

**Research & Vehicle Technology**

**“Infotainment Systems Product Development”**

**Feature: Fuel Economy (Global)**

**Subsystem Part Specific Specification (SPSS)**

Version 1.1

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**FORD CONFIDENTIALF**

**Revision History**

|  |  |  |  |
| --- | --- | --- | --- |
| **Date** | **Version** | **Notes** | |
| **November 2, 2018** | **1.0** | **Initial Release** |  |
|  |  |  |  |
| **January 31, 2019** | **1.1** |  | |
|  | FE-582838/B-Architectural Design | | MBORREL4: Added Physical Mapping of Classes |
|  | FE-FUR-REQ-327835/B-Logical Table | | tmertiri: added new signal AvgFeActv\_B\_Dsply.  MBORRLE4: Added InstFe\_No\_Dsply, InstFeTripUnit\_D\_Stat |
|  | FE-IIR-REQ-327830/B-Fuel Economy Client Rx - Server Tx | | tmertiri: added REQ-339109.  MBORREL4: Added REQ-341021, REQ-341023 and rearranged signal order |
|  | FE-MD-REQ-327904/B-LAvgFuelEcoValue | | MBORREL4: Changed logical name from LAvFuelEco to LAvgFuelEcoValue. Added signal definition. |
|  | FE-MD-REQ-327908/B-LAvgFuelEcoUnits | | MBORREL4: Changed logical name from Lunits to LAvgFuelEcoUnits. Added signal definition. |
|  | FE-MD-REQ-339109/A-LAvgFuelEcoDataDisp | | tmertiri: New signal for the Average Fuel Economy dashes |
|  | FE-MD-REQ-341021/A-LInsFuelEcoValue | | MBORREL4: New signal for the Inst. Fuel value |
|  | FE-MD-REQ-341023/A-LInsFuelEcoUnits | | MBORREL4: New signal for the Inst. Fuel units |
|  | FE-MD-REQ-327906/B-LInstFuelEcoMax | | MBORREL4: Changed logical name from LMaxVal to LInsFuelEcoMax. Added signal definition. |
|  | FE-MD-REQ-327905/B-LConsValue | | MBORREL4: Changed logical name from LInsFuelEco to LConsValue. Added signal definition. |
|  | FE-MD-REQ-329150/B-LConsUnits | | MBORREL4: Changed logical name from LConU to LConsUnits. Added signal definition. |
|  | FE-MD-REQ-329151/B-LConsActive | | MBORREL4: Changed logical name from LConUSt to LConsActive. Added signal definition. |
|  | FE-MD-REQ-327907/B-LAvgFuelEcoReset | | MBORREL4: Changed logical name from LFuelEcoReset to LAvgFuelEcoReset. Added signal definition. |
|  | FE-598213/B-General Requirements | | MBORREL4: Moved REQ-333165 to REQ-341030. Added REQ-339110, REQ-341892, REQ-341893, REQ-341894, REQ-342186 |
|  | FE-REQ-342186/A-Feature Configuration | | MBORREL4: New req. |
|  | FE-REQ-342657/A-Reset Button Configuration | | MBORREL4: New req. |
|  | FE-SR-REQ-341893/A-Request return to Null state | | MBORREL4: New req. |
|  | FE-TMR-REQ-341892/A-T\_ReturnToNull | | MBORREL4: New req. |
|  | FE-REQ-341894/A-Missing Message Strategy | | MBORREL4: New req. |
|  | FE-582839/B-Functional Definition | | MBORREL4: Added REQ-341029, REQ-341030 |
