Research & Vehicle Technology
"Infotainment Systems Product Development"

Feature – One Pedal Drive

APIM Infotainment Subsystem Part Specific Specification (SPSS)

Version 1.1

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FORD CONFIDENTIAL

Revision History

Date	Version	Notes	
May 14, 2019	**1.0**	**Initial Release**	
August 15, 2021	**1.1**		
	STR-632560/B-Architectural Design	ndecia: revised structure to add logical signal mapping table	
	STR-632561/B-Physical Mapping of Classes	ndecia: removed references to message center client	
	STR-926200/A-Logical Signal Mapping	ndecia: table to map logical signals to physical ones	
	OPD-IIR-REQ-346134/B-OnePedalDriveClient _Rx	ndecia: removed references to message center client and added new setting indicator state signal	
	MD-REQ-425257/A-OPDSettingIndicator_St	ndecia: new signal to report the setting indicator state	
	OPD-IIR-REQ-346137/B-OnePedalDriveClient _Tx	ndecia: removed references to message center client	
	OPD-REQ-346334/B-Feature Setting Soft Button Handling	ndecia: updated to reflect new button handling strategy to suppress button presses during scrolling	
	OPD-REQ-352137/B-Feature HMI Notifications	ndecia: updated requirement to reflect new strategy of displaying pop-up upon attempted selection by user when suspended or faulted	
	OPD-REQ-346141/B-Feature Activation Indication	ndecia: updated to include reference to new feature setting indicator signal	
	OPD-UC-REQ-352138/B-One-Pedal Drive Feature Setting Suspended	ndecia: updated use case to reflect new strategy of displaying pop-up upon attempted selection by user when faulted	
	STR-632566/B-White Box View	ndecia: revised structure to add 425258	
	OPD-ACT-REQ-346146/B-Activating One-Pedal Drive Feature Setting	ndecia: updated to include reference to new feature setting indicator signal	
	OPD-SD-REQ-346147/B-Activating One-Pedal Drive Feature Setting	ndecia: updated to include reference to new feature setting indicator signal and reflect new button handling strategy to suppress button presses during scrolling	
	OPD-SD-REQ-425258/A-Suspended One-Pedal Drive Feature Setting	ndecia: new sequence diagram to reflect new strategy of displaying pop-up upon attempted selection by user when suspended	
	OPD-REQ-346338/B-Feature Deactivation Indication	ndecia: updated to include reference to new feature setting indicator signal	
	OPD-SD-REQ-346342/B-Deactivating One-Pedal Drive Feature Setting	ndecia: updated to include reference to new feature setting indicator signal and reflect new button handling strategy to suppress button presses during scrolling	
	OPD-FUN-REQ-346343/B-One-Pedal Drive Feature Error Handling	ndecia: revised structure to add 425259 & 425260	
	STR-632794/B-Requirements	ndecia: revised structure to add 425261	
	OPD-REQ-346142/B-Feature Activation Failure	ndecia: updated to include reference to new feature setting indicator signal	
	OPD-REQ-346144/B-Display Indication Upon Attempted Selection when Feature Status is Suspended	ndecia: updated requirement to reflect new strategy of displaying pop-up upon attempted selection by user when suspended	
	OPD-REQ-346336/B-Display Indication Upon Attempted Selection when Feature Status is Faulty	ndecia: updated requirement to reflect new strategy of displaying pop-up upon attempted selection by user when faulted	
	OPD-REQ-425261/A-Suppression of Press Events During Scrolling	ndecia: new requirement to reflect new button handling strategy to suppress button presses during scrolling	
	STR-632804/B-Use Cases	ndecia: revised structure to add 425262	
	OPD-UC-REQ-346335/B-One-Pedal Drive Feature Setting Faulted	ndecia: updated use case to reflect new strategy of displaying pop-up upon attempted selection by user when faulted	
	OPD-UC-REQ-425262/A-Suppressed Button Press Event when Scrolling	ndecia: new use case to reflect new button handling strategy to suppress button presses during scrolling	
	STR-923097/A-White Box View	ndecia: revised structure to add 425259 & 425260	
	OPD-SD-REQ-425259/A-Faulted One-Pedal Drive Feature Setting	ndecia: new sequence diagram to reflect new strategy of displaying pop-up upon attempted selection by user when faulted	
	OPD-SD-REQ-425260/A-Suppressed Button Press Event when Scrolling	ndecia: new sequence diagram to reflect new button handling strategy to suppress button presses during scrolling	
	STR-632574/B-Appendix: Reference Documents	ndecia: removed references to message center client	

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Table of Contents

1 Overview

The One-Pedal Drive feature enables the user to operate the speed of the vehicle via a single pedal. The driver can both increase the vehicle speed as well as decrease the vehicle speed by pressing or releasing the accelerator pedal. This means that the brakes will be automatically engaged once the driver releases the accelerator pedal.

