Research & Vehicle Technology
"Infotainment Systems Product Development"

Feature – Off-Road Controls

APIM Infotainment Subsystem Part Specific Specification (SPSS)

Version 1.1

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FORD CONFIDENTIAL

Revision History

Date	Version	Notes	
July 1, 2020	1.0	Initial Release	
October 2, 2020	1.1		
	STR-778305/B-Sequence Diagrams		ndecia: revised structure to include new diagram 385486
	ORC-SD-REQ-393764/B-Displaying Off-Road Controls Menu		ndecia: Updated diagram to correct the ORC switch signal value to NoRequest
	ORC-SD-REQ-395486/A-Exiting Off-Road Controls Menu		ndecia: new diagram for Exiting Off Road Controls Menu
	ORC-REQ-393419/B-Selecting Rear eLocker Soft-Switch		ndecia: updated requirement to drop the toggle time from 1000ms to 50ms per feature owner's request
	ORC-REQ-393420/B-Selecting Front eLocker Soft-Switch		ndecia: updated time period before setting signal back to NoRequest from 1s to 50ms per feature owner's request
	ORC-REQ-393421/B-Fault Detection of Rear eLocker Soft-Switch		ndecia: updated to include list of DTCs indicating the fault condition
	ORC-REQ-393607/B-Fault Detection of Front eLocker Soft-Switch		ndecia: updated to include list of DTCs indicating the fault condition
	ORC-REQ-393422/B-Displaying Rear eLocker Soft-Switch State		ndecia: corrected typo
	ORC-REQ-393716/B-Fault Detection of Stabilizer Bar Soft-Switch		ndecia: updated to include list of DTCs indicating the fault condition
	ORC-REQ-393729/B-Fault Detection of Off-Road Turn Assist Soft-Switch		ndecia: updated to include list of DTCs indicating the fault condition
	ORC-REQ-393746/B-Displaying Park Aid Soft-Switch State		ndecia: updated requirement to correct the ParkAid signal logic to allow for the indicator to be displayed as ON when EITHER of the signals is set to ON, rather than BOTH
	ORC-SD-REQ-377205/B-Select Park Aid Soft-Switch		ndecia: updated diagram to correct the ParkAid signal logic to allow for the indicator to be displayed as On when EITHER of the signals is set to On, rather than BOTH

Table of Contents

1 Overview

The Off-Road Controls feature is a set of menu controls within the HMI that allows the driver to control commonly used Off-Road features via soft-switches on the touchscreen display. Examples of these soft-switches subsets are as follows:

1. ORM-Braking Features:
    a. Hill Descent Control
    b. Trail Control
    c. Trail 1-Pedal Driving
2. Park-Aid
3. Rear Diff-Lock
4. Front Diff-Lock
5. Sta-Bar Disconnect
6. Trail Turn Assist

The Off-Road Controls feature also incorporates vehicle status information within the HMI. Examples of these features are as follows:

- Off Road Front Camera views available:
    - Front Normal Camera
    - Front Split Camera
    - Cargo Camera
- Off-Road Controls Vehicle Status functions available:
    - Off-Road Status
    - Pitch and Roll
    - Glass Bottom Camera view

1.1 Feature Operation

As a driver, these Off-Road Controls are available within the HMI. Please refer to the HMI specification for further details on accessing this menu.

1.2 Feature Assumptions

The Off-Road Controls feature assumes the vehicle is equipped with the necessary hardware to enable this feature. The Off-Road Controls HMI may come in 3 different variants, depending on vehicle hardware. Determined by module configuration parameters, the first variant covers both the set of menu controls and camera views, the second variant covers only the menu controls with no camera views, and the third variant covers only vehicle status information only. This third variant does not contain and Off-Road Control soft-switches, and thus is not within the scope of this specification. Since the third variant is instead a combination of Off-Road Status IOD and Pitch and Roll IOD, please refer to SPSS for each of those features.

1.3 Terminology and Abbreviations

The following table lists terminologies that are used in this document along with a brief description.

Term	Description
APIM	Accessory Protocols Interface Module
ATCM	All-Terrain Control Module
ABS	Anti-Lock Braking Module
eLocker	Front or Rear-Differential Lock
Sta-Bar	Stabilizer Bar
IOD	Information On-Demand

2 Architectural Design

2.1 ORC-CLD-REQ-393410/A-Off-Road Controls Interface Client

The Off-Road Controls Interface Client is responsible for sending requests to the Off-Road Controls Server based on user activation of any soft-switches and displaying the state of the soft-switches based on the status signals from the Off-Road Controls Server.

2.2 ORC-CLD-REQ-393411/A-Off-Road Controls Server

The Off-Road Controls Server is responsible for receiving requests from the Off-Road Controls Server and updating the status signals to send back to the Off-Road Controls Interface Client.

2.3 ORC-CLD-REQ-393933/A-Off-Road Controls Camera View Server

The Off-Road Controls Camera View Server is responsible for providing camera views to the Off-Road Controls Interface Client.

2.4 Physical Mapping of Classes

The table below shows an example of how the logical classes that make up the Off-Road Controls feature may be mapped into physical modules. This mapping example is specific to the FNV2 architecture and does not necessarily carryover to other carlines or vehicle architectures.

Logical Class	Physical Module (ECU)
OffRoadControlsInterfaceClient	APIM
OffRoadControlsServer	ATCM / ABS
OffRoadControlsCameraViewServer	ADAS

2.5 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: There may be cases where the actual CAN signal name is used in this documentation.

Logical Name	CAN Signal Name
CameraFrontDisplay_Rq	CamraFrnt_B_RqMnu
OffRoadMenuDisplay_Rq	OffRdSwtch_D_RqMnu
RearELocker_Rq	RearDiffLck_D_RqDrv3
FrontELocker_Rq	FrontDiffLck_D_RqDrv3
RearELocker_St	RearDiffLckLamp_D_Rq
FrontELocker_St	FrontDiffLckLamp_D_Rq
StabilizerBarConnectButton_St	StabBarCnncButtn_D_Sta3
StabilizerBarConnect_St	StabBarCnnctLamp_D_Rq
OffRoadTurnAssistButton_St	TurnAsstSwtch_D_Stat
OffRoadTurnAssist_St	OrtaSwtchLamp_B_Rq
ParkAidSwitchButton_St	PrkAidSwtch_D_RqMnu
ParkAidRear_St	PrkAidRear_D_Stat
ParkAidFront_St	PrkAidFront_D_Stat
TrailOnePedalDriveButton_St	TrailCtlSwtch_B_Stat4
TrailOnePedalDrive_St	TrailCtl_D_Stat
Feature.Rq : Operation (FBMP)	CtrStkDsplyOp_D_Rq
Feature.Rq : FeatureID (FBMP)	CtrStkFeatNoActl

Feature.Rq : Configuration (FBMP)	CtrStkFeatConfigActl
HillDescentControl_St	HdcOn_B_Ind

Table: Logical name/CAN signal mapping

2.6 ORC-IIR-REQ-393412/A-OffRoadControlsInterfaceClient_Rx

2.6.1 MD-REQ-358488/A-FrontELocker_St

Message Type: Status

This signal is used to report the status of Front Differential Lock Lamp

Name	Literals	Value	Description
FrontELocker_St	-	-	This provides the status of Front eLocker indication
	Off	0x0	
	On	0x1	
	Flash	0x2	
	Triggered	0x3	

2.6.2 MD-REQ-358489/A-RearELocker_St

Message Type: Status

The signal is used to report the status of Rear Differential Lock Lamp

Name	Literals	Value	Description
RearELocker_St	-	-	The status of Rear eLocker indication
	Off	0x0	
	On	0x1	
	Flash	0x2	
	Not_Used	0x3	

2.6.3 MD-REQ-358485/A-StabilizerBarConnect_St

Message Type: Status

This signal is used to report the status of Stabilizer Bar indication

Name	Literals	Value	Description
StabilizerBarConnect_St	-	-	This provides the Stabilizer Bar indication status
	Off	0x00	
	On	0x01	
	Slow_Flash	0x02	
	Fast_Flash	0x03	

2.6.4 MD-REQ-391487/A-OffRoadMenuDisplay_Rq

Message Type: Request

The signal is used to send the Off-Road Controls Menu Display request

Name	Literals	Value	Description

OffRoadMenuDisplay_Rq	-	-	A request to display the Off-Road Controls Menu
	Off	0x0	
	On	0x1	
	NoRequest	0x2	
	Faulty	0x3	

2.6.5 MD-REQ-391490/A-OffRoadTurnAssist_St

Message Type: Status

The signal is used to provide the status of the Off-Road Turn Assist

Name	Literals	Value	Description
OffRoadTurnAssist_St	-	-	The status of the ORTA feature state
	Off	0x0	
	On	0x1	

2.6.6 MD-REQ-393587/A-ParkAidRear_St

Message Type: Status

The signal is used to report the status of the Rear Park Aid

Name	Literals	Value	Description
ParkAidRear_St	-	-	The status of the Rear Park Aid state
	Disabled	0x0	
	Enabled	0x1	
	Unused	0x2	
	Faulted	0x3	

2.6.7 MD-REQ-393589/A-ParkAidFront_St

Message Type: Status

This signal is used to provide the status of the Front Park Aid

Name	Literals	Value	Description
ParkAidFront_St	-	-	The status of the Front Park Aid state
	Disabled	0x0	
	Enabled	0x1	
	Unused	0x2	
	Faulted	0x3	

2.6.8 MD-REQ-393590/A-TrailOnePedalDrive_St

Message Type: Status

The signal is used to provide the status of the Trail One Pedal Drive or Trail Control status

Name	Literals	Value	Description
TrailOnePedalDrive_St	-	-	The status of the Trail OPD or Trail Control feature state
	Off	0x0	
	EnabledDescent	0x1	

	Active	0x2	
	StandbyOverride	0x3	
	StandbyOverThreshold	0x4	
	EnabledDeny	0x5	
	DescentOnly	0x6	
	Faulty	0x7	

2.6.9 MD-REQ-393744/A-HillDescentControl_St

Message Type: Status

The signal is used to provide the status of the Hill Descent Control status

Name	Literals	Value	Description
HillDescentControl_St	-	-	The status of the Hill Descent Control feature state
	Off	0x0	
	On	0x1	

2.7 ORC-IIR-REQ-393415/A-OffRoadControlsInterfaceClient_Tx

2.7.1 MD-REQ-393416/A-RearELocker_Rq

Message Type: Request

This signal is used to send the Rear eLocker request

Name	Literals	Value	Description
RearELocker_Rq	-	-	A request to activate or deactivate the rear eLocker
	Off	0x0	
	On	0x1	
	NoRequest	0x2	
	Faulty	0x3	

2.7.2 MD-REQ-393417/A-FrontELocker_Rq

Message Type: Request

The signal is used to send the Front eLocker request

Name	Literals	Value	Description
FrontELocker_Rq	-	-	A request to activate or deactivate the front eLocker
	Off	0x0	
	On	0x1	
	NoRequest	0x2	
	Faulty	0x3	

2.7.3 MD-REQ-391486/A-StabilizerBarConnectButton_St

Message Type: Status

This signal is used to send the Stabilizer Bar Connect button press status

Name	Literals	Value	Description
StabilizerBarConnectButton_St	-	-	The status of the Stabilizer Bar Connect button press state
	Not_Pressed	0x0	
	Pressed	0x1	
	NotUsed	0x2	
	Faulty	0x3	