|  | FE-FUN-REQ-333218/B-Average Fuel Economy | | MBORREL4: Changed function name, addd new sections, usecases, reqs. |
|  | STR-612654/A-Requirements | | MBORREL4: New section/header/paragraph item. Added REQ-341051, REQ-341052, REQ-341058 |
|  | FE-REQ-341051/A-Displaying Average Fuel Economy Data | | MBORREL4: New req. |
|  | FE-REQ-341052/A-Displaying Average Fuel Economy Units | | MBORREL4: New req. |
|  | FE-REQ-341058/A-Average Fuel Economy Reset Request | | MBORREL4: New req. |
|  | STR-612655/A-Use Cases | | MBORREL4: New section/header/paragraph item |
|  | FE-UC-REQ-342200/A-Displaying Average Fuel Economy to the User | | MBORREL4: New usecase |
|  | FE-UC-REQ-342306/A-Displaying Missing Data to the User | | MBORREL4: New usecase |
|  | FE-UC-REQ-342198/A-User Performs Average Fuel Economy Reset | | MBORREL4: New usecase |
|  | STR-612701/A-White Box Views | | MBORREL4: New section/header/paragraph item |
|  | STR-612702/A-Activity Diagrams | | MBORREL4: New section/header/paragraph item |
|  | FE-ACT-REQ-342525/A-Average Fuel Economy & Reset | | MBORREL4: New diagram |
|  | FE-SD-REQ-329149/B-Average Fuel Economy & Reset | | MBORREL4: Changed sequence name and diagram |
|  | FE-REQ-341053/A-Displaying Instantaneous Fuel Economy Data | | MBORREL4: New req. |
|  | FE-REQ-341054/A-Displaying Instantaneous Fuel Economy Units | | MBORREL4: New req. |
|  | FE-REQ-341055/A-Displaying Instantaneous Fuel Economy Graph | | MBORREL4: New req. |
|  | FE-UC-REQ-342201/A-Displaying Instantaneous Fuel Economy to the User | | MBORREL4: New usecase |
|  | STR-617024/A-Activity Diagrams | | MBORREL4: New section/header/paragraph item |
|  | FE-ACT-REQ-342528/A-Instantaneous & Consumption Fuel Economy | | MBORREL4: New diagram |
|  | STR-617026/A-Sequence Diagrams | | MBORREL4: New section/header/paragraph item |
|  | FE-SD-REQ-342529/A-Instantaneous & Consumption Fuel Economy | | MBORREL4: New diagram |
|  | FE-REQ-333165/B-Consumption vs. Instantaneous Fuel Economy | | MBORREL4: Change req. name and content. |
|  | FE-REQ-341056/A-Displaying Consumption Data | | MBORREL4: New req. |
|  | FE-REQ-341057/A-Displaying Consumption Units | | MBORREL4: New req. |
|  | FE-UC-REQ-342199/A-Displaying Consumption Data to the User | | MBORREL4: New usecase |
|  | STR-617024/A-Activity Diagrams | | MBORREL4: New section/header/paragraph item |
|  | FE-ACT-REQ-342528/A-Instantaneous & Consumption Fuel Economy | | MBORREL4: New diagram |
|  | STR-617026/A-Sequence Diagrams | | MBORREL4: New section/header/paragraph item |
|  | FE-SD-REQ-342529/A-Instantaneous & Consumption Fuel Economy | | MBORREL4: New diagram |
|  | FE-582840/B-Appendix: Reference Documents | | MBORREL4: Added reference table |