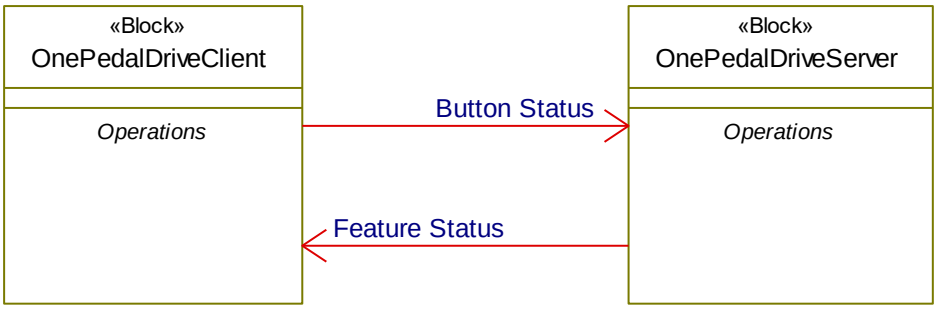
1.1 Feature Operation

To activate the One-Pedal Drive feature, the user would navigate to the settings menu where the setting is located and then touch on the setting soft-button. Once the indication of the soft-button transitions to the ON state, the feature is active and operation of the vehicle can be done solely via the accelerator pedal.

1.2 Feature Assumptions

The activation of One-Pedal Drive feature is dependent on certain vehicle pre-conditions and the status of other related features (e.g Cruise Control).

1.3 Logical Block Diagram



1.4 Terminology and Abbreviations

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

Term	Description
APIM	Accessory Protocol Interface Module
IPC	Instrument Panel Cluster
OPD	One-Pedal Drive
PCM	Powertrain Control Module

2 Architectural Design

2.1 OPD-CLD-REQ-346132/A-One-Pedal Drive Client

The One-Pedal Drive Client is responsible for sending the status of the soft-button pressed state to the One-Pedal Drive Server. The One-Pedal Drive Client is also responsible for informing the user of the status of the soft-button indication state and any error condition indication states.

2.2 OPD-CLD-REQ-346133/A-One-Pedal Drive Server

The One-Pedal Drive Server is responsible for receiving the state of the soft-button status from the One-Pedal Drive client and assessing all preconditions and feature interaction conditions to determine when to activate the One-Pedal Drive feature while updating the feature display status message accordingly.

2.3 Physical Mapping of Classes

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

Logical Class	Physical Module (ECU)
OnePedalDriveClient	APIM
OnePedalDriveServer	PCM

2.4 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
OPDDisplay_St	OnePdlDrv_D_Dsply
OPDSettingIndicator_St	OnePdlDrvButtn_D_Dsply
OPDButton_St	OnePdlDrvButtn_B_Stat
OPDButtonFault_St	OnePdlDrvButtn_B_Falt

Table: Logical name/CAN signal mapping

2.5 OPD-IIR-REQ-346134/B-OnePedalDriveClient _Rx

2.5.1 MD-REQ-346135/A-OPDDisplay_St

Message Type: Status

This signal is used to update the status of the One-Pedal Drive activation display state

Name	Literals	Value	Description
OPDDisplay_St	-	-	A status message indicating the activation display state of the One-Pedal Drive feature
	Off	0x00	

	On	0x01	
	Suspended	0x02	
	Faulty	0x03	

2.5.2 MD-REQ-425257/A-OPDSettingIndicator_St

Message Type: Status

This signal is used to update the status of the One-Pedal Drive feature setting indicator state

Name	Literals	Value	Description
OPDSettingIndicator_St	-	-	A status message indicating the indicator state to be displayed of the One-Pedal Drive feature
	Off	0x00	
	On	0x01	
	OffGreyedOut	0x02	
	OnGreyedOut	0x03	

2.6 OPD-IIR-REQ-346137/B-OnePedalDriveClient _Tx

2.6.1 MD-REQ-346139/A-OPDButton_St

Message Type: Status

The signal is used to update the status of the One-Pedal Drive soft-button pressed state

Name	Literals	Value	Description
OPDButton_St	-	-	The status of the soft-button pressed state for the One-Pedal Drive feature
	NotPressed	0x0	
	Pressed	0x1	

2.6.2 MD-REQ-346138/A-OPDButtonFault_St

Message Type: Status

The signal is used to update the status of the One-Pedal Drive soft-button fault state

Name	Literals	Value	Description
OPDButtonFault_St	-	-	The status of the soft-button fault state for the One-Pedal Drive feature
	NotFaulted	0x0	
	Faulted	0x1	

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3 General Requirements

3.1 OPD-REQ-346334/B-Feature Setting Soft Button Handling

The One-Pedal Drive feature setting soft button shall translated into paired Pressed and NotPressed events via the OPDButton_St signal. When the user presses anywhere in the touch zone of the soft button, the One-Pedal Drive client shall wait until the release of the touch zone and then set the value of the OPDButton_St signal to the Pressed value, followed by setting the signal back to the NotPressed value after 200ms. Two exceptions to this are if the setting is unavailable (OPDSettingIndicator_St = OnGreyedOut OR OffGreyedOut) or if the user begins a scroll gesture after the initial contact of the touch zone (as defined in OPD-REQ-425261-Suppression of Press Events During Scrolling.)

