

**Research & Vehicle Technology**

**“Infotainment Systems Product Development”**

**Pitch and Roll**

**Subsystem Part Specific Specification (SPSS)**

Version 1.0.1

**UNCONTROLLED COPY IF PRINTED**

**Version Date: December 18, 2018**

**FORD CONFIDENTIALF**

**Revision History**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Date** | | **Version** | **Notes** | |
| **December 14, 2018** | | **1.0** | **Initial Release** |  |
|  |  | |  |  |
| **December 18, 2018** | **1.0.1** | | **Adding FID to requirement items** | |
|  | 599180/B-Overview | | | tmertiri: Updated structure details. Add FID |
|  | 599179/B-Architectural Design | | | tmertiri: Updated structure details. Add FID |
|  | PNR-CLD-REQ-333195/B-Pitch And Roll Client | | | tmertiri: Updated structure details. Add FID |
|  | PNR-CLD-REQ-333196/B-Pitch And Roll Server | | | tmertiri: Updated structure details. Add FID |
|  | 599181/B-Logical Signal Mapping | | | tmertiri: Updated structure details. Add FID |
|  | PNR-IIR-REQ-333198/B-PNRClient\_Rx | | | tmertiri: Updated structure details. Add FID |
|  | MD-REQ-333342/B-LVehPtch | | | tmertiri: Updated structure details. |
|  | MD-REQ-333344/B-LVehRol | | | tmertiri: Updated structure details. |
|  | MD-REQ-333345/B-LStePinAn | | | tmertiri: Updated structure details. |
|  | MD-REQ-333346/B-LStePinQf | | | tmertiri: Updated structure details. |
|  | 604671/A-Functional Definition | | | tmertiri:New structure |
|  | PNR-FUN-REQ-337613/A-Pitch and Roll | | | tmertiri:added function |
|  | 604831/A-Requirements | | | tmertiri: reorganize structure |
|  | PNR-REQ-336992/B-Steering Angle Calculation | | | tmertiri: Updated structure details. Add FID |
|  | 604686/A-Use Cases | | | tmertiri: new structure |
|  | PNR-UC-REQ-337614/A-Angles Display | | | Tmertiri:added usecase |
|  | PNR-UC-REQ-337615/A-Faults in Angles | | | tmertiri: New usecase |

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# Overview

Pitch and Roll feature provides the user with Vehicle Pitch, Roll, and steering wheel angle information through HMI screen.

# Architectural Design

## PNR-CLD-REQ-333195/B-Pitch And Roll Client

Pitch and Roll Client displays the information provided by the server to the user.

## PNR-CLD-REQ-333196/B-Pitch And Roll Server

Pitch and Roll Server provides the vehicle data to the client so that the client may display that information to the user.

## Logical Signal Mapping

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: some CAN signals referenced throughout this document may use the logical name while some may use the actual CAN signal name.

|  |  |
| --- | --- |
| **Logical Name** | **CAN Signal Name** |
| LVehPtch | VehPtch\_An\_Dsply |
| LVehRol | VehRol\_An\_Dsply |
| LStePinAn | StePinComp\_An\_Est |
| LStePinQf | StePinCompAnEst\_D\_Qf |

## PNR-IIR-REQ-333198/B-PNRClient\_Rx

### MD-REQ-333342/B-LVehPtch

LVehPtch: This signal is sent by the server to the client to indicate Vehicle Pitch Angle.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Detail** | **Units** | **Res** | **Offset** | **State Encoded** | **Min.** | **Max.** |
|  | Degrees | 1 | -64 |  | -64 (0X0) | 63 (0X7D) |
| Unknown |  |  |  | 7E |  |  |
| Fault |  |  |  | 7F |  |  |

Pitch Angle Graphic explanation. The below graphics are to provide a visual explanation of angle value. The graphics are for information only, not necessary to be implemented by the client in its HMI display. Refer to Client HMI spec for display state in cases where a fault is transmitted from the signal.

|  |  |
| --- | --- |
| Pitch\_Graphic | Display |
| -1 to -45 deg  1 degree resolution  When negative, rotate the front of the vehicle down and display vehicle at an angle as per input signal. |  |
| 1 to 45 deg  1 degree resolution  When positive, rotate the rear of the vehicle down and display vehicle at an angle as per input signal. |  |
| 0 deg w/number |  |

