Research & Vehicle Technology
"Infotainment Systems Product Development"

Feature – Multi Contoured Seats

APIM Infotainment Subsystem Part Specific Specification (SPSS)

Version 1.2

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Version Date: June 9, 2015

FORD CONFIDENTIAL

Revision History

Date	Version	Notes	
May 31, 2013	**1.0**	**Initial Release**	
June 9, 2014	**1.1**	**Updated Release**	
	MCS-SD-REQ-021357/B-Set Cushion Massage Intensity to High from Touch Screen (TcSE ROIN-199000-1)		AFISHER1- New Sequence Diagram to support MultiContoured Seats Feature
	MCS-SD-REQ-021358/B-Set Cushion Massage Intensity to Low from Touch Screen (TcSE ROIN-199007-1)		AFISHER1- New Sequence Diagram to support MultiContoured Seats Feature
	MCS-SD-REQ-021360/B-Set Lumbar Massage Intensity to High from Touch Screen (TcSE ROIN-199021-1)		AFISHER1- New Sequence Diagram to support MultiContoured Seats Feature
	MCS-SD-REQ-021361/B-Set Lumbar Massage Intensity to Low from Touch Screen (TcSE ROIN-199028-1)		AFISHER1- New Sequence Diagram to support MultiContoured Seats Feature
June 9, 2015	**1.2**	**Updated Release**	
	MCS-CLD-REQ-021433/B-Multi Contoured Seat Client (TcSE ROIN-198818-1)		wstephe1: Additional functional requirement added to Multi Contour Seat (MCS) Client
	MCS-SR-REQ-165826/A-Multi Contoured Seats Adjustment via TouchScreen		wstephe1: Added MCS functional requirement added to MCS Client to help define TouchScreen "press & hold" functionality and signal state as Tx by MCS client

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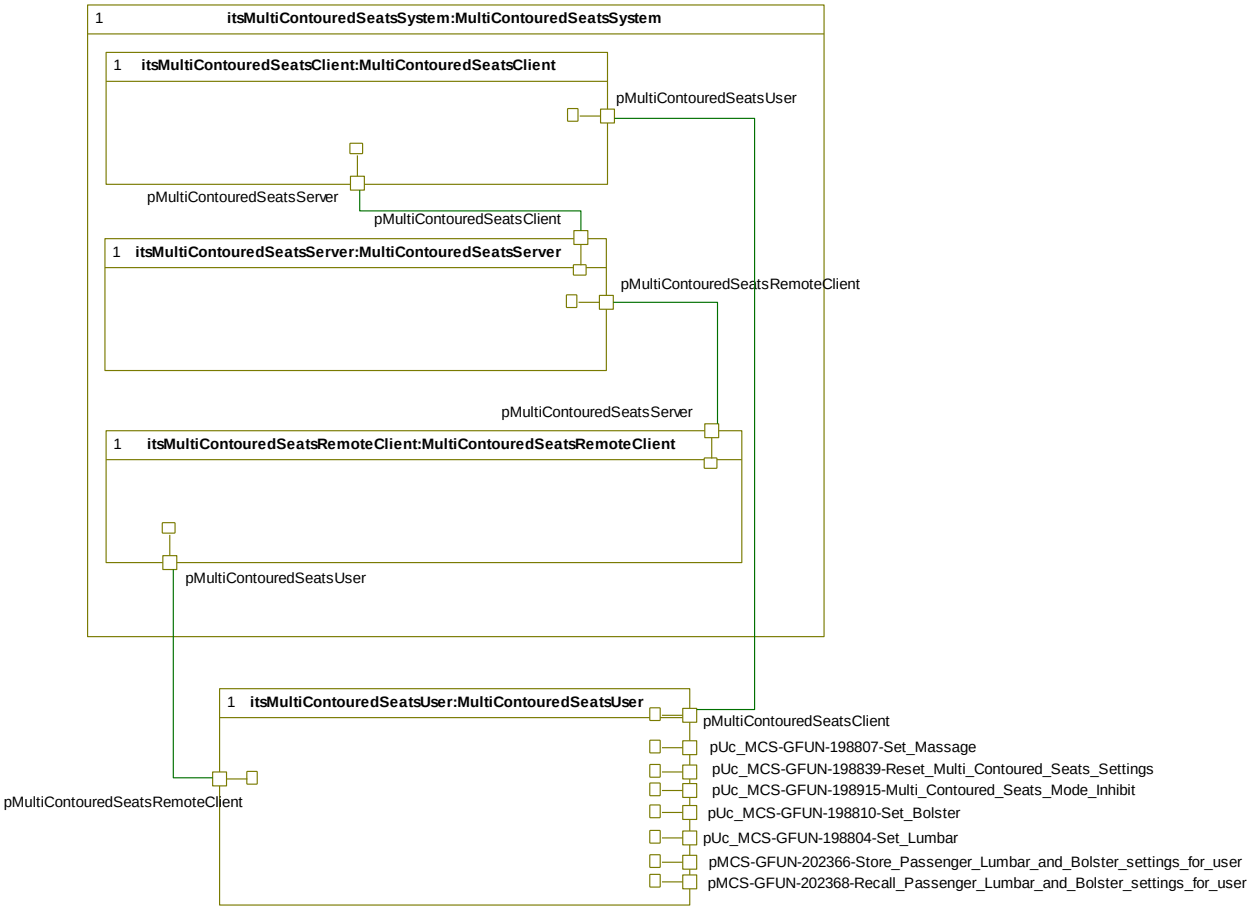
1 Architectural Design

1.1 MCS-SV-REQ-021432/A-IBD_MultiContouredSeatSystem (TcSE ROIN-198772-1)

Internal Block Diagram



1.2 MCS-CLD-REQ-021433/B-Multi Contoured Seat Client (TcSE ROIN-198818-1)

The Multi Contoured Seats Client has two functions:

1. Interface between the user and all Multi Contoured Seat functions, both inputs and outputs from the display device.
2. Control inputs to the Multi Contoured Seats Server directing the server to initiate some Multi Contoured Seats function.

1.2.1 Functional Requirements

1.2.1.1 MCS-SR-REQ-021423/A-MultiContoured Seats Change Request Latency - Driver Seat (TcSE ROIN-199636-1)

The MultiContoured Seats Client shall ignore the DriverActiveSeatControl_St status message for T_Response_SeatMode after sending DriverActiveSeatControl_Rq to the MultiContoured Seats Server to allow for Gateway Latency.

1.2.1.2 MCS-SR-REQ-021429/A-MultiContoured Seats Change Request Latency - Passenger Seat (TcSE ROIN-201074-1)

The MultiContoured Seats Client shall ignore the PassengerActiveSeatControl_St status message for T_Response_SeatMode after sending PassengerActiveSeatControl_Rq to the MultiContoured Seats Server to allow for Gateway Latency.

1.2.1.3 MCS-TMR-REQ-021424/A-Change Request Latency timing (TcSE ROIN-199637-1)

Name	Description	Units	Range	Resolution	Default
Change Request Latency timing	Minimum amount of time between sending signals (DriverActiveSeatControl_Rq or PassengerActiveSeatControl_Rq) then updating the HMI based on status signals (DriverActiveSeatControl_St or PassengerActiveSeatControl_St) by the MultiContoured Seats Client.	msec	0-1000	10	500

1.2.1.4 MCS-SR-REQ-021421/A-Inactivity of any user input to MultiContoured Seats (TcSE ROIN-199485-1)

After the MultiContouredSeatsUser has stopped making inputs on the specific drivers or passengers seat controls at the seat:

DriverInitiateSeatControlMode_St = SeatControlOff from SeatControlOn or
PassengerInitiateSeatControlMode_St = SeatControlOff from SeatControlOn

then the Multicontoured Seats Client shall reset timeout T_MCS_Input and start the timer. After the timer expires, either seat may become the primary seat on the touch screen display.

1.2.1.5 MCS-TMR-REQ-021422/A-MCS Input Timeout - Seat or TouchScreen (TcSE ROIN-200107-1)

Name	Description	Units	Range	Resolution	Default
MCS Input Timeout - Seat or TouchScreen	Timer initiated by the MultiContoured Seats Client that restarts after there are no inputs by the user, either at the seat, or the touch screen display.	sec	0-20	1	10

1.2.1.6 MCS-SR-REQ-021430/A-Highlighted Function and pressure percentage memory (TcSE ROIN-201098-1)

The MultiContouredSeats Client shall remember Lumbar bladder fill percentages, and Bolster bladder fill percentages upon powering down of current key cycle. The Client will use these values during initialization of the next key cycle, until it receives an updated actual value from the MultiContouredSeats Server.

1.2.1.7 MCS-SR-REQ-021427/A-Selecting the Adjust Tab from the touch screen (TcSE ROIN-200453-1)

If the user selects the adjust tab from the touch screen, the MCS Client shall initiate an DriverActiveSeatControl_Rq or PassengerActiveSeatControl_Rq with parameters equal to

HighlightedFunction = MiddleLumbar
SeatModeSelect = Inactive

1.2.1.8 MCS-SR-REQ-021428/A-Selecting the Massage Tab from the touch screen (TcSE ROIN-200454-1)

If the user selects the Massage tab from the touch screen, the MCS Client shall initiate an DriverActiveSeatControl_Rq or PassengerActiveSeatControl_Rq with parameters equal to

HighlightedFunction = CushionMassage
SeatModeSelect = Inactive

1.2.1.9 MCS-SR-REQ-165826/A-Multi Contoured Seats Adjustment via TouchScreen

The Multi Contoured Seat (MCS) Client does not arbitrate if an input is a "press and hold" or a "tap". This shall be done by the Multi Contoured Seat (MCS) Server.

If the user presses the plus (+) or minus (-) button from the touch screen, the MCS Client shall initiate DriverActiveSeatControl_Rq or PassengerActiveSeatControl_Rq with associated parameter SeatModeSelect = Increase or SeatModeSelect = Decrease

Parameter shall be transmitted as a continuously held high signal for as long as the button is pressed

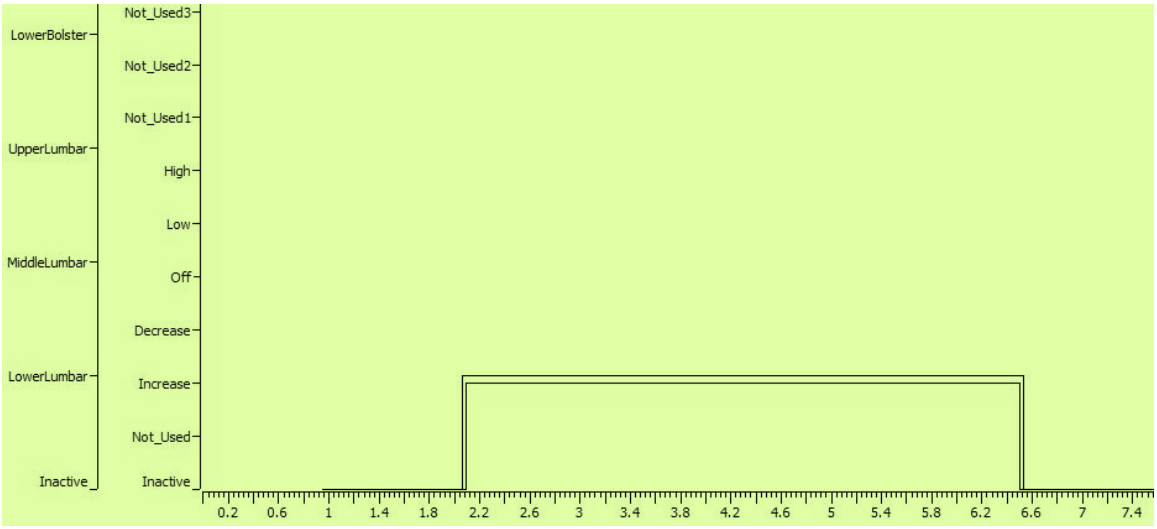


Figure 1 – SeatModeSelect transmission (Tx) - Expected Behavior Example

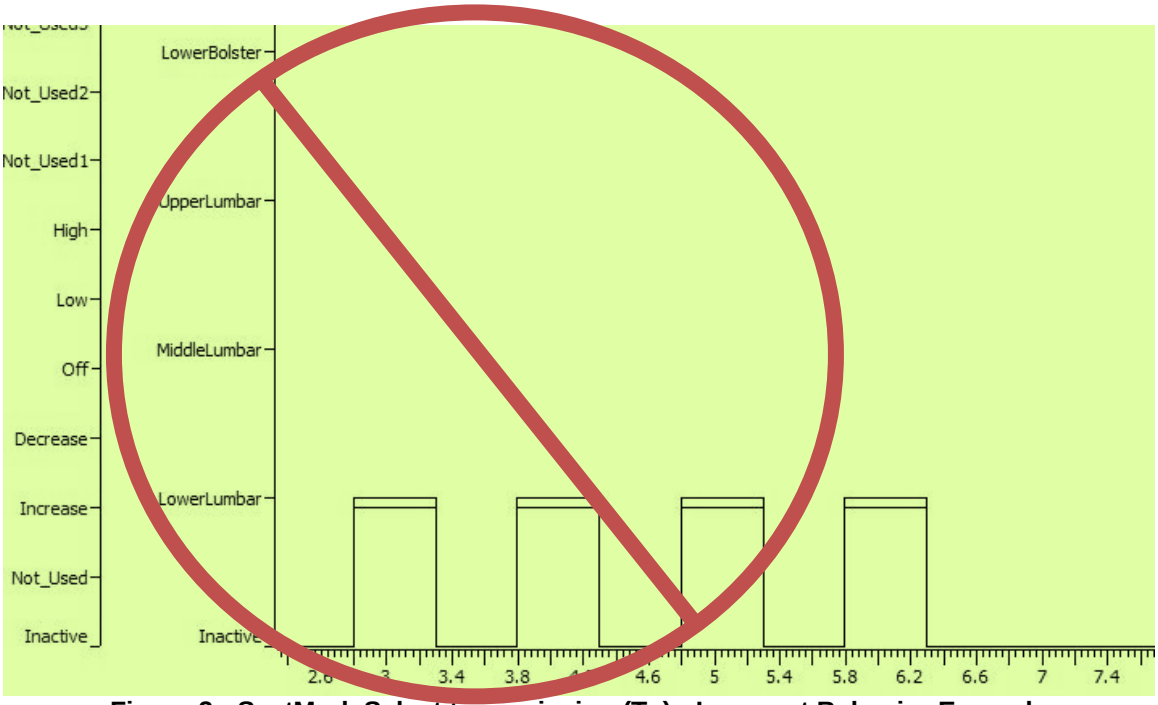


Figure 2 - SeatModeSelect transmission (Tx) - Incorrect Behavior Example

1.3 MultiContouredSeatClient Interface

1.3.1 MCS-IIR-REQ-021434/A-iMultiContouredSeatsClient_Tx (TcSE ROIN-264548-2)

1.3.1.1 MD-REQ-021435/A-DriverActiveSeatControl_Rq (TcSE ROIN-199569-2)

Message Type: Request

This method is a signal from the Multi Contoured Seat Client to the Multi Contoured Seat Server (Driver's side). This request indicates to the server what seat control update is requested (Massage, Bolster, Lumbar)

Name	Literals	Value	Description
HighlightedFunction	-	-	Requested active function.
	Inactive	0x0	
	LowerLumbar	0x1	

	MiddleLumbar	0x2	
	UpperLumbar	0x3	
	LowerBolster	0x4	
	UpperBolster	0x5	
	LumbarMassage	0x6	
	CushionMassage	0x7	
SeatModeSelect	-	-	Indicates if the current highlighted function should increase pressure, decrease pressure, or increase/decrease seat/lumbar massage intensity.
	Inactive	0x0	
	Not_Used	0x1	
	Increase	0x2	
	Decrease	0x3	
	Off	0x4	
	Low	0x5	
	High	0x6	
	Not_Used	0x7-0xE	
	Fault	0xF	

1.3.1.2 MD-REQ-021436/A-DriverResetFactorySettings_Rq (TcSE ROIN-199425-1)

Message Type: Request

This method is a signal from the Multi Contoured Seat Client to the Multi Contoured Seat Server to request a reset of all applicable Multi Contoured Seats settings to default settings.

Name	Literals	Value	Description
Mode	-	-	
	Inactive	0x0	
	Active	0x1	

1.3.1.3 MD-REQ-021437/A-PassengerActiveSeatControl_Rq (TcSE ROIN-201060-2)

Message Type: Request

This method is a signal from the Multi Contoured Seat Client to the Multi Contoured Seat Server (Passenger's side). This request indicates to the server what seat control update is requested (Massage, Bolster, Lumbar)

Name	Literals	Value	Description
HighlightedFunction	-	-	Requested active function.
	Inactive	0x0	
	LowerLumbar	0x1	
	MiddleLumbar	0x2	
	UpperLumbar	0x3	
	LowerBolster	0x4	
	UpperBolster	0x5	
	LumbarMassage	0x6	
	CushionMassage	0x7	
SeatModeSelect	-	-	Indicates if the current highlighted function should increase pressure, decrease pressure, or increase/decrease seat/lumbar massage intensity.
	Inactive	0x0	
	Not_Used	0x1	
	Increase	0x2	

	Decrease	0x3	
	Off	0x4	
	Low	0x5	
	High	0x6	
	Not_Used	0x7-0xE	
	Fault	0xF	

1.3.1.4 MD-REQ-021438/A-PassengerResetFactorySettings_Rq (TcSE ROIN-202421-1)

Message Type: Request

This method is a signal from the Multi Contoured Seat Client to the Multi Contoured Seat Server to request a reset of all applicable Multi Contoured Seats settings to default settings.

Name	Literals	Value	Description
Mode	-	-	
	Inactive	0x0	
	Active	0x1	

1.3.1.5 MD-REQ-021439/A-PassengerSeatMemoryCommand_Rq (TcSE ROIN-202414-1)

Message Type : Request

This method is from the MultiContoured Seats Client to the MultiContoured Seats Server to request a store or recall operation for the specified setting number. If a Recall is selected, the MultiContoured Seats Server will update the Lumbar and Bolster pressures to the stored values for that user. If a Store operation is selected, the MultiContoured Seats Server will stored the current values of the Lumbar and Bolster pressures in the specified user.

Name	Literals	Value	Description
Mode	-	-	Specifies operation and user that is selected by the user.
	Inactive	0x0	
	Store1	0x1	
	Store2	0x2	
	Store3	0x3	
	Store4	0x4	
	Recall1	0x5	
	Recall2	0x6	
	Recall3	0x7	
	Recall4	0x8	

1.3.1.6 MD-REQ-021440/A-UpdateData (TcSE ROIN-199437-1)

This event is from the Multi Contoured Seat Client to the HMI device. This signal represents a change to the display device's data on the screen, either what highlighted function is now selected, or actual pressure values that are changing.

1.3.1.7 MD-REQ-021441/A-UpdateView (TcSE ROIN-199436-1)

This event is from the Multi Contoured Seat Client to the HMI device. This signal represents a change to the display device's view, either changing to the MultiContoured Seats screen, or updating the screen graphics to show that a pressure update is taking place for a specific bladder.

1.3.2 MCS-IIR-REQ-021442/A-iMultiContouredSeatsClient_Rx (TcSE ROIN-264549-2)

1.3.2.1 MD-REQ-021443/A-DriverActiveSeatControl_St (TcSE ROIN-199404-1)

Message Type: Status

This method is a signal from the Multi Contoured Seat Server to the Multi Contoured Seat Client. If the seat function is being controlled at the seat HMI, this signal indicates what seat mode is to be highlighted by the display HMI. If the seat function is being controlled at the display HMI, this signal is a confirmation from the Server that the function that was requested by DriverActiveSeatControl_Rq has been accepted, and the Server is reacting to inputs from the display client.

Name	Literals	Value	Description
HighlightedFunction	-	-	Indicates the current active function.
	Null	0x0	
	LowerLumbar	0x1	
	MiddleLumbar	0x2	
	UpperLumbar	0x3	
	LowerBolster	0x4	
	UpperBolster	0x5	
	LumbarMassage	0x6	
	CushionMassage	0x7	
PressureUpdates	-	-	Indicates if the pressure of the highlighted function is currently being updated.
	NotUpdating	0x0	
	Updating	0x1	

1.3.2.2 MD-REQ-021444/A-DriverBolsterPressureLower_St (TcSE ROIN-199410-1)

Message Type: Status

This method is a signal from the Multi Contoured Seat Server to the Multi Contoured Seat Client indicating the status of the Bolster Lower Bladder Pair Pressure in percentage of full.

Name	Literals	Value	Description
ActualPressure	-	0x00 – 0x64	Percentage of Full

1.3.2.3 MD-REQ-021445/A-DriverBolsterPressureUpper_St (TcSE ROIN-199412-1)

This method is a signal from the Multi Contoured Seat Server to the Multi Contoured Seat Client indicating the status of the Bolster Upper Bladder Pair Pressure in percentage of full.

Name	Literals	Value	Description
ActualPressure	-	0x00 – 0x64	Percentage of Full

1.3.2.4 MD-REQ-021446/A-DriverCushionMassageIntensity_St (TcSE ROIN-199415-1)

Message Type: Status

This method is a signal from the Multi Contoured Seat Server to the Multi Contoured Seat Client which reports the current value of Seat Massage Intensity.

Name	Literals	Value	Description
MassageIntensity	-	-	Current Value of Cushion Massage Intensity

	Null	0x0	
	Off	0x1	
	Low	0x2	
	High	0x3	

1.3.2.5 MD-REQ-021447/A-DriverInitiateSeatControlMode_St (TcSE ROIN-199414-1)

Message Type: Status

This method is a signal from the Multi Contoured Seat Server (Driver's side) to the Multi Contoured Seat Client informing the Client that a request has been made by the user to change a Multi Contoured Seat function from the seat controls. This signal allows the Client to update the HMI output.

Name	Literals	Value	Description
Mode	-	-	
	SeatControlOff	0x0	
	SeatControlOn	0x1	

1.3.2.6 MD-REQ-021448/A-DriverLumbarMassageIntensity_St (TcSE ROIN-199421-1)

Message Type: Status

This method is a signal from the Multi Contoured Seat Server to the Multi Contoured Seat Client which reports the current value of Lumbar Masage Intensity.

Name	Literals	Value	Description
MassageIntensity	-	-	Current value of Lumbar Massage Intensity
	Null	0x0	
	Off	0x1	
	Low	0x2	
	High	0x3	

1.3.2.7 MD-REQ-021449/A-DriverLumbarPressureLower_St (TcSE ROIN-199409-1)

Message Type: Status

This method is a signal from the Multi Contoured Seat Server to the Multi Contoured Seat Client indicating the status of the Lumbar Lower Bladder Pressure in percentage of full.

Name	Literals	Value	Description
ActualPressure	-	0x00 – 0x64	Percentage of Full

1.3.2.8 MD-REQ-021450/A-DriverLumbarPressureMiddle_St (TcSE ROIN-199422-1)

Message Type: Status

This method is a signal from the Multi Contoured Seat Server to the Multi Contoured Seat Client indicating the status of the Lumbar Middle Bladder Pressure in percentage of full.

Name	Literals	Value	Description
ActualPressure	-	0x00 – 0x64	Percentage of Full

1.3.2.9 MD-REQ-021451/A-DriverLumbarPressureUpper_St (TcSE ROIN-199416-1)

Message Type: Status

This method is a signal from the Multi Contoured Seat Server to the Multi Contoured Seat Client indicating the status of the Lumbar Upper Bladder Pressure in percentage of full.

Name	Literals	Value	Description
ActualPressure	-	0x00 – 0x64	Percentage of Full

1.3.2.10 MD-REQ-021452/A-PassengerActiveSeatControl_St (TcSE ROIN-201068-1)

Message Type: Status

This method is a signal from the Multi Contoured Seat Server to the Multi Contoured Seat Client. If the seat function is being controlled at the seat HMI, this signal indicates what seat mode is to be highlighted by the display HMI. If the seat function is being controlled at the display HMI, this signal is a confirmation from the Server that the function that was requested by PassengerActiveSeatControl_Rq has been accepted, and the Server is reacting to inputs from the display client.

Name	Literals	Value	Description
HighlightedFunction	-	-	Indicates the current active function.
	Null	0x0	
	LowerLumbar	0x1	
	MiddleLumbar	0x2	
	UpperLumbar	0x3	
	LowerBolster	0x4	
	UpperBolster	0x5	
	LumbarMassage	0x6	
	CushionMassage	0x7	
PressureUpdates	-	-	Indicates if the pressure of the highlighted function is currently being updated.
	NotUpdating	0x0	
	Updating	0x1	

1.3.2.11 MD-REQ-021453/A-PassengerBolsterPressureLower_St (TcSE ROIN-201069-1)

Message Type: Status

This method is a signal from the Multi Contoured Seat Server to the Multi Contoured Seat Client indicating the status of the Bolster Lower Bladder Pair Pressure in percentage of full.

