
|  |  |  |  |
| **Industry Standards** | | | |
|  | <Example: some ISO/IEEE/SAE or other standard> |  |  |
|  |  |  |  |
| **Other Sources** | | | |
|  | <Example: some stakeholder document> |  |  |
|  |  |  |  |

Table 21: Input Requirements/Documents

#### Assumptions

**Assumptions**

1. APIM will serve as the HMI arbitrator.
2. Trailer Trip Distance information will be used to calculate the Trailer Maintenance Notifications.
3. HMI has already a way to read and process the user inputs
4. This Feature will provide Trailer Trip status information to the user. However, this values can be updated/reset according to vehicle user needs.

**Constraints**

1. Vehicle user trailer information inputs determine the accuracy of the Feature functions.
2. Sync Notification hierarchy determine when the Feature Notifications are shown.
3. HMI structure design
4. Display capability of the HMI screen

### Function Scope

Figure 9: Context Diagram of HMI Function 1

### Function Interfaces

#### Logical Inputs

|  |  |
| --- | --- |
| **Signal Name** | **Description** |
| TrailerInfo\_HS3  TrlrLampCnnct\_B\_Actl = YES | Trailer Light connected signal to determine the Trailer is connected to the vehicle. |
| BodyInfo\_3\_HS2  Ignition\_Status = RUN | Key Ignition Status signal to determine if the vehicle is in run position |
| Battery\_Mgmt  BSBattSOC > 75% | Battery State of Charge to determine if the feature functionality can be supported |
| TransGearData  GearLvrPos\_D\_Actl = Park | Transmission gear signal to determine the vehicle is on Park position. |

#### Logical Outputs

|  |  |
| --- | --- |
| **Signal Name** | **Description** |
| Transport Protocol Message | Byte 7 up to 88/44 (Coding Table I / Coding Table II): Trailer Mileage  Mileage Fixed 7 characters long string  Trailer Average Fuel Economy: Max 6 characters, 5 for fuel data and 1 end of string character.  Trailer Name: Max 31 characters, 30 characters (for the name) and 1 end of string character. |
|  |  |

#### Logical Parameters

|  |  |
| --- | --- |
| **Parameter Name** | **Description** |
| <(Mandatory) Word reference to the “Logical Parameters” name bookmark in the Data Dictionary> | <(Optional) Word reference to the “Logical Parameters” description bookmark in the Data Dictionary> |
|  |  |

### Function Modeling

#### Use Case(s)

###R\_FNC\_Trailer Settings and Profile\_00001### Preconditions met

Upon user selection of Trailer Maintenance or Trailer Trip menu in-vehicle HMI, the function shall verify preconditions are met.

###R\_FNC\_Trailer Settings and Profile\_00001### Preconditions not met

When the Preconditions are not met, SYNC display shall send a Pop-Up/Notification in vehicle HMI as following:

[Header] Trailer Maintenance menu not available

[Subject] -Verify if the Trailer is attached to the vehicle.

-Verify the shifter is on Park position.

-Battery state of charge is below 75%.

### Function Requirements

#### Functional Requirements

###R\_FNC\_Trailer Settings and Profile\_00004### Vehicle not stationary (automatic transmission ONLY)

When Vehicle\_Speed is more than 4 KPH and/or GearLvrPos\_D\_Actl != 0x0 (PARK), the Feature Settings and Profile precondition is met.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Requirement ID: ###R\_FNC\_Trailer Light Check\_00051###** | | | | | | |
| **Rationale** | | | | | | |
| <Put any rationale here> | | | | | | |
| **Acceptance Criteria** | | | | | | **V&V Method** |
| <Put any acceptance criteria here> | | | | | | <TestCase trace link> |
| **Notes** | | | | | | |
| <Put any notes here> | | | | | | |
| **Type** | | Choose an item. | | **Source** | <Put any source here, which is not a requirement reference> | |
| **Priority** | | Choose an item. | | **Source Req.** | <Put any parent requirement trace link here> | |
| **Status** | | Choose an item. | | **Owner** |  | |
| **Change Log** | | | | | | |
| **Version** | **Date** | **Author** | **Change** | | | |
| 1 |  |  | Initial version | | | |
| **Requirement ID: ###R\_FNC\_Trailer Light Check\_00052###** | | | | | | |
| **Rationale** | | | | | | |
| <Put any rationale here> | | | | | | |
| **Acceptance Criteria** | | | | | | **V&V Method** |
| <Put any acceptance criteria here> | | | | | | <TestCase trace link> |
| **Notes** | | | | | | |
| <Put any notes here> | | | | | | |
| **Type** | | Choose an item. | | **Source** | <Put any source here, which is not a requirement reference> | |
| **Priority** | | Choose an item. | | **Source Req.** | <Put any parent requirement trace link here> | |
| **Status** | | Choose an item. | | **Owner** |  | |
| **Change Log** | | | | | | |
| **Version** | **Date** | **Author** | **Change** | | | |
| 1 |  |  | Initial version | | | |

###R\_FNC\_Trailer Settings and Profile\_00005### Vehicle is stationary (automatic transmission ONLY)

When Vehicle\_Speed is less than or equal to 4 KPH and ElPw\_D\_Stat= 0x1 (Supported), the Feature Settings and Profile precondition is met.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Requirement ID: ###R\_FNC\_Trailer Light Check\_00053###** | | | | | | |
| **Rationale** | | | | | | |
| <Put any rationale here> | | | | | | |
| **Acceptance Criteria** | | | | | | **V&V Method** |
| <Put any acceptance criteria here> | | | | | | <TestCase trace link> |
| **Notes** | | | | | | |
| <Put any notes here> | | | | | | |
| **Type** | | Choose an item. | | **Source** | <Put any source here, which is not a requirement reference> | |
| **Priority** | | Choose an item. | | **Source Req.** | <Put any parent requirement trace link here> | |
| **Status** | | Choose an item. | | **Owner** |  | |
| **Change Log** | | | | | | |
| **Version** | **Date** | **Author** | **Change** | | | |
| 1 |  |  | Initial version | | | |

###R\_FNC\_Trailer Settings and Profile\_00006### Vehicle is stationary (manual transmission ONLY)

When Vehicle\_Speed is less than or equal to 4 KPH and Ignition\_Status = 0x4 (RUN), the Feature Settings and Profile precondition is met.

###R\_FNC\_Trailer Settings and Profile\_00007### Trailer Trip Menu access

When the user tries to enter the Trailer Trip Menu, the user shall have access the function in the Active Trailer Profile.

###R\_FNC\_Trailer Settings and Profile\_00008### Trailer Trip Menu for EV vehicles

When the user enters the Trailer Trip Menu, the system shall display the following HMI:

[Header] Trailer Trip

[Content] Edit Trailer Distance soft button

Reset Trailer Fuel Economy soft button

Reset All soft button

Back soft button



Fig 5.5.5.1 HMI Proposal just for reference

###R\_FNC\_Trailer Settings and Profile\_00008### Trailer Trip Menu for Non EV vehicles

When the user enters the Trailer Trip Menu, the system shall display the following HMI:

[Header] Trailer Trip

[Content] Edit Trailer Distance soft button

Reset Trailer Fuel Economy soft button

Reset All soft button

Back soft button



Fig 5.5.5.2 HMI Proposal just for reference

###R\_FNC\_Trailer Settings and Profile\_00009### Trailer Trip Reset Notification

When the user reset the Trailer distance and/or Trailer Fuel Economy Menu, Trailer Range per Full Charge, the system shall display the following HMI:

[Header] {Trailer Trip reset text}



Fig 5.5.5.3 HMI Proposal just for reference

###R\_FNC\_Trailer Settings and Profile\_00010### Trailer Trip Edit/Update

When the user updates the Trailer distance or Trailer Fuel Economy Menu, Trailer Range per Full Charge, the system shall display the following HMI:

[Header] Edit Trailer Distance for {Trailer name}

-Back Menu soft button

-Reset soft button

-Numbers pad



Fig 5.5.5.4 HMI Proposal just for reference

###R\_FNC\_Trailer Settings and Profile\_00010### Cluste IOD Trailer Trip Status

When the Trailer Trip parameter are updated, the system shall display the following HMI in the Cluster IOD:

[Content]

-Trailer Name

-Trailer Distance

-Trailer Fuel Economy

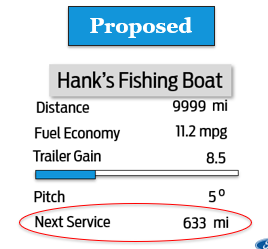


Fig 5.5.5.5 HMI Proposal just for reference

#### Non-Functional Requirements

No applicable for this Feature

#### Functional Safety Requirements

No applicable for this Feature

# Feature Implementation Specification

## Feature Implementation Overview

### Description

All vehicle with architecture FNV 3.0 and above have the capability to support the Trailer Settings and Profile functionality. Trailer Settings and Profile feature will be providing the Trailer Maintenance and Trailer Trip information to the user by using IPC and Sync Screen.

### Input Requirements/Documents

|  |  |  |  |
| --- | --- | --- | --- |
| **Reference**  (Reference as listed in ch. “References”) | **Section/Requirement** | **Description** | **Derived Requirement**  (optional – reference to requirement in ch. “Feature Implementation Requirements”) |
| **Feature/Function Requirements** | | | |
|  |  |  |  |
|  |  |  |  |
| **Ford Engineering Standards** | | | |
|  |  |  |  |
|  |  |  |  |
| **Legal Regulations** | | | |
|  |  |  |  |
|  |  |  |  |
| **Industry Standards** | | | |
|  |  |  |  |
|  |  |  |  |
| **Other Sources** | | | |
| NATM | The Trailer Handbook | Trailer Maintenance and Inspection Schedules. | [https://www.trailersafetyweek.com/trailer-maintenance](https://clicktime.symantec.com/3CrsFPkxnzHqVCEmALCDKt57Vc?u=https%3A%2F%2Fwww.trailersafetyweek.com%2Ftrailer-maintenance) |
|  |  |  |  |

Table 23: Input Requirements/Documents

### Lessons Learned

### Assumptions

**Assumptions**

1. APIM will serve as the feature arbitrator.
2. High Speed and Medium Speed CAN interfaces between the modules are already implemented
3. Battery status and SOC monitoring function is already implemented on the power supply module
4. 12V primary battery supported/not and transmission status monitoring functions are already implemented on the PCM/ECM/TCM
5. Vehicle Speed monitoring function is already implemented on the ABS and PCM/ECM/TCM
6. HMI has already a way to read and process the user inputs
7. This Feature will provide suggested/recommended Trailer maintenance steps and intervals, but It will not replace the Trailer Owner Manual.

**Constraints**

1. Vehicle User trailer information inputs determine the accuracy of the Feature functions.
2. SYNC Notification hierarchy determine when the Feature Notifications are shown.
3. SYNC/APIM software versions
4. Applicable for vehicles equipped with automatic transmission and manual transmissions with electric park brake
5. Capability of modules to implement the function
6. Memory of the modules
7. Bandwidth of the buses
8. Netcom regulations for CAN interfaces
9. Existing messages on the vehicle network.
10. HMI structure design
11. Display capability of the HMI screen
12. Vehicle battery usage by other features

**Dependencies**

1. Implementation depends on vehicle electrical architecture.
2. Configuration of the modules
3. Customer usage and maintenance
4. Vehicle architecture must be at least FNV3
5. Vehicles with at least SYNC 4.0 shall have this feature
6. BCM version must be at least BCM Gen 1 M

## Functional Architecture

## Physical Architecture

### E/E Architecture

#### E/E Architecture Variants

No Variants Defined

|  |  |  |
| --- | --- | --- |
| E/E Architecture Variant Name | Variant Description | Variant Condition (optional) |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

##### E/E Architecture



#### E/E Components

|  |  |
| --- | --- |
| Component Name | **Description** |
| BCM | Body Control Module |
| PCM | Powertrain Control Module |
| ITRM | Trailer Tow Module |
| ECG | Enhanced Gateway Module |
| APIM | SYNC User Interface |
| IPC | Instrument Panel Control |
|  |  |

Table 5‑24: Electrical Components

#### E/E Connections

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Connection Name | **Connection Type** | **Protocol**  Only if ‘Connection Type’ is “Network”/”RF-Digital” | **Description** | **Allocated Messages**  Only if ‘Connection Type’ is “Network”/”RF-Digital” | **Connected Nodes** |
| HS3 | Network | CAN (High Speed) | High speed 3 CAN network | Trailerinfo\_HS3 | TRM\_ITRM, GWM\_ECG |
| CAN FD1 | Network | CAN FD | CAN – Flexible Data-rate | TransGearData | PCM TCM\_DSL, GWM\_ECG |
| CAN FD1 | Network | CAN FD | CAN – Flexible Data-rate | Battery\_Mgmt\_3 | BCM, GWM\_ECG |
| CAN FD1 | Network | CAN FD | CAN – Flexible Data-rate | BodyInfo\_3 | BCM, GWM\_ECG |
|  |  |  |  |  |  |

Table 5‑25: E/E Connections

##### HS3 CAN message list

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Message Name** | **CAN ID** | **Transmission Mode** | **Period** | **Technical Signal Name** | **Transmitters** | **Receiver** |
| TrailerInfo\_HS3 | 0x443 | Event Periodic | 1000 | TrlrLampCnnct\_B\_Actl | TRM\_ITRM | GWM\_ECG(Gateway) |
| MFD\_DataTime | 0x91 | Event |  | MFD\_Year | APIM | INTERNAL |
|  | MFD\_Month |
|  | MFD\_Day |

Table 110: HS3 CAN message list

##### FD1 CAN message list

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Message Name** | **CAN ID** | **Transmission Mode** | **Period** | **Technical Signal Name** | **Transmitters** | **Receiver** |
| TransGearData | 0x230 | Fixed Periodic | 20 | GearLvrPos\_D\_Actl | PCM TCM\_DSL | GWM\_ECG(Gateway) |
| BodyInfo\_3 | 0x3B3 | Event Periodic | 500 | Ignition\_Status | BCM | GWM\_ECG(Gateway) |
| BatteryMgmt\_3 | 0x43C | Fixed Periodic | 1000 | BSBattSOC | BCM | GWM\_ECG(Gateway) |