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# Architectural Design

## Overview

Fuel Economy IOD shows fuel economy related data in centerstack HMI. Consult with HMI Spec on how this data is displayed.

## FE-CLD-REQ-327828/A-Fuel Economy Client

Fuel Economy Client among other duties it may have, is responsible for displaying the Fuel Economy data in HMI. Consult with HMI spec on how this data would look like.

## FE-CLD-REQ-327829/A-Fuel Economy Server

Fuel Economy Server: Is responsible for sending the Fuel Economy data and relevant information to the client for displaying in HMI.

## Physical Mapping of Classes

The table below shows an example of how the logical classes that make up the Fuel Economy IOD feature can be mapped into physical modules. This mapping is an example only and does not necessarily carryover to other carlines or vehicle architectures.

|  |  |
| --- | --- |
| **Logical Class** | **Physical Module (ECU)** |
| FuelEconomyServer | IPC |
| FuelEconomyClient | SYNC |

## FE-FUR-REQ-327835/B-Logical Table

The CAN signals mentioned throughout this document shall refer to the CAN signal’s logical name. The logical names shall be mapped to their actual CAN signal names. Please use the table below to perform the mapping. The InfoCAN database file is the master file for the actual CAN signal names. Note: There may be cases where the actual CAN signal name is used in this documentation.

|  |  |
| --- | --- |
| **Logical Name** | **Can Physical Name** |
| LAvgFuelEcoValue | AvgFe\_No\_Dsply |
| LAvgFuelEcoUnits | AvgFeTripUnit\_D\_Stat |
| LAvgFuelEcoDataDisp | AvgFeActv\_B\_Dsply |
| LInsFuelEcoValue | InstFe\_No\_Dsply |
| LInsFuelEcoUnits | InstFeTripUnit\_D\_Stat |
| LInstFuelEcoMax | InstFeMax\_No\_Dsply |
| LConsValue | ConsInst\_No\_Dsply |
| LConsUnits | ConsInstUnit\_D\_Stat |
| LConsActive | ConsInstActv\_B\_Dsply |
| LAvgFuelEcoReset | ResetAvgFE\_B\_Rq |

## FE-IIR-REQ-327830/B-Fuel Economy Client Rx - Server Tx

### FE-MD-REQ-327904/B-LAvgFuelEcoValue

Message Type: Status

This signal indicates the average fuel economy data value to display.

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Literals** | **Value** | **Description** |
| Type | - | - | Indicates average fuel economy data value  Unit: unitless  Resolution: 0.1  Offset: 0 |
|  | units | 0x0000 to 0x3FFF |  |

### FE-MD-REQ-327908/B-LAvgFuelEcoUnits

Message Type: Status

This signal indicates the average fuel economy units to display.

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Literals** | **Value** | **Description** |
| Type | - | - | Indicates average fuel economy units |
|  | Inactive | 0x0 |  |
|  | MPG | 0x1 |  |
|  | Km/L | 0x2 |  |
|  | L/100Km | 0x3 |  |
|  | Reserved | 0x4-0xF |  |

### FE-MD-REQ-339109/A-LAvgFuelEcoDataDisp

Message Type: Status

This signal indicates whether the actual average fuel economy data shall be displayed, or dashes.

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Literals** | **Value** | **Description** |
| Type | - | - | Indicates what average fuel economy data to display |
|  | Inactive | 0x0 |  |
|  | Active | 0x1 |  |

### FE-MD-REQ-341021/A-LInsFuelEcoValue

Message Type: Status

This signal indicates the instantaneous fuel economy data value to display.

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Literals** | **Value** | **Description** |
| Type | - | - | Indicates instantaneous fuel economy data value  Unit: unitless  Resolution: 0.1  Offset: 0 |
|  | units | 0x0000 to 0x3FFF |  |

### FE-MD-REQ-341023/A-LInsFuelEcoUnits

Message Type: Status

This signal indicates the instantaneous fuel economy units to display.

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Literals** | **Value** | **Description** |
| Type | - | - | Indicates instantaneous fuel economy units |
|  | Inactive | 0x0 |  |
|  | MPG | 0x1 |  |
|  | Km/L | 0x2 |  |
|  | L/100Km | 0x3 |  |
|  | Reserved | 0x4-0xF |  |

### FE-MD-REQ-327906/B-LInstFuelEcoMax

Message Type: Status

This signal indicates the maximum labeled scale for instantaneous fuel economy.

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Literals** | **Value** | **Description** |
| Type | - | - | Indicates the max instantaneous fuel economy scale  Unit: unitless  Resolution: 1  Offset: 0 |
|  | units | 0x00 to 0xFF |  |

### FE-MD-REQ-327905/B-LConsValue

Message Type: Status

This signal indicates the consumption data value to display.

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Literals** | **Value** | **Description** |
| Type | - | - | Indicates consumption data value  Unit: unitless  Resolution: 0.1  Offset: 0 |
|  | units | 0x000 to 0x3FF |  |

### FE-MD-REQ-329150/B-LConsUnits

Message Type: Status

This signal indicates the consumption units to display.