3.2 OPD-REQ-352137/B-Feature HMI Notifications

When the user attempts to toggle the One-Pedal Drive feature setting while the feature is not available to be selected, certain One-Pedal Drive HMI message notifications/pop-ups are to be displayed to the user by One-Pedal Drive Client. These notifications/pop-ups are to be presented to the user when the HMI must indicate additional information to the user upon their attempt to change the feature setting when the One-Pedal Drive feature is either in a suspended of faulted state. For additional detail, please refer to the requirements OPD-REQ-346336-Display Indication Upon Attempted Selection when Feature Status is Faulty, OPD-REQ-346144/B-Display Indication Upon Attempted Selection when Feature Status is Suspended) as well as the One Pedal Drive HMI specification.

4 Functional Definition

4.1 OPD-FUN-REQ-346140/A-Activating One-Pedal Drive Feature Setting

4.1.1 Requirements

4.1.1.1 OPD-REQ-346141/B-Feature Activation Indication

When the One-Pedal Drive Feature is in the Inactive/Off state, the user pressing and releasing the soft-button will generate a coupled Pressed and NotPressed event which is then processed by the One-Pedal Drive Server. If all preconditions are met, the Server will update the status of the OPDSettingIndicator_St signal from Off to On. The One-Pedal Drive Client shall then update the indication status of the feature setting to reflect that the feature is now On/Active.

If the Server updates the status of OPDSettingIndicator_St to OnGreyedOut, the Client likewise shall update the indication status of the feature setting to reflect that the feature is On/GreyedOut and unavailable to be selected.

4.1.2 Use Cases

4.1.2.1 OPD-UC-REQ-346145/A-Activating One-Pedal Drive Feature Setting

Actors	User, One-Pedal Drive Client, One-Pedal Drive Server
Pre-conditions	One-Pedal Drive Feature is Off/Inactive The One-Pedal Drive Server assesses all feature preconditions are met
Scenario Description	User presses on the One-Pedal Drive feature setting
Post-conditions	The One-Pedal Drive feature is activated
List of Exception Use Cases	One-Pedal Drive Feature Setting Suspended One-Pedal Drive Feature Setting Faulty
Interfaces	HMI

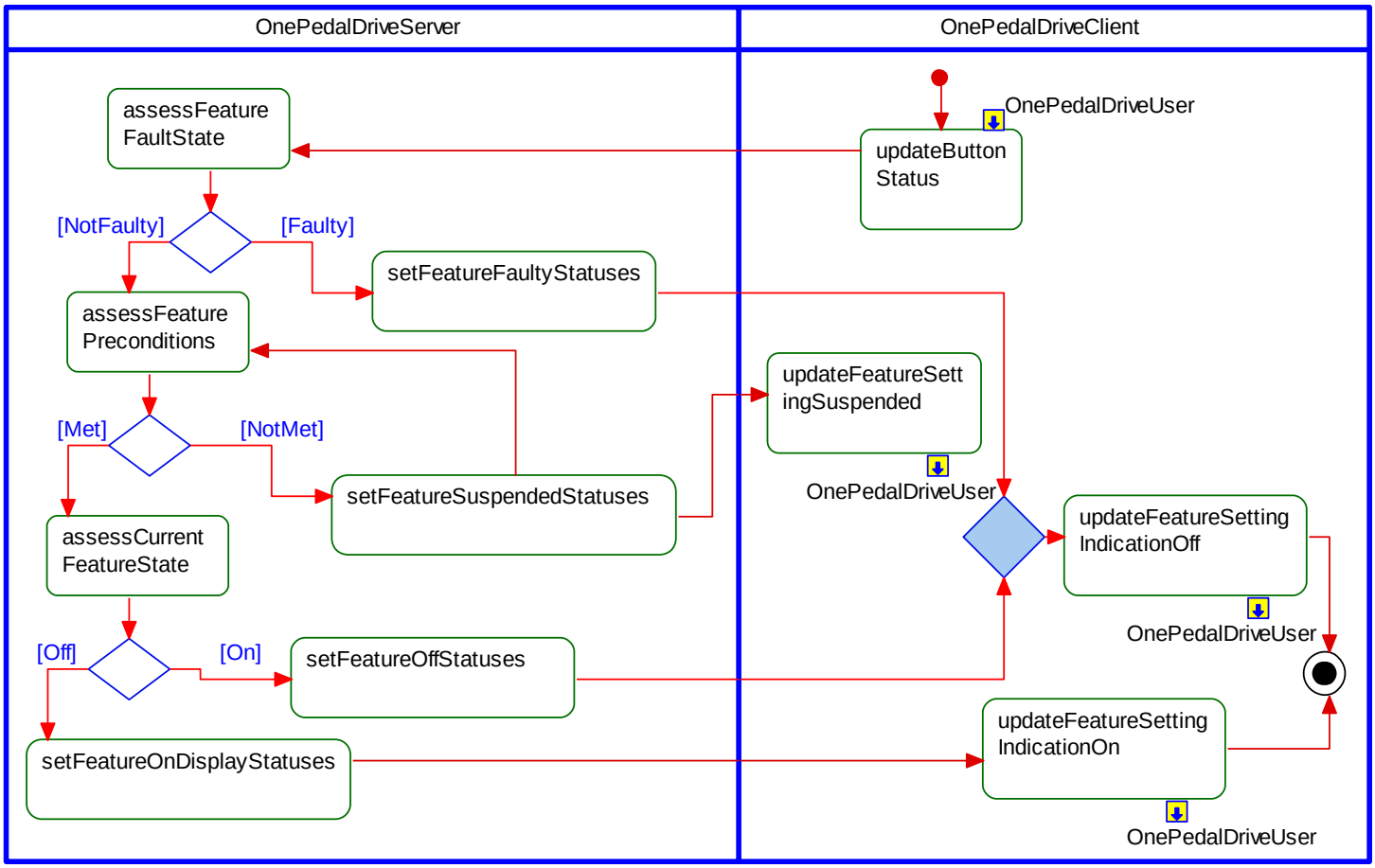
4.1.2.2 OPD-UC-REQ-352138/B-One-Pedal Drive Feature Setting Suspended