### MD-REQ-333344/B-LVehRol

LVehRol: This signal is sent by the server to the client to indicate the vehicle roll angle value.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Detail** | **Units** | **Res** | **Offset** | **State Encoded** | **Min.** | **Max.** |
|  | Degrees | 1 | -64 |  | -64 (0X0) | 63 (0X7D) |
| Unknown |  |  |  | 7E |  |  |
| Fault |  |  |  | 7F |  |  |

The graphic below is to provide a visual explanation to the signal values. Client HMI screen may not necessarily has to implement same graphical explanation. Refer to Client HMI spec for display state in cases where a fault is transmitted from the signal

|  |  |
| --- | --- |
| Pitch\_Graphic | Display |
| -1 to -45 deg  1 degree resolution  When negative, rotate the driver side of the vehicle down and display vehicle at an angle as per input signal. |  |
| 1 to 45 deg  1 degree resolution  When positive, rotate the passenger side of the vehicle down and display vehicle at an angle as per input signal. |  |
| 0 deg w/number |  |

### MD-REQ-333345/B-LStePinAn

LStePinAn: This signal is sent by the server to the client to indicate the steering wheel angle position. The data of this signal is considered only when LStePinQf has a value of 0x3 (OK).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Units** | **Res** | **Offset** | **State Encoded** | **Min.** | **Max.** |
| Deg | 0.1 | -1600 |  | -1600 (0x0) | 1676.7  (0x7FFF) |

The graphics below provides visual explanation of the signal values. Client HMI may not necessarily has to implement these graphical items. Refer to Client HMI spec for display state in cases where a fault is transmitted from the signal.

|  |  |
| --- | --- |
| Steering\_Angle\_Graphic | Display |
| -1 to -45 deg  1 degree resolution  When negative, rotate wheels to the right |  |
| 1 to 45 deg  1 degree resolution  When Positive, rotate wheels to the left |  |
| 0 deg |  |

### MD-REQ-333346/B-LStePinQf

LStePinQf: This signal is sent by the server to the client. It provides the quality factor of the LStePinAn signal.

|  |  |
| --- | --- |
| **Literals** | **State**  **Encoded** |
|  |  |
| Fault | 0x0 |
| No\_Data\_ Exists | 0x1 |
| Not\_Within\_ Specification | 0x2 |
| OK | 0x3 |

Note to development team: Typically at key on the LStePinQf will initialize to state (0x1) until receiving sufficient data to transition to (0x3). Transition to (0x3) will generally take driving at above roughly 10 MPH for 100 feet.

# Functional Definition

## PNR-FUN-REQ-337613/A-Pitch and Roll

### Requirements

#### PNR-REQ-336992/B-Steering Angle Calculation

Steering angle data comes in Hex value. To be converted for end user consumption, this data needs to be processed like in the formula below:

Steering Wheel Gear ratio – Configurable parameter. As of now there are vehicle with 17:1 and 20:1 ratios.

Convert LStePinAn hex value to decimal -> DecValue

( DecValue \* 0.1-1600) /SteeringWheelGearRatio

HMI to truncate the data to display full numbers.

### Use Cases

#### PNR-UC-REQ-337614/A-Angles Display

|  |  |
| --- | --- |
| **Actors** | User |
| **Pre-conditions** | Vehicle is On. There are no errors in angles signals |
| **Scenario Description** | Vehicle changes steering angle, pitch or roll (one or all of them) |
| **Post-conditions** | HMI Displays updates the actual relevant signals in the IOD. |
| **List of Exception Use Cases** | Errors in the signals. |
| **Interfaces** | Client HMI screen. |

#### PNR-UC-REQ-337615/A-Faults in Angles

|  |  |
| --- | --- |
| **Actors** | User |
| **Pre-conditions** | Client HMI is displaying vehicle angles (pitch, roll & steering angle) |
| **Scenario Description** | Server generates and sends error code in the angle signals. |
| **Post-conditions** | Client HMI updates the screen to display proper signal states, indicating that there is error in the incoming data. |
| **List of Exception Use Cases** |  |
| **Interfaces** | Client HMI screen. |