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Literals** | **Value** | **Description** |
| Type | - | - | Indicates consumption units |
|  | Inactive | 0x0 |  |
|  | GallonPer Hour | 0x1 |  |
|  | LiterPerHour | 0x2 |  |
|  | Reserved | 0x3 |  |

### FE-MD-REQ-329151/B-LConsActive

Message Type: Status

This signal indicates whether to display consumption data or instantaneous fuel economy data.

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Literals** | **Value** | **Description** |
| Type | - | - | Indicates whether to display consumption data or instantaneous fuel economy data |
|  | Inactive | 0x0 |  |
|  | Active | 0x1 |  |

## FE-IIR-REQ-327831/A-Fuel Economy Client Tx - Server Rx

### FE-MD-REQ-327907/B-LAvgFuelEcoReset

Message Type: Request

This signal is used to request a reset of the average fuel economy data.

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Literals** | **Value** | **Description** |
| Type | - | - | Average fuel economy data reset request |
|  | Null | 0x0 |  |
|  | Reset | 0x1 |  |

# General Requirements

## FE-REQ-342188/A-Powermode Conditions

The FuelEconomyClient shall only allow the functionality defined by this feature/SPSS when the IgnitionStatus\_St = Run/Start, and the touch screen display is On.

If IgnitionStatus\_St != Run/Start, the FuelEconomyClient shall display dashes (ex. “--.-”) in place of any Average Fuel Economy Data, Instantaneous Fuel Economy Data, or Fuel Consumption Data.

## FE-REQ-342186/A-Feature Configuration

The FuelEconomyClient shall have a configurable parameter to determine whether the vehicle supports the Fuel Economy IOD.

* If the parameter indicates that the vehicle supports the Fuel Economy IOD, all of the requirements and functions in this SPSS shall be followed, and the FuelEconomyClient shall make the Fuel Economy IOD available/visible to the user.
* If the parameter indicates that the vehicle does not support the Fuel Economy IOD, none of the requirements and functions in this SPSS shall be followed, and the FuelEconomyClient shall not make the Fuel Economy IOD available/visible to the user.

## FE-REQ-342657/A-Reset Button Configuration

The FuelEconomyClient shall have a configurable parameter to determine whether it supports the Average Fuel Economy Reset Button.

* If the parameter indicates that the FuelEconomyClient supports the Reset Button, the Fuel Economy IoD shall make the Reset button available/visible to the user.
* If the parameter indicates that the FuelEconomyClient does not support the Reset Button, the Fuel Economy IoD shall not make the Reset button available/visible to the user.

*Note: This configuration is used so that only one module/Client has the ability to request the Reset from the Server (ex. for CX727, the Reset button will remain on the Server, and so this button shall not be offered on the Client).*

## FE-SR-REQ-341893/A-Request return to Null state

When updating on event, the following event-periodic signals listed below shall hold there signal encoding values for a period of time defined by T\_ReturnToNull and then shall transition back to Null as shown in the sequence diagrams:

* LAvgFuelEcoReset

The receiving modules of these signals shall act upon the event signal and shall not wait for the “Null” to act upon the signal request.

## FE-TMR-REQ-341892/A-T\_ReturnToNull

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Name** | **Description** | **Units** | **Range** | **Resolution** | **Default** |
| T\_ReturnToNull | The nominal hold time before returning to a Null state. Use the default value +/- 10%. | sec | 0.5-2 | 0.5 | 1 |

## FE-REQ-341894/A-Missing Message Strategy

If any of the signals defined in this SPSS (used for displaying any fuel economy data) become unavailable or missing from the bus for more than 5 seconds, the FuelEconomyClient shall display dashes (ex. “--.-”) in place of actual fuel economy data.