Name	Literals	Value	Description
ActualPressure	-	0x00 – 0x64	Percentage of Full

1.3.2.12 MD-REQ-021454/A-PassengerBolsterPressureUpper_St (TcSE ROIN-201070-1)

This method is a signal from the Multi Contoured Seat Server to the Multi Contoured Seat Client indicating the status of the Bolster Upper Bladder Pair Pressure in percentage of full.

Name	Literals	Value	Description
ActualPressure	-	0x00 – 0x64	Percentage of Full

1.3.2.13 MD-REQ-021455/A-PassengerCushionMassageIntensity_St (TcSE ROIN-201063-1)

Message Type: Status

This method is a signal from the Multi Contoured Seat Server to the Multi Contoured Seat Client which reports the current value of Cushion Masage Intensity.

Name	Literals	Value	Description
MassageIntensity	-	-	Current Value of Cushion Massage Intensity
	Null	0x0	
	Off	0x1	
	Low	0x2	
	High	0x3	

1.3.2.14 MD-REQ-021456/A-PassengerInitiateSeatControlMode_St (TcSE ROIN-201061-1)

Message Type: Status

This method is a signal from the Multi Contoured Seat Server (Passenger's side) to the Multi Contoured Seat Client informing the Client that a request has been made by the user to change a Multi Contoured Seat function from the seat controls. This signal allows the Client to update the HMI output.

Name	Literals	Value	Description
Mode	-	-	
	SeatControlOff	0x0	
	SeatControlOn	0x1	

1.3.2.15 MD-REQ-021457/A-PassengerLumbarMassageIntensity_St (TcSE ROIN-201062-1)

Message Type: Status

This method is a signal from the Multi Contoured Seat Server to the Multi Contoured Seat Client which reports the current value of Lumbar Masage Intensity.

Name	Literals	Value	Description
MassageIntensity	-	-	Current value of Lumbar Massage Intensity
	Null	0x0	
	Off	0x1	
	Low	0x2	
	High	0x3	

1.3.2.16 MD-REQ-021458/A-PassengerLumbarPressureLower_St (TcSE ROIN-201071-1)

Message Type: Status

This method is a signal from the Multi Contoured Seat Server to the Multi Contoured Seat Client indicating the status of the Lumbar Lower Bladder Pressure in percentage of full.

Name	Literals	Value	Description
ActualPressure	-	0x00 – 0x64	Percentage of Full

1.3.2.17 MD-REQ-021459/A-PassengerLumbarPressureMiddle_St (TcSE ROIN-201072-1)

Message Type: Status

This method is a signal from the Multi Contoured Seat Server to the Multi Contoured Seat Client indicating the status of the Lumbar Middle Bladder Pressure in percentage of full.

Name	Literals	Value	Description
ActualPressure	-	0x00 – 0x64	Percentage of Full

1.3.2.18 MD-REQ-021460/A-PassengerLumbarPressureUpper_St (TcSE ROIN-201073-1)

Message Type: Status

This method is a signal from the Multi Contoured Seat Server to the Multi Contoured Seat Client indicating the status of the Lumbar Upper Bladder Pressure in percentage of full.

Name	Literals	Value	Description
ActualPressure	-	0x00 – 0x64	Percentage of Full

1.3.2.19 MD-REQ-021461/A-PassengerSeatMemory_Rsp (TcSE ROIN-202415-1)

Message Type : Response

This metthod is from the MultiContoured Seats Server to the MultiContoured Seats Cleint to confirm that a store or recall operation for the specified setting number has taken place.

Name	Literals	Value	Description
Mode	-	-	Confirms to the Client what operation and user was requested by the user
	Inactive	0x0	
	Store1	0x1	
	Store2	0x2	
	Store3	0x3	
	Store4	0x4	
	Recall1	0x5	
	Recall2	0x6	
	Recall3	0x7	
	Recall4	0x8	

1.3.2.20 MD-REQ-021462/A-Input (TcSE ROIN-199438-1)

This event is from the Multi Contoured Seats Client or the Mult Contoured Seats Remote Client to the Multi Contoured Seats Server. This signal represents a user input from the touch screen display or from the seat controls. If the input is a seat input, the Multi Contoured Seats Remote Client is responsible for interpreting the user input and then informing the Multi Contoured Seats Server of the input. If the seat input is a touch screen input, the Multi Contoured Seats Client will interpret this input, and send the appropriate request using DriverActiveSeatControl_Rq or PassengerActiveSeatControl_Rq as appropriate.

2 Functional Definition

2.1 MCS-FUN-REQ-021334/A-Set Lumbar (TcSE ROIN-293499-1)

2.1.1 Use Cases

2.1.1.1 MCS-UC-REQ-021335/A-Adjust Front Seat Bladder Pressure from HMI (TcSE ROIN-291758)

Actors	Vehicle Occupant
Pre-conditions	Display is ON, Ignition = Run
Scenario Description	User Selects Upper, Middle, or Lower < Adjust Bladder Pressure > via HMI
Post-conditions	HMI indicates {mode and pressure updates}
List of Exception Use Cases	{Ignition not equal Run}
Interfaces	G-HMI & vehicle system
Links to Referenced Use Cases	NA

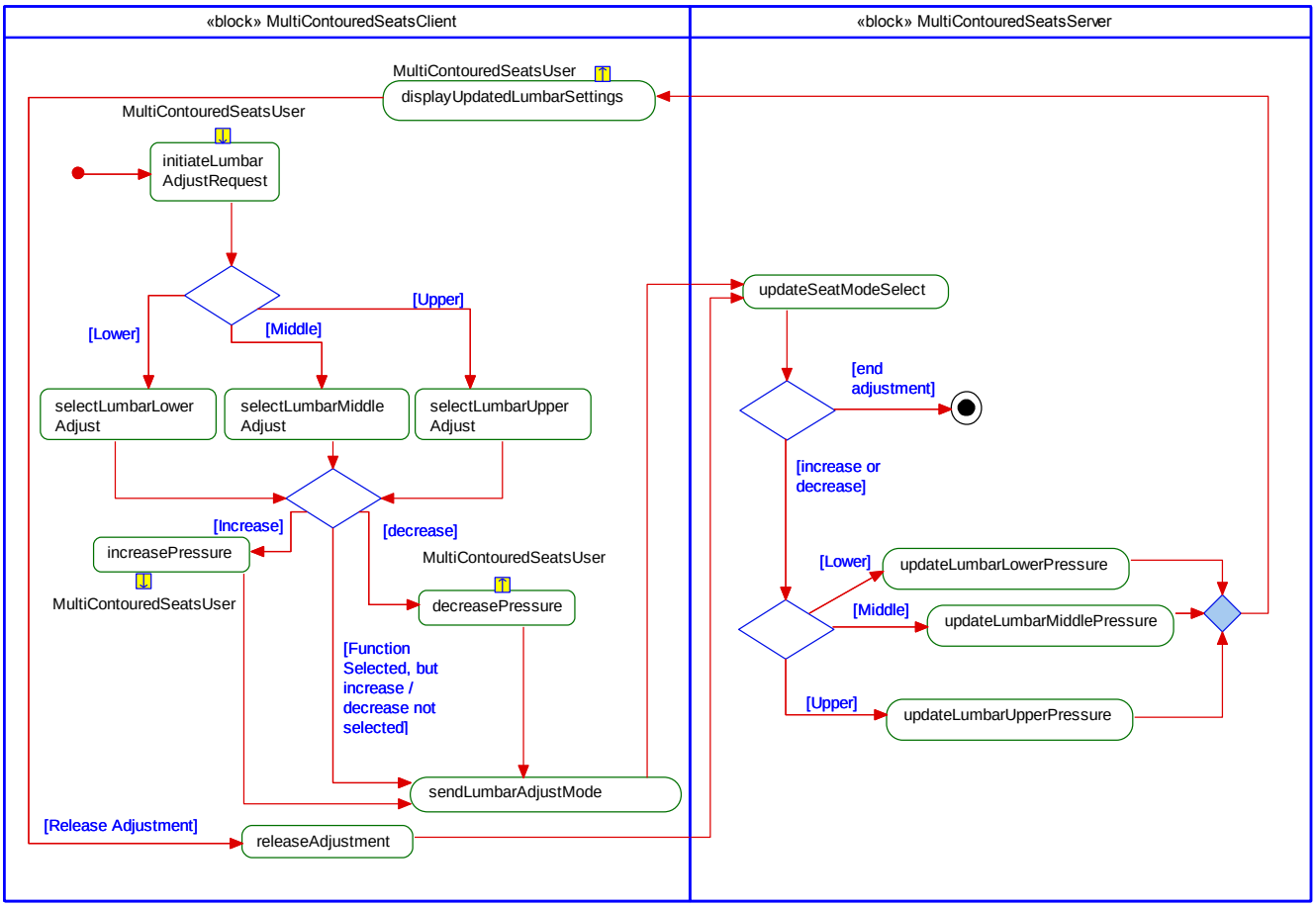
2.1.1.2 MCS-UC-REQ-021336/A-Adjust Front Seat Bladder Pressure from Seat (TcSE ROIN-291759)

Actors	Vehicle Occupant
Pre-conditions	Display is ON, Ignition = Run
Scenario Description	User Selects Upper, Middle, or Lower <Adjust Bladder Pressure> via seat module
Post-conditions	HMI indicates {mode and pressure updates}
List of Exception Use Cases	{Ignition not equal Run}
Interfaces	G-HMI & vehicle system
Links to Referenced Use Cases	NA

2.1.2 White Box View

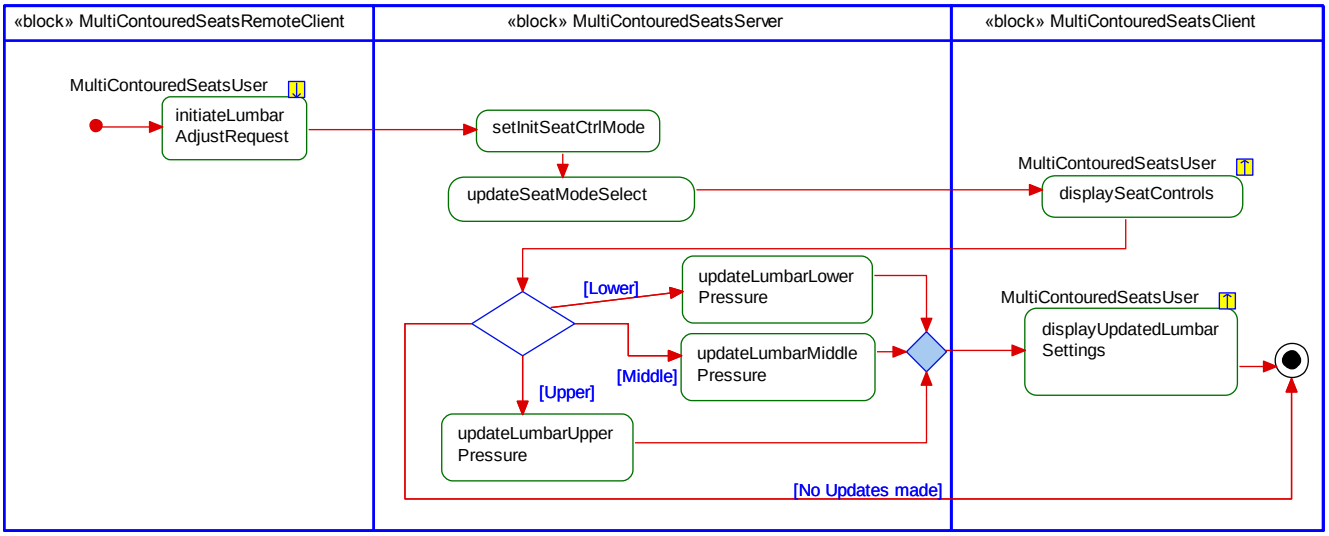
2.1.2.1 MCS-ACT-REQ-021324/A-Set Lumbar - Display Initiated (TcSE ROIN-198769-1)

Activity Diagram



2.1.2.2 MCS-ACT-REQ-021329/A-Set Lumbar - Seat Initiated (TcSE ROIN-199573-1)

Activity Diagram



2.1.2.3 MCS-SD-REQ-021337/A-Select Lumbar Middle Bladder at Touch Screen - No pressure updates (TcSE ROIN-200149-1)

Scenarios

Normal Usage

User <selects Set Lumbar Middle Bladder> via touchscreen HMI, but does not make any changes to the actual pressure.

Constraints

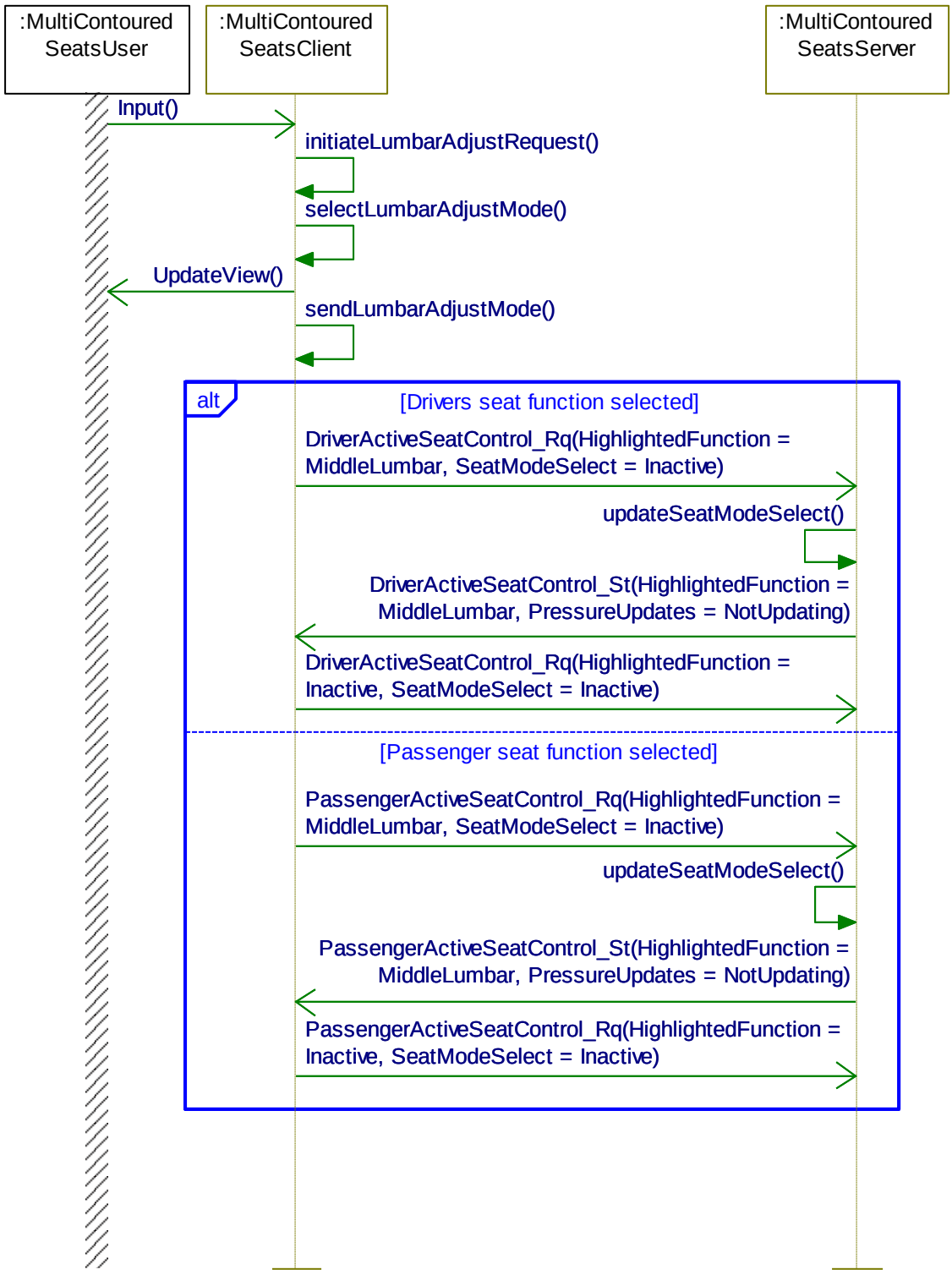
Pre-condition

Display is ON

Post-condition

HMI indicates {changes to Lumbar Adjust Mode}

Sequence Diagram



2.1.2.4 MCS-SD-REQ-021338/A-Select Lumbar Upper Bladder at Touch Screen - No pressure updates (TcSE ROIN-200156-1)

Scenarios

Normal Usage

User <selects Set Lumbar Upper Bladder> via touchscreen HMI, but does not make any changes to the actual pressure.

Constraints

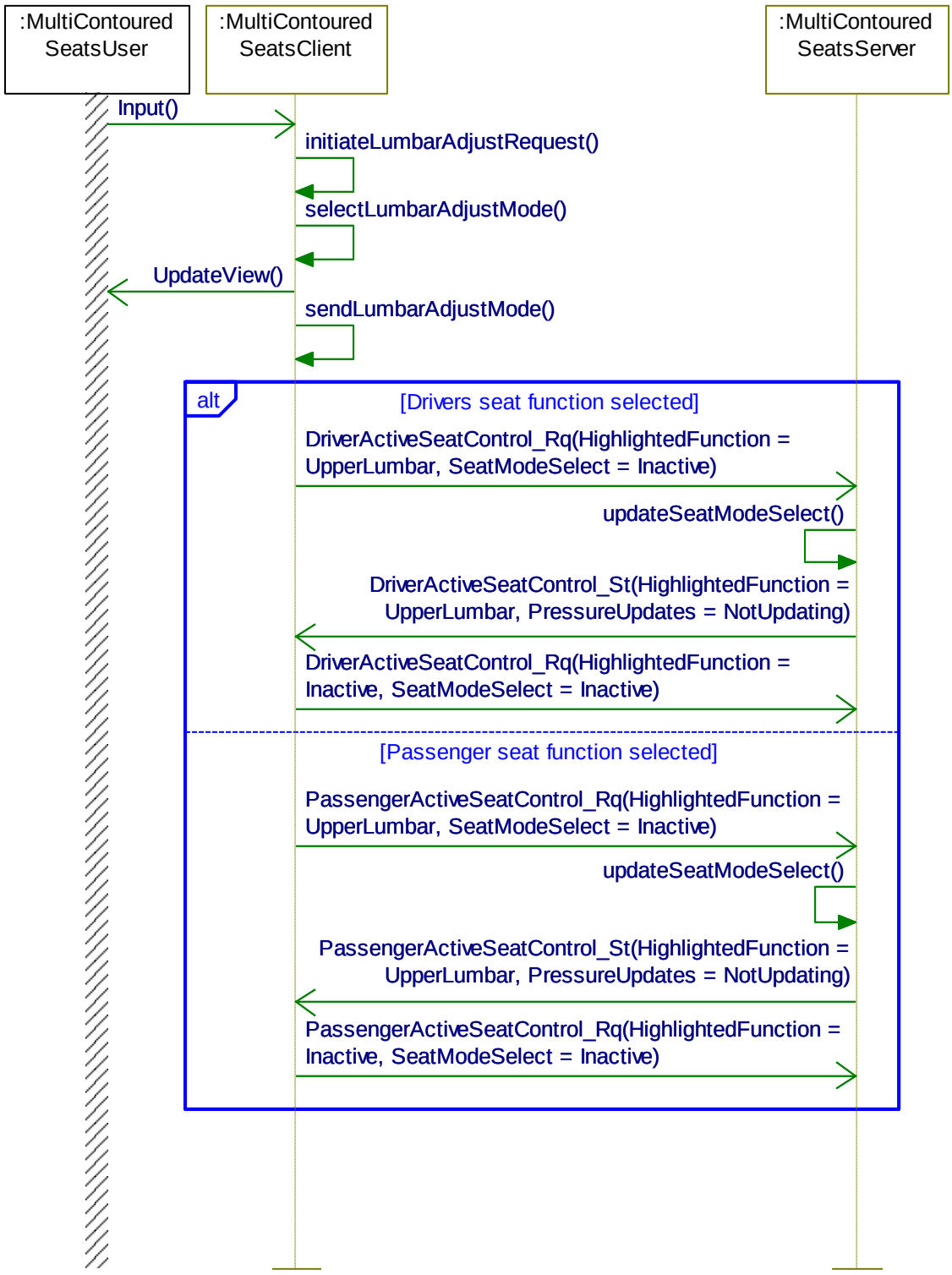
Pre-condition

Display is ON

Post-condition

HMI indicates {changes to Lumbar Adjust Mode}

Sequence Diagram



2.1.2.5 MCS-SD-REQ-021339/A-Initiate Lumbar Adjust at Seat - No pressure updates (TcSE ROIN-200163-1)

Scenarios

Normal Usage

User <selects Set Lumbar Lower, Middle, or Upper Bladder> via seat HMI, and does not attempt to adjust the pressures.

Constraints

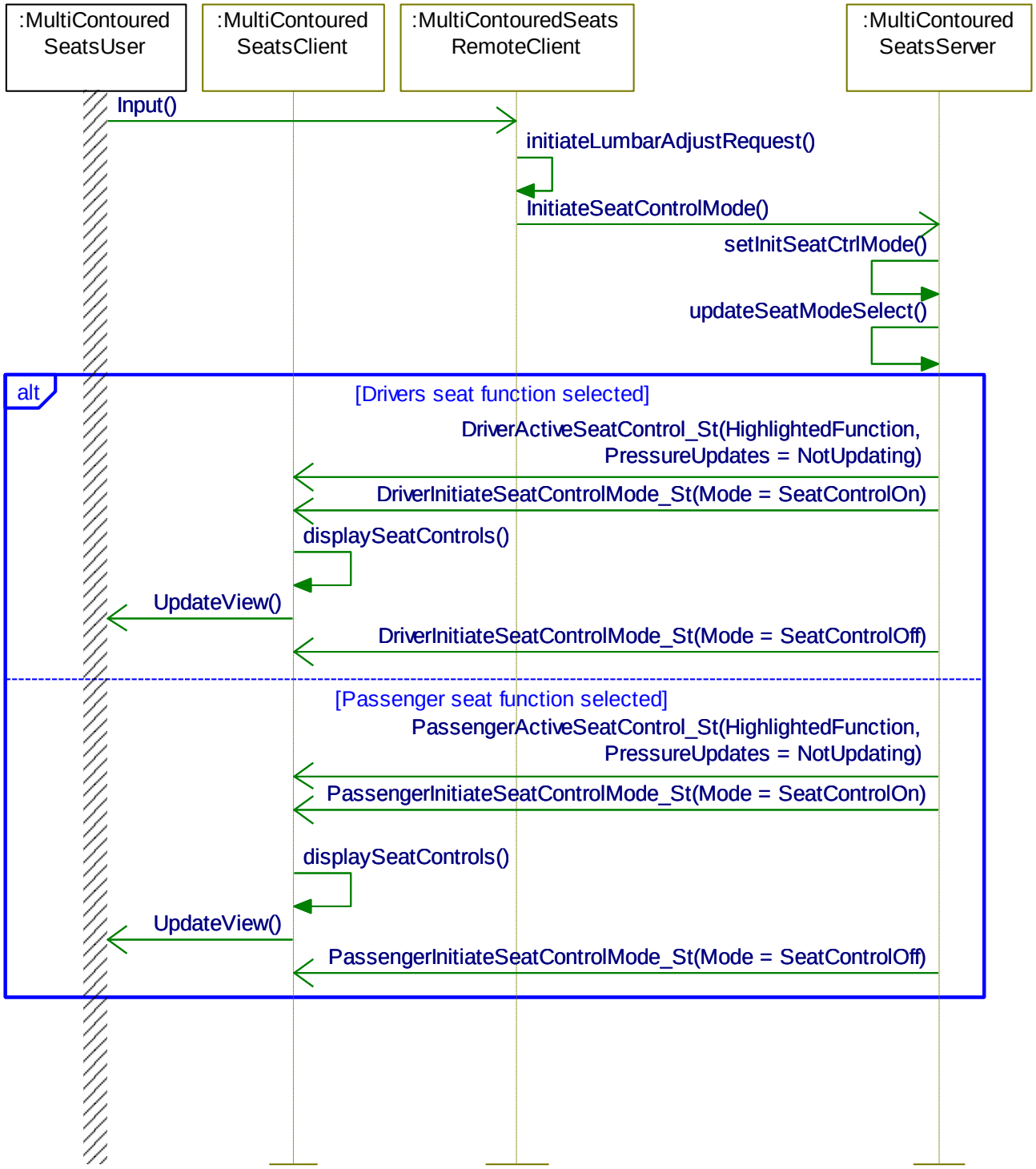
Pre-condition

Display is ON

Post-condition

HMI indicates {changes to Lumbar Adjust Mode}

Sequence Diagram



2.1.2.6 MCS-SD-REQ-021340/A-Select Lumbar Lower Bladder at Touch Screen - No pressure updates (TcSE ROIN-200170-1)

Scenarios

Normal Usage

User <selects Set Lumbar Lower Bladder> via touch screen HMI, but does not make any changes to the actual pressure.