2.7.4 MD-REQ-391489/A-CameraFrontDisplay_Rq

Message Type: Request

This signal is used to send the Camera Front Display request

Name	Literals	Value	Description
CameraFrontDisplay_Rq	-	-	A request to activate the Front Camera Display
	Off	0x0	
	On	0x1	

2.7.5 MD-REQ-393413/A-OffRoadTurnAssistButton_St

Message Type: Status

This signal is used to send the Off-Road Turn Assist button state

Name	Literals	Value	Description
OffRoadTurnAssistButton_St	-	-	The status of the ORTA button press state
	Not_Pressed	0x0	
	Pressed	0x1	
	NotUsed	0x2	
	Faulty	0x3	

2.7.6 MD-REQ-393414/A-ParkAidSwitchButton_St

Message Type: Status

The signal is used to Park Aid switch button state

Name	Literals	Value	Description
ParkAidSwitchButton_St	-	-	The status of the Park Aid button press state
	Not_Pressed	0x0	
	Pressed	0x1	

2.7.7 MD-REQ-393586/A-TrailOnePedalDriveButton_St

Message Type: Status

This signal is used to send the Trail One-Pedal Drive or Trail Control button state

Name	Literals	Value	Description

TrailOnePedalDriveButton_St	-	-	The status of the Trail One Pedal Drive or Trail Control button press state
	Not_Pressed	0x0	
	Pressed	0x1	

3 General Requirements

3.1 ORC-REQ-377202/A-Off-Road_Status_IOD_SPSS Reference

Some vehicle status information for the Off-Road Controls Menu HMI may overlap with the vehicle status information as captured in the Off-Road Status IOD SPSS. For details on this, please refer to the latest version of the Off-Road Status IOS SPSS.

3.2 ORC-REQ-393712/A-Multi-Camera_Client_SPSS Reference

Some camera view functions for the Off-Road Controls Menu HMI may overlap with the camera view functions captured in the Multi-Camera Client APIM SPSS. For details on these functions and interfaces, please refer to the latest version of the Multi-Camera Client APIM SPSS.

3.3 ORC-REQ-393742/A-Feature_Based_Message_Protocol SPSS Reference

Some functions within this specification utilize the Feature Based Message Protocol to issue requests or be provided with status information. Please refer to the Feature Based Message Protocol APIM SPSS for more details on this interface.

3.4 ORC-REQ-393743/A-Off-Road_Controls_Feature_Configurations

The Off-Road Controls HMI Menu allows for different combinations of functions and switches to be displayed or made available based on vehicle type and configuration. The Off-Road Controls Interface Client shall have configurable parameters to determine which functions shall be supported and how the HMI is to be presented. Please refer to the Off-Road Controls HMI specification for further details.

4 Functional Definition

4.1 ORC-FUN-REQ-393757/A-Display Off-Road Controls Menu

4.1.1 Requirements

4.1.1.1 ORC-REQ-393758/A-Selecting Off-Road Controls Menu

Upon the user selecting the Off-Road Controls Menu soft-switch, or upon receiving OffRoadMenuDisplay_Rq set to On from the Off-Road Controls Server, the Off-Road Controls Interface Client shall display the Off-Road Controls Menu.

4.1.1.2 ORC-REQ-393759/A-Selecting Off-Road Controls Menu With Camera View

If the configuration of the Off-Road Controls Menu feature is configured to also display camera views, then upon the user selecting the Off-Road Controls Menu soft-switch, or upon receiving OffRoadMenuDisplay_Rq set to On from the Off-Road Controls Server, the Off-Road Controls Interface Client shall send the CameraFrontDisplay_Rq signal to the Off-Road Camera View Server, set to On for as long as the Off-Road Controls Menu is being displayed. The OffRoadMenuDisplay_Rq will then be reset back to NoRequest.

4.1.1.3 ORC-REQ-393760/A-Selecting IOD Types

If the configuration of the Off-Road Controls Menu feature is configured to not display camera views, then upon receiving OffRoadMenuDisplay_Rq set to On from the Off-Road Controls Server, the Off-Road Controls Interface Client shall display an IOD according to the HMI specification. The user may all select to display multiple IOD types from this view. Please refer to the corresponding IOD SPSS for each of these types for further details on the interfaces and functions associated with them.

4.1.1.4 ORC-REQ-393934/A-Displaying Off-Road Controls Menu Camera Views

If the configuration of the Off-Road Controls Menu feature is configured to also display camera views, the Off-Road Controls Interface Client shall display any camera views as triggered via the Feature Based Message Protocol by the Off-Road Controls Camera View Server in accordance with the functions defined in the Multi-Camera Client APIM SPSS. Please refer to the Multi-Camera Client APIM SPSS for further details.

4.1.1.5 ORC-REQ-393935/A-Exiting Off-Road Controls Menu With Camera View

If the configuration of the Off-Road Controls Menu feature is configured to also display camera views, and while currently displaying the Off-Road Controls Menu, then upon the user exiting the Off-Road Controls Menu either via a Cancel soft-button, or upon receiving another OffRoadMenuDisplay_Rq set to On from the Off-Road Controls Server, the Off-Road Controls Interface Client shall send the CameraFrontDisplay_Rq signal set to Off to the Off-Road Camera View Server, and exit the Off-Road Control Menu.

4.1.2 Use Cases

4.1.2.1 ORC-UC-REQ-393762/A-Displaying Off-Road Controls Menu

Actors	User, Off-Road Controls Interface Client, Off-Road Controls Server, Off-Road Controls Camera View Server
Pre-conditions	Off-Road Controls Menu is not displayed
Scenario Description	User selects the Off-Road Controls Menu hard-switch or soft-switch
Post-conditions	Off-Road Controls Menu is displayed
List of Exception Use Cases	
Interfaces	HMI

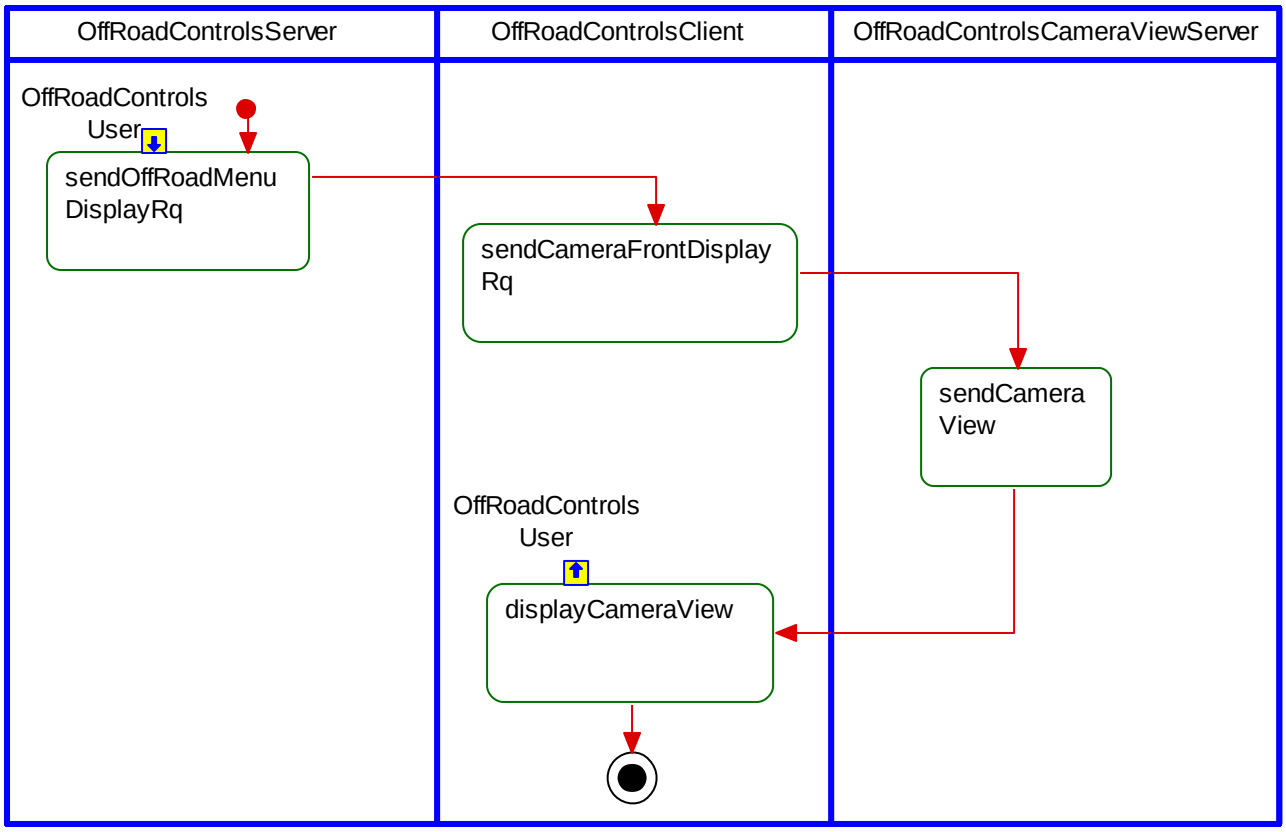
4.1.2.2 ORC-UC-REQ-393949/A-Exiting Off-Road Controls Menu

Actors	User, Off-Road Controls Interface Client, Off-Road Controls Server, Off-Road Controls Camera View Server
Pre-conditions	Off-Road Controls Menu is displayed
Scenario Description	User selects the Off-Road Controls Menu hard-switch or the Cancel soft-button
Post-conditions	Off-Road Controls Menu is not displayed
List of Exception Use Cases	
Interfaces	HMI