Actors	User, One-Pedal Drive Client, One-Pedal Drive Server
Pre-conditions	One-Pedal Drive Feature is Off/Inactive The One-Pedal Drive Server assesses all feature preconditions are not met
Scenario Description	User presses on the One-Pedal Drive feature setting
Post-conditions	The One-Pedal Drive feature setting indicates the setting is unavailable to be selected.
List of Exception Use Cases	
Interfaces	HMI
Notes	Note: If the user attempts to toggle the setting while it's unavailable, an HMI indication is presented informing them of the Suspended state.

4.1.3 White Box View

4.1.3.1 OPD-ACT-REQ-346146/B-Activating One-Pedal Drive Feature Setting

Activity Diagram



4.1.3.2 OPD-SD-REQ-346147/B-Activating One-Pedal Drive Feature Setting

Scenarios

Normal Usage

User presses and releases the feature setting soft button

Constraints

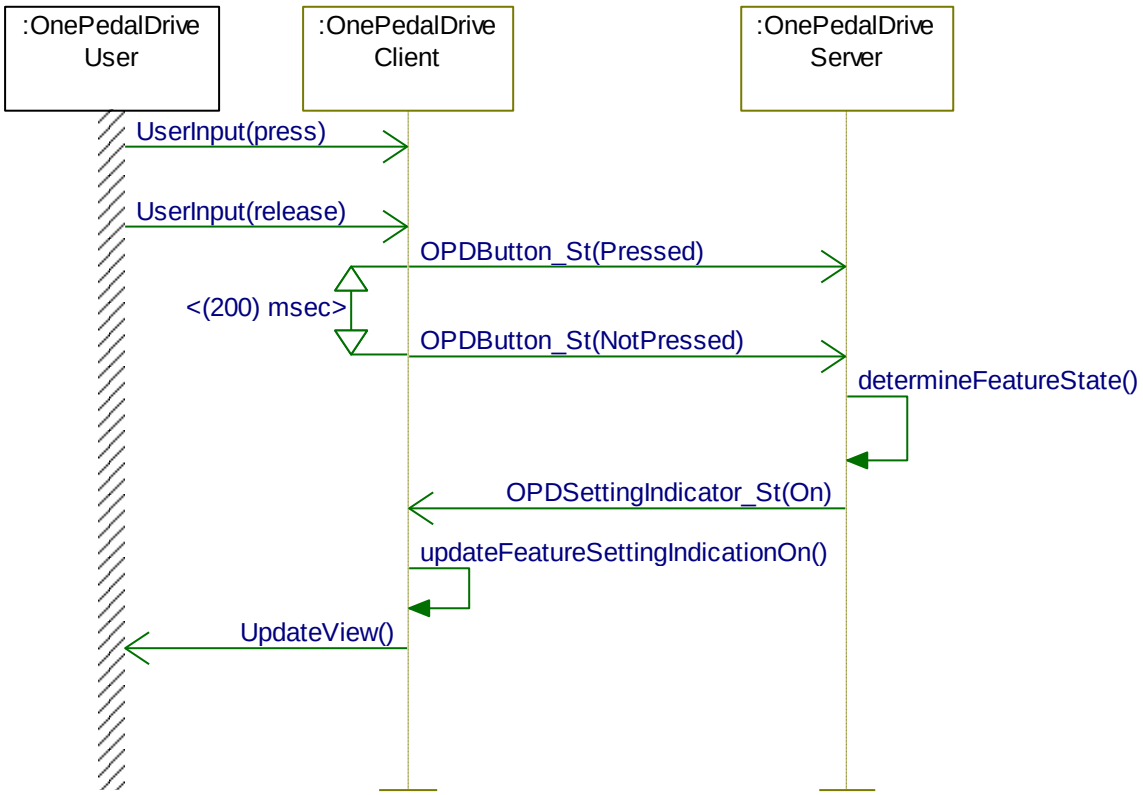