Constraints

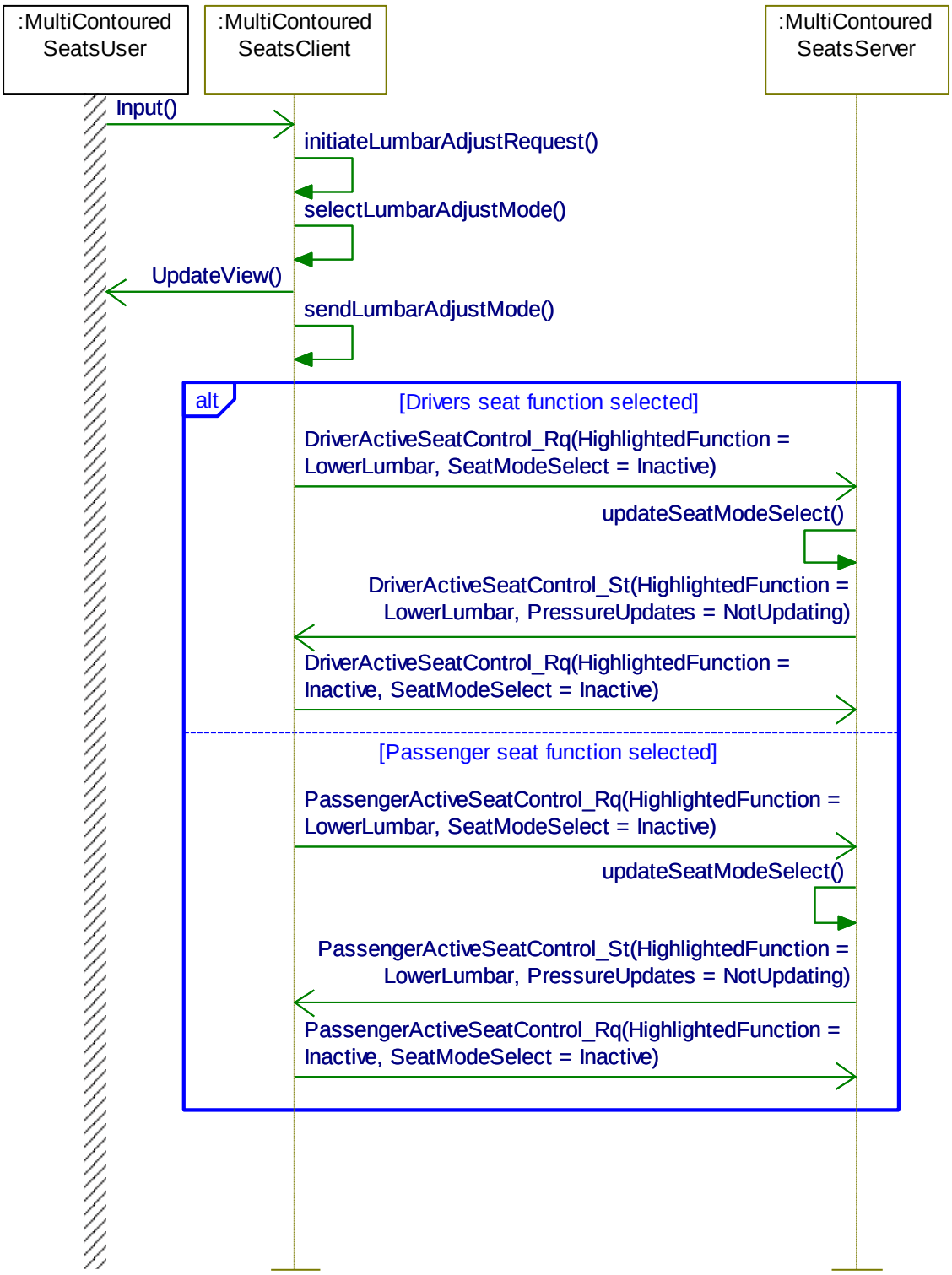
Pre-condition

Display is ON

Post-condition

HMI indicates {changes to Lumbar Adjust Mode}

Sequence Diagram



2.1.2.7 MCS-SD-REQ-021341/A-Decrease Lumbar Lower Bladder from Touch Screen (TcSE ROIN-200773-1)

Scenarios

Normal Usage

User <selects decrease Lumbar Lower Bladder> via touch screen HMI.

Constraints

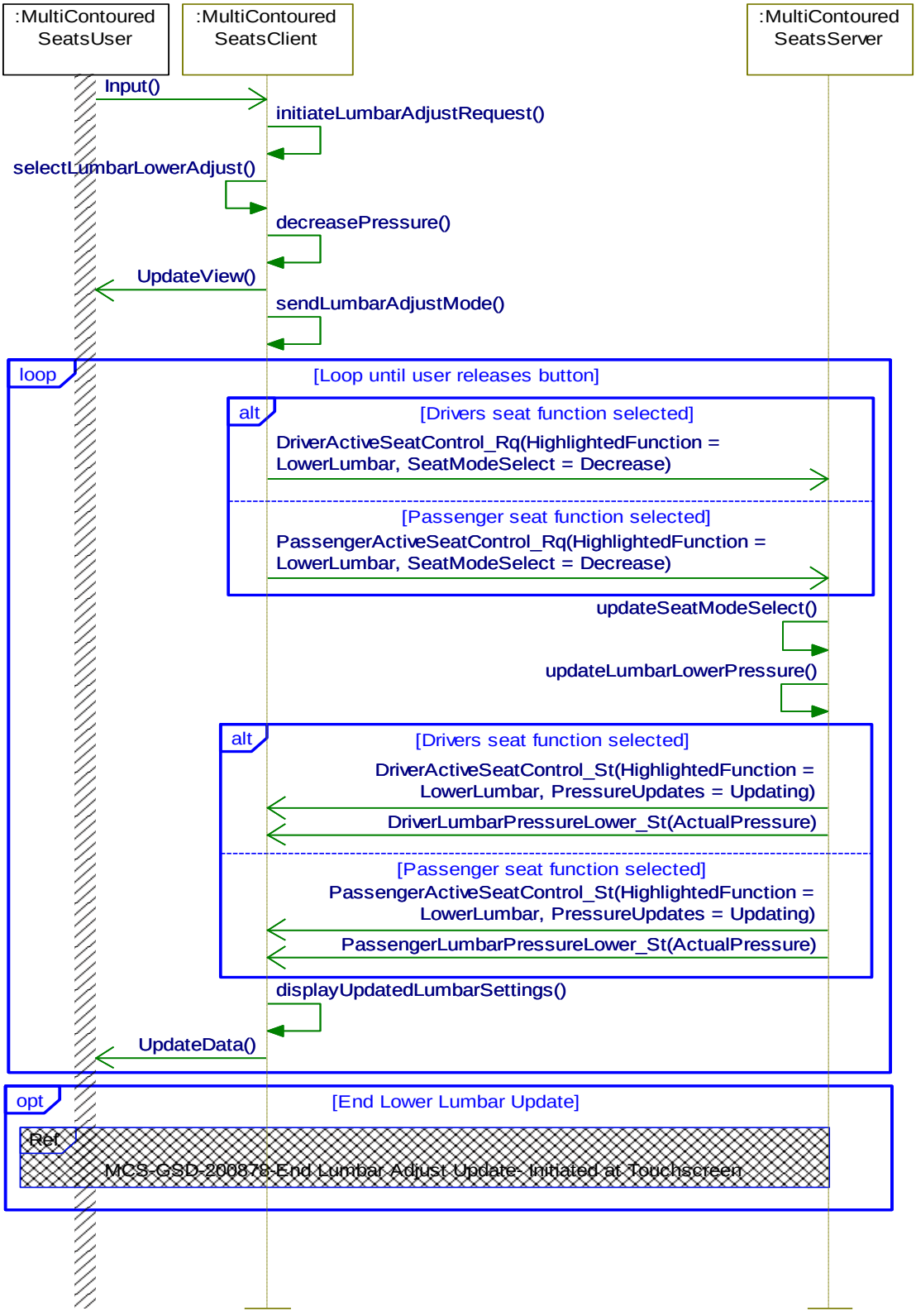
Pre-condition

Display is ON

Post-condition

HMI indicates {change Actual Pressure Settings as Seat Bladder pressure changes}

Sequence Diagram



2.1.2.8 MCS-SD-REQ-021342/A-Decrease Lumbar Middle Bladder from Touch Screen (TcSE ROIN-200780-1)

Scenarios

Normal Usage

User <selects decrease Lumbar Middle Bladder> via touch screen HMI.

Constraints

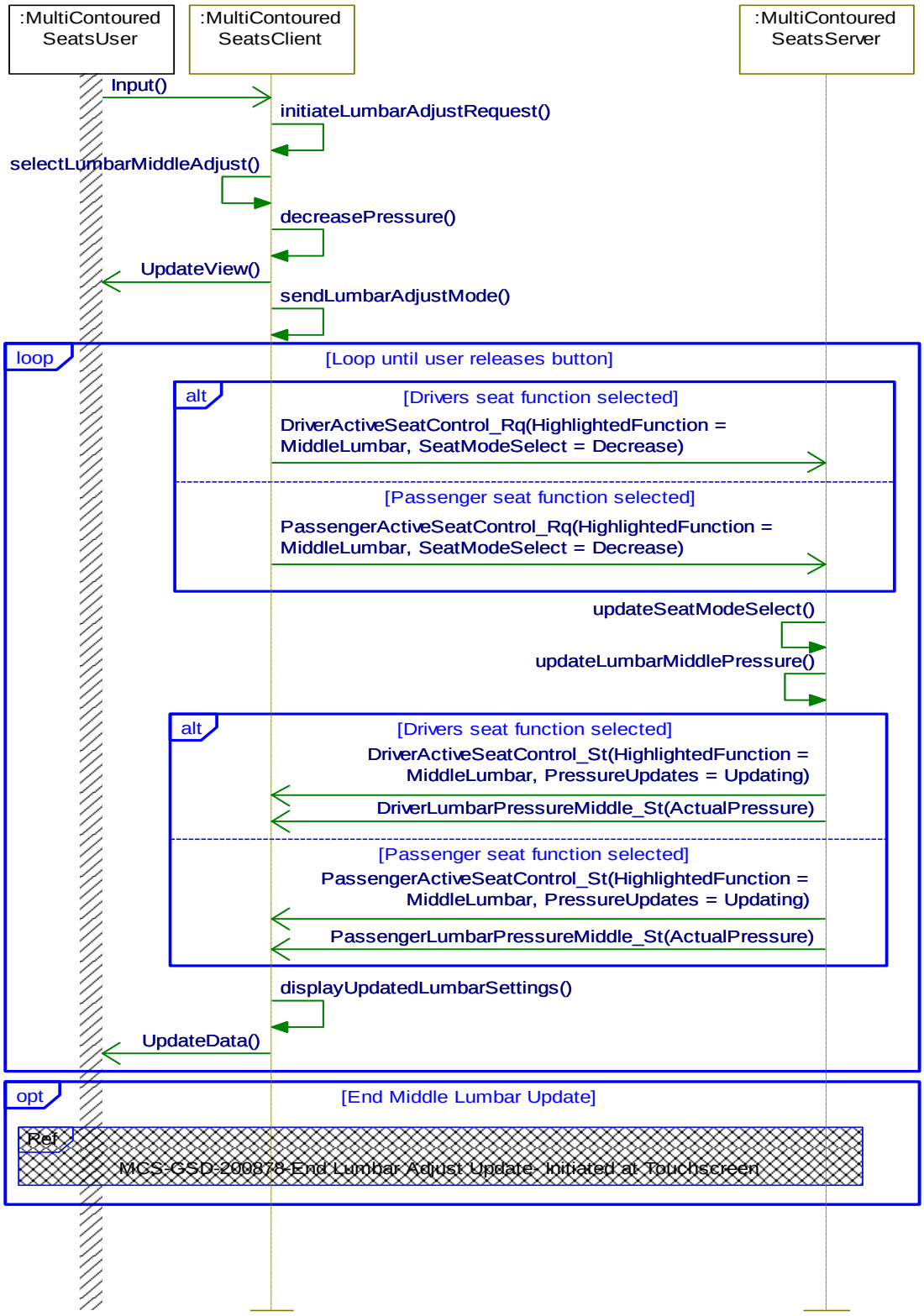
Pre-condition

Display is ON

Post-condition

HMI indicates {change Actual Pressure Settings as Seat Bladder pressure changes}

Sequence Diagram



2.1.2.9 MCS-SD-REQ-021343/A-Decrease Lumbar Upper Bladder from Touch Screen (TcSE ROIN-200787-1)

Scenarios

Normal Usage

User <selects decrease Lumbar Upper Bladder> via touch screen HMI.

Constraints

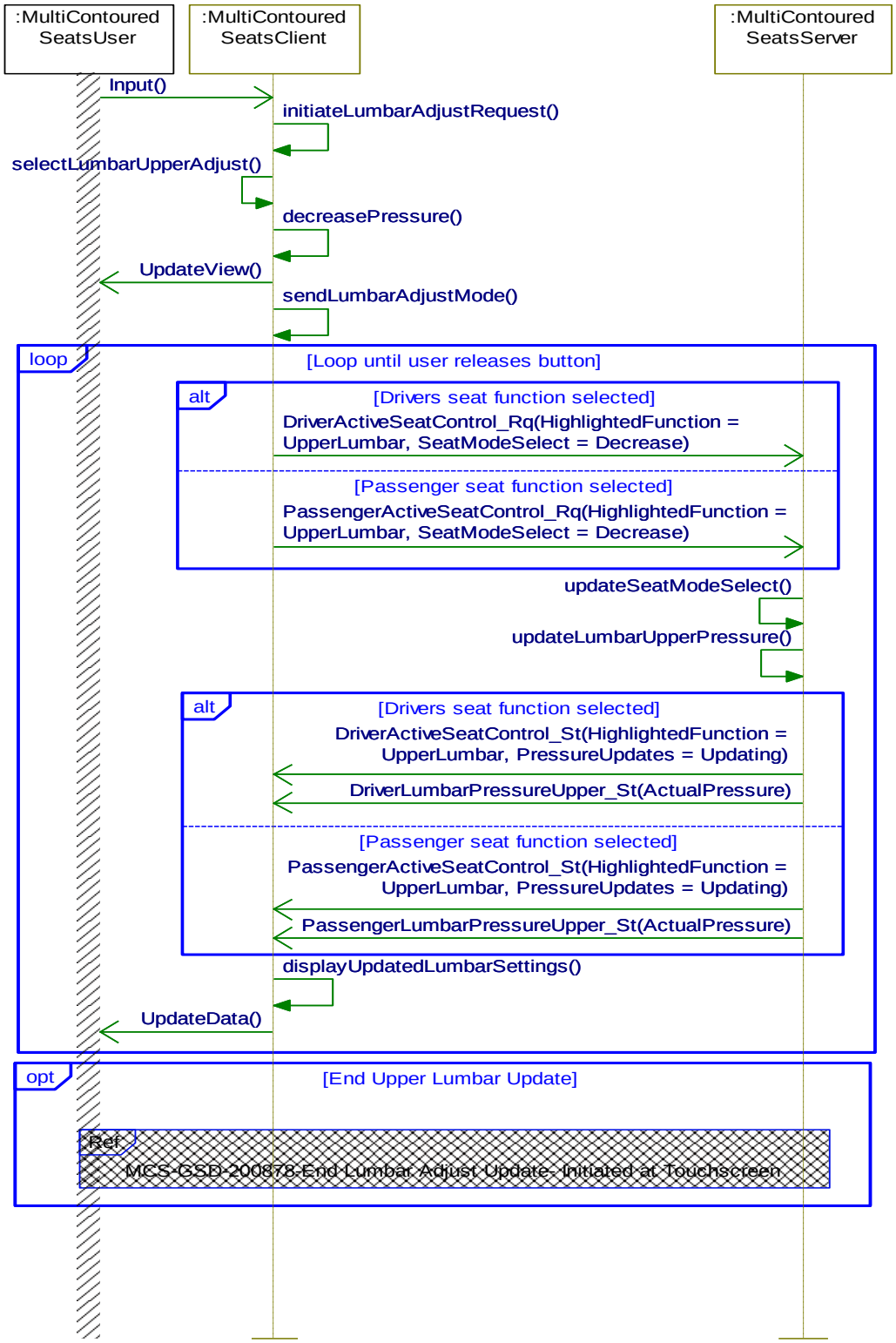
Pre-condition

Display is ON

Post-condition

HMI indicates {change Actual Pressure Settings as Seat Bladder pressure changes}

Sequence Diagram



2.1.2.10 MCS-SD-REQ-021344/A-Increase Lumbar Lower Bladder from Touch Screen (TcSE ROIN-200794-1)

Scenarios

Normal Usage

User <selects increrase Lumbar Lower Bladder> via touch screen HMI.

Constraints

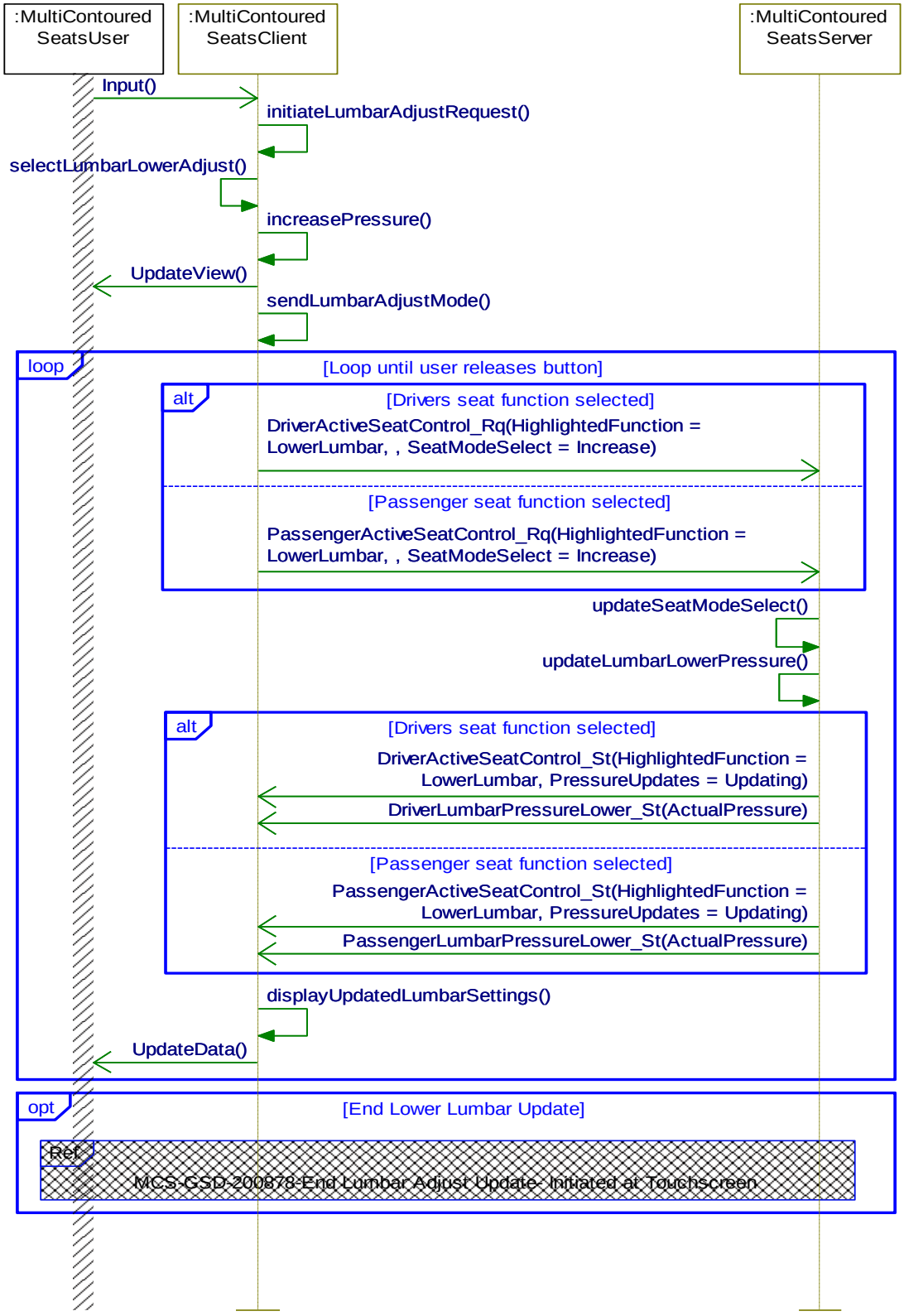
Pre-condition

Display is ON

Post-condition

HMI indicates {change Actual Pressure Settings as Seat Bladder pressure changes}

Sequence Diagram



2.1.2.11 MCS-SD-REQ-021345/A-Increase Lumbar Middle Bladder from Touch Screen (TcSE ROIN-200801-1)

Scenarios

Normal Usage

User <selects increase Lumbar Middle Bladder> via touch screen HMI.

Constraints

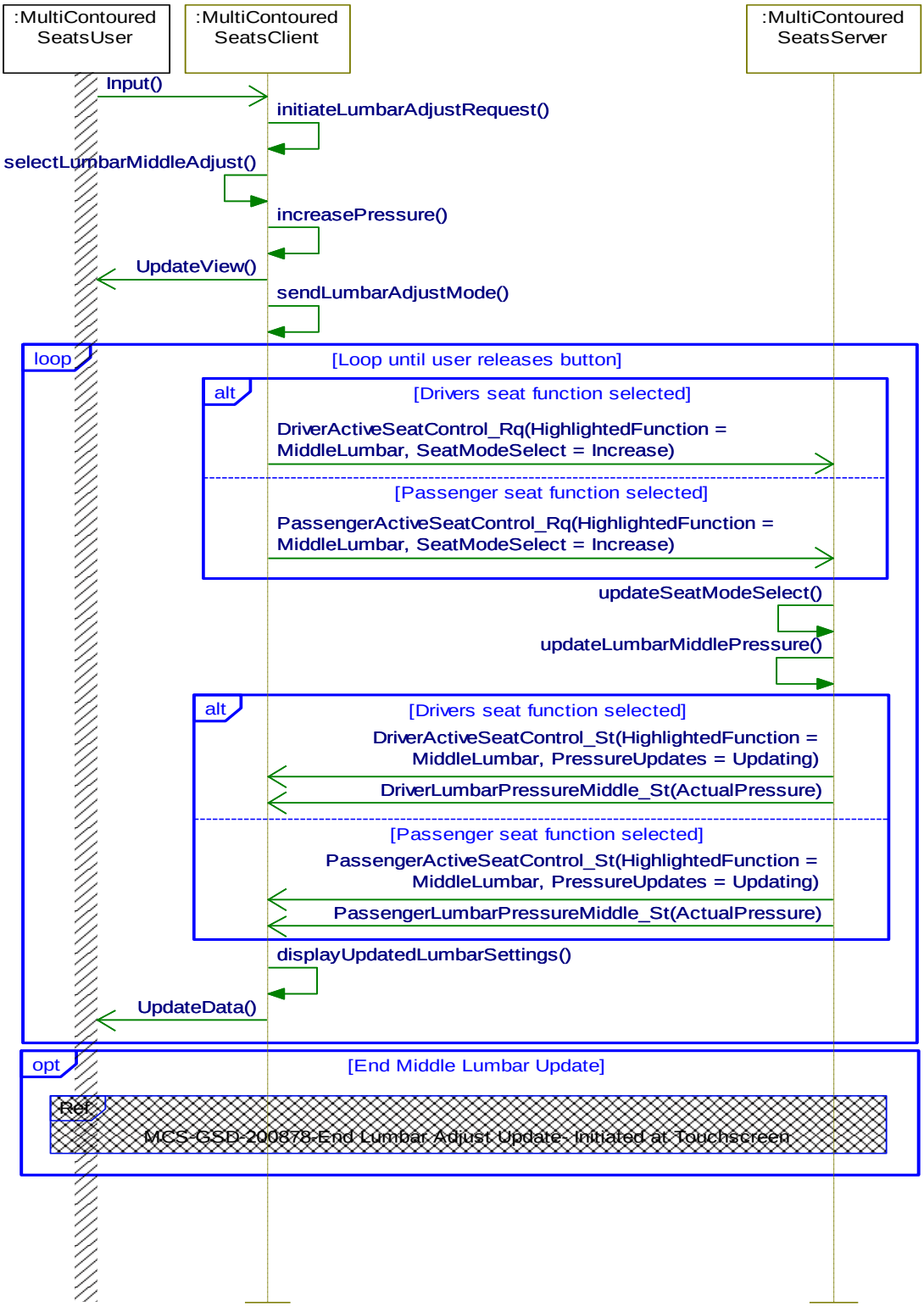
Pre-condition

Display is ON

Post-condition

HMI indicates {change Actual Pressure Settings as Seat Bladder pressure changes}

Sequence Diagram



2.1.2.12 MCS-SD-REQ-021346/A-Increase Lumbar Upper Bladder from Touch Screen (TcSE ROIN-200808-1)

Scenarios

Normal Usage

User <selects increase Lumbar Upper Bladder> via touch screen HMI.