4.1.3 White Box View

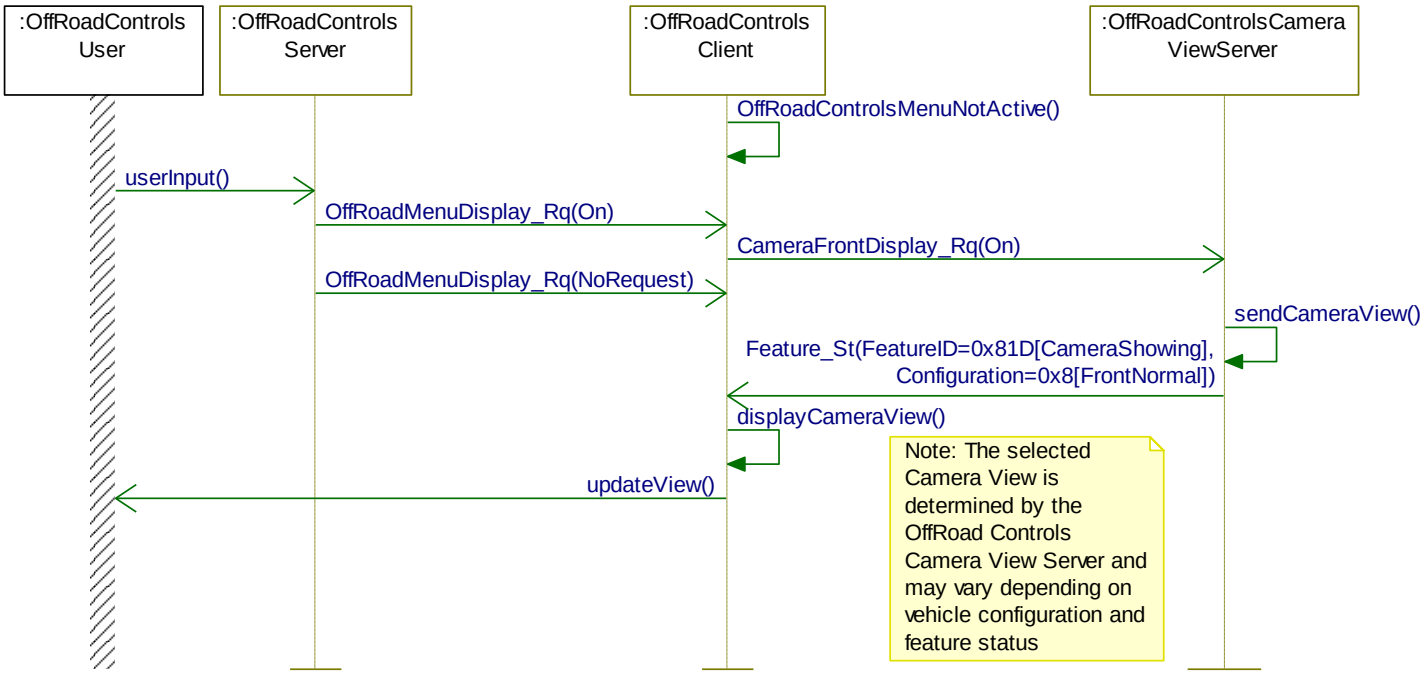
4.1.3.1 Activity Diagrams

4.1.3.1.1 ORC-ACT-REQ-393763/A-Displaying Off-Road Controls Menu

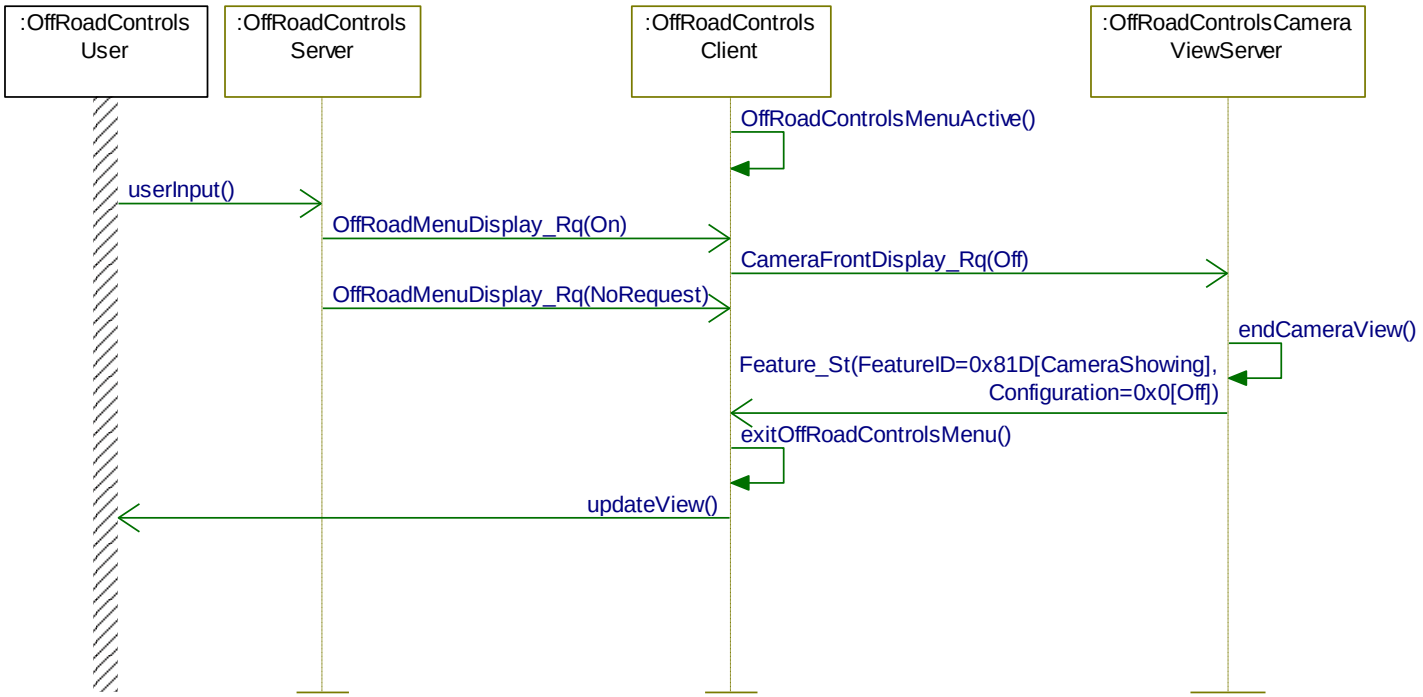


4.1.3.2 Sequence Diagrams

4.1.3.2.1 ORC-SD-REQ-393764/B-Displaying Off-Road Controls Menu



4.1.3.2.2 ORC-SD-REQ-395486/A-Exiting Off-Road Controls Menu



4.2 ORC-FUN-REQ-393418/A-Select Rear or Front eLocker Soft-Switch

4.2.1 Requirements

4.2.1.1 ORC-REQ-393419/B-Selecting Rear eLocker Soft-Switch

Upon the user touching and releasing the Rear eLocker switch while it was in the “OFF” state, the Off-Road Controls Interface Client shall send the RearELocker_Rq signal to the Off-Road Controls Server, set to On for a period of 50 ms, then set back to NoRequest.

Upon the user touching and releasing the Rear eLocker switch while it was in the “ON” state, the Off-Road Controls Interface Client shall send the RearELocker_Rq signal to the Off-Road Controls Server, set to Off for a period of 50 ms, then set back to NoRequest

4.2.1.2 ORC-REQ-393420/B-Selecting Front eLocker Soft-Switch

Upon the user touching and releasing the Front eLocker switch while it was in the “OFF” state, the Off-Road Controls Interface Client shall send the FrontELocker_Rq signal to the Off-Road Controls Server, set to On for a period of 50 ms, then set back to NoRequest.

Upon the user touching and releasing the Front eLocker switch while it was in the “ON” state, the Off-Road Controls Interface Client shall send the FrontELocker_Rq signal to the Off-Road Controls Server, set to Off for a period of 50 ms, then set back to NoRequest

4.2.1.3 ORC-REQ-393421/B-Fault Detection of Rear eLocker Soft-Switch

If the Off-Road Controls Interface Client detects a fault or failure, of the soft button handling component or of the Off-Road Controls Interface Client in general (including the presence of any of the DTCs listed below), that prevents the user from interacting with the feature setting (e.g. failure to register touch input, persistent contact or “stuck button” condition, etc.) then the Off-Road Controls Interface Client shall set the RearELocker_Rq signal to Faulty for as long as the fault condition persists.

DTC 0x908E01 - Display General Electrical Failure
DTC 0x908E4A - Display Incorrect Component Installed
DTC 0x908E02 - Display General Signal Failure
DTC 0xC16200 - Lost Communication With Navigation Display Module No Sub Type Information
DTC 0x908E87 - Display Missing Message
DTC 0xF00041 - Control Module General Checksum Failure
DTC 0xF00317 - Battery Voltage Circuit Voltage Above Threshold
DTC 0xF00316 - Battery Voltage Circuit Voltage Below Threshold
DTC 0x908E02 - Display General Signal Failure

4.2.1.4 ORC-REQ-393607/B-Fault Detection of Front eLocker Soft-Switch

If the Off-Road Controls Interface Client detects a fault or failure, of the soft button handling component or of the Off-Road Controls Interface Client in general (including the presence of any of the DTCs listed below), that prevents the user from interacting with the feature setting (e.g. failure to register touch input, persistent contact or “stuck button” condition, etc.) then the Off-Road Controls Interface Client shall set the FrontELocker_Rq signal to Faulty for as long as the fault condition persists.

DTC 0x908E01 - Display General Electrical Failure
DTC 0x908E4A - Display Incorrect Component Installed
DTC 0x908E02 - Display General Signal Failure
DTC 0xC16200 - Lost Communication With Navigation Display Module No Sub Type Information
DTC 0x908E87 - Display Missing Message
DTC 0xF00041 - Control Module General Checksum Failure
DTC 0xF00317 - Battery Voltage Circuit Voltage Above Threshold
DTC 0xF00316 - Battery Voltage Circuit Voltage Below Threshold
DTC 0x908E02 - Display General Signal Failure

4.2.1.5 ORC-REQ-393422/B-Displaying Rear eLocker Soft-Switch State

The Off-Road Controls Interface Client shall update the state of the Rear eLocker soft-switch accordingly, upon receiving the RearELocker_St signal from the Off-Road Controls Server.

This signal being received with a value of On or Flash, shall result in the soft-switch being displayed in the On state.
As an example, below may be the Rear eLocker soft-switch in the On state:

This signal being received with a value of Off, shall result in the soft-switch being displayed in the Off state.
As an example, below may be the Rear eLocker soft-switch in the Off state:

This signal being received with a value of Not_Used shall result in no state change of the soft-switch.

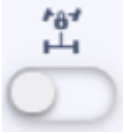
Note: The icon state appearances and corresponding graphics referenced above are for example purposes only. For further details on icon states, text, or graphics, please refer to the graphical assets and HMI specifications.

4.2.1.6 ORC-REQ-393597/A-Displaying Front eLocker Soft-Switch State

The Off-Road Controls Interface Client shall update the state of the Front eLocker soft-switch accordingly, upon receiving the FrontELocker_St signal from the Off-Road Controls Server.

This signal being received with a value of On or Flash, shall result in the soft-switch being displayed in the On state.
As an example, below may be the Front eLocker soft-switch in the On state:

This signal being received with a value of Off, shall result in the soft-switch being displayed in the Off state.
As an example, below may be the Front eLocker soft-switch in the Off state:



This signal being received with a value of Triggered shall result in no state change of the soft-switch.

Note: The icon state appearances and corresponding graphics referenced above are for example purposes only. For further details on icon states, text, or graphics, please refer to the graphical assets and HMI specifications.