Pre-condition

One-Pedal Drive feature setting is Off

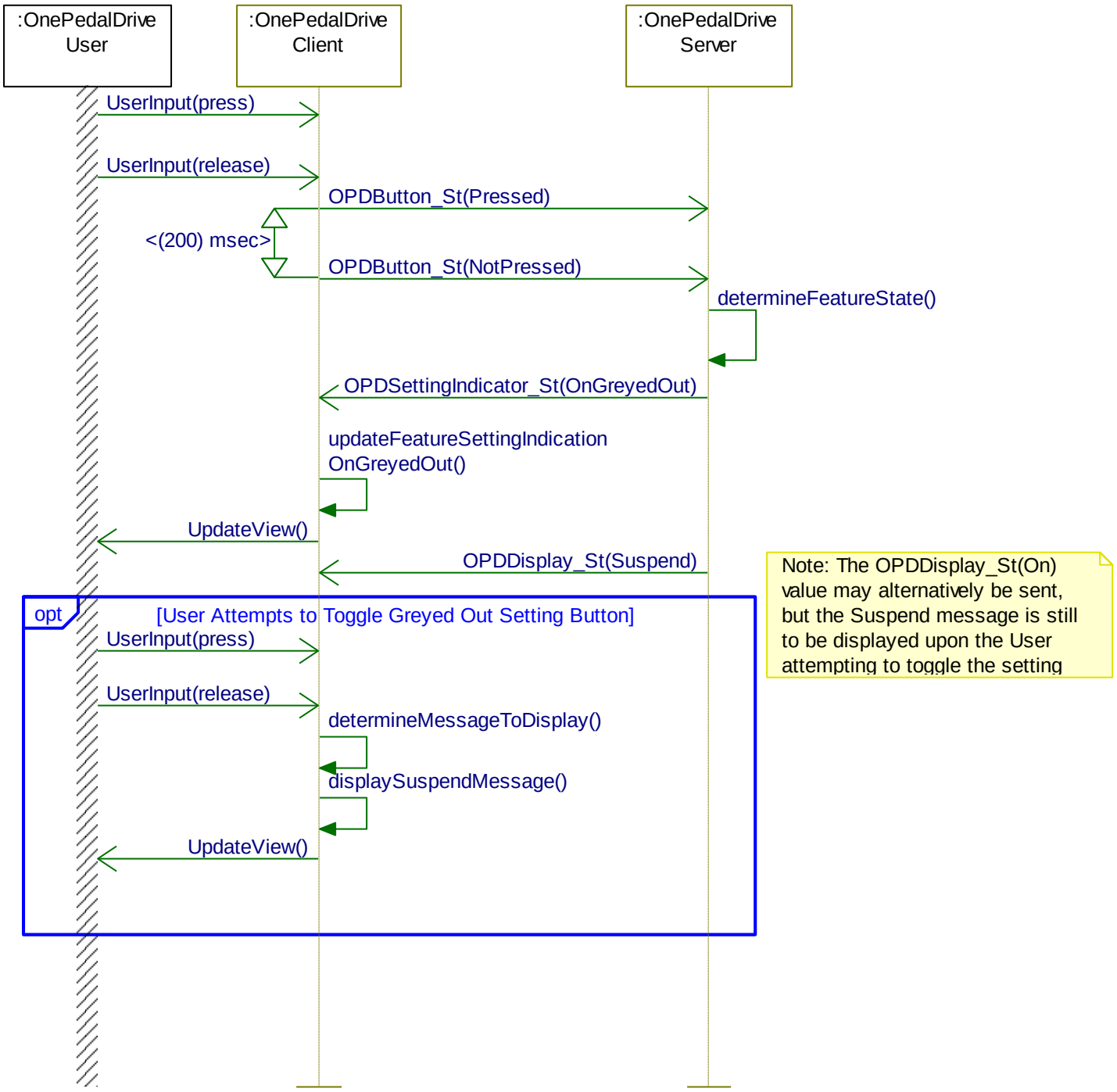
Post-condition

One-Pedal Drive feature setting is On

Sequence Diagram



4.1.3.3 OPD-SD-REQ-425258/A-Suspended One-Pedal Drive Feature Setting



4.2 OPD-FUN-REQ-346337/A-Deactivating One-Pedal Drive Feature Setting

4.2.1 Requirements

4.2.1.1 OPD-REQ-346338/B-Feature Deactivation Indication

When the One-Pedal Drive Feature is in the Active/On state, the user pressing and releasing the soft-button will generate a coupled Pressed and NotPressed event which is then processed by the One-Pedal Drive Server. If all preconditions are met,

the Server will update the status of the OPDSettingIndicator_St signal from On to Off. The One-Pedal Drive Client shall then update the indication status of the feature setting to reflect that the feature is now Off/Inactive.