Constraints

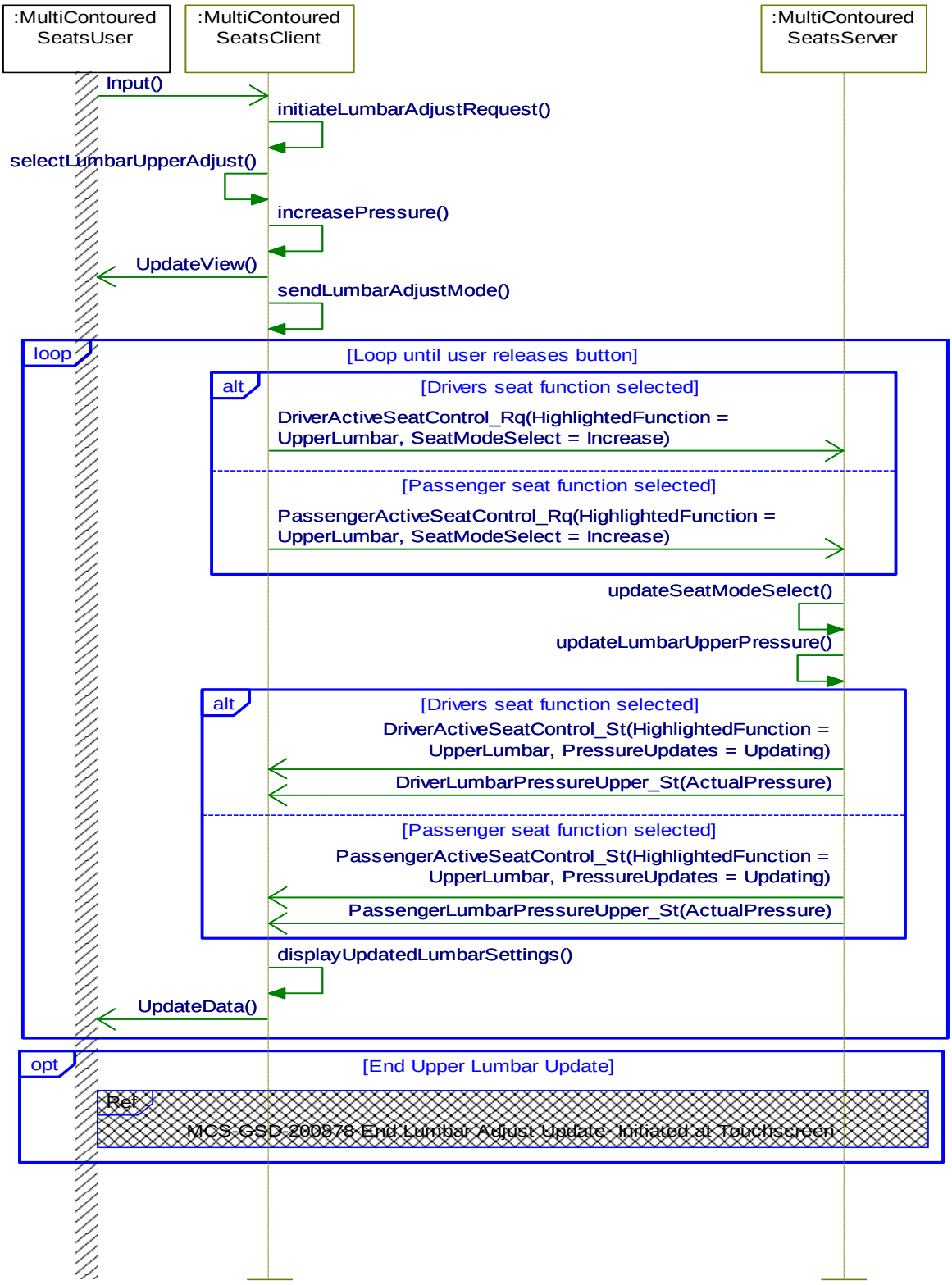
Pre-condition

Display is ON

Post-condition

HMI indicates {change Actual Pressure Settings as Seat Bladder pressure changes}

Sequence Diagram



2.1.2.13 MCS-SD-REQ-021347/A-Set Lumbar Lower Bladder from Seat (TcSE ROIN-200822-1)

Scenarios

Normal Usage

User <selects Set Lumbar Lower Bladder and increases or decreases the pressure> via seat HMI

Constraints

Pre-condition

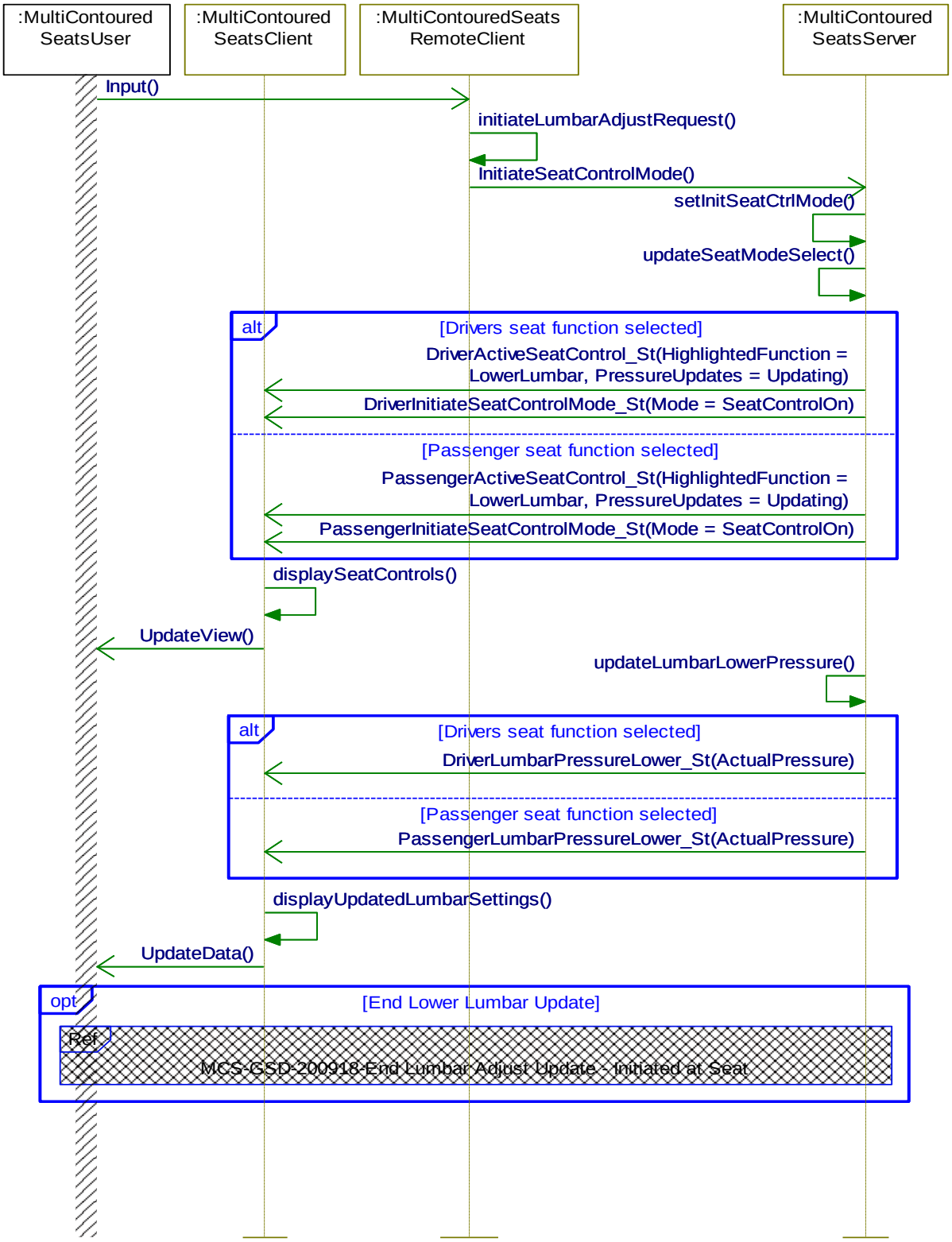
Display is ON

Post-condition

HMI indicates {changes to Lumbar Adjust Mode}

HMI indicates {changes to Actual Pressure Settings as Seat Bladder pressure changes}

Sequence Diagram



2.1.2.14 MCS-SD-REQ-021348/A-Set Lumbar Middle Bladder at Seat (TcSE ROIN-200829-1)

Scenarios

Normal Usage

User <selects Set Lumbar Middle Bladder and increases or decreases the pressure> via seat HMI

Constraints

Pre-condition

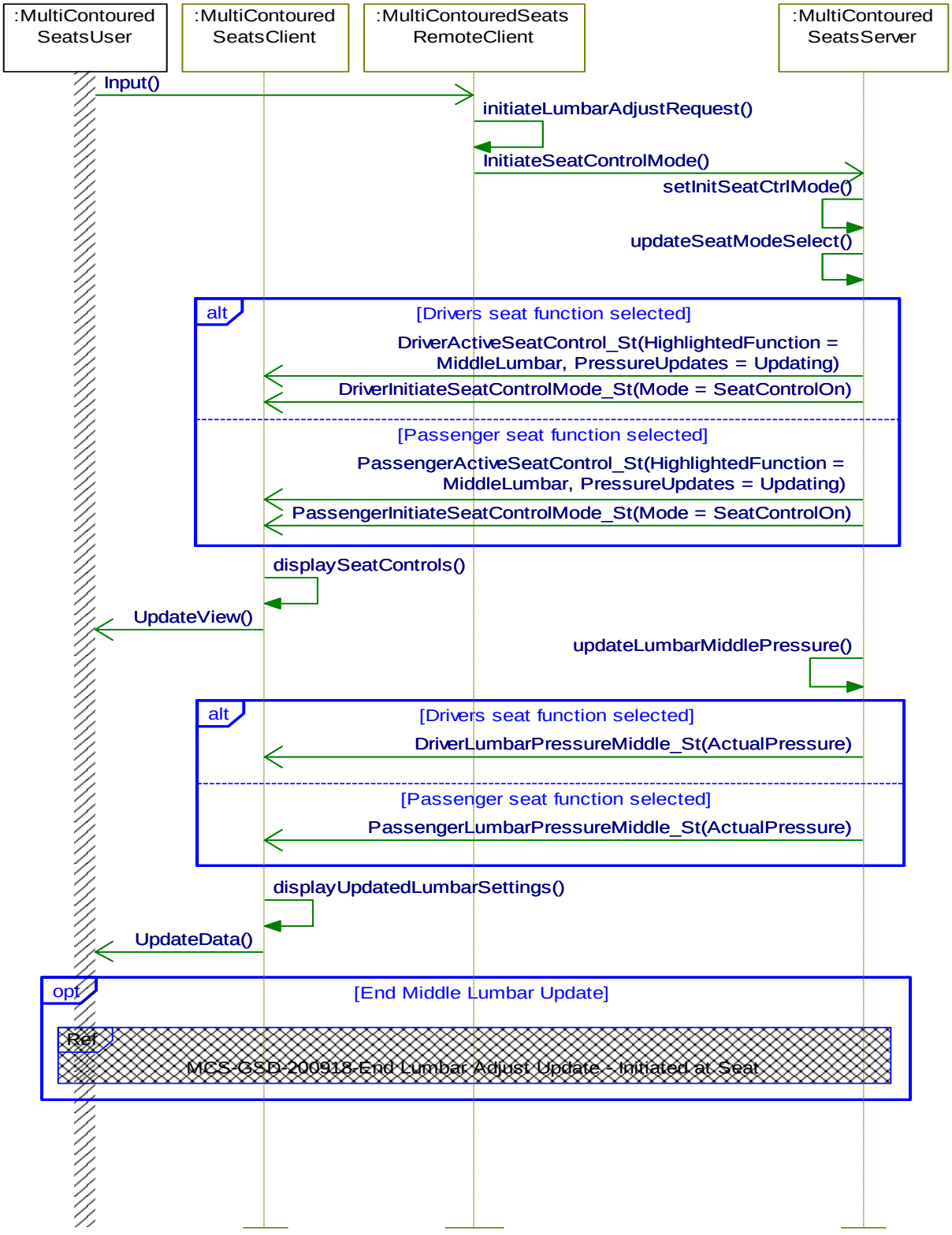
Display is ON

Post-condition

HMI indicates {changes to Lumbar Adjust Mode}

HMI indicates {changes to Actual Pressure Settings as Seat Bladder pressure changes}

Sequence Diagram



2.1.2.15 MCS-SD-REQ-021349/A-Set Lumbar Upper Bladder at Seat (TcSE ROIN-200836-1)

Scenarios

Normal Usage

User <selects Set Lumbar Upper Bladder and increases or decreases the pressure> via seat HMI

Constraints

Pre-condition

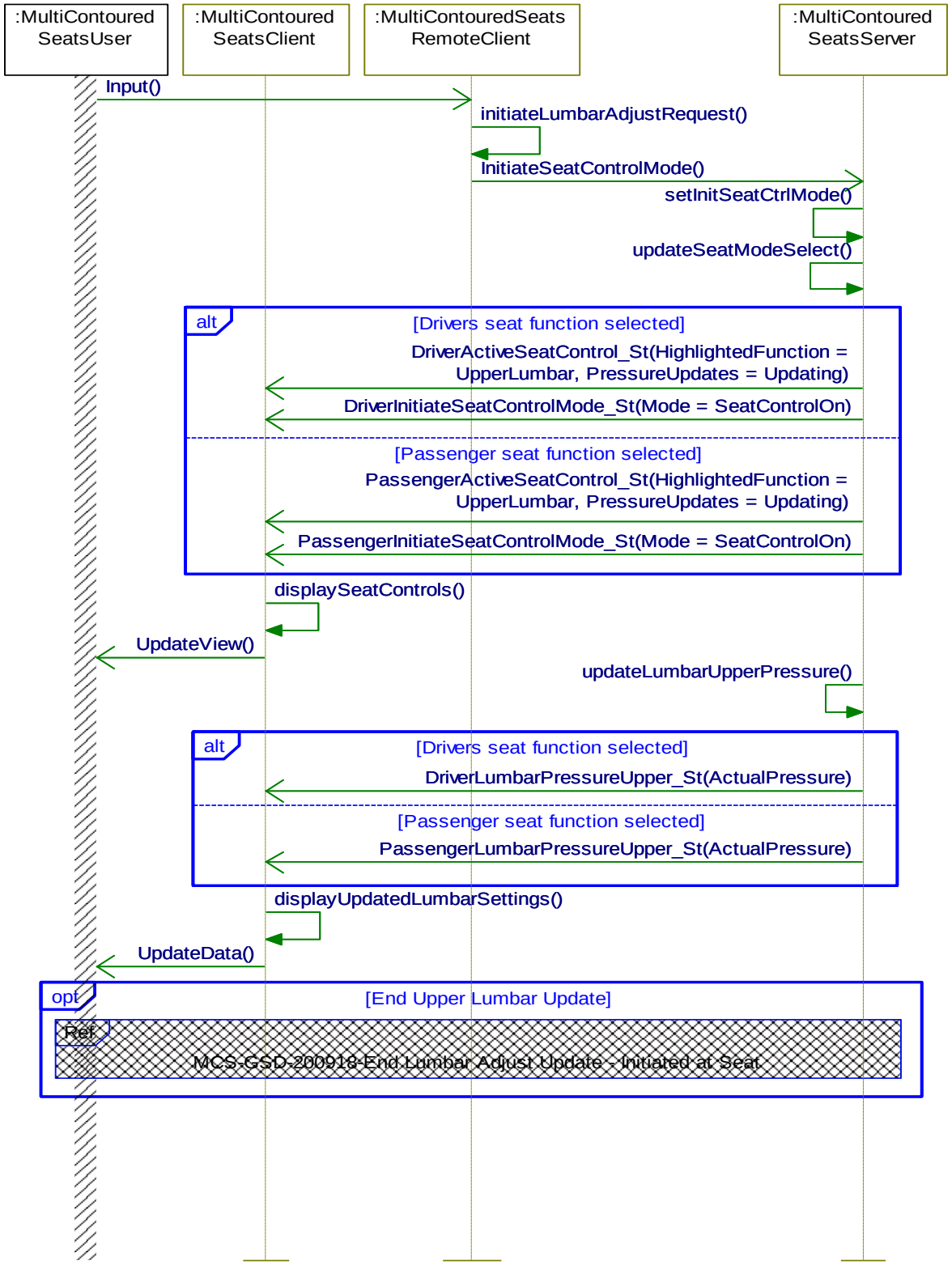
Display is ON

Post-condition

HMI indicates {changes to Lumbar Adjust Mode}

HMI indicates {changes to Actual Pressure Settings as Seat Bladder pressure changes}

Sequence Diagram



2.1.2.16 MCS-SD-REQ-021350/A-End Lumbar Adjust Update- Initiated at Touchscreen (TcSE ROIN-200878-1)

Scenarios

Normal Usage

The user ends Lumbar Adjust Mode update.

Constraints

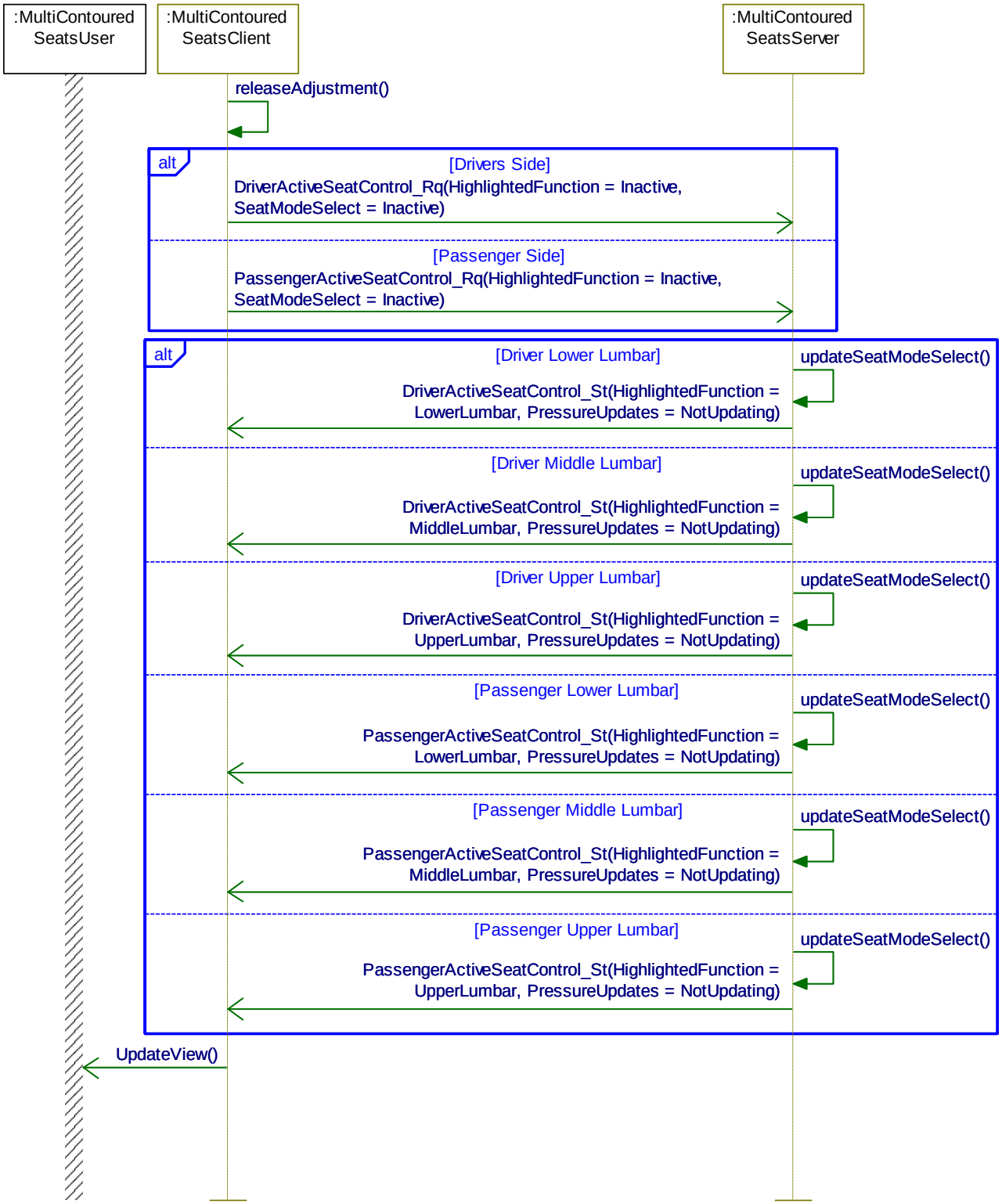
Pre-condition

Lumbar Adjust is currently being updated by the user via Touch screen HMI

Post-condition

Lumbar Adjust is no longer updated by the user via Touch screen HMI

Sequence Diagram



2.1.2.17 MCS-SD-REQ-021351/A-End Lumbar Adjust Update - Initiated at Seat (TcSE ROIN-200918-1)

Scenarios

Normal Usage

The user ends Lumbar Adjust Mode update.