4.2.2 Use Cases

4.2.2.1 ORC-UC-REQ-393423/A-Activating Rear eLocker Soft-Switch

Actors	User, Off-Road Controls Interface Client, Off-Road Controls Server
Pre-conditions	Rear eLocker Setting is Off

Scenario Description	User selects the Rear eLocker soft-switch
Post-conditions	Rear eLocker Setting is On
List of Exception Use Cases	
Interfaces	HMI

4.2.2.2 ORC-UC-REQ-391496/A-Deactivating Rear eLocker Soft-Switch

Actors	User, Off-Road Controls Interface Client, Off-Road Controls Server
Pre-conditions	Rear eLocker Setting is On
Scenario Description	User selects the Rear eLocker soft-switch
Post-conditions	Rear eLocker Setting is Off
List of Exception Use Cases	
Interfaces	HMI

4.2.2.3 ORC-UC-REQ-391504/A-Activating Front eLocker Soft-Switch

Actors	User, Off-Road Controls Interface Client, Off-Road Controls Server
Pre-conditions	Front eLocker Setting is Off
Scenario Description	User selects the Rear eLocker soft-switch
Post-conditions	Front eLocker Setting is On
List of Exception Use Cases	
Interfaces	HMI

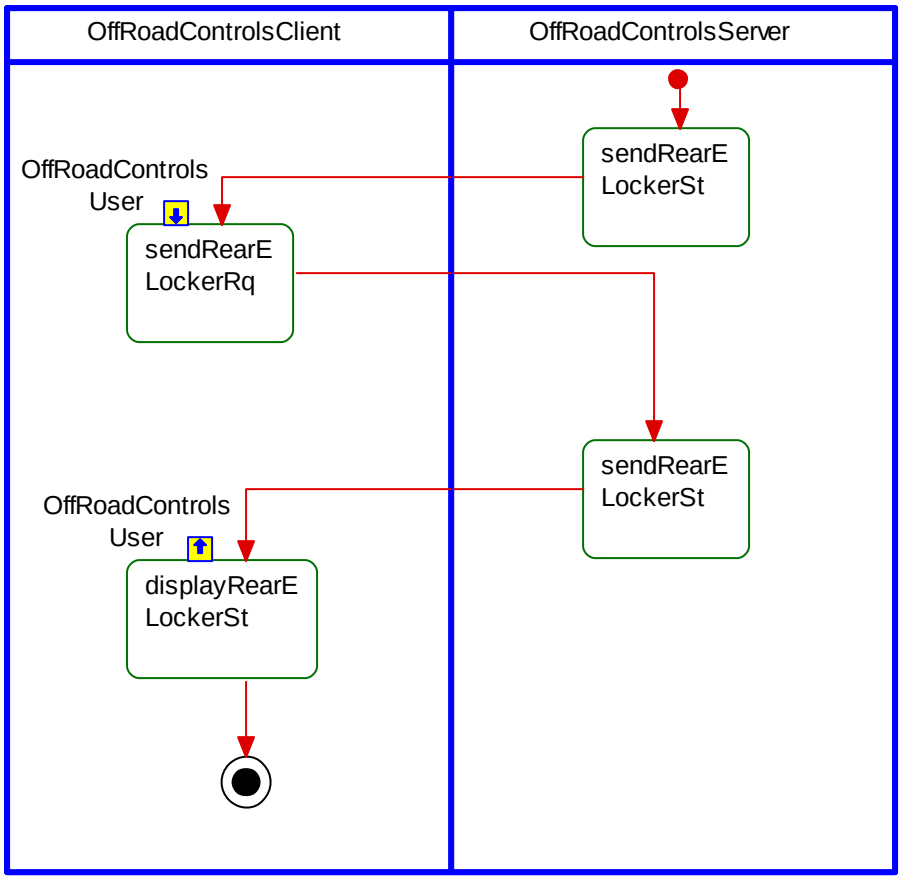
4.2.2.4 ORC-UC-REQ-391513/A-Deactivating Front eLocker Soft-Switch

Actors	User, Off-Road Controls Interface Client, Off-Road Controls Server
Pre-conditions	Front eLocker Setting is On
Scenario Description	User selects the Rear eLocker soft-switch
Post-conditions	Front eLocker Setting is Off
List of Exception Use Cases	
Interfaces	HMI

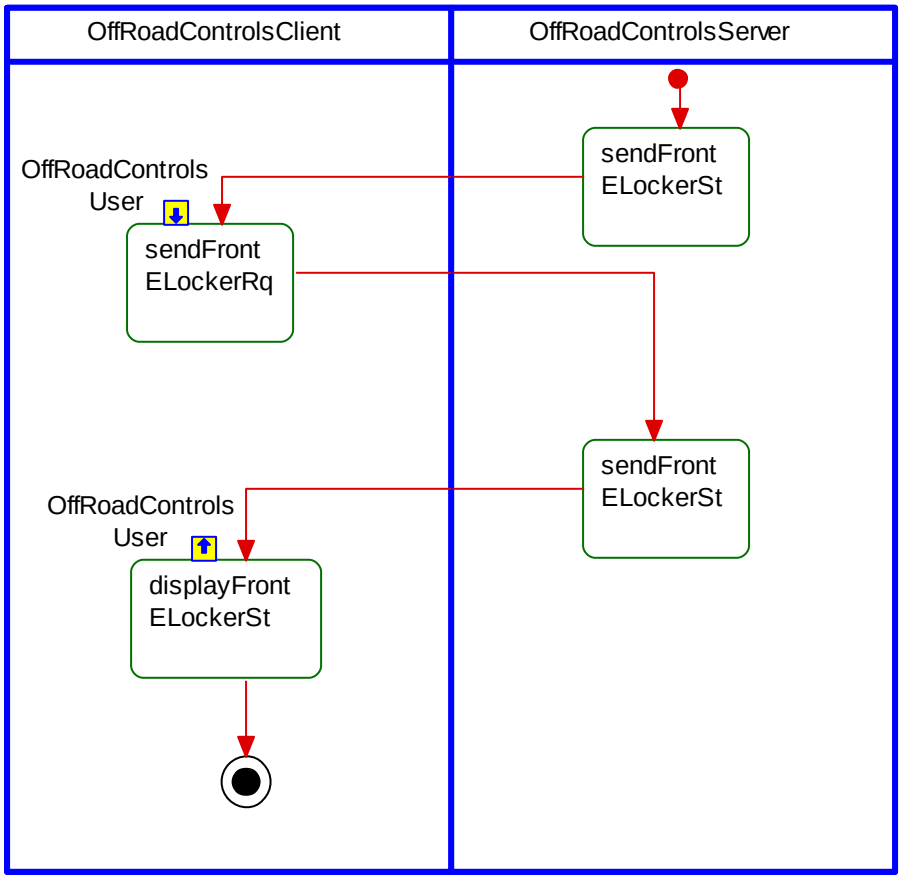
4.2.3 White Box View

4.2.3.1 Activity Diagrams

4.2.3.1.1 ORC-ACT-REQ-393424/A-Select Rear eLocker Soft-Switch

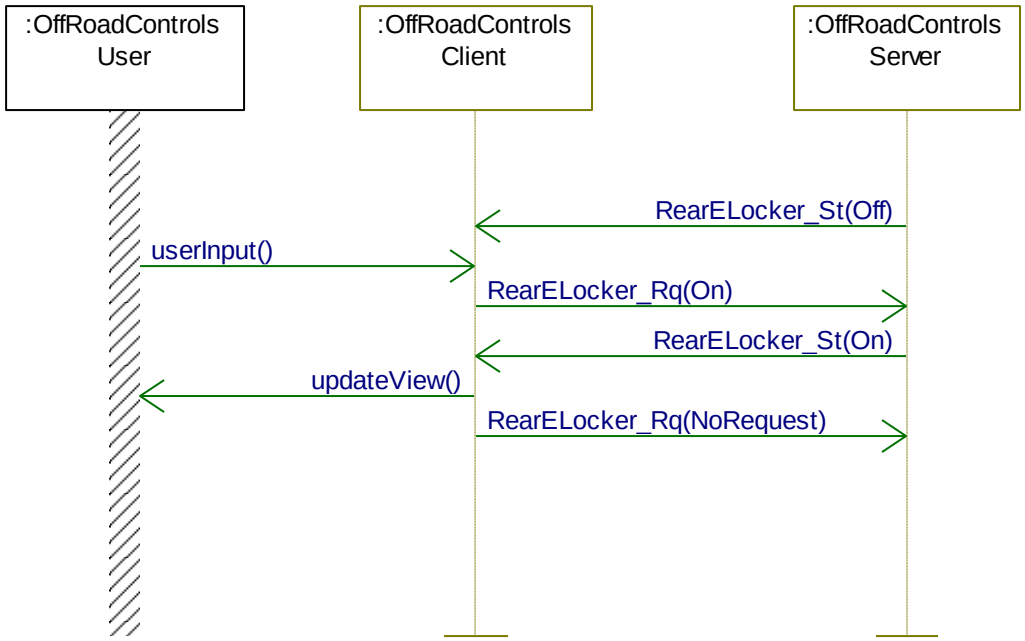


4.2.3.1.2 ORC-ACT-REQ-393936/A-Select Front eLocker Soft-Switch

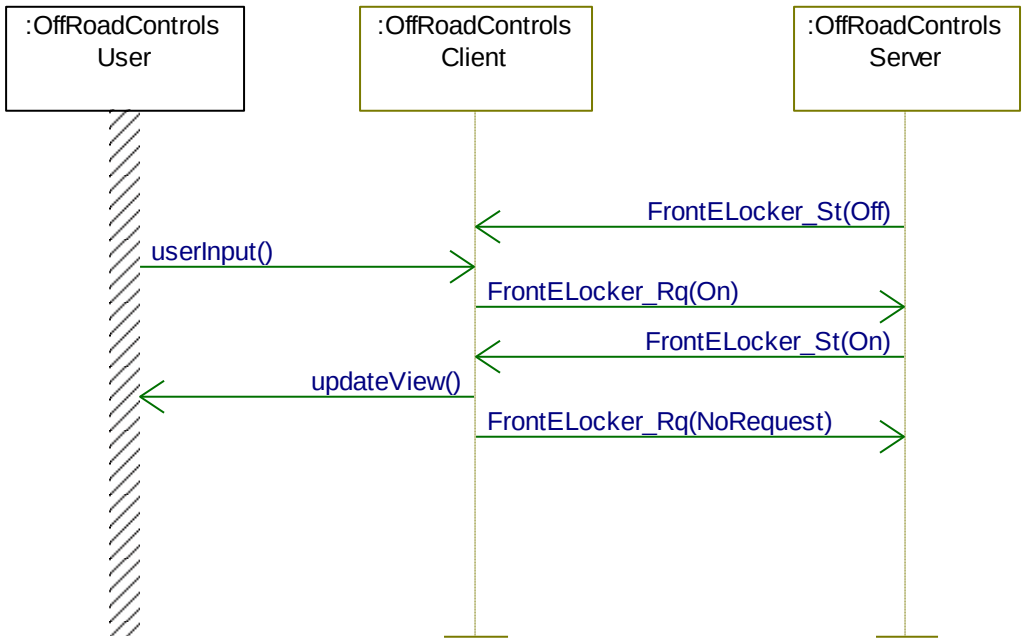


4.2.3.2 Sequence Diagrams

4.2.3.2.1 ORC-SD-REQ-393425/A-Select Rear eLocker Soft-Switch



4.2.3.2.2 ORC-SD-REQ-393937/A-Select Front eLocker Soft-Switch



4.3 ORC-FUN-REQ-393713/A-Select Stabilizer Bar Soft-Switch

4.3.1 Requirements

4.3.1.1 *ORC-REQ-393714/A-Selecting Stabilizer Bar Soft-Switch*

Upon the user touching the Stabilizer Bar soft-switch, the Off-Road Controls Interface Client shall send the StabilizerBarConnectButton_St signal to the Off-Road Controls Server, set to a value of Pressed. Upon the user releasing the soft-switch, the StabilizerBarConnectButton_St signal shall be set back to NotPressed.

4.3.1.2 *ORC-REQ-393716/B-Fault Detection of Stabilizer Bar Soft-Switch*

If the Off-Road Controls Interface Client detects a fault or failure, of the soft button handling component or of the Off-Road Controls Interface Client in general (including the presence of any of the DTCs listed below), that prevents the user from interacting with the feature setting (e.g. failure to register touch input, persistent contact or “stuck button” condition, etc.) then the Off-Road Controls Interface Client shall set the StabilizerBarConnectButton_St signal to Faulty for as long as the fault condition persists.