Table 6.3.1.1: FD1 CAN message list

#### Signal List

##### Signal / Parameter Mapping

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Logical Signal Name | Value | Type | Mapped to | | |
| Technical (CAN) Signal Name | Value | Connection |
| Trailer Connected | 0x0 – No  0x1 – Yes | CAN signal | TrlrLampCnnct\_B\_Actl | 0x0 – No  0x1 – Yes | TRM\_ITRM to APIM (via GWM\_ECG) |
| Shifter Position | 0x0 – Park  0x1 – Reverse  0x2 – Neutral  0x3 – Drive  0x4 – Sport\_DriveSport  0x5 – Low  0x6 – First  0x7 – Second  0x8 – Third  0x9 – Fourth  0xA – Fifth  0xC – Sixth  0xD – Undefined\_Treat\_as\_Fault  0xE –  0xF – | CAN signal | GearLvrPos\_D\_Actl | 0x0 – Park  0x1 – Reverse  0x2 – Neutral  0x3 – Drive  0x4 – Sport\_DriveSport  0x5 – Low  0x6 – First  0x7 – Second  0x8 – Third  0x9 – Fourth  0xA – Fifth  0xC – Sixth  0xD – Undefined\_Treat\_as\_Fault  0xE –  0xF – | PCM to APIM (via GWM\_ECG) |
| Battery SOC | 0x0 – 0  0x7F – 127 | CAN signal | BSBattSOC | 0x0 – 0  0x7F – 127 | BCM to APIM (via GWM\_ECG) |
| Ignition Status | 0x0 – Unknown  0x1 – Off  0x2 – Accessory  0x4 – Run  0x8 – Start  0xF – Invalid | CAN signal | Veh\_V\_AlEng | 0x0 – Unknown  0x1 – Off  0x2 – Accessory  0x4 – Run  0x8 – Start  0xF – Invalid | BCM to APIM (via GWM\_ECG) |
| MFD\_Year | 0x0  0xFE | CAN signal | MFD\_Year | 0x0  0xFE | APIM internal |
| MFD\_Month | 0x0  0xC | CAN signal | MFD\_Month | 0x0  0xC | APIM internal |
| MFD\_Day | 0x0  0x1F | CAN signal | MFD\_Day | 0x0  0x1F | APIM internal |

**Table 6.3.1.2: Signal / Parameter Mapping**

## Feature Implementation Modeling

### Component Interaction Diagrams

#### Scenario: “Trailer Maintenance Normal Operation”



Figure 6.4.1.1: Sequence Chart "Trailer Maintenance - SYNC"

Overall average response time of this sequence: <20 ms APIM>

#### Scenario: “Trailer Trip Normal Operation”



Figure 6.4.1.2: Sequence Chart "Trailer Trip - SYNC"

Overall average response time of this sequence: <20 ms APIM>



Figure 6.4.1.3: Sequence Chart "Trailer Setting and Profile Precondition – TRM\_ITRM"

Overall average response time of this sequence: <1020 ms ((20 (APIM)+(1000 (ITRM))>



Figure 6.4.1.4: Sequence Chart "Trailer Setting and Profile Precondition – BCM"

Overall average response time of this sequence: <1520 ms ((20 (APIM) + (1000 (BCM) + (500 (BCM))>



Figure 6.4.1.5: Sequence Chart "Trailer Setting and Profile Precondition – PCM"

Overall average response time of this sequence: <40 ms ((20 (APIM) + (20 (PCM))>



Figure 6.4.1.6: Sequence Chart "Trailer Settings and Profile Feature Enabling – APIM HMI"

## Feature Implementation Requirements

### Functional Safety

Feature is not Functional Safety Critical

### Requirements on Components

#### APIM

##### Interface Requirements

###R\_CMP\_Trailer Settings and Profile\_00001### APIM CAN HS3 Interface for Trailer Settings and Profile.

APIM shall implement an interface to CAN HS3 for FNV3+ architectures.

###### Publisher Signals

|  |  |  |  |
| --- | --- | --- | --- |
| **Signal ID** | **Signal Name** | **Description** | **Interface** |
| N/A | N/A | Publish Trailer Trip Status info to IPC | TP Level 2 Message |

Table 6.5.2.1: APIM -Publisher signals

#### TRM\_ITRM

##### Interfaces Requirements

###R\_CMP\_Trailer Settings and Profile\_00002### HS3 CAN FD1 interface to GWM\_ECG

TRM\_ITRM shall implement CAN HS3 interface to GWM\_ECG

###### Publisher Signals

|  |  |  |  |
| --- | --- | --- | --- |
| **Signal ID** | **Signal Name** | **Description** | **Interface** |
| Trailer Connected | TrlrLampCnnct\_B\_Actl | Publish Trailer Connected on the Trailer Light Circuit signal to GWM\_ECG | CAN HS3 |

Table 6.5.2.2: TRM\_ITRM -Publisher signals

#### PCM/ECM

##### Interfaces Requirements

###R\_CMP\_Trailer Settings and Profile\_00002### PCM/ECM CAN FD1 interface to GWM\_ECG

PCM/ECM shall implement CAN FD1 interface to GWM\_ECG

###### Publisher Signals

|  |  |  |  |
| --- | --- | --- | --- |
| **Signal ID** | **Signal Name** | **Description** | **Interface** |
| Shifter Position | GearLvrPos\_D\_Actl | Publish Transmission Gear Level Actual Position signal to GWM\_ECG | CAN FD1 |

Table 6.5.2.3: PCM/ECM -Publisher signals

#### BCM

##### Interfaces Requirements

###R\_CMP\_ Trailer Settings and Profile\_00003### PCM/ECM CAN FD1 interface to GWM\_ECG

BCM shall implement CAN FD1 interface to GWM\_ECG

###### Publisher Signals

|  |  |  |  |
| --- | --- | --- | --- |
| **Signal ID** | **Signal Name** | **Description** | **Interface** |
| Battery SOC | Ignition\_Status | Publish Vehicle Ignition Status signal to GWM\_ECG | CAN FD1 |
| Ignition Status | BSBattSOC | Publish Battery State of Charge signal to GWM\_ECG | CAN FD1 |

Table 6.5.2.4: BCM -Publisher signals

|  |
| --- |
| **Requirement ID: ###R\_CMP\_360 Lighting\_00303###** |
| **Rationale** |
|  |

### Requirements on Connections

#### Networks

##### “CAN Bus xxx”

###### Protocol Requirements

###### Message List

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Message Name** | **CAN ID** | **Transmission Mode** | **Period** | **Technical Signal Name** | **Transmitters** | **Receiver** |
| TrailerInfo\_HS3 | 0x443 | Event Periodic | 1000 | TrlrLampCnnct\_B\_Actl | TRM\_ITRM | GWM\_ECG(Gateway) |
| MFD\_DataTime | 0x91 | Event |  | MFD\_Year | APIM | INTERNAL |
|  | MFD\_Month |
|  | MFD\_Day |
| TransGearData | 0x230 | Fixed Periodic | 20 | GearLvrPos\_D\_Actl | PCM TCM\_DSL | GWM\_ECG(Gateway) |
| BodyInfo\_3 | 0x3B3 | Event Periodic | 500 | Ignition\_Status | BCM | GWM\_ECG(Gateway) |
| BatteryMgmt\_3 | 0x43C | Fixed Periodic | 1000 | BSBattSOC | BCM | GWM\_ECG(Gateway) |

###### Electrical Requirements

The feature shall function when the voltage is above 9V with battery not supported (battery SOC >/= 75%)

#### HW I/Os

|  |  |  |
| --- | --- | --- |
| **Technical Signal Name** | **Transmitters** | **Receiver** |
| Trailer is connected on the trailer lamp circuit | Trailer | TRM\_ITRM |

### Requirements on Development Process

Not Applicable

# Open Concerns

**#Hint:** The following list presents open concerns, which have to be discussed or clarified over the course of the on-going requirements engineering.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ID | Concern Description | e-Tracker / Reference | Responsible | Status | Solution |
| 1 | Implementation – Sequence Diagrams |  | Raul Rodriguez | Pending to Update | Diagrams will be updated with the Feature Model Diagrams |
| 2 | Function Specification - Diagrams |  | Raul Rodriguez | Pending to Update | Diagrams will be updated with the Feature Model Diagrams |
| 3 |  |  |  |  |  |
| 4 |  |  |  |  |  |
| 5 |  |  |  |  |  |
| 6 |  |  |  |  |  |
| 7 |  |  |  |  |  |
| 8 |  |  |  |  |  |
| 9 |  |  |  |  |  |

