Research & Vehicle Technology
"Infotainment Systems Product Development"

Pitch and Roll

Subsystem Part Specific Specification (SPSS)

Version 1.0.1
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Version Date: December 18, 2018

FORD CONFIDENTIAL

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

Table of Contents

1 Overview

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

2   Architectural Design

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

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

2.2   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.

2.3   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

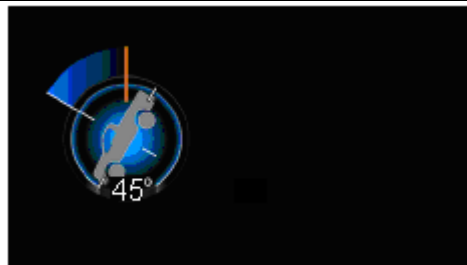## 2.4   PNR-IIR-REQ-333198/B-PNRClient_Rx

2.4.1   MD-REQ-333342/B-LVehPtch

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

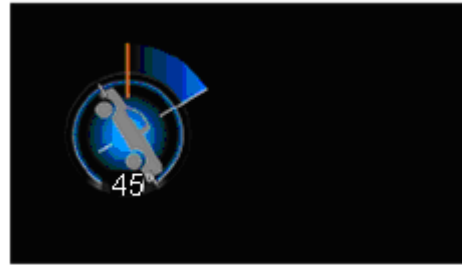| Detail	Units	Res	Offset	State Encoded	Min.	Max.
	Degrees	1	-64		-64 (0X0)	63 (0X7D)
Unknown				7E		
Fault				7F		

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.

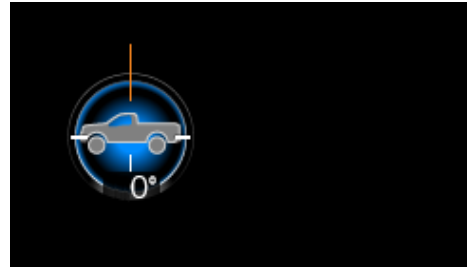| Pitch_Graphic	Display
-1 to -45 deg 1 degree resolution When negative, rotate the front of the vehicle down and display vehicle at an angle as per input signal.	

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	

2.4.2 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

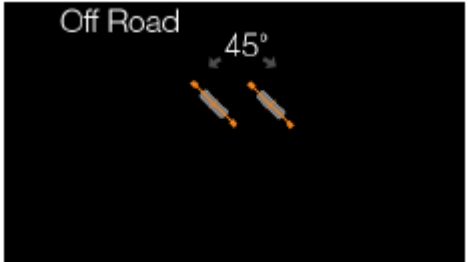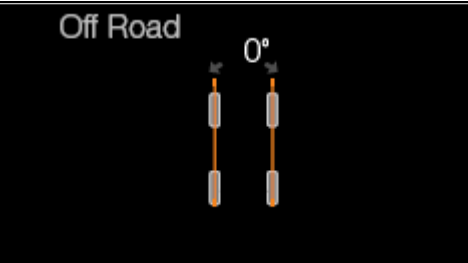| Pitch_Graphic	Display
-1 to -45 deg 1 degree resolution When negative, rotate the driver side of the vehicle down and display vehicle at an angle as per input signal.	
1 to 45 deg 1 degree resolution When positive, rotate the passenger side of the vehicle down and display vehicle at an angle as per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

2.4.3   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	

2.4.4   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.

3   Functional Definition

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

3.1.1   Requirements

3.1.1.1   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.

3.1.2   Use Cases

3.1.2.1   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.

3.1.2.2   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.