DTC 0x908E01 - Display General Electrical Failure
DTC 0x908E4A - Display Incorrect Component Installed
DTC 0x908E02 - Display General Signal Failure
DTC 0xC16200 - Lost Communication With Navigation Display Module No Sub Type Information
DTC 0x908E87 - Display Missing Message
DTC 0xF00041 - Control Module General Checksum Failure
DTC 0xF00317 - Battery Voltage Circuit Voltage Above Threshold
DTC 0xF00316 - Battery Voltage Circuit Voltage Below Threshold
DTC 0x908E02 - Display General Signal Failure

4.3.1.3 *ORC-REQ-393718/A-Displaying Stabilizer Bar Soft-Switch State*

The Off-Road Controls Interface Client shall update the state of the Stabilizer Bar soft-switch accordingly, upon receiving the StabilizerBarConnect_St signal from the Off-Road Controls Server.

This signal being received with a value of On or Fast_Flash, shall result in the soft-switch being displayed in the On state. As an example, below may be the Stabilizer Bar soft-switch in the On state:

This signal being received with a value of Off or Slow_Flash, shall result in the soft-switch being displayed in the Off state. As an example, below may be the Stabilizer Bar soft-switch in the Off state:

Note: The icon state appearances and corresponding graphics referenced above are for example purposes only. For further details on icon states, text, or graphics, please refer to the graphical assets and HMI specifications.

4.3.2 Use Cases

4.3.2.1 ORC-UC-REQ-393720/A-Activating Stabilizer Bar Soft-Switch

Actors	User, Off-Road Controls Interface Client, Off-Road Controls Server
Pre-conditions	Stabilizer Bar Setting is Off
Scenario Description	User selects the Stabilizer Bar soft-switch
Post-conditions	Stabilizer Bar Setting is On
List of Exception Use Cases	
Interfaces	HMI

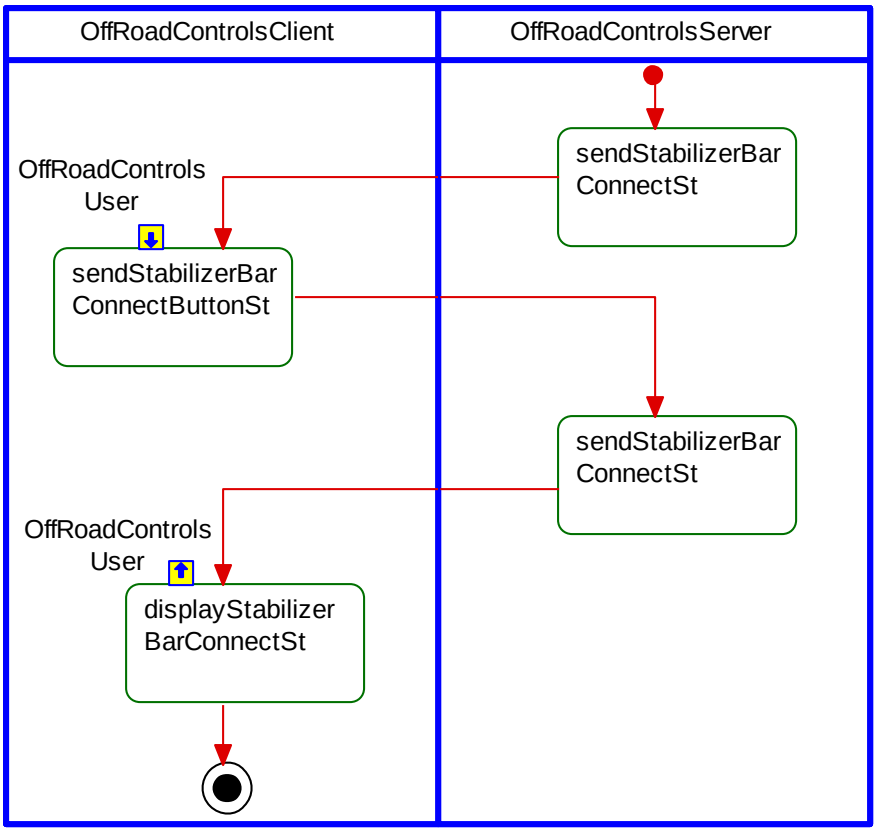
4.3.2.2 ORC-UC-REQ-393721/A-Deactivating Stabilizer Bar Soft-Switch

Actors	User, Off-Road Controls Interface Client, Off-Road Controls Server
Pre-conditions	Stabilizer Bar Setting is On
Scenario Description	User selects the Stabilizer Bar soft-switch
Post-conditions	Stabilizer Bar Setting is Off
List of Exception Use Cases	
Interfaces	HMI

4.3.3 White Box View

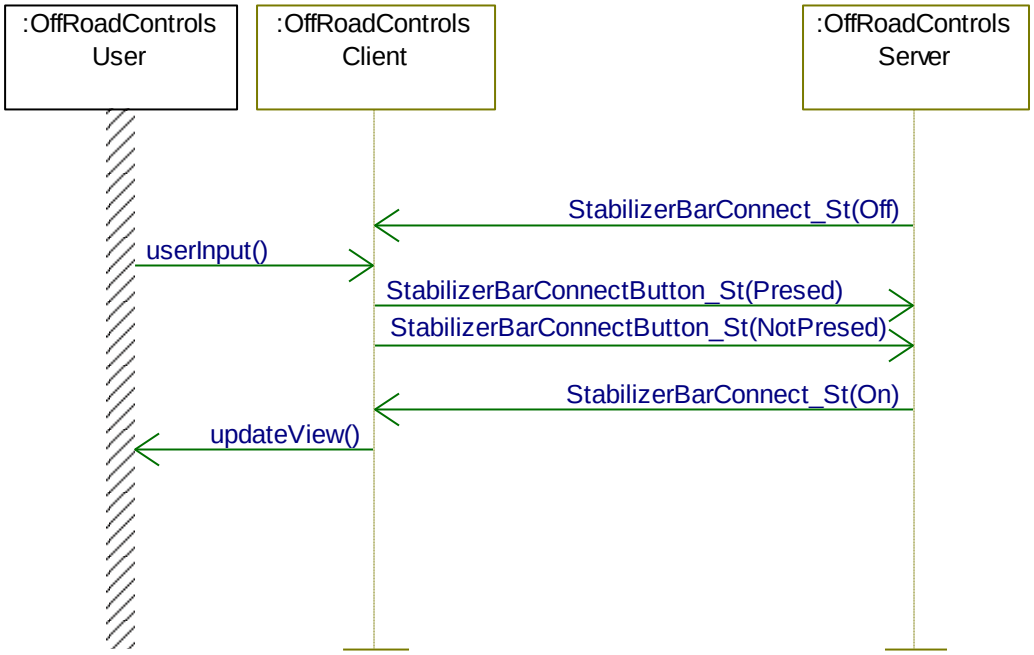
4.3.3.1 Activity Diagrams

4.3.3.1.1 ORC-ACT-REQ-393724/A-Select Stabilizer Bar Soft-Switch



4.3.3.2 Sequence Diagrams

4.3.3.2.1 ORC-SD-REQ-393725/A-Select Stabilizer Bar Soft-Switch



4.4 ORC-FUN-REQ-393726/A-Select Off-Road Turn Assist Soft-Switch

4.4.1 Requirements

4.4.1.1 *ORC-REQ-393727/A-Selecting Off-Road Turn Assist Soft-Switch*

Upon the user touching the Off-Road Turn Assist soft-switch, the Off-Road Controls Interface Client shall send the OffRoadTurnAssistButton_St signal to the Off-Road Controls Server, set to a value of Pressed. Upon the user releasing the soft-switch, the OffRoadTurnAssistButton_St signal shall be set back to NotPressed.

4.4.1.2 *ORC-REQ-393729/B-Fault Detection of Off-Road Turn Assist Soft-Switch*

If the Off-Road Controls Interface Client detects a fault or failure, of the soft button handling component or of the Off-Road Controls Interface Client in general (including the presence of any of the DTCs listed below), that prevents the user from interacting with the feature setting (e.g. failure to register touch input, persistent contact or “stuck button” condition, etc.) then the Off-Road Controls Interface Client shall set the OffRoadTurnAssistButton_St signal to Faulty for as long as the fault condition persists.

DTC 0x908E01 - Display General Electrical Failure
DTC 0x908E4A - Display Incorrect Component Installed
DTC 0x908E02 - Display General Signal Failure
DTC 0xC16200 - Lost Communication With Navigation Display Module No Sub Type Information
DTC 0x908E87 - Display Missing Message
DTC 0xF00041 - Control Module General Checksum Failure
DTC 0xF00317 - Battery Voltage Circuit Voltage Above Threshold
DTC 0xF00316 - Battery Voltage Circuit Voltage Below Threshold
DTC 0x908E02 - Display General Signal Failure

4.4.1.3 *ORC-REQ-393731/A-Displaying Off-Road Turn Assist Soft-Switch State*

The Off-Road Controls Interface Client shall update the state of the Off-Road Turn Assist soft-switch accordingly, upon receiving the OffRoadTurnAssist_St signal from the Off-Road Controls Server.

This signal being received with a value of On, shall result in the soft-switch being displayed in the On state.

As an example, below may be the Off-Road Turn Assist soft-switch in the On state:

This signal being received with a value of Off, shall result in the soft-switch being displayed in the Off state.
As an example, below may be the Off-Road Turn Assist soft-switch in the Off state:

Note: The icon state appearances and corresponding graphics referenced above are for example purposes only. For further details on icon states, text, or graphics, please refer to the graphical assets and HMI specifications.

4.4.2 Use Cases

4.4.2.1 ORC-UC-REQ-393733/A-Activating Off-Road Turn Assist Soft-Switch

Actors	User, Off-Road Controls Interface Client, Off-Road Controls Server
Pre-conditions	Off-Road Turn Assist Setting is Off
Scenario Description	User selects the Off-Road Turn Assist soft-switch
Post-conditions	Off-Road Turn Assist Setting is On
List of Exception Use Cases	
Interfaces	HMI

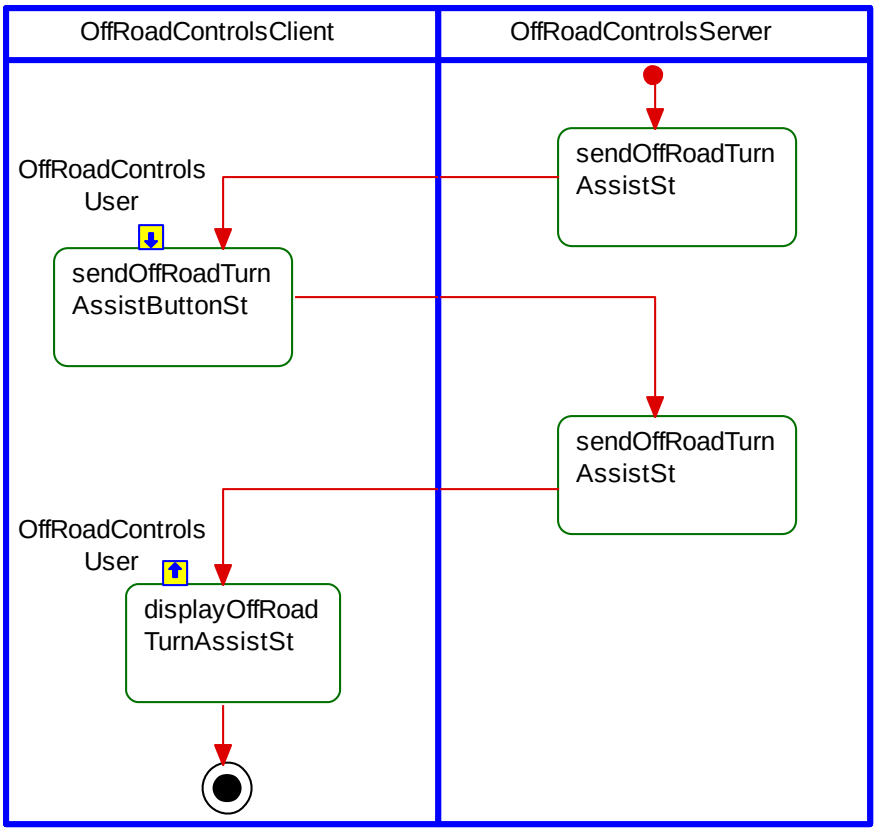
4.4.2.2 ORC-UC-REQ-393734/A-Deactivating Off-Road Turn Assist Soft-Switch