Table 34: Open Concerns

# Revision History

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Revision | Date | Description | Approved by | Responsible |
| Rev1 | 09/10/2020 | UPV1 First Feature Review   * New Trailer Maintenance HMI requested (Bobby Keith/Andrew Brown) * Use Cases review | Tony Deddeh | Raul Rodriguez-Flores |
| Rev1 | 09/11/2020 | UPV1 Second Feature Review   * Trailer Maintenance Function Requirements * Trailer Trip Use Cases Review | Tony Deddeh | Raul Rodriguez-Flores |
| Rev1 | 9/22/2020 | UPV1 Feature Final Review   * Trailer Maintenance HMI Freeze | Tony Deddeh | Raul Rodriguez-Flores |
| Rev2 | 9/28/2020 | UPV2 Feature Review   * Feature Use Cases Freeze | Tony Deddeh | Raul Rodriguez-Flores |
| Rev2 | 10/01/2020 | UPV2 Feature Review   * Feature HMI Freeze * Feature ConOps Freeze | Tony Deddeh | Raul Rodriguez-Flores |
| Rev3 | 10/28/2020 | UPV2 Feature Update   * Feature Modeling - Use Cases 3.3.2 * Feature Requirements - Functional Requirements 3.4.1 * HMI Functions - Trailer Maintenance 5.4, Trailer Trip 5.5 | Tony Deddeh | Raul Rodriguez-Flores |
| Rev4 | 11/16/2020 | UPV2 Feature Update   * Functional requirements (updated) * Logical Requirements (updated) * HMI requirements (updated) * Feature Architecture (updated) | Tony Deddeh | Raul Rodriguez-Flores |
| Rev5 | 11/17/2020 | UPV2 Feature Specification   * Logical Signals | Tony Deddeh | Raul Rodriguez-Flores |
| Rev6 | 11/18/2020 | UPV2 Feature Specification   * Logical Parameters | Tony Deddeh | Raul Rodriguez-Flores |
| Rev7 | 11/19/2020 | UPV2 Feature Specification  Pre-review | Tony Deddeh | Raul Rodriguez-Flores |
| Rev8 | 11/20/2020 | UPV2 Feature Specification Cascade | Tony Deddeh | Raul Rodriguez-Flores |

## Template Revisions

*#Important: Do not change this section*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Version | Rev. | Date | Description | Responsible |
| 1 | 0 | 2016-04-07 | * Initial version based on FDS v1.2 and Feature Doc 1.5 structure | Jbaden1 |
| 1 | 1 | 2016-05-10 | * Minor rewording in ch. 1.1 * Cleanup of document properties | Jbaden1 |
| 1 | 2 | 2016-06-16 | * Lessons learned from pilots incorporated into feature and function decomposition part. | Jbaden1 |
| 1 | 3 | 2016-07-08 | * Template version added to footer. | Jbaden1 |
| 2 | 0 | 2016-07-15 | * Template updated according to latest Feature, Function and Platform Specification Templates * RE\_SafetyRequirement style added | Jbaden1 |
| 3 | 0 | 2016-09-05 | * Lessons learned from IPRB pilot incorporated * Harmonization with CV&S PRD | Jbaden1 |
| 3 | 1 | 2016-12-09 | * Logical Signal and Data Types section content moved to Specification\_Macros.dotm (v3.1) | Jbaden1 |
| 4 |  |  | Skipped to synchronize with Specification\_Macros.dotm |  |
| 5 | 0 | 2017-01-13 | * Meta data updated for specification macros, version 3.1 * SW Unit chapter removed for the time being * Green boxes added for user hints | Jbaden1 |
| 5 | 1b | 2017-01-31 | * Some editorial corrections * Substructure of old Network Communication (now Connections) moved to Requirements on Connections * Harmonized with FIS template | Jbaden1 |
| 6 | 0 | 2017-04-28 | * RequirementsTraceability chapter removed | Jbaden1 |
| 6 | 0 | 2018-07-18 | * CR73: Expand ToC of AFS to level 5 * CR63: Updated links to Functional Safety Sharepoint * CR74: new chapter “Safety Assumptions” added * CR75: Some rewording -> Terminology to Glossary, Notation -> Document Conventions * CR76: no longer maintain 2 different sections for configuration and for calibration parameters | Jbaden1 |
| 6 | 0 | 2018-08-06 | * CR53: New non-FAP-150 cover sheet * CR80: Harmonize chapters of the Aggregated Feature Spec and the Aggregated Service Spec with the Function Group Spec. Each Function subsection should follow exactly the Function Spec Template * CR81: Incorporate lessons learned from System Service Spec pilot (Vehicle Speed) into AFS and FIS | Jbaden1 |
| 6 | 0 | 2018-09-28 | * Broken links to RE Wiki repaired | Jbaden1 |
| 6 | 0 | 2018-10-31 | * “Overview” and “Description” exchanged in headings * Some smaller modifications on cover sheet and in footer * Functinonal Safety alignment:   + New sections “Parameter / Values” on Feature level, Functional Safety Req. and (Decomposed) Functional Safety Req. added   + “Logical Architecture” Section removed | Jbaden1 |
| 6 | 0 | 2018-12-01 | * Variant condition fields added consistently * Links updated * Background, Goals, Objectives, … removed. Left to separate document Feature Charter Document | Jbaden1 |
| 6 | 0a | 2019-01-03 | * Chapter heading “Inherited Function Requirements” removed. Corresponding table renamed to “Requirements not cascaded”. * E/E Connection table got another column for allocated messages * Naming conventions for Implemented Functions corrected (FncName\_CmpName instead of FncName\_on\_CmpName) * Editorial corrections on the cover sheet * Explanatory text added to “Ethernet” section in chapter “Requirements on Connections” * AIS templates updated. Linked to Wiki page | Jbaden1 |
| 6 | 0b | 2019-01-15 | * Change: "doc acronym" and "product type" added to Word doc properties to ease spec alignment of certain capters across FIS, AFS and ASS. * Bugfix: table 22 renamed from FTTI table to FHT table, includes a bug fix: each FSR is allocated to only one ECU/component | Jbaden1 |
| 6 | 0b | 2019-02-04 | * Change: Chapter “Interface Requirements” added to “Implemented Function xxx” section (to have a single chapter for to collect subscriber/publisher interface and mapping requirements which to not conform to the corresponding Data Dictionary objects) * Change: “CAN Interface” subsection renamed to “AIS Interfaces” again. Although several Subscriber/Publisher interface attributes are probably CAN bus specific, other attributes seem to be well suited for other networks than CAN. * Change: Chapter “ECU Specific Requirements” renamed to “Component Specific Requirements” in chapter “Implemented Function xxx”. Table “Requirements not cascaded” renamed to “Component Specific Requirements” and refined to describe changes from Logical Function requirements set more formally. This is also to help during VSEM import to identify those requirements of the Logical Function which cannot be simply carried over to the ECU. * Change: Explanatory text in section “Implemented Function xxx” improved. | Jbaden1 |
| 6 | 0b | 2019-02-05 | * Change: Layout of AIS Interfaces in Data Dictionary reworked to enable Excel Import | Jbaden1 |
| 6 | 0c | 2019-02-20 | * Bugfix: AIS Interfaces tables partially formatted incorrectly (heading “Network Timing” and “Signal Integrity/Robustness” got exported for Publisher Interface). A few values formatted as invisible | Jbaden1 |
| 6 | 0d | 2019-11-06 | * Copyright notice shortened and moved to cover sheet and added to footer (to be compliant [with Ford copyright guidelines](http://www.fgti.ford.com/client/NewFGTI/CopyrightNotice.html)) * Term “Disclaimer” no longer used for what is actually only a copyright notice | Jbaden1 |
| 6 | 0d | 2019-12-05 | * Upstream Documents section added to “Input Requirements/Documents” table * Custom style table formatting removed * FuSa alignments from v6.1 Feature Doc, Function Spec and FIS transferred to AFS | Jbaden1 |
| 6 | 1a | 2019-12-10 | * Version number renamed from 6.0d to 6.1 due to the changes documented for 6.0d above (specifically for Functional Safety as well as for SOA and EDAS signals) | Jbaden1 |
| 6 | 1a | 2020-03-11 | * Heading styles cleaned up. New style RE\_UserHint added. * Missing document properties “LatestSigMappingID” and “LatestAisInterfaceID” added * doc property “CopyrightDate” re-formatted to text and copyright date field in footer corrected * Version numbering re-initialized as 0.1 * Init value of version/revision date set to “yyyy/mm/dd” instead of “yyyy-mm-dd” to be in line with the “Edit Document Property” dialog * “Latest…ID” doc properties: type changed from Text to Number | Jbaden1 |
| 6 | 1a | 2020-03-11 | * Alignment with Feature Doc v6.1a   + Error Handling subsection removed in chapter “Functional Requirements”   + “Cloud Connectivity Data Analytics Requirements” chapter added to section “Service Requirements”   + “Cybersecurity” chapter added   + ASIL Decomposition Table updated (to avoid issues with the VSEM import) * Alignment with FIS Doc v6.1a   + Tables for AIS Publisher/Subscriber interfaces and mappings removed (now part of the macros)   + Functional Safety changes copied from FIS (ASIL Decomposition, no HW metrics, no Architecture Redundancy Summary) | Jbaden1 |
| 6 | 1a | 2020-03-13 | * Separate chapter “Technical Safety Requirements” removed. Content already covered by Allocation Table in chapter Function Allocation. * Alignment with Feature Doc v6.1a   + “Requirements on Connections” copied from FIS v6.1a | Jbaden1 |