Constraints

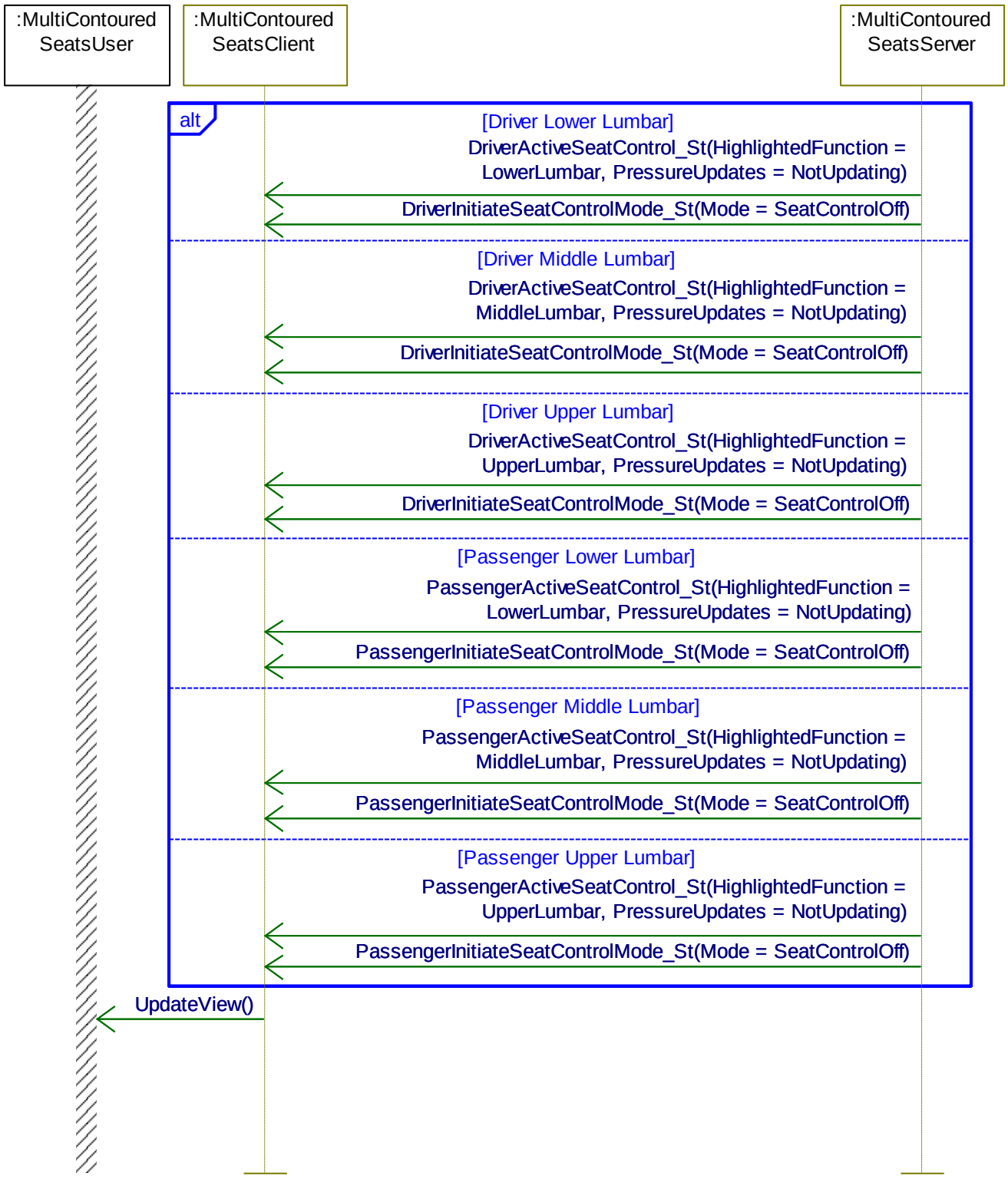
Pre-condition

Lumbar Adjust is currently being updated by the user via Seat HMI

Post-condition

Lumbar Adjust is no longer being updated by the user via Seat HMI

Sequence Diagram



2.2 MCS-FUN-REQ-021352/A-Set Massage (TcSE ROIN-293502-1)

2.2.1 Use Cases

2.2.1.1 MCS-UC-REQ-021353/A-Adjust Front Seat Massage Intensity from HMI (TcSE ROIN-291760)

Actors	Vehicle Occupant
Pre-conditions	Display is ON, Ignition = Run
Scenario Description	User Selects < Massage Intensity> via HMI
Post-conditions	HMI indicates (Mode & Intensity}
List of Exception Use Cases	NA
Interfaces	G-HMI & vehicle system
Links to Referenced Use Cases	NA

2.2.1.2 MCS-UC-REQ-021354/A-Adjust Front Seat Massage Intensity from Seat (TcSE ROIN-291761)

Actors	Vehicle Occupant
Pre-conditions	Display is ON, Ignition = Run
Scenario Description	User Selects < Massage Intensity> via seat module
Post-conditions	HMI indicates (Mode & Intensity}
List of Exception Use Cases	NA
Interfaces	G-HMI & vehicle system
Links to Referenced Use Cases	NA

2.2.1.3 MCS-UC-REQ-021355/A-Exiting Front Massage and transitioning to Adjust bladder pressure via HMI (TcSE ROIN-292490)

Actors	Vehicle Occupant

Pre-conditions	Display is ON, Ignition = Run Massage Screen is ON
Scenario Description	User exiting Massage and transitioning to Adjust bladder pressure via HMI
Post-conditions	HMI Pop – Up indicates {Massage off and restoring seat settings}
List of Exception Use Cases	NA
Interfaces	G-HMI & vehicle system
Links to Referenced Use Cases	NA

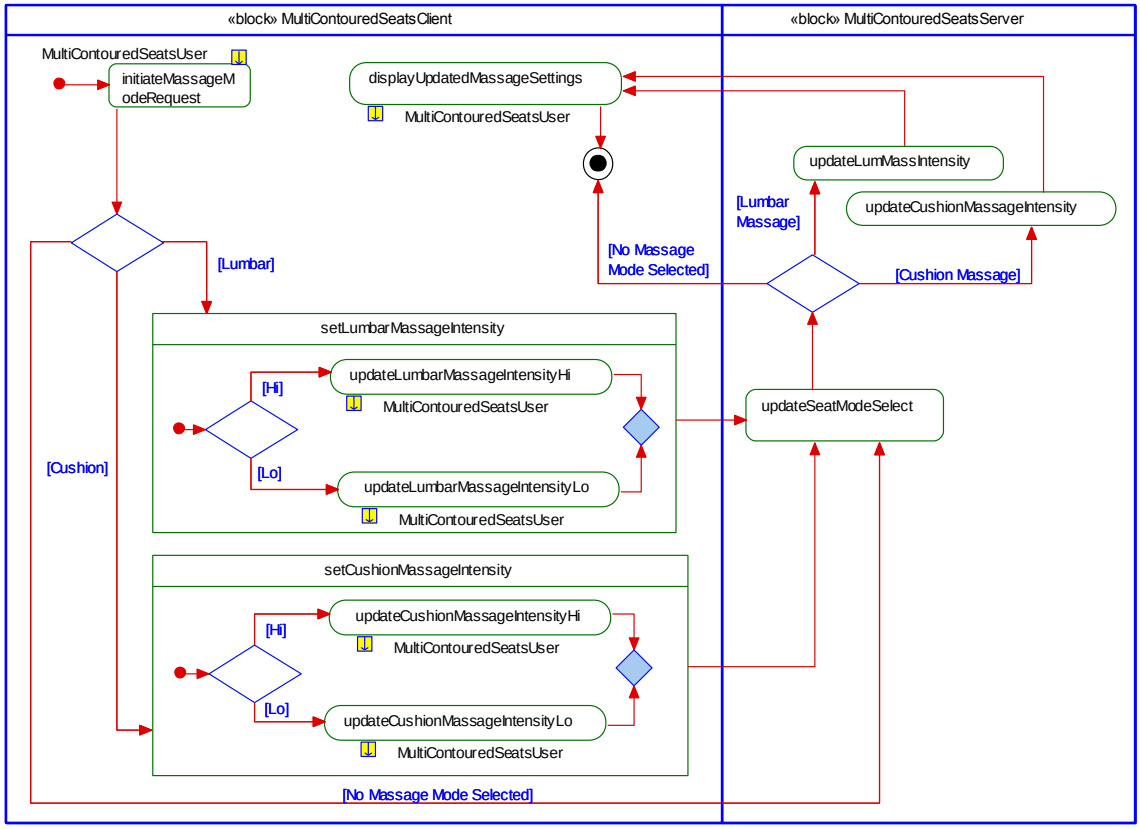
2.2.1.4 MCS-UC-REQ-021356/A-Exiting Front Massage and transitioning to adjust bladder pressure via HMI seat. (TcSE ROIN-292491)

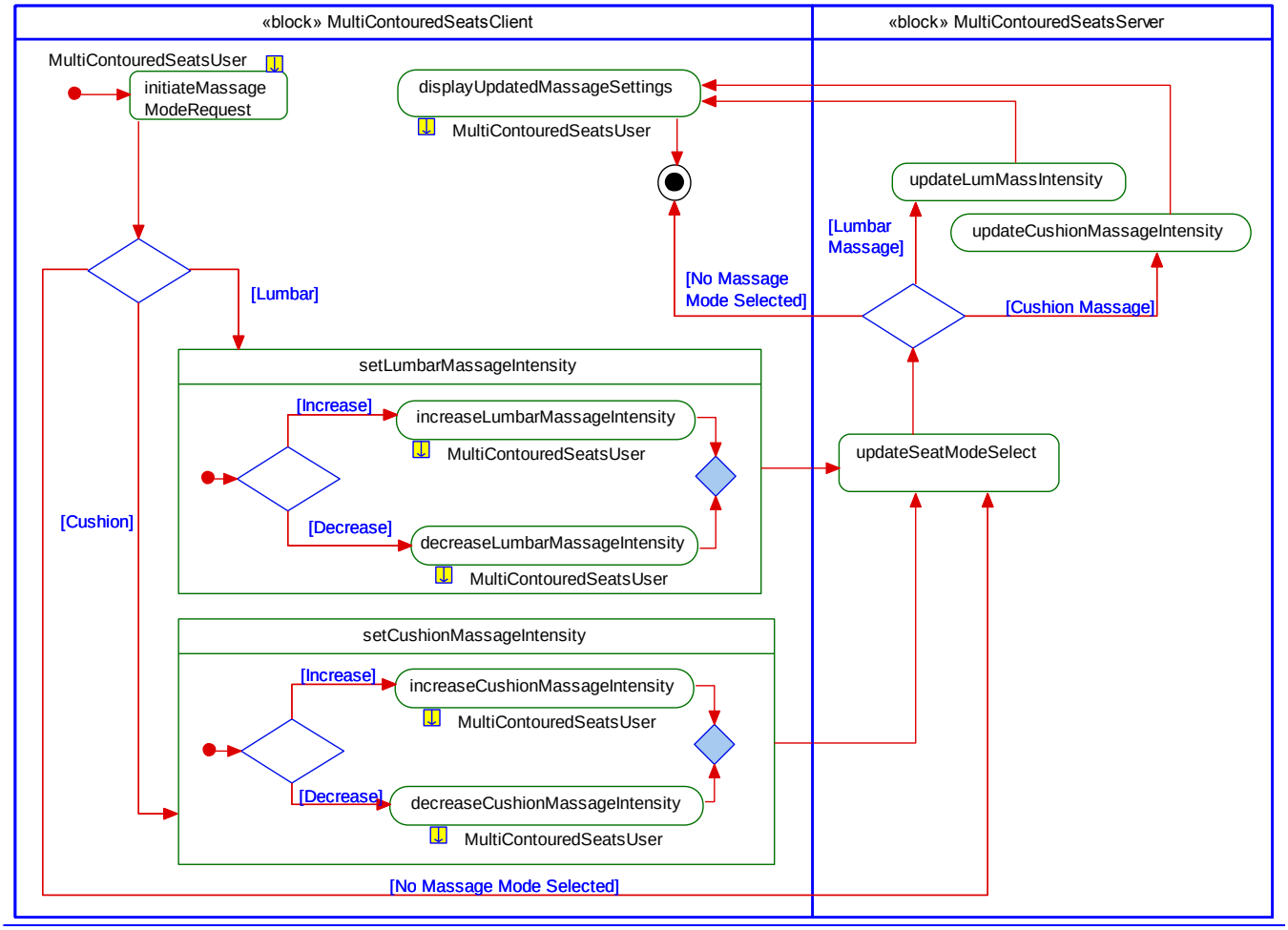
Actors	Vehicle Occupant
Pre-conditions	Display is ON, Ignition = Run Massage Screen is ON
Scenario Description	User exiting Massage and transitioning to Adjust bladder pressure via Seat.
Post-conditions	HMI Pop – Up indicates {Massage off and restoring seat settings}
List of Exception Use Cases	NA
Interfaces	G-HMI & vehicle system
Links to Referenced Use Cases	NA

2.2.2 White Box View

2.2.2.1 MCS-ACT-REQ-021325/A-Set Massage - Display Initiated (TcSE ROIN-198833-1)

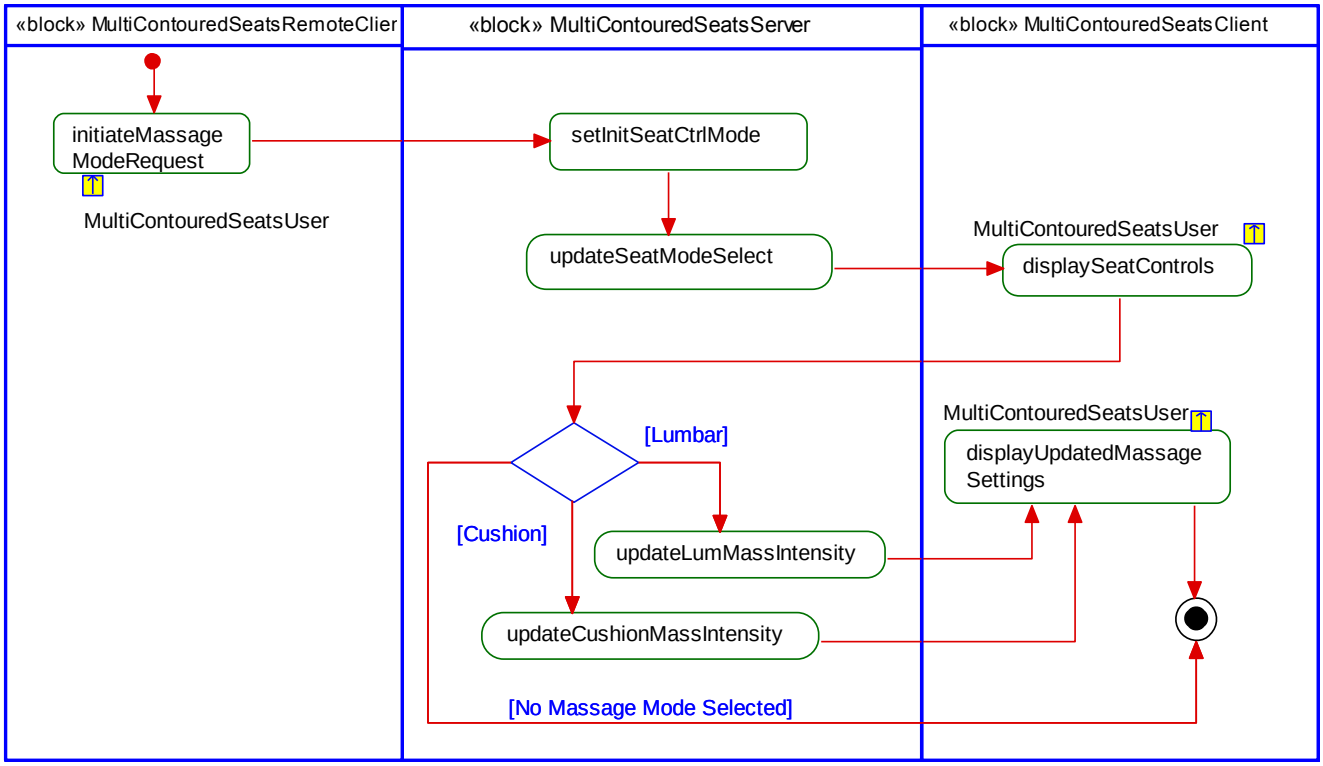
Activity Diagram


«block» MultiContouredSeatsClient
«block» MultiContouredSeatsServer
MultiContouredSeatsUser
initiateMassageModeRequest
displayUpdatedMassageSettings
MultiContouredSeatsUser
updateLumMassIntensity
updateCushionMassageIntensity
[Lumbar Massage]
[No Massage Mode Selected]
[Cushion Massage]
[Lumbar]
[Cushion]
setLumbarMassageIntensity
updateLumbarMassageIntensityHi
MultiContouredSeatsUser
[Hi]
[Lo]
updateLumbarMassageIntensityLo
MultiContouredSeatsUser
updateSeatModeSelect
setCushionMassageIntensity
updateCushionMassageIntensityHi
MultiContouredSeatsUser
[Hi]
[Lo]
updateCushionMassageIntensityLo
MultiContouredSeatsUser
[No Massage Mode Selected]



2.2.2.2 MCS-ACT-REQ-021331/A-Set Massage - Seat Initiated (TcSE ROIN-199577-1)

Activity Diagram



2.2.2.3 MCS-SD-REQ-021357/B-Set Cushion Massage Intensity to High from Touch Screen (TcSE ROIN-199000-1)

Scenarios

Normal Usage

User <selects High Cushion Massage Intensity> via Touch Screen HMI

Constraints

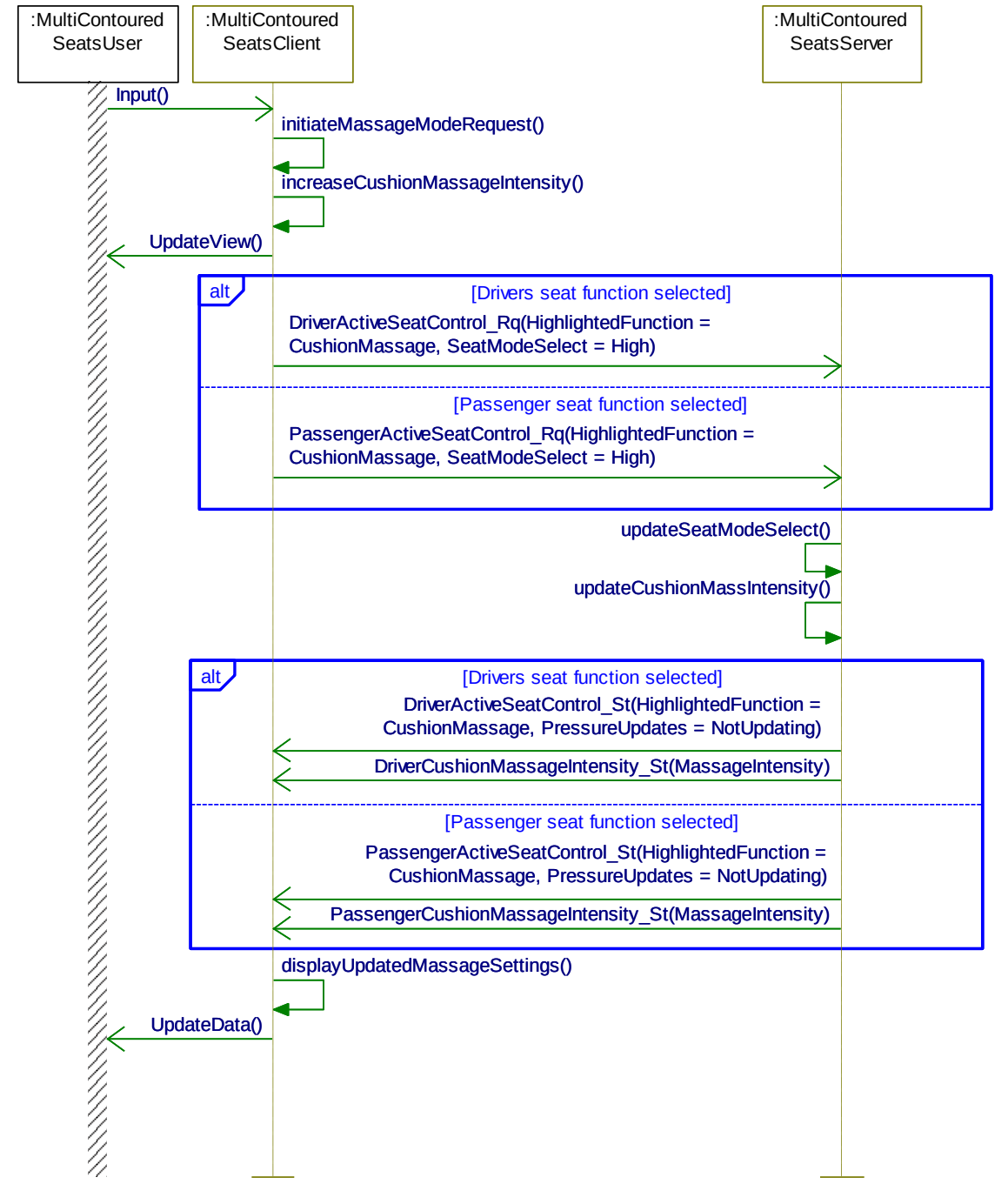
Pre-condition

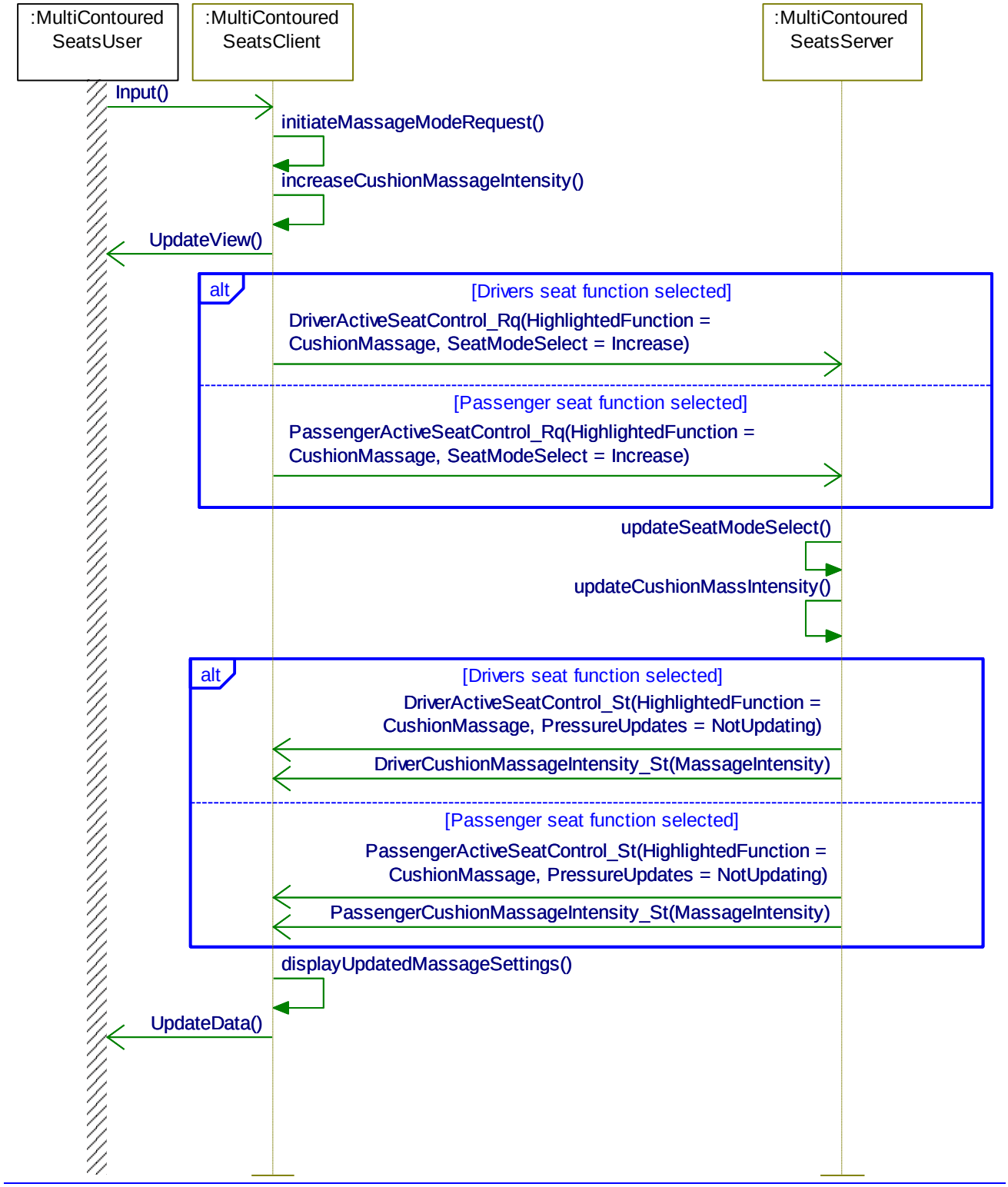
Display is ON

Post-condition

HMI indicates {changes to Cushion Massage Intensity}

Sequence Diagram


:MultiContoured SeatsUser
:MultiContoured SeatsClient
:MultiContoured SeatsServer
Input()
initiateMassageModeRequest()
increaseCushionMassageIntensity()
UpdateView()
alt
[Drivers seat function selected]
DriverActiveSeatControl_Rq(HighlightedFunction = CushionMassage, SeatModeSelect = High)
[Passenger seat function selected]
PassengerActiveSeatControl_Rq(HighlightedFunction = CushionMassage, SeatModeSelect = High)
updateSeatModeSelect()
updateCushionMassIntensity()
alt
[Drivers seat function selected]
DriverActiveSeatControl_St(HighlightedFunction = CushionMassage, PressureUpdates = NotUpdating)
DriverCushionMassageIntensity_St(MassageIntensity)
[Passenger seat function selected]
PassengerActiveSeatControl_St(HighlightedFunction = CushionMassage, PressureUpdates = NotUpdating)
PassengerCushionMassageIntensity_St(MassageIntensity)
displayUpdatedMassageSettings()
UpdateData()