Actors	User, Off-Road Controls Interface Client, Off-Road Controls Server
Pre-conditions	Off-Road Turn Assist Setting is On
Scenario Description	User selects the Off-Road Turn Assist soft-switch
Post-conditions	Off-Road Turn Assist Setting is Off
List of Exception Use Cases	
Interfaces	HMI

4.4.3 White Box View

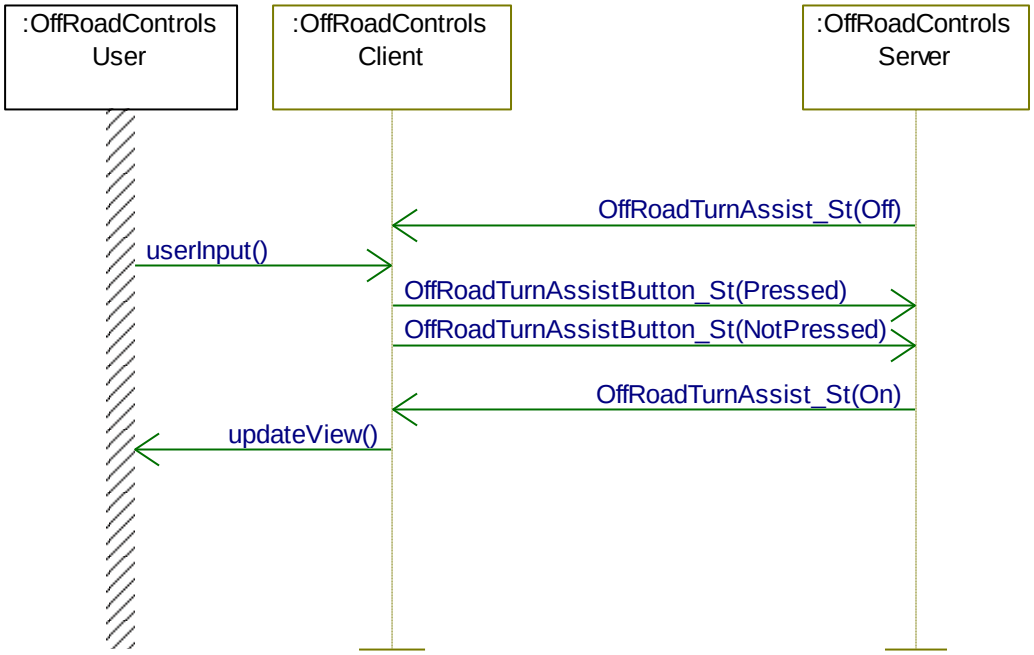
4.4.3.1 Activity Diagrams

4.4.3.1.1 ORC-ACT-REQ-393737/A-Select Off-Road Turn Assist Soft-Switch



4.4.3.2 Sequence Diagrams

4.4.3.2.1 ORC-SD-REQ-393738/A-Select Off-Road Turn Assist Soft-Switch



4.5 ORC-FUN-REQ-380680/A-Select Park Aid Soft-Switch

4.5.1 Requirements

4.5.1.1 ORC-REQ-393745/A-Selecting Park Aid Soft-Switch

Upon the user touching the Park Aid soft-switch, the Off-Road Controls Interface Client shall send the ParkAidSwitchButton_St signal to the Off-Road Controls Server, set to a value of Pressed. Upon the user releasing the soft-switch, the ParkAidSwitchButton_Stsignal shall be set back to NotPressed.

4.5.1.2 ORC-REQ-393746/B-Displaying Park Aid Soft-Switch State

The Off-Road Controls Interface Client shall update the state of the Park Aid soft-switch accordingly, upon receiving the ParkAidRear_St and ParkAidFront_St signals from the Off-Road Controls Server.

Either of the signals (ParkAidRear_St and ParkAidFront_St) being received with a value of Enabled, shall result in the soft-switch being displayed in the On state.
As an example, below may be the Park Aid soft-switch in the On state:

Both signals (ParkAidRear_St and ParkAidFront_St) being received with a value of Disabled/Unused/Faulted, shall result in the soft-switch being displayed in the Off state.
As an example, below may be the Park Aid soft-switch in the Off state:

Note: The icon state appearances and corresponding graphics referenced above are for example purposes only. For further details on icon states, text, or graphics, please refer to the graphical assets and HMI specifications.

4.5.2 Use Cases

4.5.2.1 ORC-UC-REQ-393735/A-Activating Park Aid Soft-Switch

Actors	User, Off-Road Controls Interface Client, Off-Road Controls Server
Pre-conditions	Park Aid Setting is Off
Scenario Description	User selects the Park Aid soft-switch
Post-conditions	Park Aid Setting is On
List of Exception Use Cases	
Interfaces	HMI

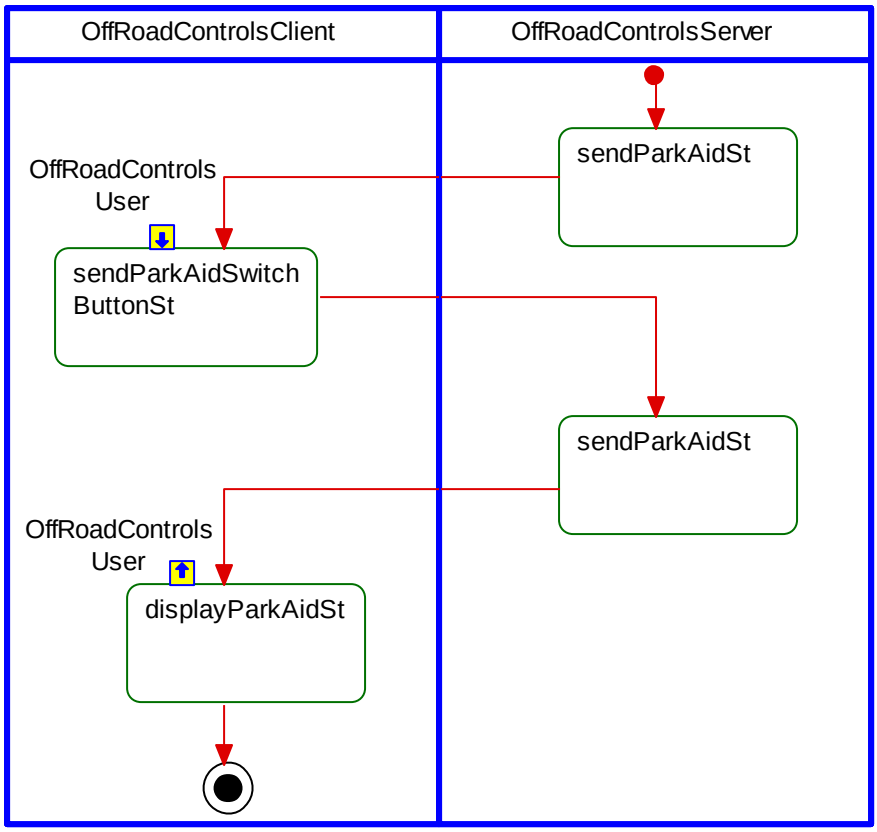
4.5.2.2 ORC-UC-REQ-393736/A-Deactivating Park Aid Soft-Switch

Actors	User, Off-Road Controls Interface Client, Off-Road Controls Server
Pre-conditions	Park Aid Setting is On
Scenario Description	User selects the Park Aid soft-switch
Post-conditions	Park Aid Setting is Off
List of Exception Use Cases	
Interfaces	HMI

4.5.3 White Box View

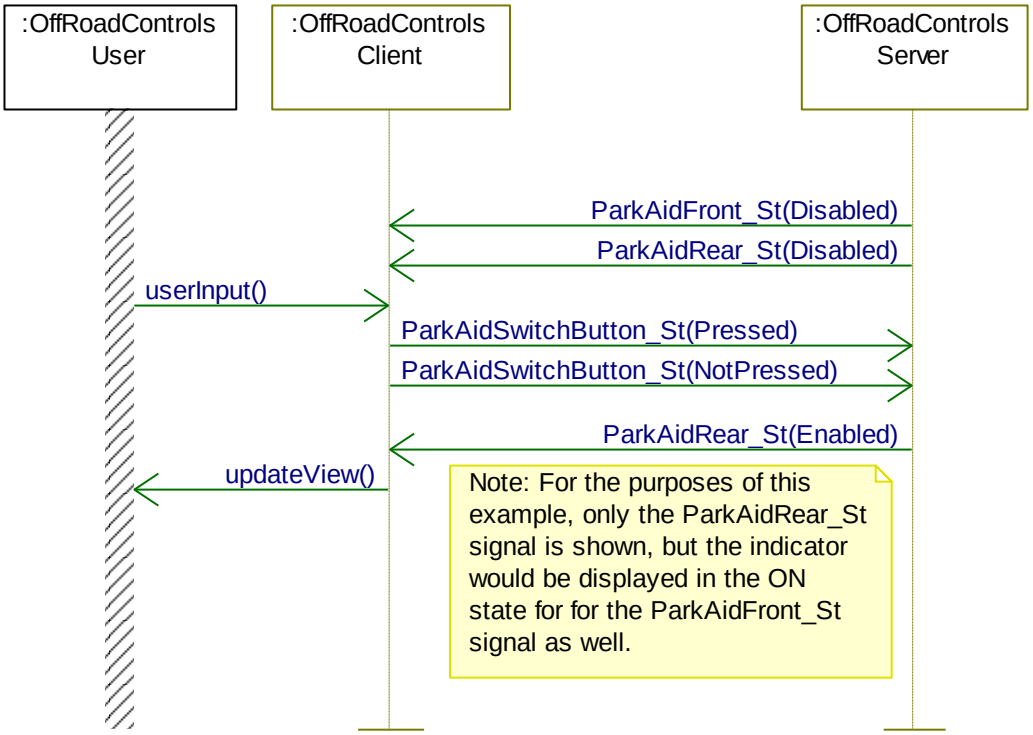
4.5.3.1 Activity Diagrams

4.5.3.1.1 ORC-ACT-REQ-377204/A-Select Park Aid Soft-Switch



4.5.3.2 Sequence Diagrams

4.5.3.2.1 ORC-SD-REQ-377205/B-Select Park Aid Soft-Switch



4.6 ORC-FUN-REQ-393749/A-Select Hill Descent Control, Trail Control, or Trail One-Pedal Drive Soft-Switch

4.6.1 Requirements

4.6.1.1 ORC-REQ-393750/A-Configurable Soft-Switch for Hill Descent Control, Trail Control, or Trail One-Pedal Drive

The Off-Road Controls Interface Client shall have configurable parameter(s) to determine which of the following soft-switches to support for a particular Off-Road Controls Menu layout:

- Hill Descent Control
- Trail Control
- Trail One-Pedal Drive

4.6.1.2 ORC-REQ-393751/A-Selecting Hill Descent Control Soft-Switch

Upon the user touching the Hill Descent Control soft-switch while it was in the “OFF” state, the Off-Road Controls Interface Client shall utilize the Feature Based Message Protocol as follows to send the request to enable Hill Descent Control to the Off-Road Controls Server:

Feature.Rq : Operation = Set
Feature.Rq : FeatureID = 0x0E02
Feature.Rq : Configuration = 0x1 ON

Upon the user touching the Hill Descent Control soft-switch while it was in the “ON” state, the Off-Road Controls Interface Client shall utilize the Feature Based Message Protocol as follows to send the request to enable Hill Descent Control to the Off-Road Controls Server:

Feature.Rq : Operation = Set
Feature.Rq : FeatureID = 0x0E02

Feature.Rq : Configuration = 0x0 OFF

Feature Description	Feature Number	Configuration Number	HMI selection / Configuration Name
Hill Decent Control	0x0E02	0x00	OFF / Disabled
		0x01	ON / Enabled

For further details on utilizing this interface, refer to the Feature Based Message Protocol APIM SPSS.