# Appendix

## Data Dictionary

### Logical Signals

###LSG\_Trailer Settings and Profile\_00001### Trailer Connected

When the user attached the Trailer to the vehicle, this logical signal notifies if the Trailer is connected or not.

|  |  |  |  |
| --- | --- | --- | --- |
| **Encoding Type Name** | | NA | |
| **Encoding Type Description** | | NA | |
| **Encoding Type** | | Numeric | |
| **Value** | **Min Value** | 0x0 | |
| **Max Value** | 0x1 | |
| **Resolution** | NA | |
| **Offset** | NA | |
| **Unit** | NA | |
| **Encoding Type** | | SED | |
| **Value** | | 0x0 | Null (Defaulted) |
| 0x1 | Yes (Connected) |
|  |  |
|  |  |
|  |  |
| **Init Default Value** | | Null (Defaulted) | |

###LSG\_Trailer Settings and Profile\_00002### Shifter Position

When the user shifts the Transmission Gear, this logical signal notifies if the Transmission Gear position change.

|  |  |  |  |
| --- | --- | --- | --- |
| **Encoding Type Name** | | NA | |
| **Encoding Type Description** | | NA | |
| **Encoding Type** | | Numeric | |
| **Value** | **Min Value** | 0x0 | |
| **Max Value** | 0xF | |
| **Resolution** | NA | |
| **Offset** | NA | |
| **Unit** | NA | |
| **Encoding Type** | | SED | |
| **Value** | | 0x0 | Park |
| 0x1 | Reverse |
| 0x2 | Neutral |
| 0x3 | Drive |
| 0x4 | Sport\_DriveSport |
| 0x5 | Low |
| 0x6 | First |
| 0x7 | Second |
| 0x8 | Third |
| 0x9 | Fourth |
| 0xA | Fifth |
| 0xB | Sixth |
| 0xC | Undefined\_Treat\_as\_Fault |
| 0xD | Undefined\_Treat\_as\_Fault |
| 0xE | Unknown\_Position |
| 0xF | Fault |
| **Init Default Value** | | Park | |

###LSG\_Trailer Settings and Profile\_00003### Battery SOC

When the vehicle Ignition Status is on RUN position, this logical signal notifies the Battery State of Charge.

|  |  |  |  |
| --- | --- | --- | --- |
| **Encoding Type Name** | | NA | |
| **Encoding Type Description** | | NA | |
| **Encoding Type** | | Numeric | |
| **Value** | **Min Value** | 0x0 | |
| **Max Value** | 0x7F | |
| **Resolution** | NA | |
| **Offset** | NA | |
| **Unit** | NA | |
| **Encoding Type** | | SED | |
| **Value** | | 0x0 | 0 |
| … |  |
| 0x7F | 127 |
|  |  |
|  |  |
|  |  |
| **Init Default Value** | |  | |

###LSG\_Trailer Settings and Profile\_00003### Ignition Status

When the user change the Start Stop Button Ignition Status, this logical signal notifies Ignition Status change.

|  |  |  |  |
| --- | --- | --- | --- |
| **Encoding Type Name** | | NA | |
| **Encoding Type Description** | | NA | |
| **Encoding Type** | | Numeric | |
| **Value** | **Min Value** | 0x0 | |
| **Max Value** | 0x7F | |
| **Resolution** | NA | |
| **Offset** | NA | |
| **Unit** | NA | |
| **Encoding Type** | | SED | |
| **Value** | | 0x0 | Unknown |
| 0x1 | Off |
| 0x2 | Accessory |
| 0x4 | Run |
| 0x8 | Start |
| 0xF | Invalid |
| **Init Default Value** | |  | |

###LSG\_Trailer Settings and Profile\_00003### Year

When the user configure a time interval for a Maintenance Item, this logical signal define the current year.

|  |  |  |  |
| --- | --- | --- | --- |
| **Encoding Type Name** | | NA | |
| **Encoding Type Description** | | NA | |
| **Encoding Type** | | Numeric | |
| **Value** | **Min Value** | 0x0 | |
| **Max Value** | 0xFE | |
| **Resolution** | NA | |
| **Offset** | NA | |
| **Unit** | Years | |
| **Encoding Type** | | SED | |
| **Value** | | 0x0 | 2000 |
| … |  |
| 0xFE | 2254 |
|  |  |
|  |  |
|  |  |
| **Init Default Value** | |  | |

###LSG\_Trailer Settings and Profile\_00003### Month

When the user configure a time interval for a Maintenance Item, this logical signal define the current month.

|  |  |  |  |
| --- | --- | --- | --- |
| **Encoding Type Name** | | NA | |
| **Encoding Type Description** | | NA | |
| **Encoding Type** | | Numeric | |
| **Value** | **Min Value** | 0x0 | |
| **Max Value** | 0xC | |
| **Resolution** | NA | |
| **Offset** | NA | |
| **Unit** | Months | |
| **Encoding Type** | | SED | |
| **Value** | | 0x0 | 00 |
| 0x1 | 01 |
| 0x2 | 02 |
| 0x3 | 03 |
| 0x4 | 04 |
| 0x5 | 05 |
| 0x6 | 06 |
| 0x7 | 07 |
| 0x8 | 08 |
| 0x9 | 09 |
| 0xA | 10 |
| 0xB | 11 |
| 0xC | 12 |
| **Init Default Value** | |  | |

###LSG\_Trailer Settings and Profile\_00003### Day

When the user configure a time interval for a Maintenance Item, this logical signal define the current day.

|  |  |  |  |
| --- | --- | --- | --- |
| **Encoding Type Name** | | NA | |
| **Encoding Type Description** | | NA | |
| **Encoding Type** | | Numeric | |
| **Value** | **Min Value** | 0x0 | |
| **Max Value** | 0x1F | |
| **Resolution** | NA | |
| **Offset** | NA | |
| **Unit** | Days | |
| **Encoding Type** | | SED | |
| **Value** | | 0x0 | 0 |
| … |  |
| 0x1F | 31 |
|  |  |
|  |  |
| **Init Default Value** | |  | |