If the Server updates the status of OPDSettingIndicator_St to OffGreyedOut, the Client likewise shall update the indication status of the feature setting to reflect that the feature is Off/GreyedOut and unavailable to be selected.

4.2.2 Use Cases

4.2.2.1 OPD-UC-REQ-346339/A-Deactivating One-Pedal Drive Feature Setting

Actors	User, One-Pedal Drive Client, One-Pedal Drive Server
Pre-conditions	One-Pedal Drive Feature is On/Active The One-Pedal Drive Server assesses all feature preconditions are met
Scenario Description	User presses on the One-Pedal Drive feature setting
Post-conditions	The One-Pedal Drive feature is deactivated
List of Exception Use Cases	One-Pedal Drive Feature Setting Faulty
Interfaces	HMI

4.2.3 White Box View

4.2.3.1 OPD-SD-REQ-346342/B-Deactivating One-Pedal Drive Feature Setting

Scenarios

Normal Usage

User presses and releases the feature setting soft button

Constraints

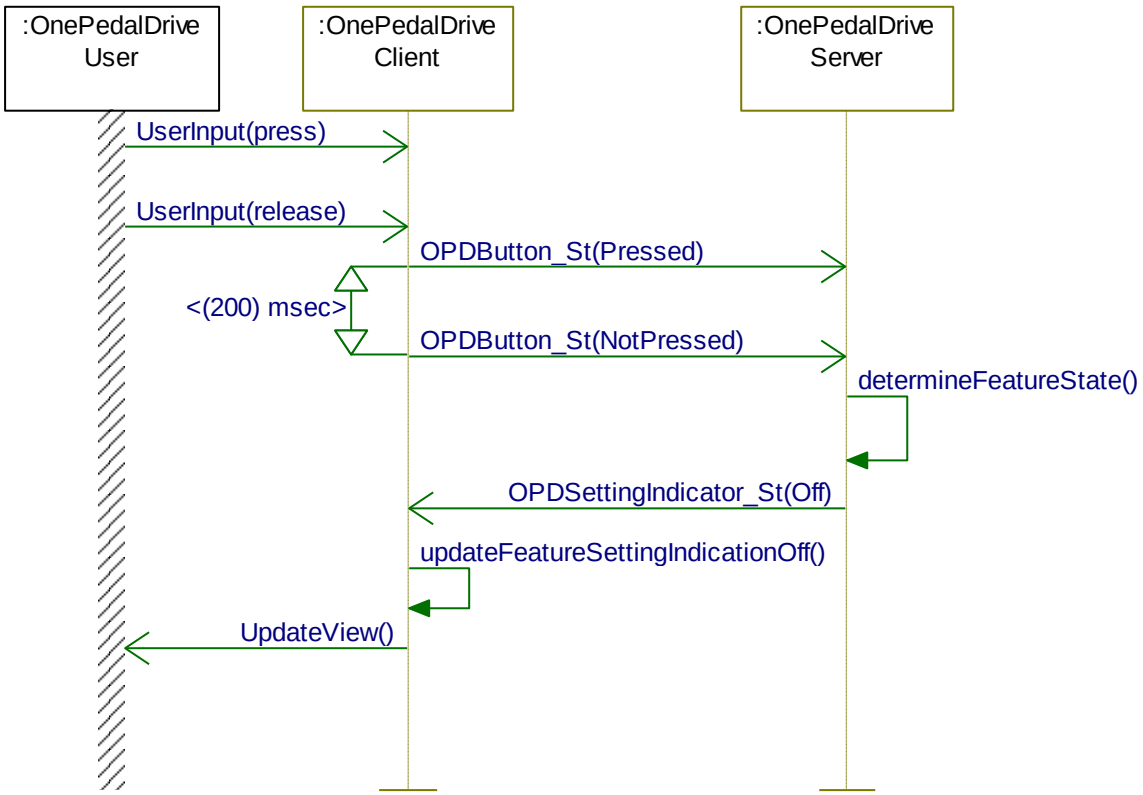
Pre-condition

One-Pedal Drive feature setting is On

Post-condition

One-Pedal Drive feature setting is Off

Sequence Diagram



4.3 OPD-FUN-REQ-346343/B-One-Pedal Drive Feature Error Handling

4.3.1 Requirements

4.3.1.1 *OPD-REQ-346142/B-Feature Activation Failure*

Whether the One-Pedal Drive Feature is in the On or Off state, the user pressing and releasing the soft-button will generate a Pressed and NotPressed event which is then processed by the One-Pedal Drive Server. If the Server fails to update the status of the OPDSettingIndicator_St signal, the One-Pedal Drive Client shall not update the indication status of the feature setting.

4.3.1.2 *OPD-REQ-346143/A-Soft Button Handling Fault*

The initial value of the OPDButtonFault_St shall be set to the NotFaulted state. If the One-Pedal Drive Client detects a fault or failure, of the soft button handling component or of the One-Pedal Drive Client in general, 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 Client shall set the OPDButtonFault_St signal to Faulted. Otherwise, the value of the signal shall be set to NotFaulted when the Client and touch input component are functioning normally.