4.6.1.3 ORC-REQ-393752/A-Selecting Trail Control Soft-Switch

Upon the user touching the Trail Control soft-switch, the Off-Road Controls Interface Client shall send the TrailOnePedalDriveButton_St signal to the Off-Road Controls Server, set to a value of Pressed. Upon the user releasing the soft-switch, the TrailOnePedalDriveButton_St signal shall be set back to NotPressed.

4.6.1.4 ORC-REQ-393753/A-Selecting Trail One-Pedal Drive Soft-Switch

Upon the user touching the Trail One-Pedal Drive soft-switch, the Off-Road Controls Interface Client shall send the TrailOnePedalDriveButton_St signal to the Off-Road Controls Server, set to a value of Pressed. Upon the user releasing the soft-switch, the TrailOnePedalDriveButton_St signal shall be set back to NotPressed.

4.6.1.5 ORC-REQ-393715/A-Displaying Hill Descent Control Soft-Switch State

The Off-Road Controls Interface Client shall update the state of the Hill Descent Control soft-switch accordingly, upon receiving the HillDescentControl_St signal from the Off-Road Controls Server.

This signal being received with a value of On, shall result in the soft-switch being displayed in the On state.
As an example, below may be the Hill Descent Control soft-switch in the On state:

This signal being received with a value of Off, shall result in the soft-switch being displayed in the Off state.
As an example, below may be the Hill Descent Control soft-switch in the Off state:

Note: The icon state appearances and corresponding graphics referenced above are for example purposes only. For further details on icon states, text, or graphics, please refer to the graphical assets and HMI specifications.

4.6.1.6 ORC-REQ-393717/A-Displaying Trail Control Soft-Switch State

The Off-Road Controls Interface Client shall update the state of the Trail Control soft-switch accordingly, upon receiving the TrailOnePedalDrive_St signal from the Off-Road Controls Server.

This signal being received with any of the following values, shall result in the soft-switch being displayed in the On state:

- EnabledDescent
- Active
- StandbyOverride
- StandbyOverThreshold
- EnabledDeny
- DescentOnly

As an example, below may be the Trail Control soft-switch in the On state:

This signal being received with a value of Off or Faulty, shall result in the soft-switch being displayed in the Off state.
As an example, below may be the Trail Control soft-switch in the Off state:

Note: The icon state appearances and corresponding graphics referenced above are for example purposes only. For further details on icon states, text, or graphics, please refer to the graphical assets and HMI specifications.

4.6.1.7 ORC-REQ-393719/A-Displaying Trail One-Pedal Drive Soft-Switch State

The Off-Road Controls Interface Client shall update the state of the Trail One-Pedal Drive soft-switch accordingly, upon receiving the TrailOnePedalDrive_St signal from the Off-Road Controls Server.

This signal being received with any of the following values, shall result in the soft-switch being displayed in the On state:

- EnabledDescent
- Active
- StandbyOverride
- StandbyOverThreshold
- EnabledDeny
- DescentOnly

As an example, below may be the Trail One-Pedal Drive soft-switch in the On state:

This signal being received with a value of Off or Faulty, shall result in the soft-switch being displayed in the Off state.
As an example, below may be the Trail One-Pedal Drive soft-switch in the Off state:

Note: The icon state appearances and corresponding graphics referenced above are for example purposes only. For further details on icon states, text, or graphics, please refer to the graphical assets and HMI specifications.

4.6.2 Use Cases

4.6.2.1 ORC-UC-REQ-393722/A-Activating Hill Descent Control Soft-Switch

Actors	User, Off-Road Controls Interface Client, Off-Road Controls Server
Pre-conditions	Hill Descent Control Setting is Off
Scenario Description	User selects the Hill Descent Control soft-switch
Post-conditions	Hill Descent Control Setting is On

List of Exception Use Cases	
Interfaces	HMI

4.6.2.2 ORC-UC-REQ-393723/A-Deactivating Hill Descent Control Soft-Switch

Actors	User, Off-Road Controls Interface Client, Off-Road Controls Server
Pre-conditions	Hill Descent Control Setting is On
Scenario Description	User selects the Hill Descent Control soft-switch
Post-conditions	Hill Descent Control Setting is Off
List of Exception Use Cases	
Interfaces	HMI

4.6.2.3 ORC-UC-REQ-393938/A-Activating Trail Control Soft-Switch

Actors	User, Off-Road Controls Interface Client, Off-Road Controls Server
Pre-conditions	Trail Control Setting is Off
Scenario Description	User selects the Trail Control soft-switch
Post-conditions	Trail Control Setting is On
List of Exception Use Cases	
Interfaces	HMI

4.6.2.4 ORC-UC-REQ-393939/A-Deactivating Trail Control Soft-Switch

Actors	User, Off-Road Controls Interface Client, Off-Road Controls Server
Pre-conditions	Trail Control Setting is On
Scenario Description	User selects the Trail Control soft-switch
Post-conditions	Trail Control Setting is Off
List of Exception Use Cases	
Interfaces	HMI

4.6.2.5 ORC-UC-REQ-393940/A-Activating Trail One Pedal Drive Soft-Switch

Actors	User, Off-Road Controls Interface Client, Off-Road Controls Server
Pre-conditions	Trail One Pedal Drive Setting is Off

Scenario Description	User selects the Trail One Pedal Drive soft-switch
Post-conditions	Trail One Pedal Drive Setting is On
List of Exception Use Cases	
Interfaces	HMI

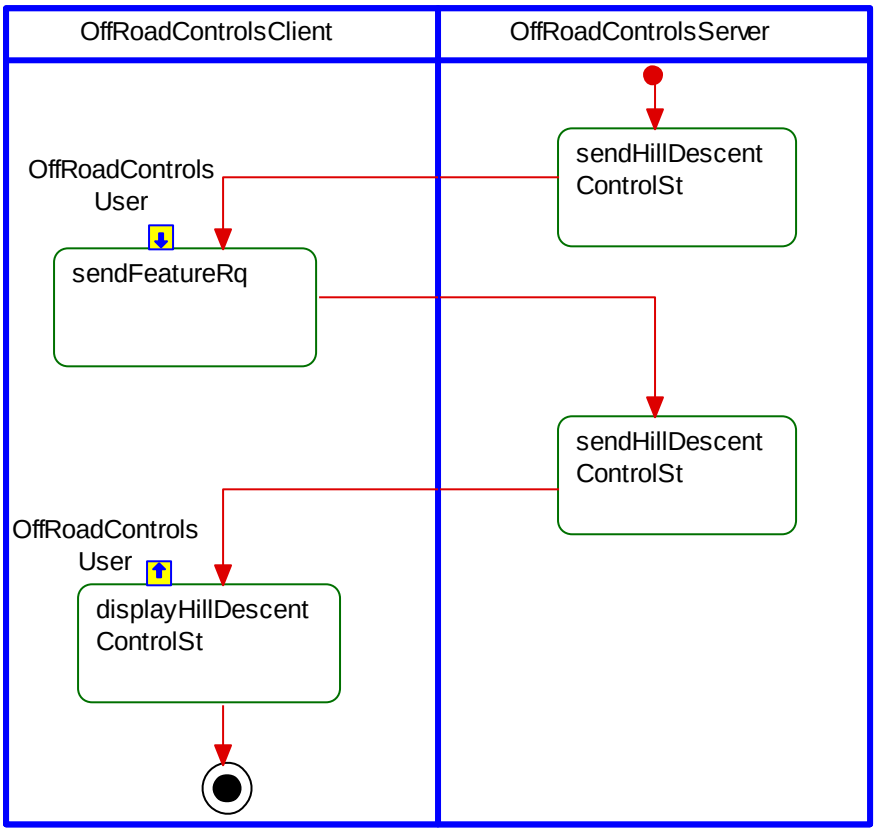
4.6.2.6 ORC-UC-REQ-393941/A-Deactivating Trail One Pedal Drive Soft-Switch

Actors	User, Off-Road Controls Interface Client, Off-Road Controls Server
Pre-conditions	Trail One Pedal Drive Setting is On
Scenario Description	User selects the Trail One Pedal Drive soft-switch
Post-conditions	Trail One Pedal Drive Setting is Off
List of Exception Use Cases	
Interfaces	HMI