2.2.2.4 MCS-SD-REQ-021358/B-Set Cushion Massage Intensity to Low from Touch Screen (TcSE ROIN-199007-1)

Scenarios

Normal Usage

User <selects Low Cushion Massage Intensity> via Touch Screen HMI

Constraints

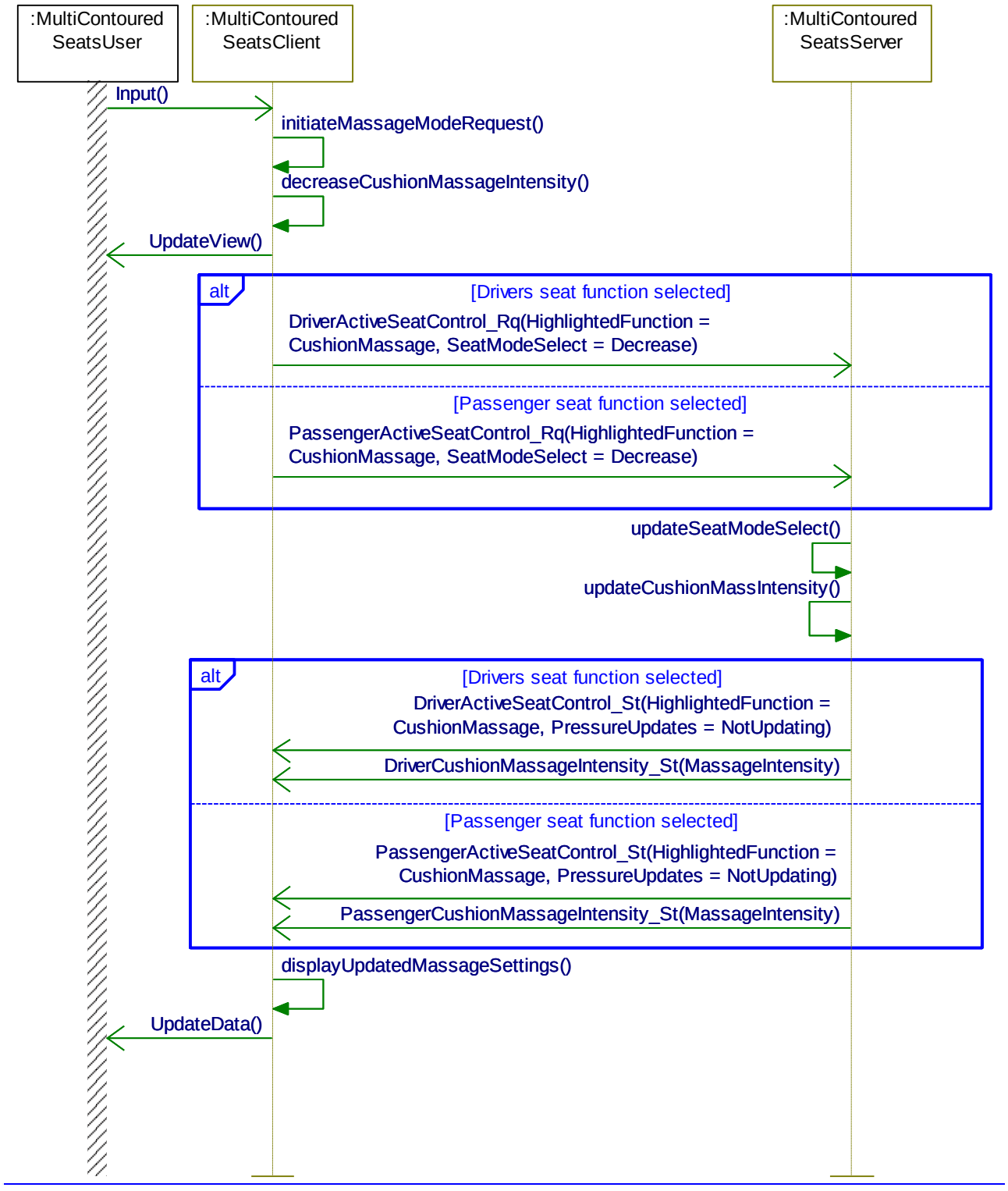
Pre-condition

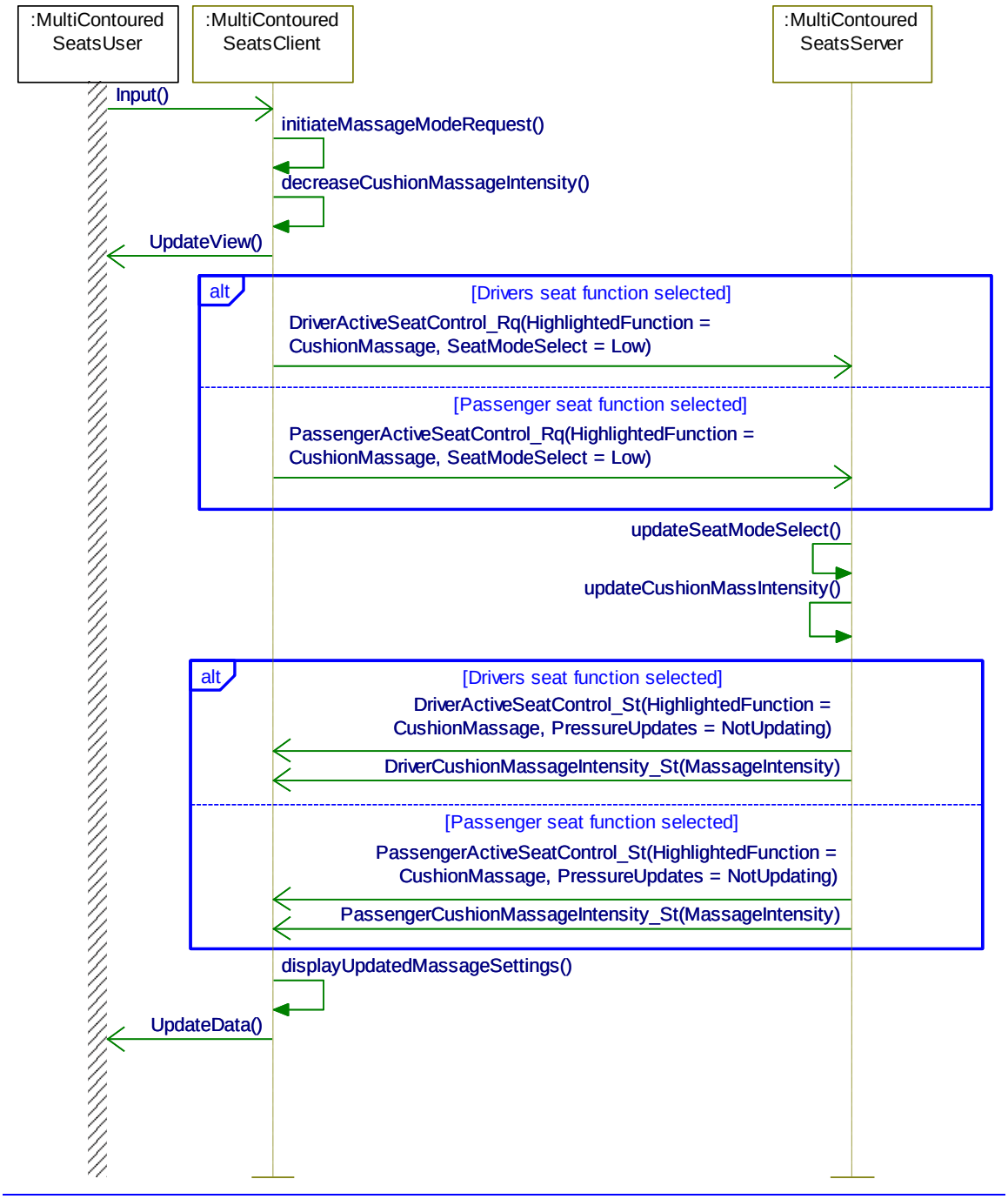
Display is ON

Post-condition

HMI indicates {changes to Cushion Massage Intensity}

Sequence Diagram


:MultiContoured SeatsUser
:MultiContoured SeatsClient
:MultiContoured SeatsServer
Input()
initiateMassageModeRequest()
decreaseCushionMassageIntensity()
UpdateView()
alt
[Drivers seat function selected]
DriverActiveSeatControl_Rq(HighlightedFunction = CushionMassage, SeatModeSelect = Decrease)
[Passenger seat function selected]
PassengerActiveSeatControl_Rq(HighlightedFunction = CushionMassage, SeatModeSelect = Decrease)
updateSeatModeSelect()
updateCushionMassIntensity()
alt
[Drivers seat function selected]
DriverActiveSeatControl_St(HighlightedFunction = CushionMassage, PressureUpdates = NotUpdating)
DriverCushionMassageIntensity_St(MassageIntensity)
[Passenger seat function selected]
PassengerActiveSeatControl_St(HighlightedFunction = CushionMassage, PressureUpdates = NotUpdating)
PassengerCushionMassageIntensity_St(MassageIntensity)
displayUpdatedMassageSettings()
UpdateData()



2.2.2.5 MCS-SD-REQ-021359/A-User selects cushion massage mode from Touch Screen and does not change intensity (TcSE ROIN-199014-1)

Scenarios

Normal Usage

User <selects Cushion Massage> via Touch Screen HMI

Constraints

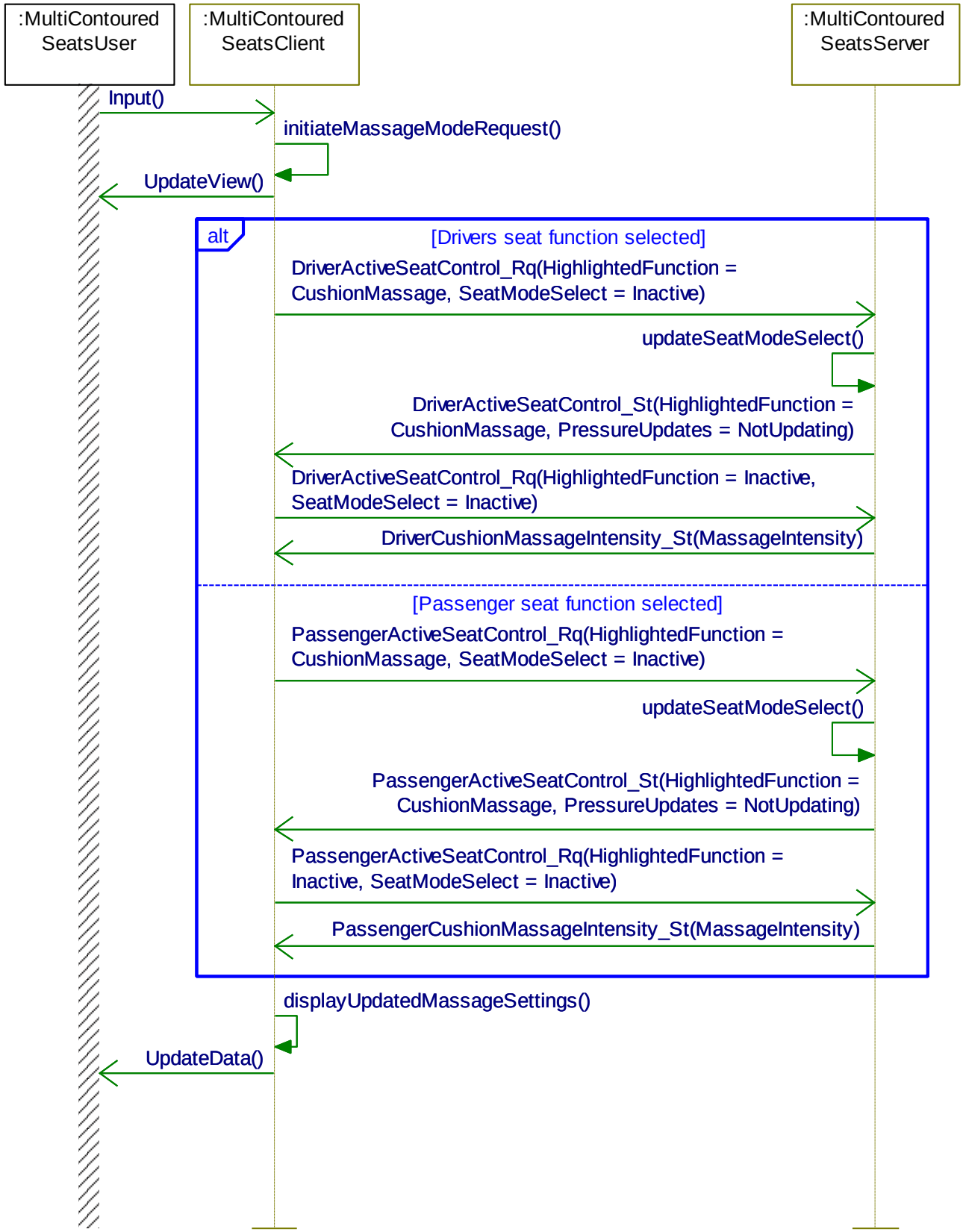
Pre-condition

Display is ON

Post-condition

HMI indicates {change to Cushion Massage Mode}

Sequence Diagram



2.2.2.6 MCS-SD-REQ-021360/B-Set Lumbar Massage Intensity to High from Touch Screen (TcSE ROIN-199021-1)

Scenarios

Normal Usage

User <Selects High Lumbar Massage Intensity> via Touch Screen HMI

Constraints

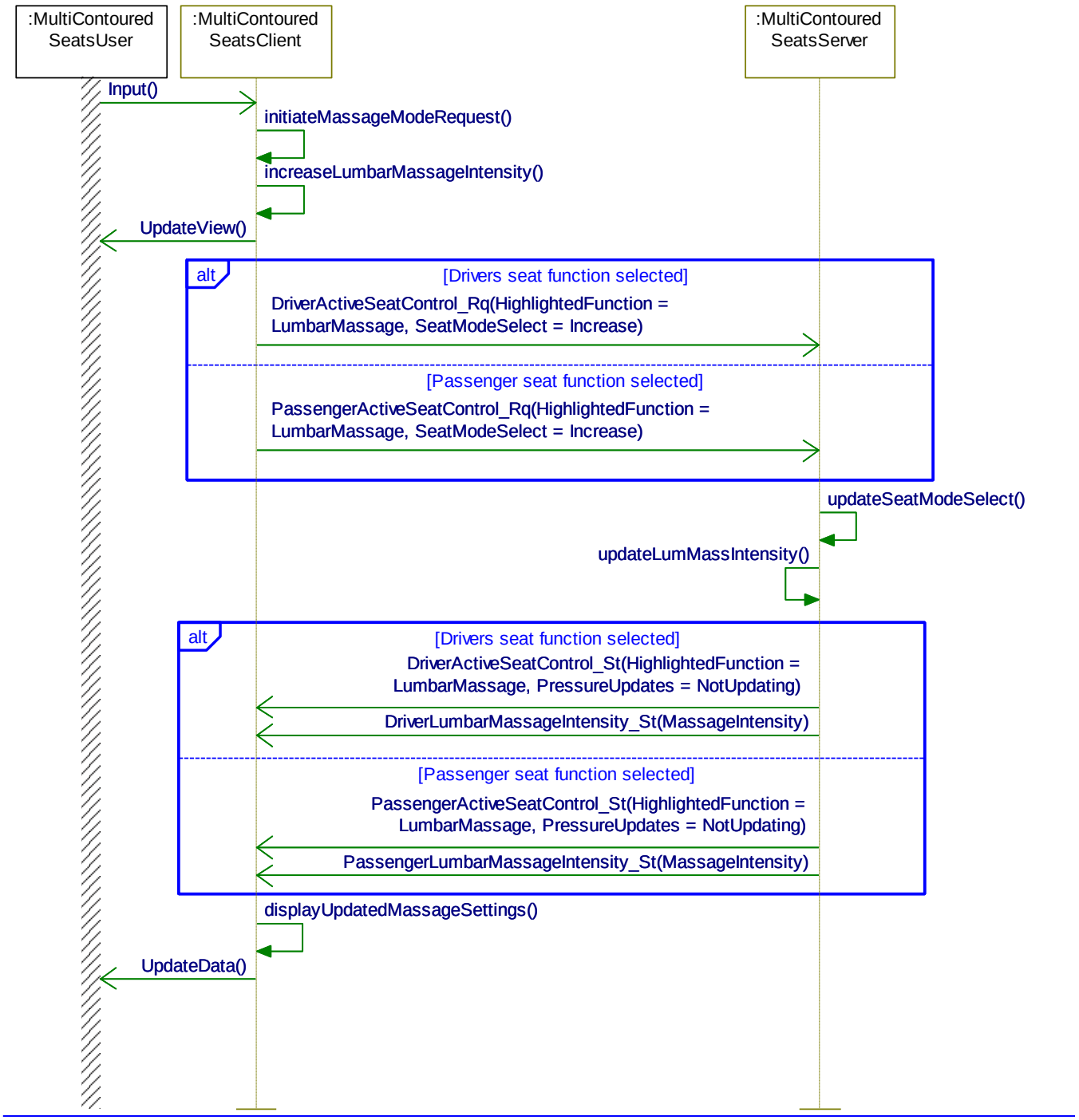
Pre-condition

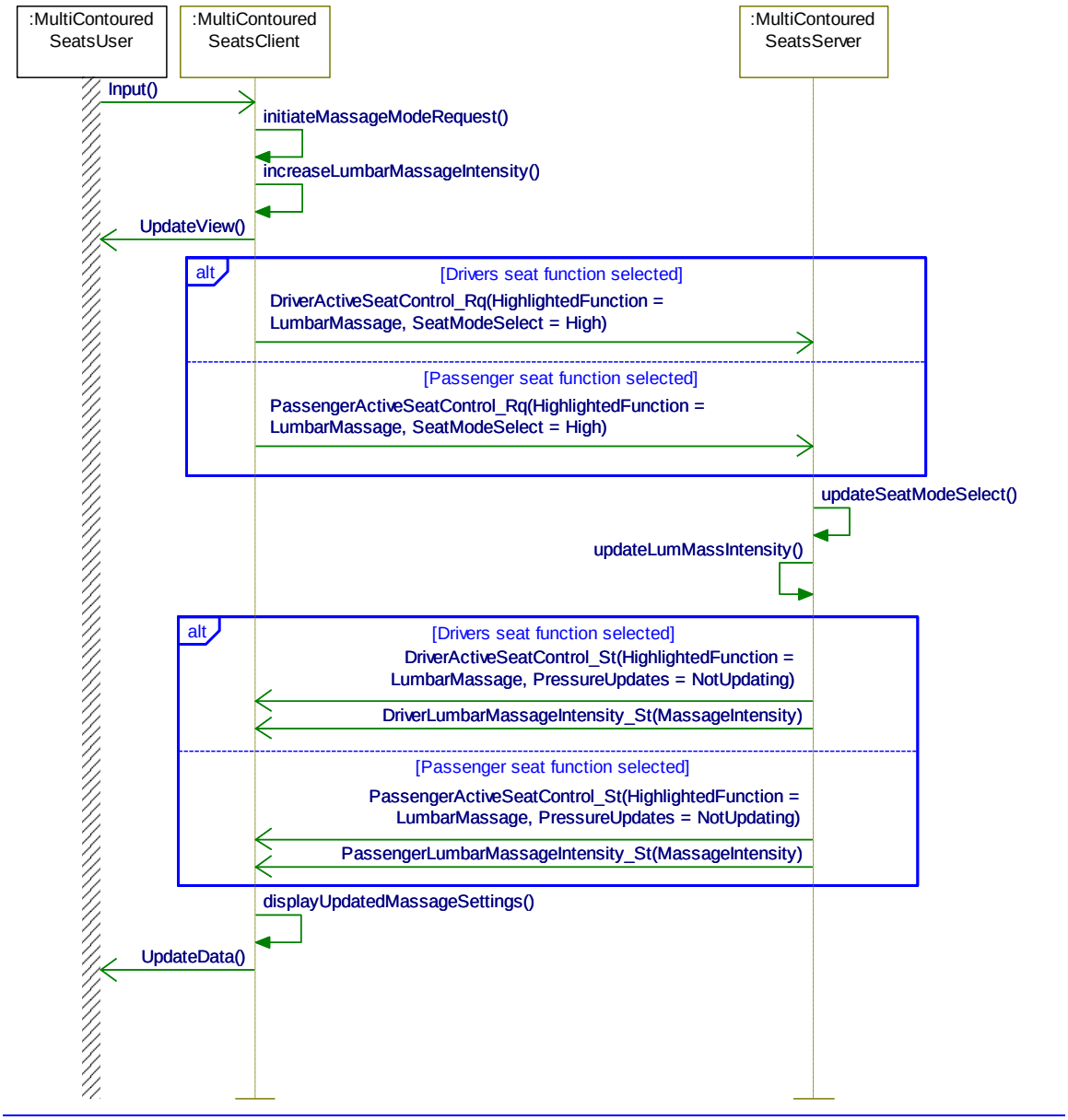
Display is ON

Post-condition

HMI indicates {changes to Lumbar Massage Intensity}

Sequence Diagram


:MultiContoured SeatsUser
:MultiContoured SeatsClient
:MultiContoured SeatsServer
Input()
initiateMassageModeRequest()
increaseLumbarMassageIntensity()
UpdateView()
alt
[Drivers seat function selected]
DriverActiveSeatControl_Rq(HighlightedFunction = LumbarMassage, SeatModeSelect = Increase)
[Passenger seat function selected]
PassengerActiveSeatControl_Rq(HighlightedFunction = LumbarMassage, SeatModeSelect = Increase)
updateSeatModeSelect()
updateLumMassIntensity()
alt
[Drivers seat function selected]
DriverActiveSeatControl_St(HighlightedFunction = LumbarMassage, PressureUpdates = NotUpdating)
DriverLumbarMassageIntensity_St(MassageIntensity)
[Passenger seat function selected]
PassengerActiveSeatControl_St(HighlightedFunction = LumbarMassage, PressureUpdates = NotUpdating)
PassengerLumbarMassageIntensity_St(MassageIntensity)
displayUpdatedMassageSettings()
UpdateData()