### Logical Parameters

###LPR\_Trailer Settings and Profile\_00001### Item#\_MaintConfigDate

This configuration parameter store the Maintenance Configuration Date

|  |  |  |  |
| --- | --- | --- | --- |
| **Encoding Type Name** | | NA | |
| **Encoding Type Description** | | NA | |
| **Encoding Type** | | Numeric | |
| **Value** | **Min Value** | 01/01/2000 | |
| **Max Value** | 12/31/2254 | |
| **Resolution** | NA | |
| **Offset** | NA | |
| **Unit** | NA | |
| **Encoding Type** | | SED | |
| **Value** | |  |  |
|  |  |
|  |  |
|  |  |
|  |  |
| **Init Default Value** | | NA | |

###LPR\_Trailer Settings and Profile\_00002### Item#\_MaintDueDate

This configuration parameter calculate the Maintenance Due Date

|  |  |  |  |
| --- | --- | --- | --- |
| **Encoding Type Name** | | NA | |
| **Encoding Type Description** | | NA | |
| **Encoding Type** | | Numeric | |
| **Value** | **Min Value** | 01/01/2000 | |
| **Max Value** | 12/31/2245 | |
| **Resolution** | NA | |
| **Offset** | NA | |
| **Unit** | NA | |
| **Encoding Type** | | SED | |
| **Value** | |  |  |
|  |  |
|  |  |
|  |  |
|  |  |
| **Init Default Value** | | NA | |

###LPR\_Trailer Settings and Profile\_00003### Item#\_TimeCountdown

This configuration parameter calculate the Maintenance Time Countdown

|  |  |  |  |
| --- | --- | --- | --- |
| **Encoding Type Name** | | NA | |
| **Encoding Type Description** | | NA | |
| **Encoding Type** | | Numeric | |
| **Value** | **Min Value** | 0 | |
| **Max Value** | 730 | |
| **Resolution** | NA | |
| **Offset** | NA | |
| **Unit** | NA | |
| **Encoding Type** | | SED | |
| **Value** | |  |  |
|  |  |
|  |  |
|  |  |
|  |  |
| **Init Default Value** | | NA | |

###LPR\_Trailer Settings and Profile\_00004### Item#\_MaintConfigOdometer

This configuration parameter store the Maintenance Odometer Configuration

|  |  |  |  |
| --- | --- | --- | --- |
| **Encoding Type Name** | | NA | |
| **Encoding Type Description** | | NA | |
| **Encoding Type** | | Numeric | |
| **Value** | **Min Value** | 1 | |
| **Max Value** | 100000 | |
| **Resolution** | NA | |
| **Offset** | NA | |
| **Unit** | Miles / Kilometers | |
| **Encoding Type** | | SED | |
| **Value** | |  |  |
|  |  |
|  |  |
|  |  |
|  |  |
| **Init Default Value** | | NA | |

###LPR\_Trailer Settings and Profile\_00005### Item#\_MaintOdometerDue

This configuration parameter calculate the Maintenance Odometer Due

|  |  |  |  |
| --- | --- | --- | --- |
| **Encoding Type Name** | | NA | |
| **Encoding Type Description** | | NA | |
| **Encoding Type** | | Numeric | |
| **Value** | **Min Value** | 0 | |
| **Max Value** | 100000 | |
| **Resolution** | NA | |
| **Offset** | NA | |
| **Unit** | Miles / Kilometers | |
| **Encoding Type** | | SED | |
| **Value** | |  |  |
|  |  |
|  |  |
|  |  |
|  |  |
| **Init Default Value** | | NA | |

###LPR\_Trailer Settings and Profile\_00006### Item#\_OdometerCountdown

This configuration parameter calculate the Maintenance Odometer Countdown

|  |  |  |  |
| --- | --- | --- | --- |
| **Encoding Type Name** | | NA | |
| **Encoding Type Description** | | NA | |
| **Encoding Type** | | Numeric | |
| **Value** | **Min Value** | 0 | |
| **Max Value** | 100000 | |
| **Resolution** | NA | |
| **Offset** | NA | |
| **Unit** | Miles / Kilometers | |
| **Encoding Type** | | SED | |
| **Value** | |  |  |
|  |  |
|  |  |
|  |  |
|  |  |
| **Init Default Value** | | NA | |

### Technical Signals

###TSG\_Trailer Settings and Profile\_00001### TrlrLampCnnct\_B\_Actl

When the user attached the Trailer to the vehicle, this logical signal notifies if the Trailer is connected or not.

|  |  |  |  |
| --- | --- | --- | --- |
| **Encoding Type Name** | | NA | |
| **Encoding Type Description** | | NA | |
| **Encoding Type** | | Numeric | |
| **Value** | **Min Value** | 0x0 | |
| **Max Value** | 0x1 | |
| **Resolution** | NA | |
| **Offset** | NA | |
| **Unit** | NA | |
| **Encoding Type** | | SED | |
| **Value** | | 0x0 | Null (Defaulted) |
| 0x1 | Yes (Connected) |
|  |  |
|  |  |
|  |  |
| **Init Default Value** | | Null (Defaulted) | |

###TSG\_Trailer Settings and Profile\_00002### GearLvrPos\_D\_Actl

When the user shifts the Transmission Gear, this logical signal notifies if the Transmission Gear position change.

|  |  |  |  |
| --- | --- | --- | --- |
| **Encoding Type Name** | | NA | |
| **Encoding Type Description** | | NA | |
| **Encoding Type** | | Numeric | |
| **Value** | **Min Value** | 0x0 | |
| **Max Value** | 0xF | |
| **Resolution** | NA | |
| **Offset** | NA | |
| **Unit** | NA | |
| **Encoding Type** | | SED | |
| **Value** | | 0x0 | Park |
| 0x1 | Reverse |
| 0x2 | Neutral |
| 0x3 | Drive |
| 0x4 | Sport\_DriveSport |
| 0x5 | Low |
| 0x6 | First |
| 0x7 | Second |
| 0x8 | Third |
| 0x9 | Fourth |
| 0xA | Fifth |
| 0xB | Sixth |
| 0xC | Undefined\_Treat\_as\_Fault |
| 0xD | Undefined\_Treat\_as\_Fault |
| 0xE | Unknown\_Position |
| 0xF | Fault |
| **Init Default Value** | | Park | |

###TSG\_Trailer Settings and Profile\_00003### BSBattSOC

When the vehicle Ignition Status is on RUN position, this logical signal notifies the Battery State of Charge.

|  |  |  |  |
| --- | --- | --- | --- |
| **Encoding Type Name** | | NA | |
| **Encoding Type Description** | | NA | |
| **Encoding Type** | | Numeric | |
| **Value** | **Min Value** | 0x0 | |
| **Max Value** | 0x7F | |
| **Resolution** | NA | |
| **Offset** | NA | |
| **Unit** | NA | |
| **Encoding Type** | | SED | |
| **Value** | | 0x0 | 0 |
| … |  |
| 0x7F | 127 |
|  |  |
|  |  |
|  |  |
| **Init Default Value** | |  | |

###TSG\_Trailer Settings and Profile\_00003### Ignition\_Status

When the user change the Start Stop Button Ignition Status, this logical signal notifies Ignition Status change.

|  |  |  |  |
| --- | --- | --- | --- |
| **Encoding Type Name** | | NA | |
| **Encoding Type Description** | | NA | |
| **Encoding Type** | | Numeric | |
| **Value** | **Min Value** | 0x0 | |
| **Max Value** | 0x7F | |
| **Resolution** | NA | |
| **Offset** | NA | |
| **Unit** | NA | |
| **Encoding Type** | | SED | |
| **Value** | | 0x0 | Unknown |
| 0x1 | Off |
| 0x2 | Accessory |
| 0x4 | Run |
| 0x8 | Start |
| 0xF | Invalid |
| **Init Default Value** | |  | |

###TSG\_Trailer Settings and Profile\_00003### Year

When the user configure a time interval for a Maintenance Item, this logical signal define the current year.