# Functional Definition

## FE-FUN-REQ-333218/B-Average Fuel Economy

### Requirements

#### FE-REQ-341051/A-Displaying Average Fuel Economy Data

The FuelEconomyClient shall display the average fuel economy as such:

* When LAvgFuelEcoDataDisp = “(0x0) Inactive” the FuelEconomyClient shall display dashes (ex. “--.-”).
* When LAvgFuelEcoDataDisp = “(0x1) Active” the FuelEconomyClient shall display the data indicated by LAvgFuelEcoValue.

#### FE-REQ-341052/A-Displaying Average Fuel Economy Units

The FuelEconomyClient shall display the average fuel economy units as indicated by LAvgFuelEcoUnits.

#### FE-REQ-341058/A-Average Fuel Economy Reset Request

When the Reset button is selected by the user, the FuelEconomyClient shall send LAvgFuelEcoReset = “(0x1) Reset” to the FuelEconomyServer.

If the Powermode Conditions are not satisfied (as per REQ-342188), the FuelEconomyClient shall disable (grey-out, hide, etc.) the Reset button.

### Use Cases

#### FE-UC-REQ-342200/A-Displaying Average Fuel Economy to the User

|  |  |
| --- | --- |
| **Actors** | Vehicle Occupant |
| **Pre-conditions** | Powermode Conditions are met  FuelEconomyClient is ON |
| **Scenario Description** | The user selects the Fuel Economy IOD on the FuelEconomyClient |
| **Post-conditions** | The FuelEconomyClient displays the Average Fuel Economy Data |
| **List of Exception Use Cases** | REQ-342306-Displaying Missing Data to the User |
| **Interfaces** | FuelEconomyClient  CAN, G-HMI |

#### FE-UC-REQ-342306/A-Displaying Missing Data to the User

|  |  |
| --- | --- |
| **Actors** | Vehicle Occupant |
| **Pre-conditions** | Powermode Conditions are not met, OR  Signals from FuelEconomyServer are missing from bus  FuelEconomyClient is ON |
| **Scenario Description** | The user selects the Fuel Economy IOD on the FuelEconomyClient |
| **Post-conditions** | The FuelEconomyClient displays dashes (ex. “--.-”) in place of the Average, Instantaneous, and Consumption Fuel Economy Data |
| **List of Exception Use Cases** |  |
| **Interfaces** | FuelEconomyClient  CAN, G-HMI |

#### FE-UC-REQ-342198/A-User Performs Average Fuel Economy Reset

|  |  |
| --- | --- |
| **Actors** | Vehicle Occupant |
| **Pre-conditions** | Powermode Conditions are met  FuelEconomyClient is ON  Fuel Economy IOD is visible |
| **Scenario Description** | The user selects the Reset button on the FuelEconomyClient |
| **Post-conditions** | The FuelEconomyServer resets the Average Fuel Economy Data  The FuelEconomyClient displays dashes (ex. “--.-”) in place of the Average Fuel Economy Data |
| **List of Exception Use Cases** |  |
| **Interfaces** | FuelEconomyClient  CAN, G-HMI |

### White Box Views

#### Activity Diagrams

##### FE-ACT-REQ-342525/A-Average Fuel Economy & Reset

Activity Diagram



#### Sequence Diagrams

##### FE-SD-REQ-329149/B-Average Fuel Economy & Reset

Constraints

Pre-Condition

Powermode Conditions are met

FuelEconomyClient is ON

Scenarios

Normal Usage

The user selects the Fuel Economy IOD on the FuelEconomyClient (and optionally selects the Reset Avergae Fuel Economy button)

Post-Condition

The FuelEconomyClient displays the Average Fuel Economy Data (or dashes if Reset was performed)

Sequence Diagram



## FE-FUN-REQ-341029/A-Instantaneous Fuel Economy

### Requirements

#### FE-REQ-341053/A-Displaying Instantaneous Fuel Economy Data

The FuelEconomyClient shall display the instantaneous fuel economy data indicated by LInsFuelEcoValue.

#### FE-REQ-341054/A-Displaying Instantaneous Fuel Economy Units

The FuelEconomyClient shall display the instantaneous fuel economy units as indicated by LInsFuelEcoUnits.