2.2.2.7 MCS-SD-REQ-021361/B-Set Lumbar Massage Intensity to Low from Touch Screen (TcSE ROIN-199028-1)

Scenarios

Normal Usage

User <selects Low Lumbar Massage Intensity> via Touch Screen HMI

Constraints

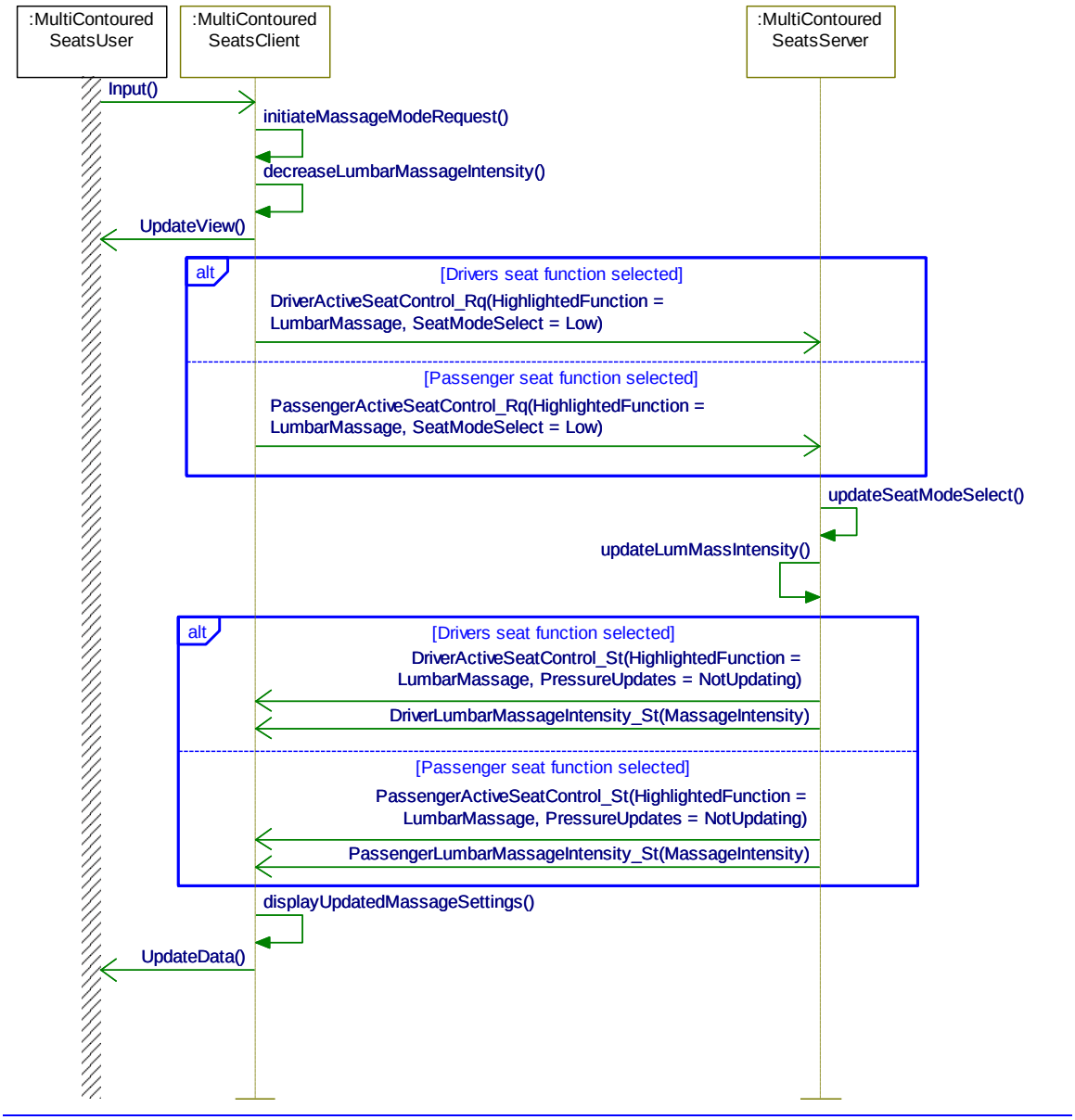
Pre-condition

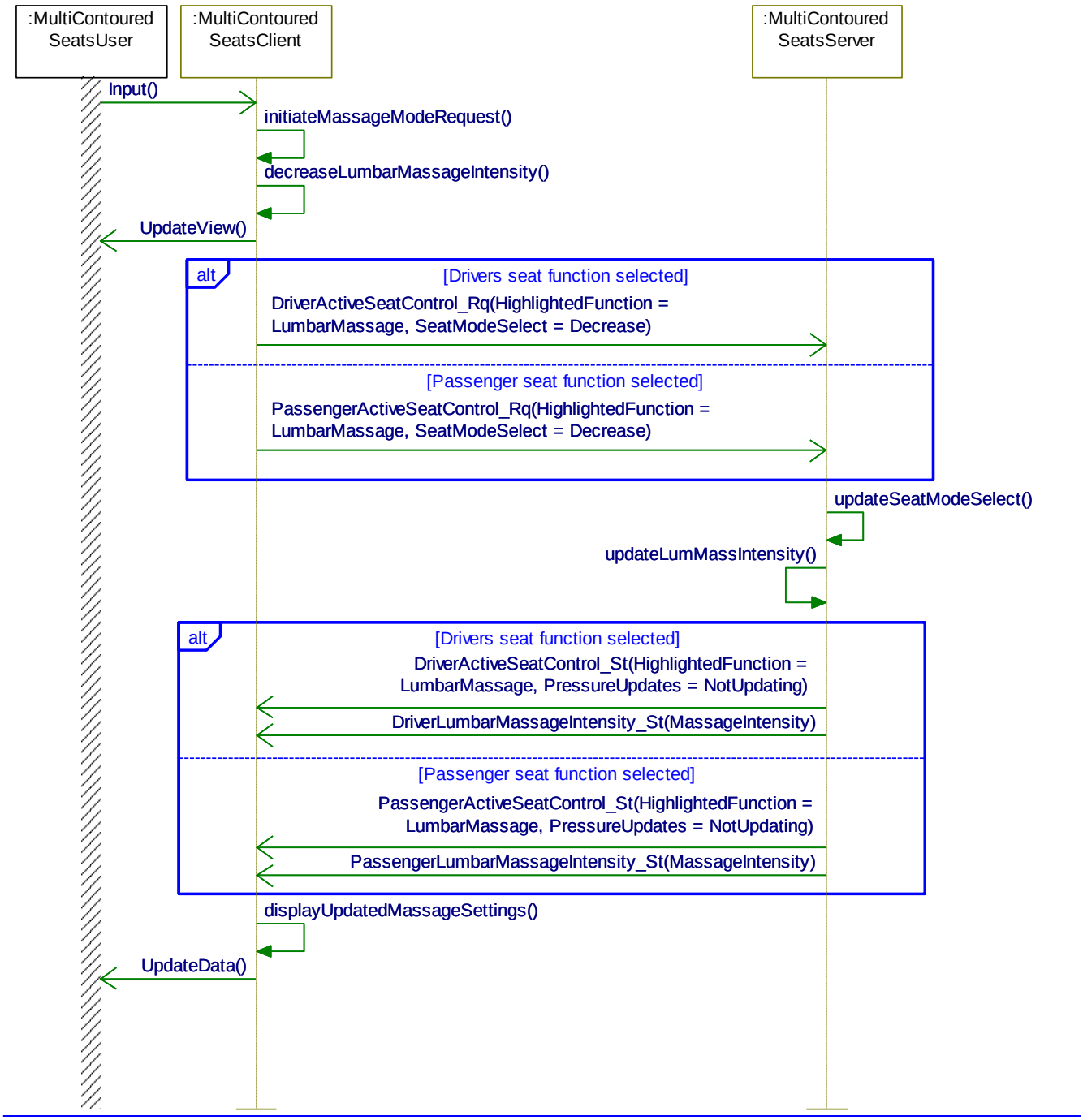
Display is ON

Post-condition

HMI indicates {changes to Lumbar Massage Intensity}

Sequence Diagram


:MultiContoured SeatsUser
:MultiContoured SeatsClient
:MultiContoured SeatsServer
Input()
initiateMassageModeRequest()
decreaseLumbarMassageIntensity()
UpdateView()
alt
[Drivers seat function selected]
DriverActiveSeatControl_Rq(HighlightedFunction = LumbarMassage, SeatModeSelect = Low)
[Passenger seat function selected]
PassengerActiveSeatControl_Rq(HighlightedFunction = LumbarMassage, SeatModeSelect = Low)
updateSeatModeSelect()
updateLumMassIntensity()
alt
[Drivers seat function selected]
DriverActiveSeatControl_St(HighlightedFunction = LumbarMassage, PressureUpdates = NotUpdating)
DriverLumbarMassageIntensity_St(MassageIntensity)
[Passenger seat function selected]
PassengerActiveSeatControl_St(HighlightedFunction = LumbarMassage, PressureUpdates = NotUpdating)
PassengerLumbarMassageIntensity_St(MassageIntensity)
displayUpdatedMassageSettings()
UpdateData()



2.2.2.8 MCS-SD-REQ-021362/A-User select Lumbar Massage Mode from Touch Screen and does not change intensity (TcSE ROIN-199035-1)

Scenarios

Normal Usage

User <selects Lumbar Massage> via Touch Screen HMI

Constraints

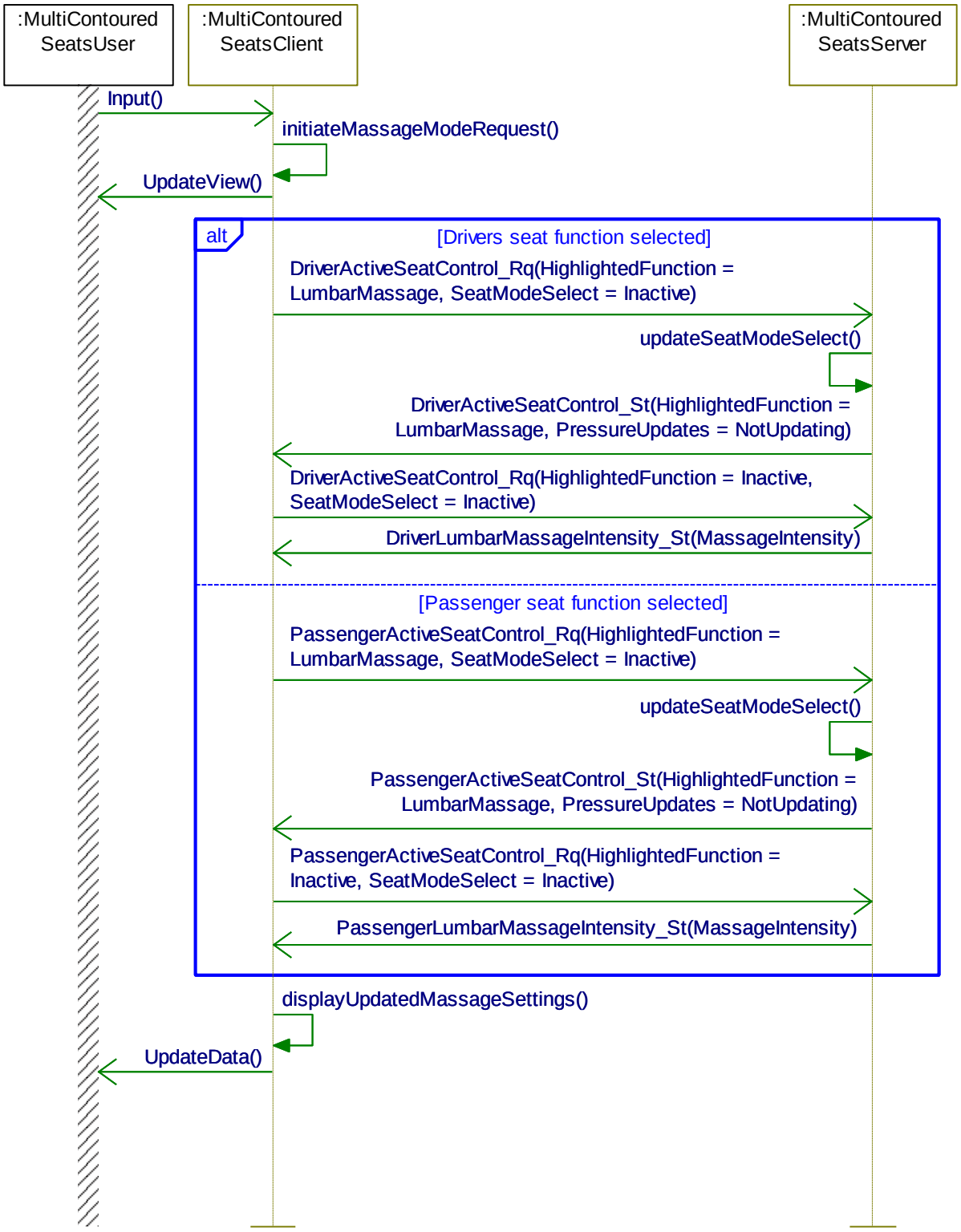
Pre-condition

Display is ON

Post-condition

HMI indicates {change to Lumbar Massage}

Sequence Diagram



2.2.2.9 MCS-SD-REQ-021363/A-Set Lumbar Massage Intensity from Seat (TcSE ROIN-200191-1)

Scenarios

Normal Usage

User <selects Set Lumbar Massage to Off, Low, or High> via Seat HMI.

Constraints

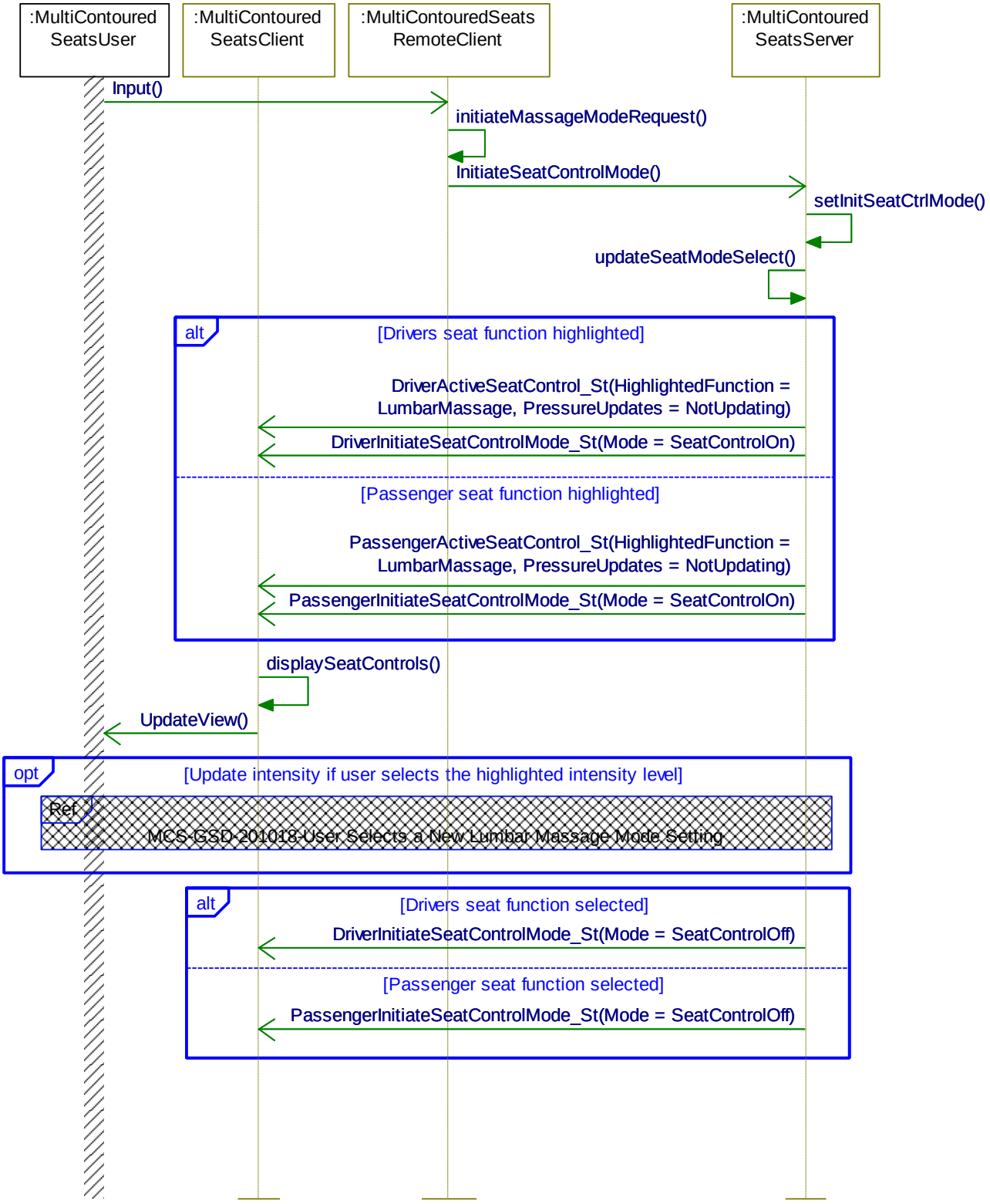
Pre-condition

Display is ON

Post-condition

HMI indicates {changes to Lumbar Massage Mode}

Sequence Diagram



2.2.2.10 MCS-SD-REQ-021364/A-User Selects a New Lumbar Massage Mode Setting (TcSE ROIN-201018-1)

Linked Elements

MCS-SD-REQ-021363/A-Set Lumbar Massage Intensity from Seat (TcSE ROIN-200191-1)

Scenarios

Normal Usage

User <selects Massage mode intensity change> via seat HMI

Constraints

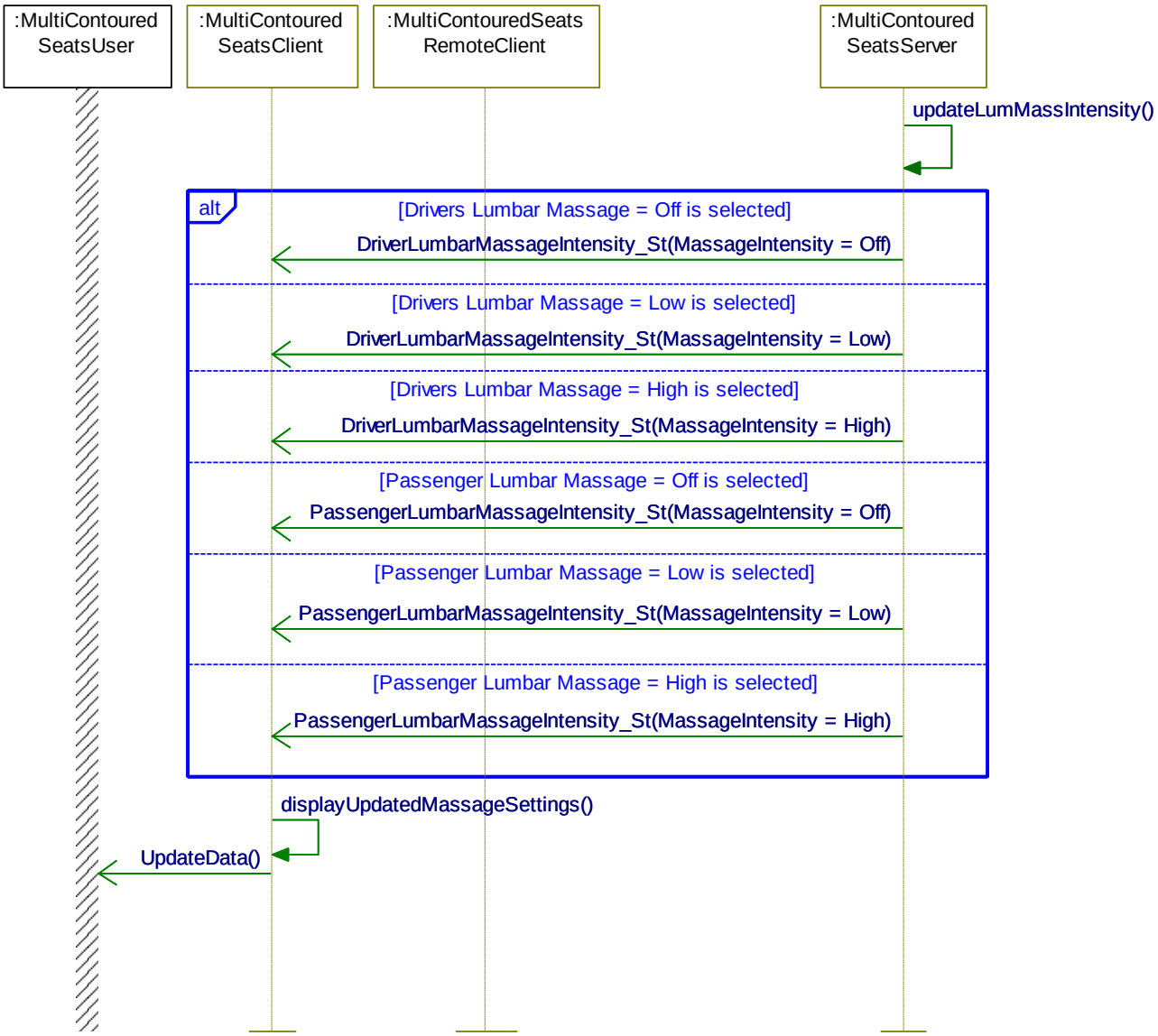
Pre-condition

Previous lumbar massage mode selection is active

Post-condition

HMI indicates {changes to Lumbar Massage Mode}

Sequence Diagram



2.2.2.11 MCS-SD-REQ-021365/A-Set Cushion Massage Intensity from Seat (TcSE ROIN-201032-1)

Scenarios

Normal Usage

User <selects Set Cushion Massage to Off, Low, or High> via Seat HMI

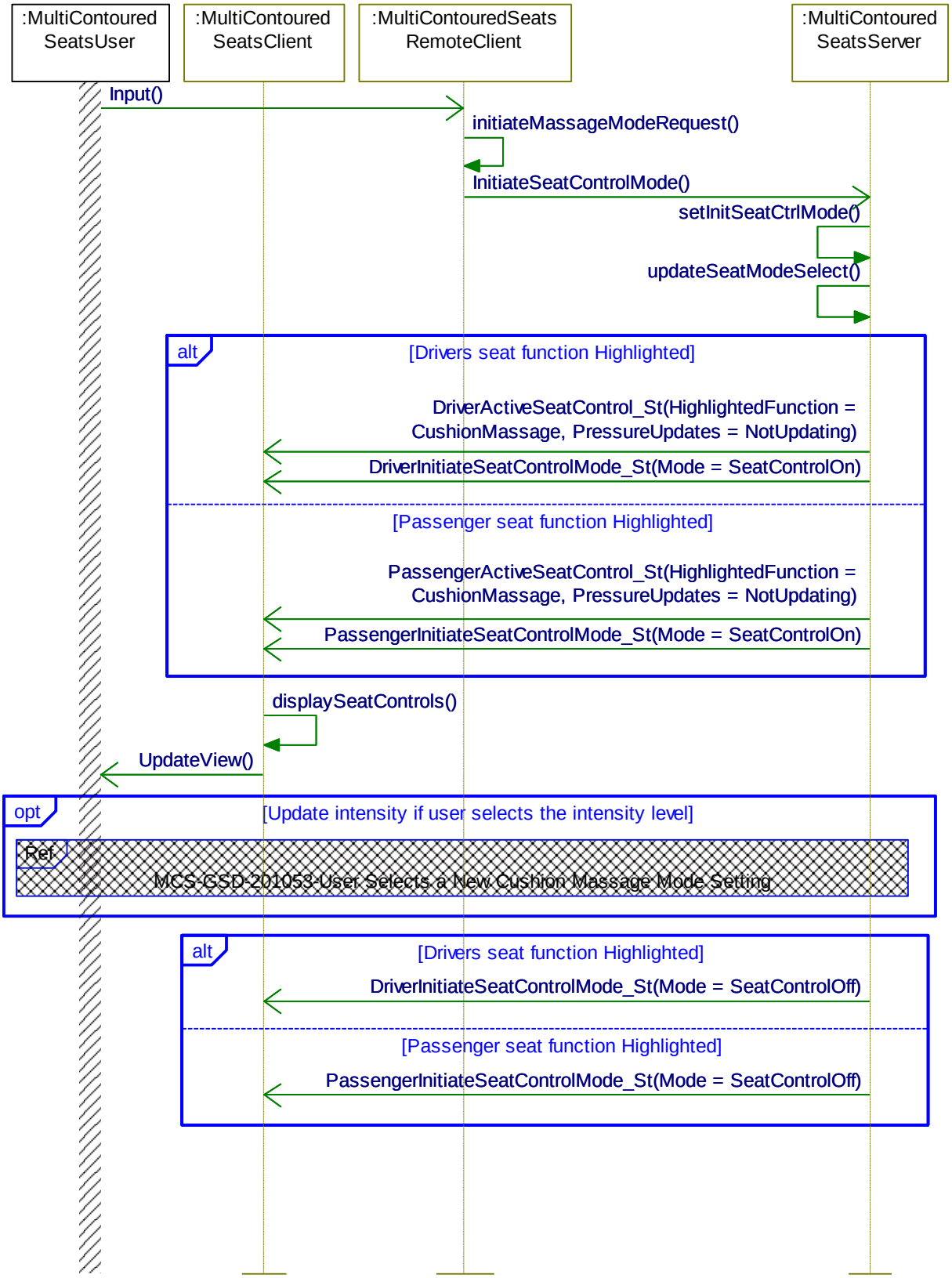
Constraints

Pre-condition

Display is ON

Post-condition
HMI indicates {changes to Cushion Massage Intensity}

Sequence Diagram



2.2.2.12 MCS-SD-REQ-021366/A-User Selects a New Cushion Massage Mode Setting (TcSE ROIN-201053-1)

Linked Elements

MCS-SD-REQ-021365/A-Set Cushion Massage Intensity from Seat (TcSE ROIN-201032-1)

Scenarios

Normal Usage

User <selects Massage mode intensity change> via seat HMI.

Constraints

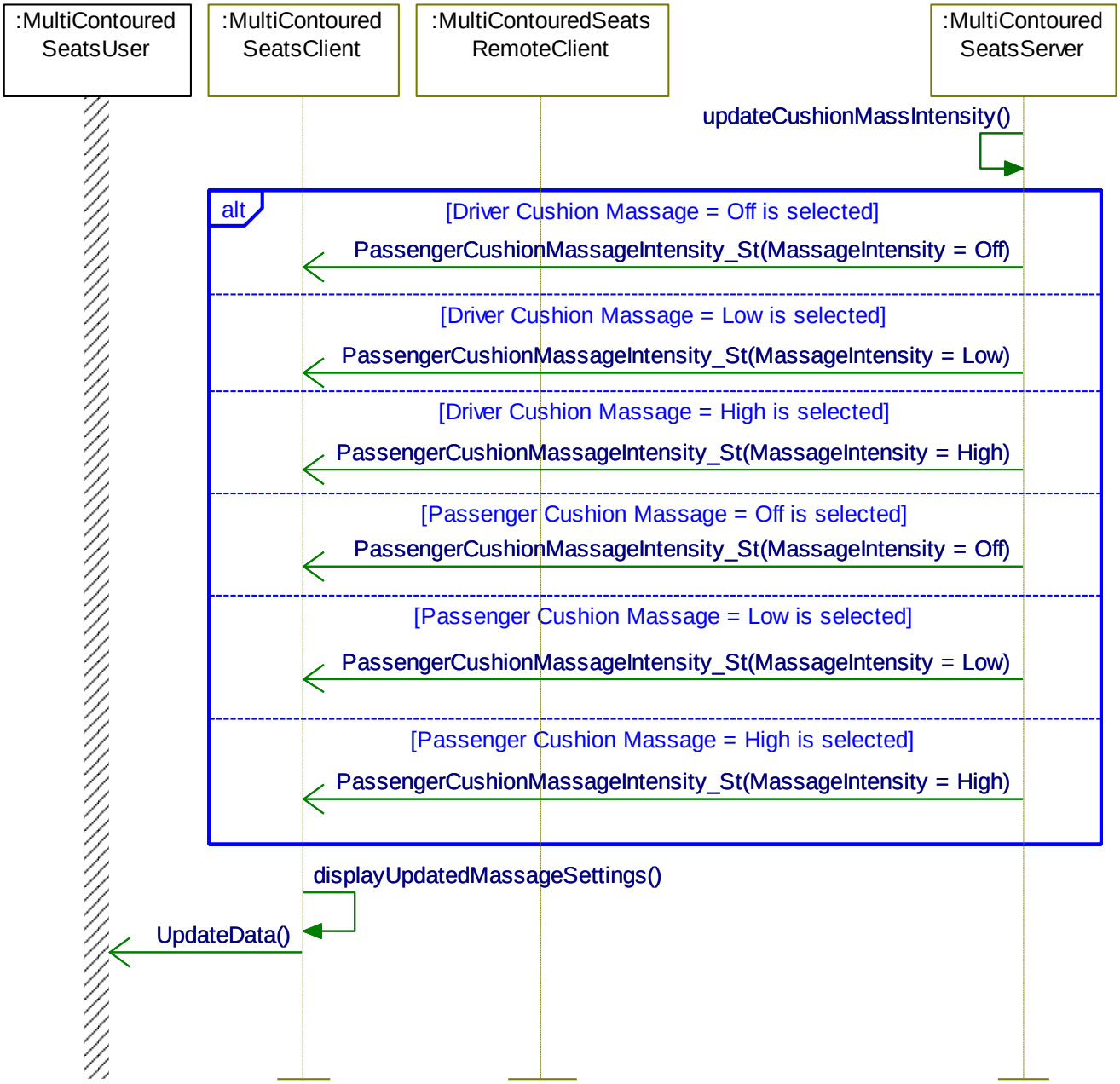
Pre-condition

Previous Cushion massage mode selection is active

Post-condition

HMI indicates {changes to Cushion Massage Mode}

Sequence Diagram



2.3 MCS-FUN-REQ-021367/A-Set Bolster (TcSE ROIN-293505-1)

2.3.1 Use Cases

2.3.1.1 MCS-UC-REQ-021368/A-Adjust Front Seat Bolster Bladder from HMI (TcSE ROIN-293588)

Actors	Vehicle Occupant
Pre-conditions	Display is ON, Ignition = Run
Scenario Description	User Selects Upper or Lower < Adjust Bolster Pressure> via HMI