4.3.1.3 *OPD-REQ-346144/B-Display Indication Upon Attempted Selection when Feature Status is Suspended*

While the One-Pedal Drive Feature setting indicator is unavailable (OPDSettingIndicator_St = OnGreyedOut OR OffGreyedOut), the user pressing and releasing the soft-button shall trigger a message notifications/pop-up to be presented to the user by the One-Pedal Drive Client indicating why the feature setting is unavailable. If, at the time of the user attempting to toggle the feature setting, the OPDDisplay_St is reporting a value other than Fault, the Suspended HMI message notification/pop-up shall be displayed by the One-Pedal Drive Client to inform the user that feature activation has been suspended.

Note: Press events in the OPDButton_St signal shall be suppressed when the user attempts to select the setting while it's unavailable.

4.3.1.4 OPD-REQ-346336/B-Display Indication Upon Attempted Selection when Feature Status is Faulty

While the One-Pedal Drive Feature setting indicator is unavailable (OPDSettingIndicator_St = OnGreyedOut OR OffGreyedOut), the user pressing and releasing the soft-button shall trigger a message notifications/pop-up to be presented to the user by the One-Pedal Drive Client indicating why the feature setting is unavailable. If, at the time of the user attempting to toggle the feature setting, the OPDDisplay_St is reporting a value of Fault, the Fault HMI message notification/pop-up shall be displayed by the One-Pedal Drive Client to inform the user that One-Pedal Drive feature has faulted.

If the either the OPDSettingIndicator_St or the OPDDisplay_St signal is missing per the conditions defined in the Infotainment Diagnostic Specification, the One-Pedal Drive Client shall indicate the setting as off and likewise update the display HMI to indicate to the user that One-Pedal Drive feature is faulted.

Note: Press events in the OPDButton_St signal shall be suppressed when the user attempts to select the setting while it's unavailable.

4.3.1.5 OPD-REQ-425261/A-Suppression of Press Events During Scrolling

Upon the user making and maintaining contact with the touch zone of the One-Pedal Drive feature setting soft-button, the One-Pedal Drive Client shall determine whether the user has intended to toggle the feature setting, or whether a scroll gesture has been detected. If a valid scroll gesture has been detected, the One-Pedal Drive Client shall suppress the sending of the couple Pressed and NotPressed events upon release of the contact zone, as the scroll gesture is not intended to be a valid setting actuation event.

4.3.2 Use Cases

4.3.2.1 OPD-UC-REQ-346335/B-One-Pedal Drive Feature Setting Faulted

Actors	User, One-Pedal Drive Client, One-Pedal Drive Server
Pre-conditions	One-Pedal Drive Feature is either On or Off
Scenario Description	One-Pedal Drive Server determines feature is Faulted
Post-conditions	The One-Pedal Drive feature setting indicates the setting is unavailable to be selected.
List of Exception Use Cases	
Interfaces	HMI
Notes	Note: If the user attempts to toggle the setting while it's unavailable, an HMI indication is presented informing them of the Faulted state.

4.3.2.2 OPD-UC-REQ-425262/A-Suppressed Button Press Event when Scrolling

Actors	User, One-Pedal Drive Client, One-Pedal Drive Server
Pre-conditions	One-Pedal Drive Feature is either On or Off
Scenario Description	One-Pedal Drive Server determines a scroll gesture has been initiated
Post-conditions	Press events are suppressed upon releases of the setting contact zone
List of Exception Use Cases	