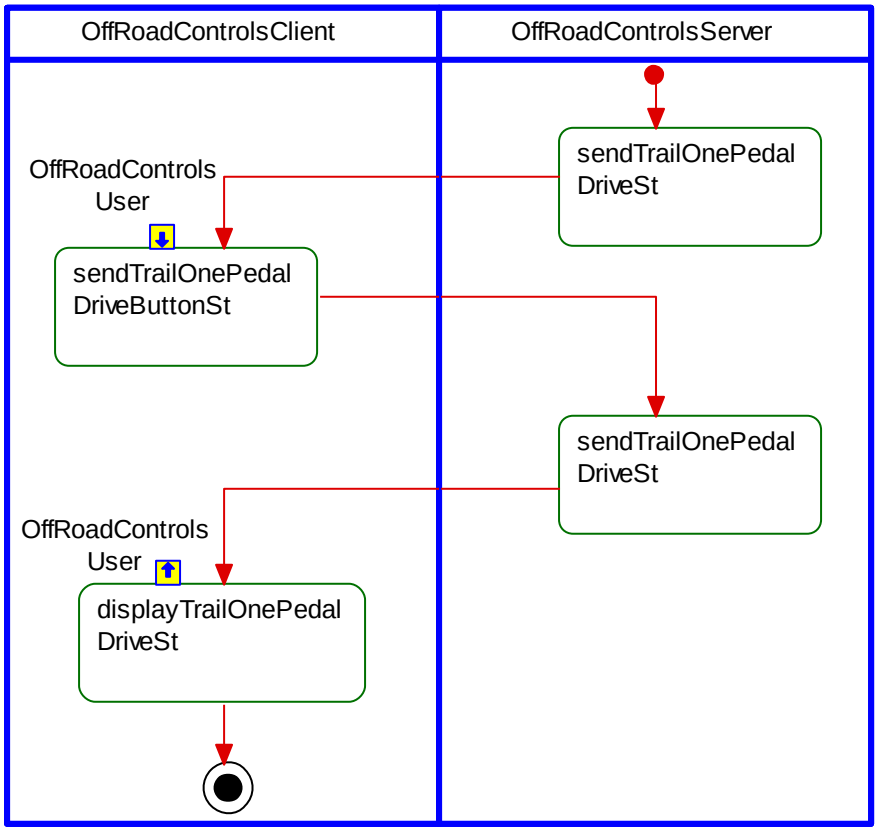
4.6.3 White Box View

4.6.3.1 Activity Diagrams

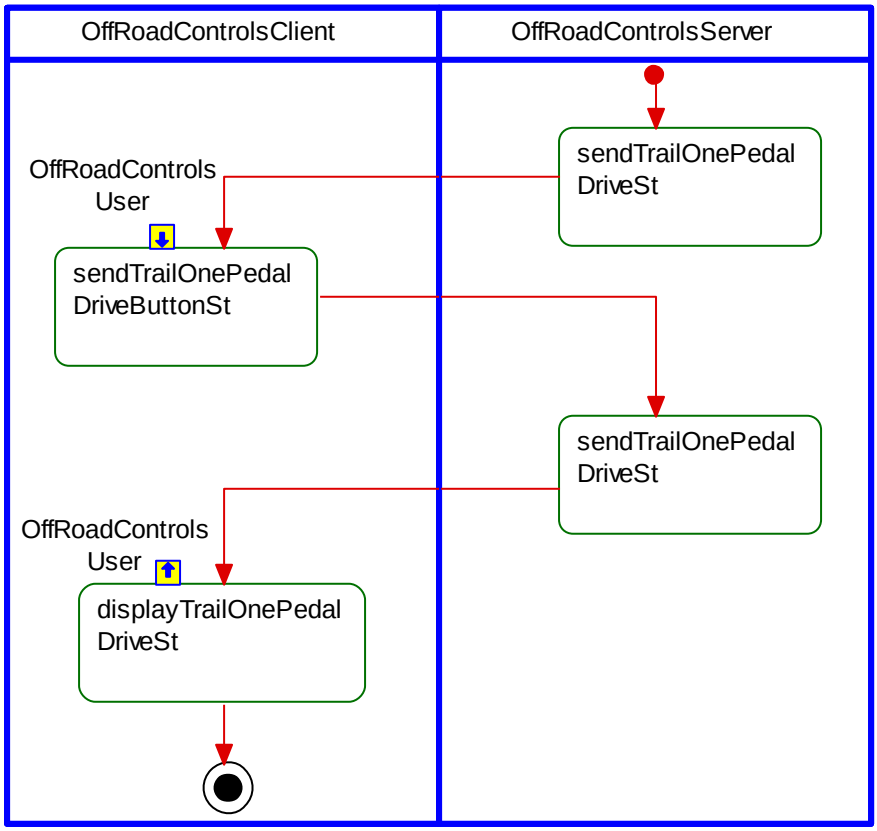
4.6.3.1.1 ORC-ACT-REQ-393755/A-Selecting Hill Descent Control Soft-Switch



4.6.3.1.2 ORC-ACT-REQ-393942/A-Selecting Trail Control Soft-Switch

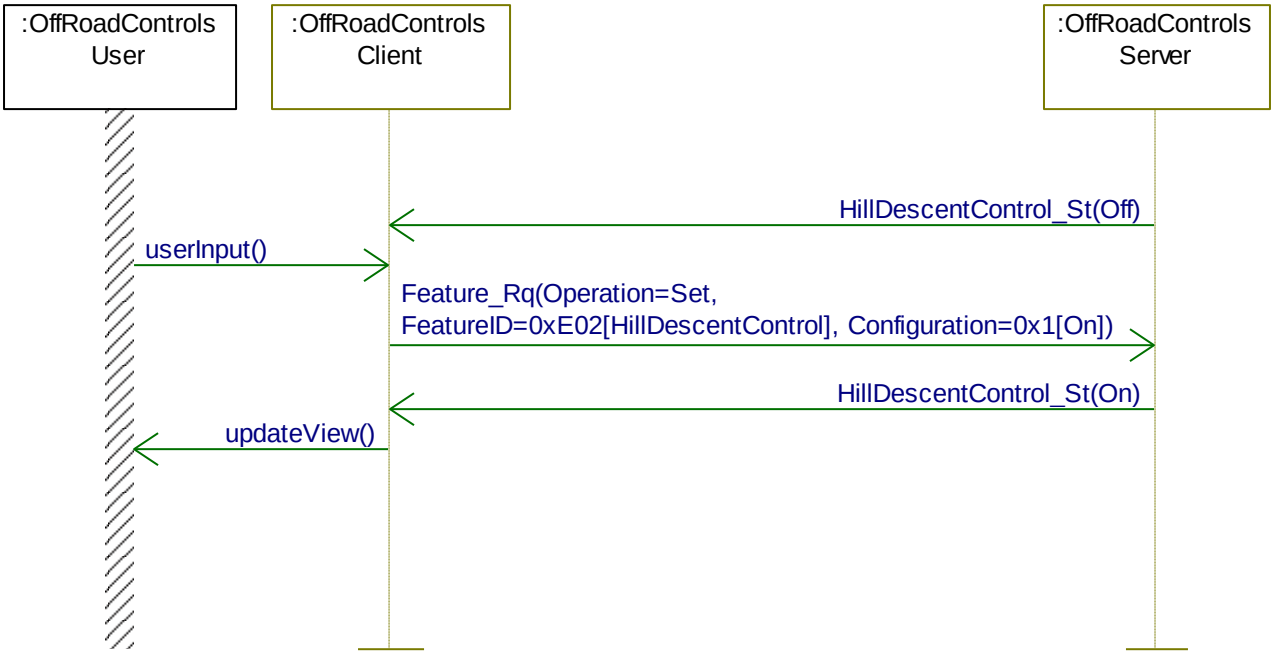


4.6.3.1.3 ORC-ACT-REQ-393943/A-Selecting Trail One Pedal Drive Soft-Switch

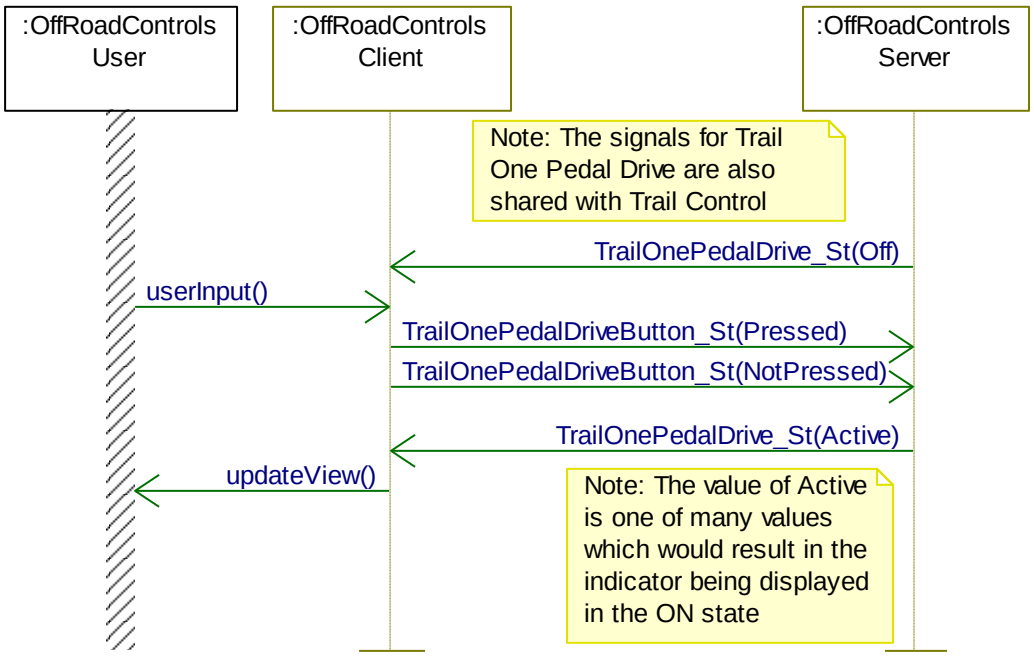


4.6.3.2 Sequence Diagrams

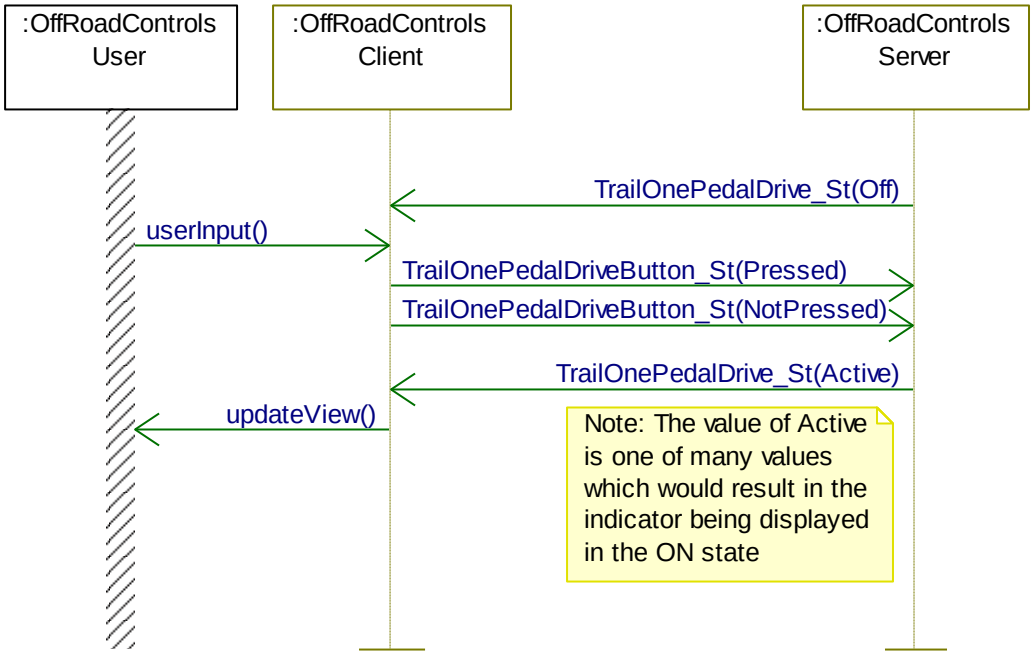
4.6.3.2.1 ORC-SD-REQ-393756/A-Selecting Hill Descent Control Soft-Switch



4.6.3.2.2 ORC-SD-REQ-393944/A-Selecting Trail Control Soft-Switch



4.6.3.2.3 ORC-SD-REQ-393945/A-Selecting Trail One Pedal Drive Soft-Switch



5 Appendix: Reference Documents

Reference #	Document Title
1	Off-Road Status IOD APIM SPSS
2	Multi-Camera Client APIM SPSS
3	Feature Based Message Protocol APIM SPSS
4	Off-Road Controls HMI specification
5	
6	
7	
8	
9	
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