#### FE-REQ-341055/A-Displaying Instantaneous Fuel Economy Graph

The FuelEconomyClient shall display the instantaneous fuel economy bar/graph with a maximum scale size indicated by LInstFuelEcoMax.

### Use Cases

#### FE-UC-REQ-342201/A-Displaying Instantaneous Fuel Economy to the User

|  |  |
| --- | --- |
| **Actors** | Vehicle Occupant |
| **Pre-conditions** | Powermode Conditions are met  FuelEconomyClient is ON |
| **Scenario Description** | The user selects the Fuel Economy IOD on the FuelEconomyClient |
| **Post-conditions** | The FuelEconomyClient displays the Instantaneous Fuel Economy Data |
| **List of Exception Use Cases** | REQ-342306-Displaying Missing Data to the User |
| **Interfaces** | FuelEconomyClient  CAN, G-HMI |

### White Box View

#### Activity Diagrams

##### FE-ACT-REQ-342528/A-Instantaneous & Consumption Fuel Economy

Activity Diagram



#### Sequence Diagrams

##### FE-SD-REQ-342529/A-Instantaneous & Consumption Fuel Economy

Constraints

Pre-Condition

Powermode Conditions are met

FuelEconomyClient is ON

Scenarios

Normal Usage

The user selects the Fuel Economy IOD on the FuelEconomyClient

Post-Condition

The FuelEconomyClient displays the Instantaneous Fuel Economy Data (or Fuel Consumption Data)

Sequence Diagram



## FE-FUN-REQ-341030/A-Fuel Consumption

### Requirements

#### FE-REQ-333165/B-Consumption vs. Instantaneous Fuel Economy

The FuelEconomyClient shall display Consumption in place of Instantaneous Fuel Economy as defined below:

* When LConsActive = “(0x1) Active” the Consumption requirements in FUN-REQ-341030-Fuel Consumption shall be followed.
* When LConsActive = “(0x0) Inactive” the Instantaneous Fuel Economy requirements in FUN-REQ-341029-Instantaneous Fuel Economy shall be followed.

#### FE-REQ-341056/A-Displaying Consumption Data

The FuelEconomyClient shall display the consumption data indicated by LConsValue.

#### FE-REQ-341057/A-Displaying Consumption Units

The FuelEconomyClient shall display the consumption units as indicated by LConsUnits.

### Use Cases

#### FE-UC-REQ-342199/A-Displaying Consumption Data to the User

|  |  |
| --- | --- |
| **Actors** | Vehicle Occupant |
| **Pre-conditions** | Powermode Conditions are met  FuelEconomyClient is ON  Vehicle is at stationary/idle |
| **Scenario Description** | The user selects the Fuel Economy IOD on the FuelEconomyClient |
| **Post-conditions** | The FuelEconomyClient displays the Consumption Data |
| **List of Exception Use Cases** | REQ-342306-Displaying Missing Data to the User |
| **Interfaces** | FuelEconomyClient  CAN, G-HMI |

### White Box View

#### Activity Diagrams

##### FE-ACT-REQ-342528/A-Instantaneous & Consumption Fuel Economy

Activity Diagram



#### Sequence Diagrams

##### FE-SD-REQ-342529/A-Instantaneous & Consumption Fuel Economy

Constraints

Pre-Condition

Powermode Conditions are met

FuelEconomyClient is ON

Scenarios

Normal Usage

The user selects the Fuel Economy IOD on the FuelEconomyClient

Post-Condition

The FuelEconomyClient displays the Instantaneous Fuel Economy Data (or Fuel Consumption Data)

Sequence Diagram



# Appendix: Reference Documents

|  |  |
| --- | --- |
| Reference # | Document Title |
| 1 | Fuel Economy IOD HMI specifications |
| 2 | H87a\_SYNC4\_IoD\_In \_SYNC\_Requirements |
| 3 |  |
| 4 |  |
| 5 |  |
| 6 |  |
| 7 |  |
| 8 |  |
| 9 |  |
| 10 |  |
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