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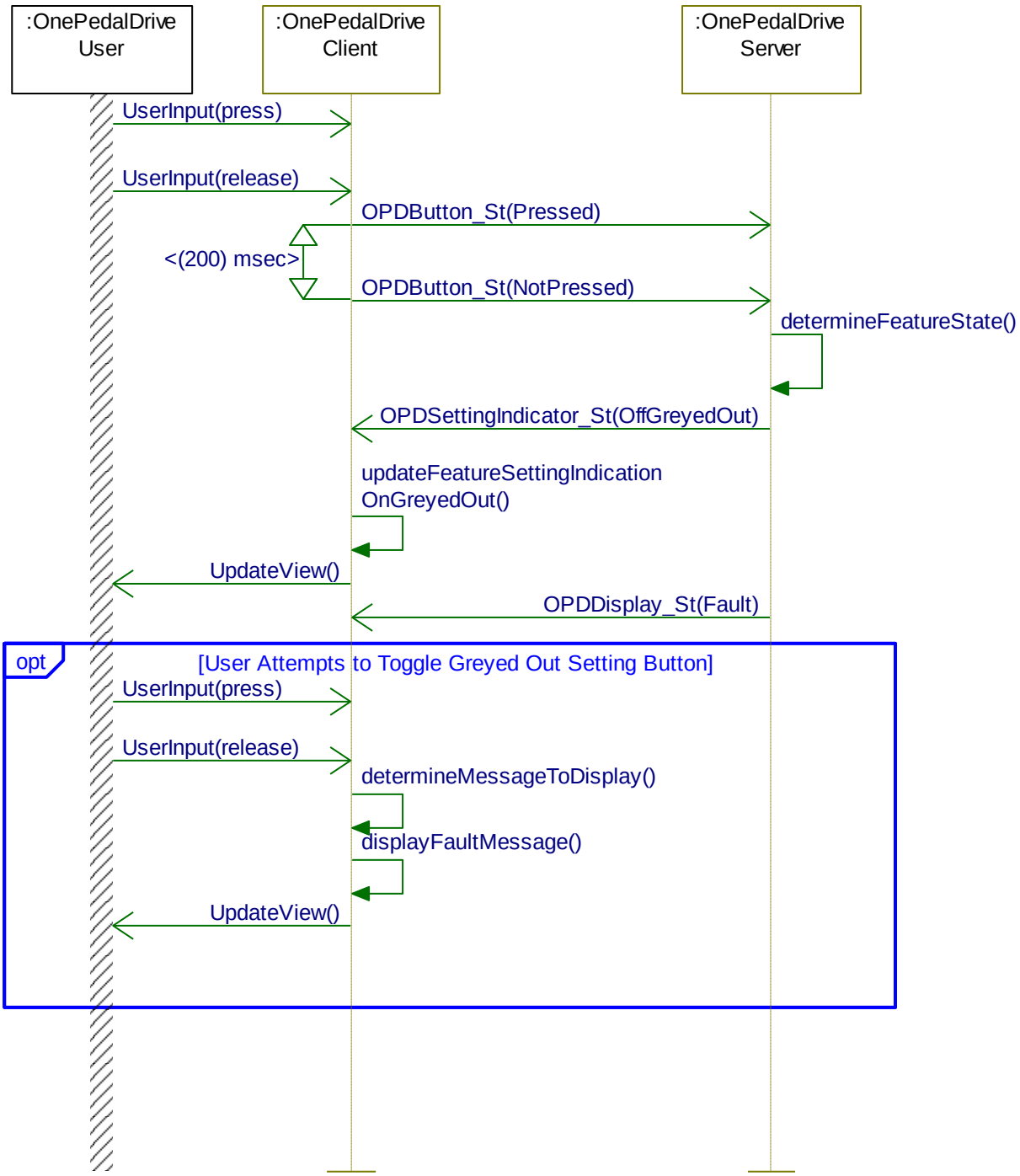
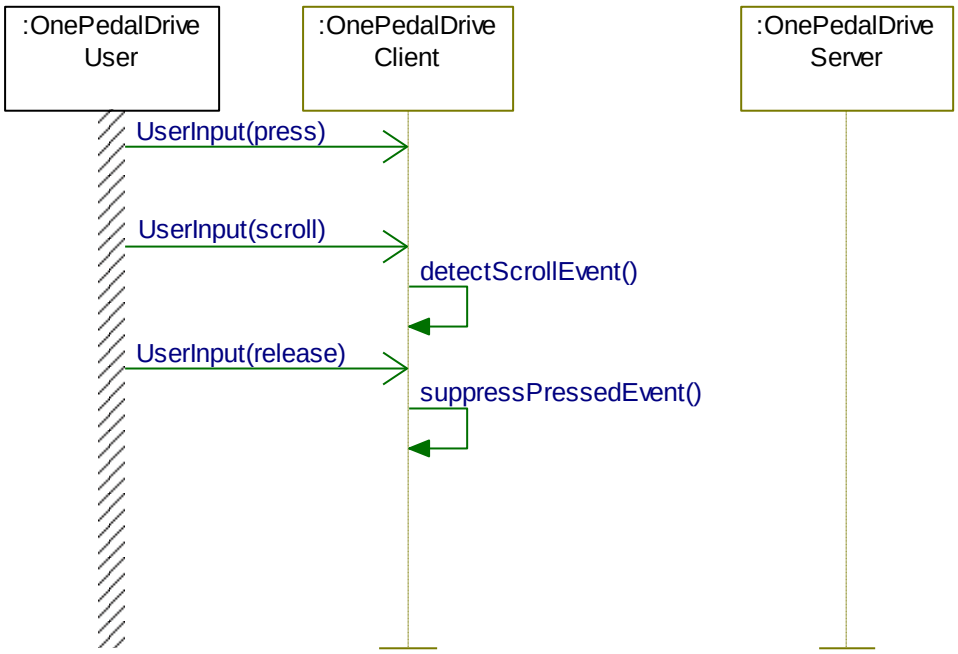
Interfaces	HMI

4.3.3 White Box View

4.3.3.1 OPD-SD-REQ-425259/A-Faulted One-Pedal Drive Feature Setting



4.3.3.2 OPD-SD-REQ-425260/A-Suppressed Button Press Event when Scrolling



5 Appendix: Reference Documents

Reference #	Document Title
1	Infotainment Diagnostic Specification
2	One Pedal Drive HMI Specification
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