|  |  |  |  |
| --- | --- | --- | --- |
| **Encoding Type Name** | | NA | |
| **Encoding Type Description** | | NA | |
| **Encoding Type** | | Numeric | |
| **Value** | **Min Value** | 0x0 | |
| **Max Value** | 0xFE | |
| **Resolution** | NA | |
| **Offset** | NA | |
| **Unit** | Years | |
| **Encoding Type** | | SED | |
| **Value** | | 0x0 | 2000 |
| … |  |
| 0xFE | 2254 |
|  |  |
|  |  |
|  |  |
| **Init Default Value** | |  | |

###TSG\_Trailer Settings and Profile\_00003### Month

When the user configure a time interval for a Maintenance Item, this logical signal define the current month.

|  |  |  |  |
| --- | --- | --- | --- |
| **Encoding Type Name** | | NA | |
| **Encoding Type Description** | | NA | |
| **Encoding Type** | | Numeric | |
| **Value** | **Min Value** | 0x0 | |
| **Max Value** | 0Xc | |
| **Resolution** | NA | |
| **Offset** | NA | |
| **Unit** | Months | |
| **Encoding Type** | | SED | |
| **Value** | | 0x0 | 00 |
| 0x1 | 01 |
| 0x2 | 02 |
| 0x3 | 03 |
| 0x4 | 04 |
| 0x5 | 05 |
| 0x6 | 06 |
| 0x7 | 07 |
| 0x8 | 08 |
| 0x9 | 09 |
| 0xA | 10 |
| 0xB | 11 |
| 0xC | 12 |
| **Init Default Value** | |  | |
| **Encoding Type Name** | | NA | |
| **Encoding Type Description** | | NA | |
| **Encoding Type** | | Numeric | |
| **Value** | **Min Value** | NA | |
| **Max Value** | NA | |
| **Resolution** | NA | |
| **Offset** | NA | |
| **Unit** | Months | |
| **Encoding Type** | | SED | |
| **Value** | |  |  |
|  |  |
|  |  |
|  |  |
|  |  |
| **Init Default Value** | |  | |

###TSG\_Trailer Settings and Profile\_00003### Day

When the user configure a time interval for a Maintenance Item, this logical signal define the current day.

|  |  |  |  |
| --- | --- | --- | --- |
| **Encoding Type Name** | | NA | |
| **Encoding Type Description** | | NA | |
| **Encoding Type** | | Numeric | |
| **Value** | **Min Value** | 0x0 | |
| **Max Value** | 0x1F | |
| **Resolution** | NA | |
| **Offset** | NA | |
| **Unit** | Days | |
| **Encoding Type** | | SED | |
| **Value** | | 0x0 | 0 |
| … |  |
| 0x1F | 31 |
|  |  |
|  |  |
| **Init Default Value** | |  | |

### Data Types

Logical Parameters Systems Data

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Artifact Type** | **Name** | **Primary Text** | **sys\_data\_allowable\_items** | **sys\_data\_type** | **sys\_data\_param\_type** | **sys\_data\_network\_type** | **sys\_data\_default\_value** | **sys\_data\_min\_value** | **sys\_data\_max\_value** | **sys\_data\_units** |
| System Data | Item#\_MaintConfigDate | Item Maintenance Configuration Date | Wheel Bearings:1, | Parameter | General | SYNC Memory | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Axle Seals:2, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Springs:3, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Suspension:4, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Brake Adjustments:5, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Brake Linings:6, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Hub and Drum Brakes:7, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Brake Lines:8, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Trailer Brake Wiring:9, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Hydraulic Brakes:10, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Trailer Brake Magnets:11, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Lug Nuts:12, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Wheels / Rims:13, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Pressure:14, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Trailer Wiring / Harness:15 | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item1:16, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item2:17, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item3:18, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item4:19, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item5:20, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item6:21, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item7:22, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item8:23, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item9:24, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item10:25, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item11:26, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item12:27, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item13:28, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item14:29, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item15:30, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item16:31, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item17:32, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item18:33, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item19:34, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item20:35, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| System Data | Item#\_MaintDueDate | Item Maintenance Due Date | Wheel Bearings:1, | Parameter | General | SYNC Memory | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Axle Seals:2, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Springs:3, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Suspension:4, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Brake Adjustments:5, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Brake Linings:6, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Hub and Drum Brakes:7, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Brake Lines:8, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Trailer Brake Wiring:9, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Hydraulic Brakes:10, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Trailer Brake Magnets:11, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Lug Nuts:12, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Wheels / Rims:13, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Pressure:14, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Trailer Wiring / Harness:15 | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item1:16, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item2:17, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item3:18, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item4:19, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item5:20, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item6:21, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item7:22, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item8:23, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item9:24, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item10:25, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item11:26, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item12:27, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item13:28, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item14:29, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item15:30, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item16:31, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item17:32, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item18:33, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item19:34, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| Custom Item20:35, | MM/DD/YY | 00/00/00 | 12/31/99 | - |
| System Data | Item#\_TimeCountdown | Item Time Countdown | Wheel Bearings:1, | Parameter | General | SYNC Memory | 0 | 0 | 730 | days |
| Axle Seals:2, | 0 | 0 | 730 | days |
| Springs:3, | 0 | 0 | 730 | days |
| Suspension:4, | 0 | 0 | 730 | days |
| Brake Adjustments:5, | 0 | 0 | 730 | days |
| Brake Linings:6, | 0 | 0 | 730 | days |
| Hub and Drum Brakes:7, | 0 | 0 | 730 | days |
| Brake Lines:8, | 0 | 0 | 730 | days |
| Trailer Brake Wiring:9, | 0 | 0 | 730 | days |
| Hydraulic Brakes:10, | 0 | 0 | 730 | days |
| Trailer Brake Magnets:11, | 0 | 0 | 730 | days |
| Lug Nuts:12, | 0 | 0 | 730 | days |
| Wheels / Rims:13, | 0 | 0 | 730 | days |
| Pressure:14, | 0 | 0 | 730 | days |
| Trailer Wiring / Harness:15 | 0 | 0 | 730 | days |
| Custom Item1:16, | 0 | 0 | 730 | days |
| Custom Item2:17, | 0 | 0 | 730 | days |
| Custom Item3:18, | 0 | 0 | 730 | days |
| Custom Item4:19, | 0 | 0 | 730 | days |
| Custom Item5:20, | 0 | 0 | 730 | days |
| Custom Item6:21, | 0 | 0 | 730 | days |
| Custom Item7:22, | 0 | 0 | 730 | days |
| Custom Item8:23, | 0 | 0 | 730 | days |
| Custom Item9:24, | 0 | 0 | 730 | days |
| Custom Item10:25, | 0 | 0 | 730 | days |
| Custom Item11:26, | 0 | 0 | 730 | days |
| Custom Item12:27, | 0 | 0 | 730 | days |
| Custom Item13:28, | 0 | 0 | 730 | days |
| Custom Item14:29, | 0 | 0 | 730 | days |
| Custom Item15:30, | 0 | 0 | 730 | days |
| Custom Item16:31, | 0 | 0 | 730 | days |
| Custom Item17:32, | 0 | 0 | 730 | days |
| Custom Item18:33, | 0 | 0 | 730 | days |
| Custom Item19:34, | 0 | 0 | 730 | days |
| Custom Item20:35, | 0 | 0 | 730 | days |
| System Data | Item#\_MaintConfigOdometer | Item Maintenance Odometer Configuration | Wheel Bearings:1, | Parameter | General | SYNC Memory | ##### | 1 | 100000 | miles/kilometers |
| Axle Seals:2, | ##### | 1 | 100000 | miles/kilometers |
| Springs:3, | ##### | 1 | 100000 | miles/kilometers |
| Suspension:4, | ##### | 1 | 100000 | miles/kilometers |
| Brake Adjustments:5, | ##### | 1 | 100000 | miles/kilometers |
| Brake Linings:6, | ##### | 1 | 100000 | miles/kilometers |
| Hub and Drum Brakes:7, | ##### | 1 | 100000 | miles/kilometers |
| Brake Lines:8, | ##### | 1 | 100000 | miles/kilometers |
| Trailer Brake Wiring:9, | ##### | 1 | 100000 | miles/kilometers |
| Hydraulic Brakes:10, | ##### | 1 | 100000 | miles/kilometers |
| Trailer Brake Magnets:11, | ##### | 1 | 100000 | miles/kilometers |
| Lug Nuts:12, | ##### | 1 | 100000 | miles/kilometers |
| Wheels / Rims:13, | ##### | 1 | 100000 | miles/kilometers |
| Pressure:14, | ##### | 1 | 100000 | miles/kilometers |
| Trailer Wiring / Harness:15 | ##### | 1 | 100000 | miles/kilometers |
| Custom Item1:16, | ##### | 1 | 100000 | miles/kilometers |
| Custom Item2:17, | ##### | 1 | 100000 | miles/kilometers |
| Custom Item3:18, | ##### | 1 | 100000 | miles/kilometers |
| Custom Item4:19, | ##### | 1 | 100000 | miles/kilometers |
| Custom Item5:20, | ##### | 1 | 100000 | miles/kilometers |
| Custom Item6:21, | ##### | 1 | 100000 | miles/kilometers |
| Custom Item7:22, | ##### | 1 | 100000 | miles/kilometers |
| Custom Item8:23, | ##### | 1 | 100000 | miles/kilometers |
| Custom Item9:24, | ##### | 1 | 100000 | miles/kilometers |
| Custom Item10:25, | ##### | 1 | 100000 | miles/kilometers |
| Custom Item11:26, | ##### | 1 | 100000 | miles/kilometers |
| Custom Item12:27, | ##### | 1 | 100000 | miles/kilometers |
| Custom Item13:28, | ##### | 1 | 100000 | miles/kilometers |
| Custom Item14:29, | ##### | 1 | 100000 | miles/kilometers |
| Custom Item15:30, | ##### | 1 | 100000 | miles/kilometers |
| Custom Item16:31, | ##### | 1 | 100000 | miles/kilometers |
| Custom Item17:32, | ##### | 1 | 100000 | miles/kilometers |
| Custom Item18:33, | ##### | 1 | 100000 | miles/kilometers |
| Custom Item19:34, | ##### | 1 | 100000 | miles/kilometers |
| Custom Item20:35, | ##### | 1 | 100000 | miles/kilometers |
| System Data | Item#\_MaintOdometerDue | Item Maintenance Odometer Due | Wheel Bearings:1, | Parameter | General | SYNC Memory | 0 | 1 | 24000 | days |
| Axle Seals:2, | 0 | 1 | 24000 | days |
| Springs:3, | 0 | 1 | 24000 | days |
| Suspension:4, | 0 | 1 | 24000 | days |
| Brake Adjustments:5, | 0 | 1 | 24000 | days |
| Brake Linings:6, | 0 | 1 | 24000 | days |
| Hub and Drum Brakes:7, | 0 | 1 | 24000 | days |
| Brake Lines:8, | 0 | 1 | 24000 | days |
| Trailer Brake Wiring:9, | 0 | 1 | 24000 | days |
| Hydraulic Brakes:10, | 0 | 1 | 24000 | days |
| Trailer Brake Magnets:11, | 0 | 1 | 24000 | days |
| Lug Nuts:12, | 0 | 1 | 24000 | days |
| Wheels / Rims:13, | 0 | 1 | 24000 | days |
| Pressure:14, | 0 | 1 | 24000 | days |
| Trailer Wiring / Harness:15 | 0 | 1 | 24000 | days |
| Custom Item1:16, | 0 | 1 | 24000 | days |
| Custom Item2:17, | 0 | 1 | 24000 | days |
| Custom Item3:18, | 0 | 1 | 24000 | days |
| Custom Item4:19, | 0 | 1 | 24000 | days |
| Custom Item5:20, | 0 | 1 | 24000 | days |
| Custom Item6:21, | 0 | 1 | 24000 | days |
| Custom Item7:22, | 0 | 1 | 24000 | days |
| Custom Item8:23, | 0 | 1 | 24000 | days |
| Custom Item9:24, | 0 | 1 | 24000 | days |
| Custom Item10:25, | 0 | 1 | 24000 | days |
| Custom Item11:26, | 0 | 1 | 24000 | days |
| Custom Item12:27, | 0 | 1 | 24000 | days |
| Custom Item13:28, | 0 | 1 | 24000 | days |
| Custom Item14:29, | 0 | 1 | 24000 | days |
| Custom Item15:30, | 0 | 1 | 24000 | days |
| Custom Item16:31, | 0 | 1 | 24000 | days |
| Custom Item17:32, | 0 | 1 | 24000 | days |
| Custom Item18:33, | 0 | 1 | 24000 | days |
| Custom Item19:34, | 0 | 1 | 24000 | days |
| Custom Item20:35, | 0 | 1 | 24000 | days |
| System Data | Item#\_OdometerCountdown | Item Odometer Countdown | Wheel Bearings:1, | Parameter | General | SYNC Memory | 0 | 0 | 24000 | days |
| Axle Seals:2, | 0 | 0 | 24000 | days |
| Springs:3, | 0 | 0 | 24000 | days |
| Suspension:4, | 0 | 0 | 24000 | days |
| Brake Adjustments:5, | 0 | 0 | 24000 | days |
| Brake Linings:6, | 0 | 0 | 24000 | days |
| Hub and Drum Brakes:7, | 0 | 0 | 24000 | days |
| Brake Lines:8, | 0 | 0 | 24000 | days |
| Trailer Brake Wiring:9, | 0 | 0 | 24000 | days |
| Hydraulic Brakes:10, | 0 | 0 | 24000 | days |
| Trailer Brake Magnets:11, | 0 | 0 | 24000 | days |
| Lug Nuts:12, | 0 | 0 | 24000 | days |
| Wheels / Rims:13, | 0 | 0 | 24000 | days |
| Pressure:14, | 0 | 0 | 24000 | days |
| Trailer Wiring / Harness:15 | 0 | 0 | 24000 | days |
| Custom Item1:16, | 0 | 0 | 24000 | days |
| Custom Item2:17, | 0 | 0 | 24000 | days |
| Custom Item3:18, | 0 | 0 | 24000 | days |
| Custom Item4:19, | 0 | 0 | 24000 | days |
| Custom Item5:20, | 0 | 0 | 24000 | days |
| Custom Item6:21, | 0 | 0 | 24000 | days |
| Custom Item7:22, | 0 | 0 | 24000 | days |
| Custom Item8:23, | 0 | 0 | 24000 | days |
| Custom Item9:24, | 0 | 0 | 24000 | days |
| Custom Item10:25, | 0 | 0 | 24000 | days |
| Custom Item11:26, | 0 | 0 | 24000 | days |
| Custom Item12:27, | 0 | 0 | 24000 | days |
| Custom Item13:28, | 0 | 0 | 24000 | days |
| Custom Item14:29, | 0 | 0 | 24000 | days |
| Custom Item15:30, | 0 | 0 | 24000 | days |
| Custom Item16:31, | 0 | 0 | 24000 | days |
| Custom Item17:32, | 0 | 0 | 24000 | days |
| Custom Item18:33, | 0 | 0 | 24000 | days |
| Custom Item19:34, | 0 | 0 | 24000 | days |
| Custom Item20:35, | 0 | 0 | 24000 | days |