Post-conditions	HMI indicates (Mode & Intensity}
List of Exception Use Cases	NA
Interfaces	G-HMI & vehicle system
Links to Referenced Use Cases	NA

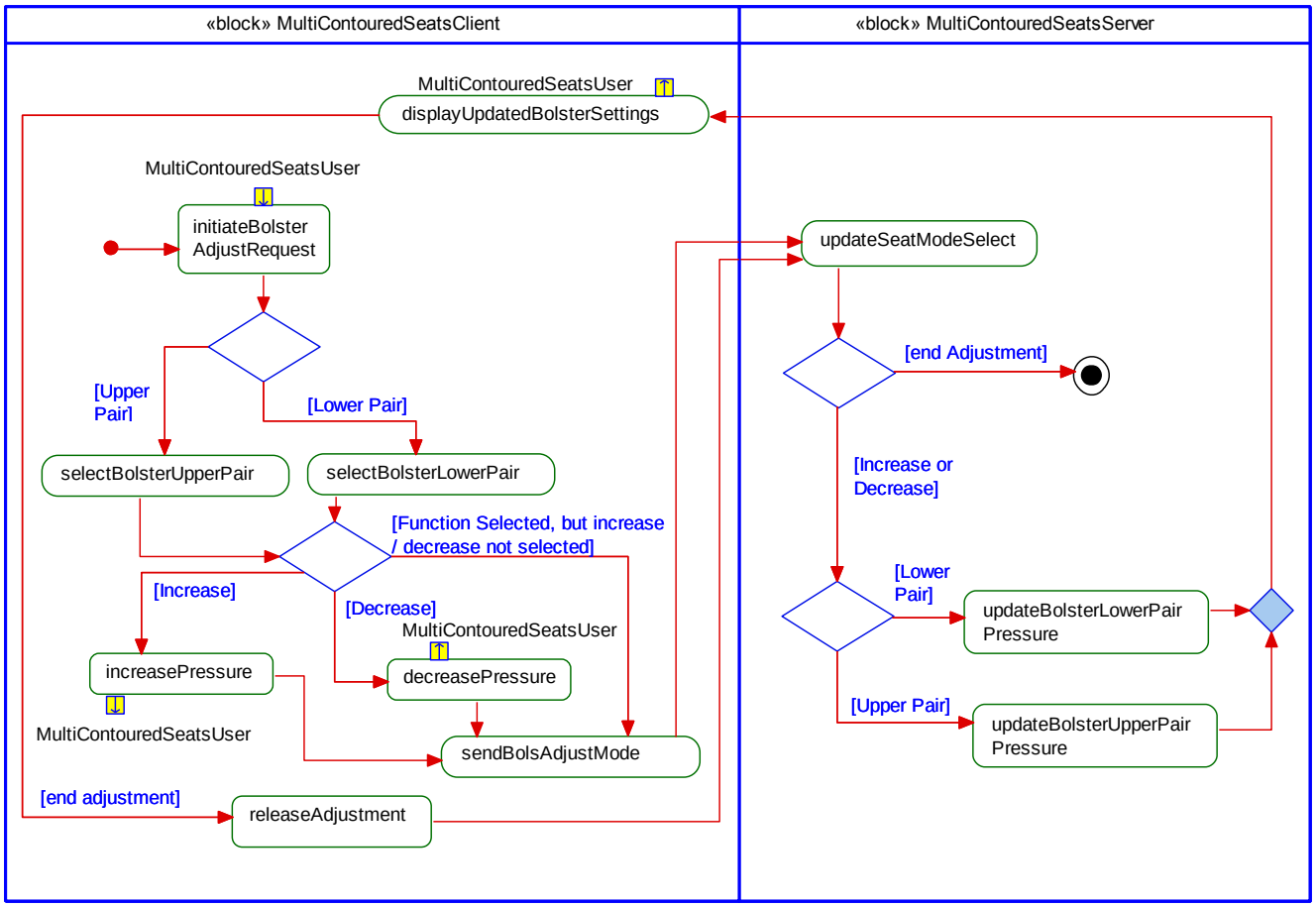
2.3.1.2 MCS-UC-REQ-021369/A-Adjust Front Seat Bolster Bladder from Seat (TcSE ROIN-293589)

Actors	Vehicle Occupant
Pre-conditions	Display is ON, Ignition = Run
Scenario Description	User Selects Upper or Lower < Adjust Bolster Pressure> via seat module
Post-conditions	HMI indicates (Mode & Intensity}
List of Exception Use Cases	NA
Interfaces	G-HMI & vehicle system
Links to Referenced Use Cases	NA

2.3.2 White Box View

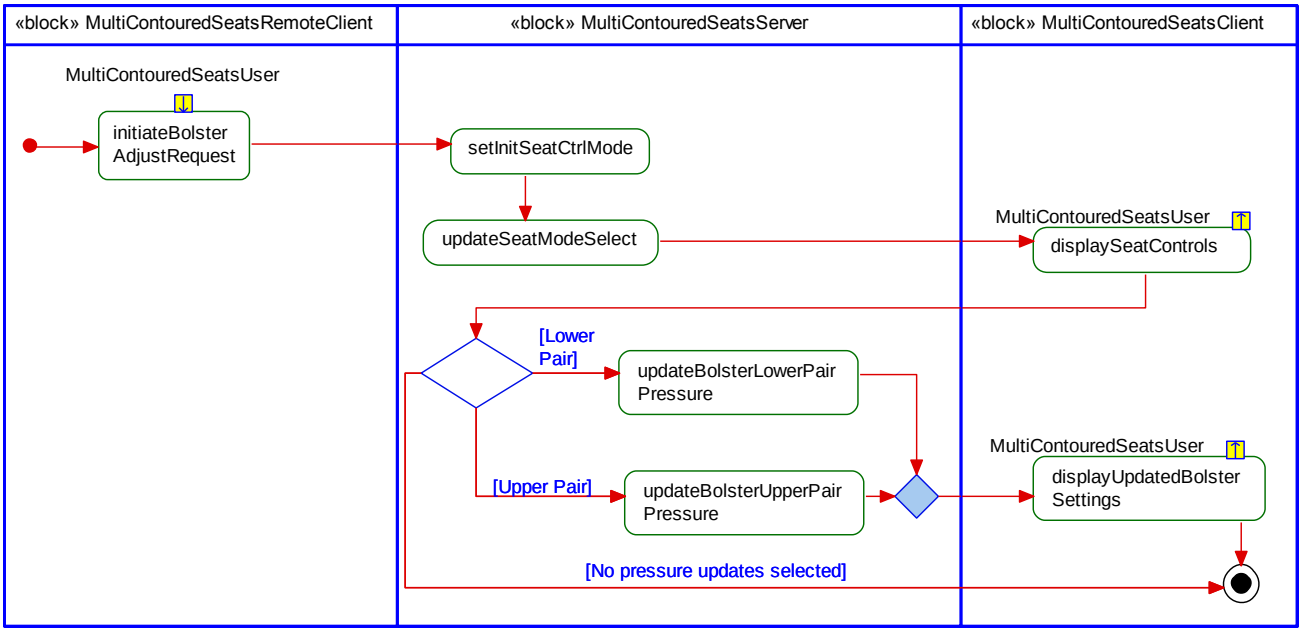
2.3.2.1 MCS-ACT-REQ-021326/A-Set Bolster - Display Initiated (TcSE ROIN-198835-1)

Activity Diagram



2.3.2.2 MCS-ACT-REQ-021330/A-Set Bolster- Seat Iinitiated (TcSE ROIN-199575-1)

Activity Diagram



2.3.2.3 MCS-SD-REQ-021370/A-Set Bolster Lower Pair from Seat (TcSE ROIN-199083-1)

Scenarios

Normal Usage

User <selects Set Bolster Lower Pair of Bladders> via seat HMI

Constraints

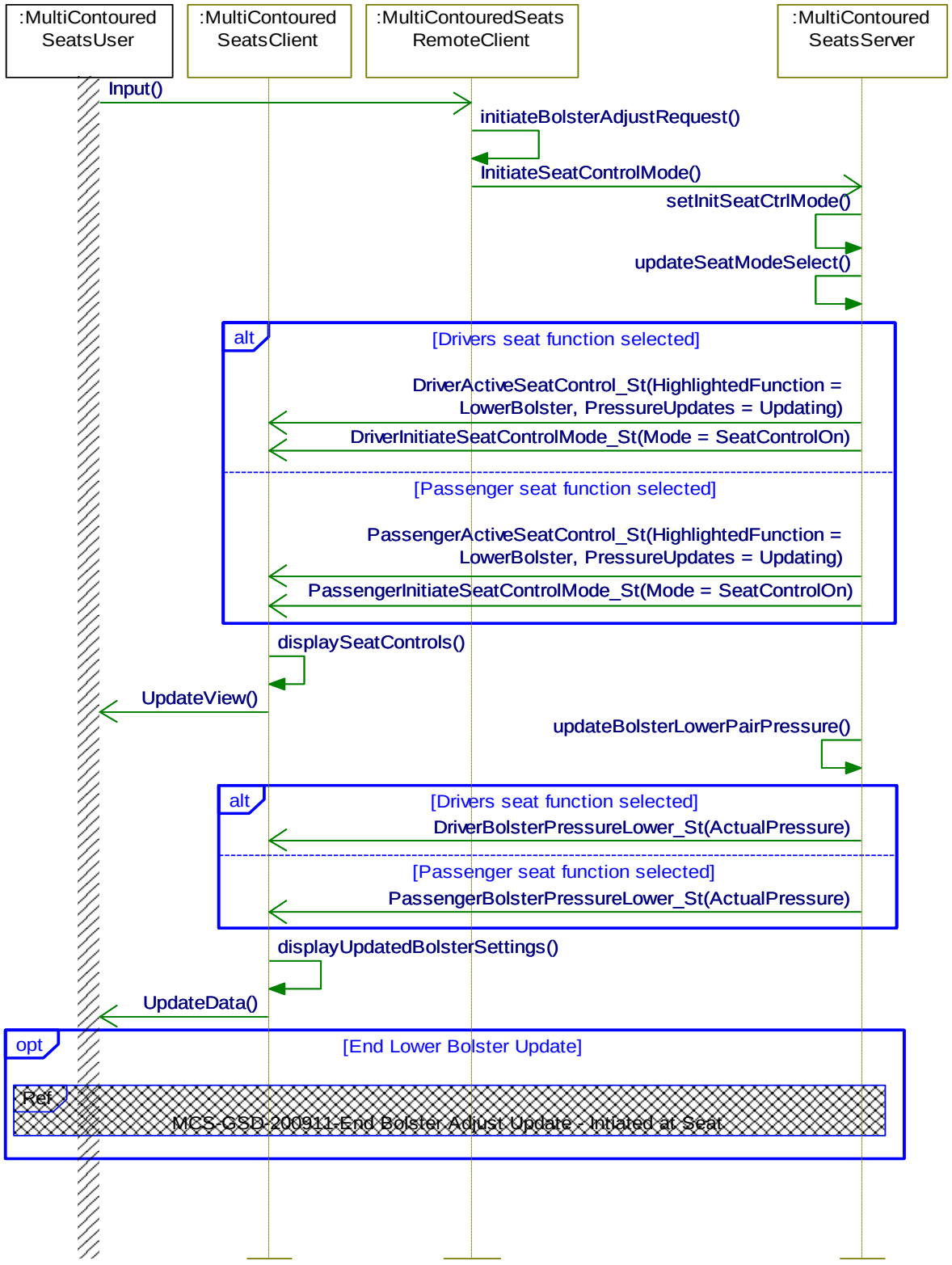
Pre-condition

Display is ON

Post-condition

HMI indicates {change Actual Pressure Settings as Seat Bladder pressure changes}

Sequence Diagram



2.3.2.4 MCS-SD-REQ-021371/A-Increase Bolster Lower Bladders from Touch Screen (TcSE ROIN-199090-1)

Scenarios

Normal Usage

User <selects increase Bolster Lower Pair of Bladders> via touch screen HMI

Constraints

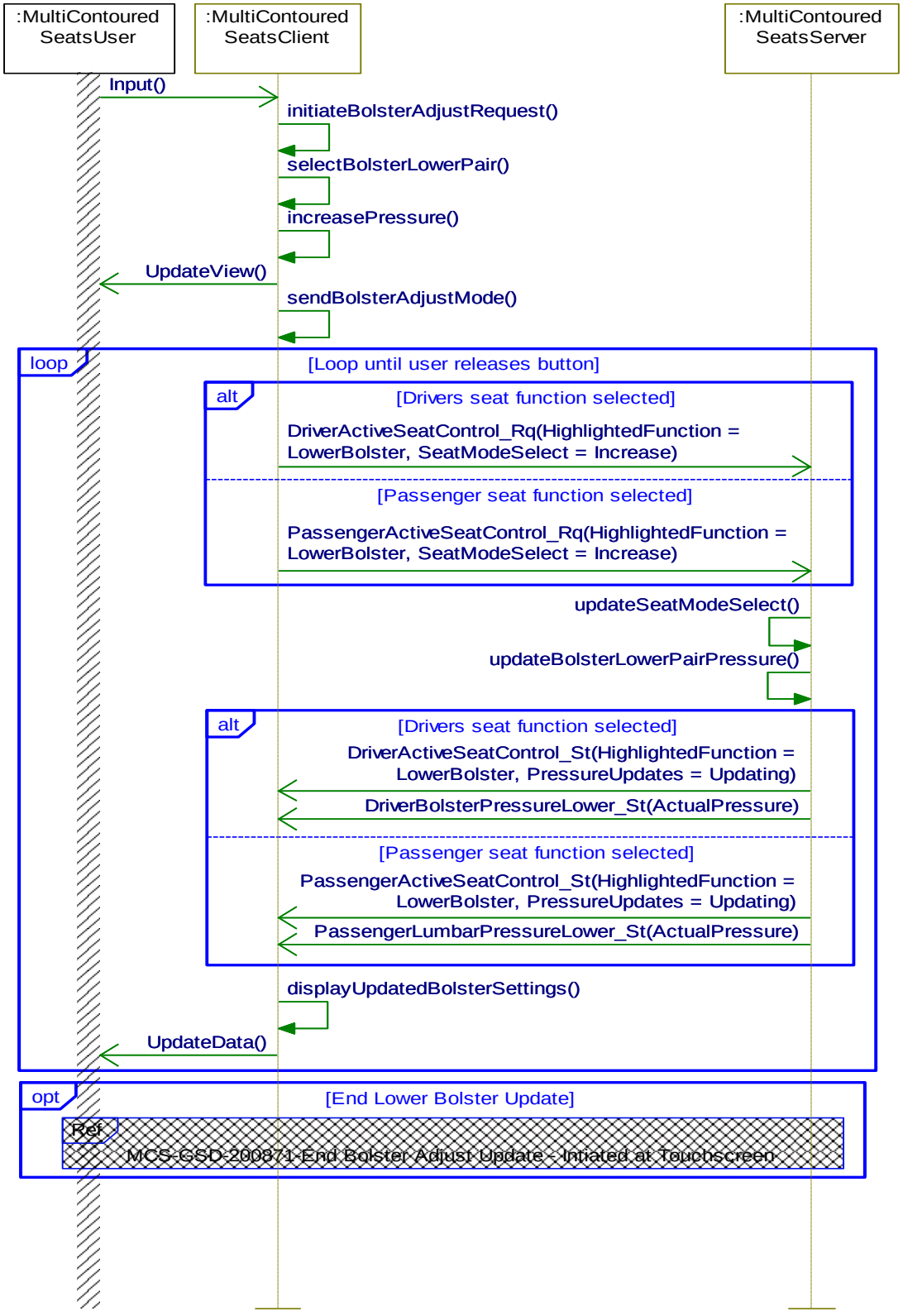
Pre-condition

Display is ON

Post-condition

HMI indicates {change Actual Pressure Settings as Seat Bladder pressure changes}

Sequence Diagram



2.3.2.5 MCS-SD-REQ-021372/A-Decrease Bolster Upper Bladders from Touch Screen (TcSE ROIN-199097-1)

Scenarios

Normal Usage

User <selects decrease Bolster Upper Pair of Bladders> via touch screen HMI

Constraints

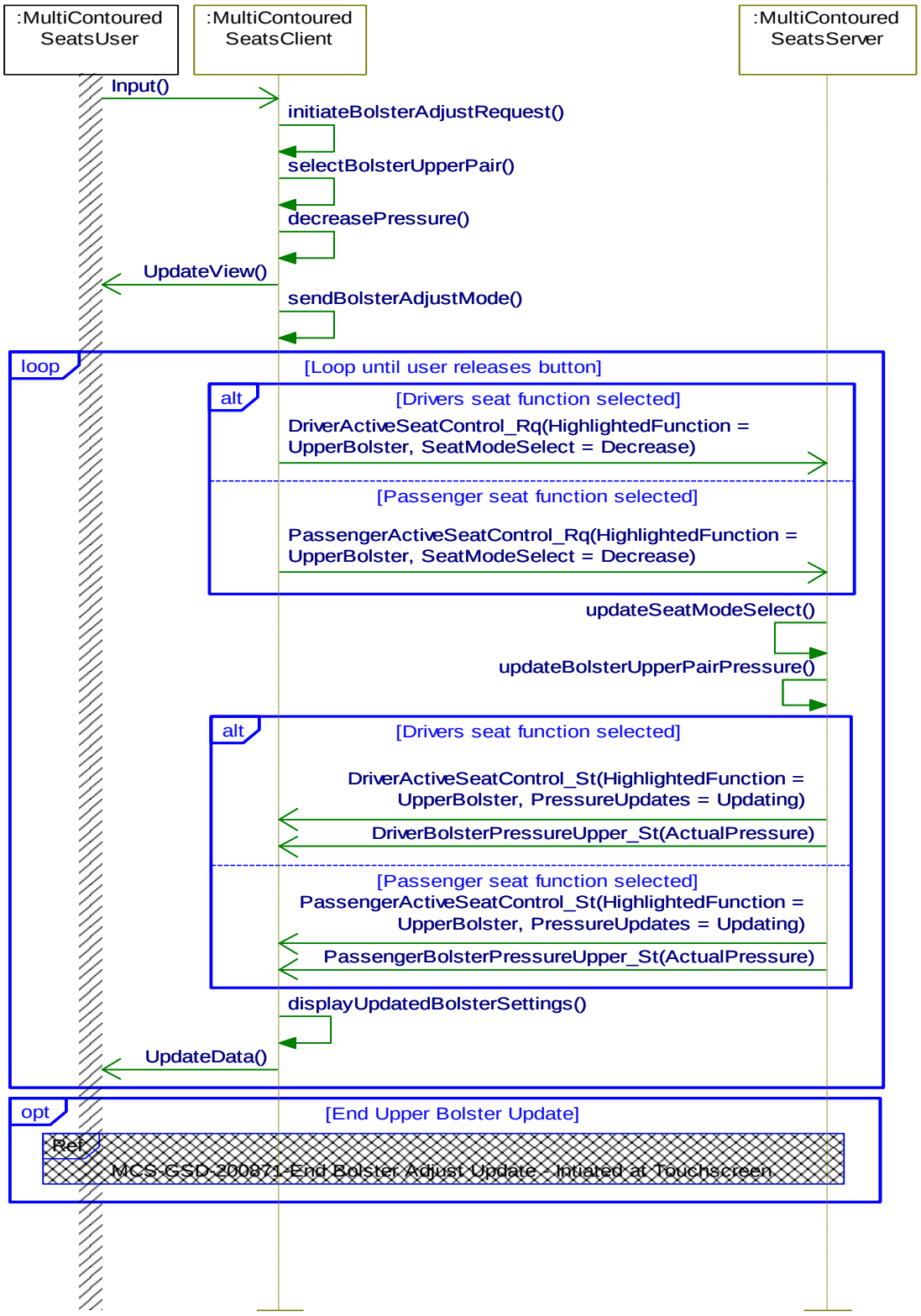
Pre-condition

Display is ON

Post-condition

HMI indicates {change Actual Pressure Settings as Seat Bladder pressure changes}

Sequence Diagram



2.3.2.6 MCS-SD-REQ-021373/A-Decrease Bolster Lower Bladders from Touch Screen (TcSE ROIN-199104-1)

Scenarios

Normal Usage

User <selects decrease Bolster Lower Pair of Bladders> via touch screen HMI

Constraints

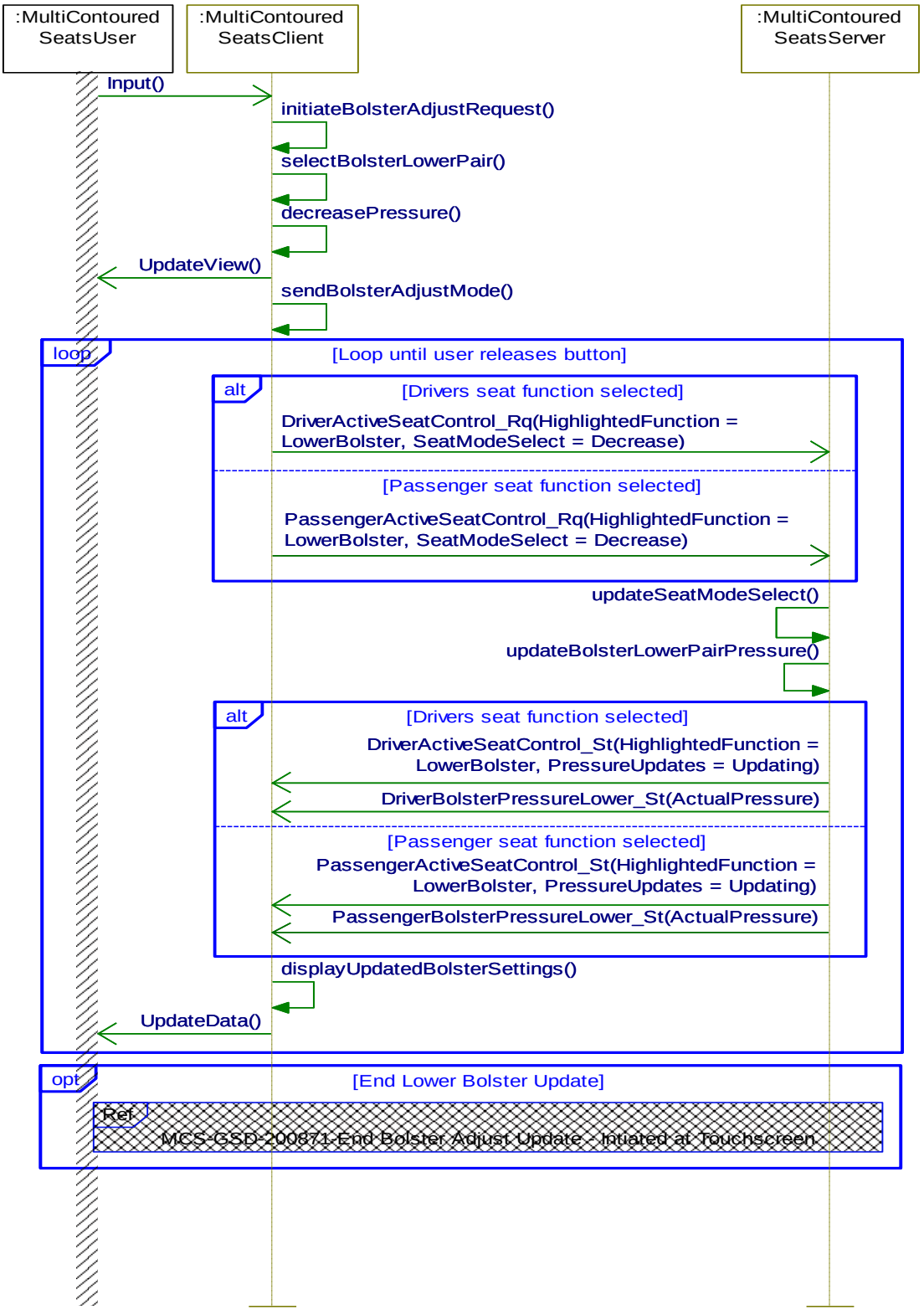
Pre-condition

Display is ON

Post-condition

HMI indicates {change Actual Pressure Settings as Seat Bladder pressure changes}

Sequence Diagram



2.3.2.7 MCS-SD-REQ-021374/A-Set Bolster Upper Pair from Seat (TcSE ROIN-199111-1)

Scenarios

Normal Usage

User <selects Set Bolster Upper Pair of Bladders> via seat HMI

Constraints

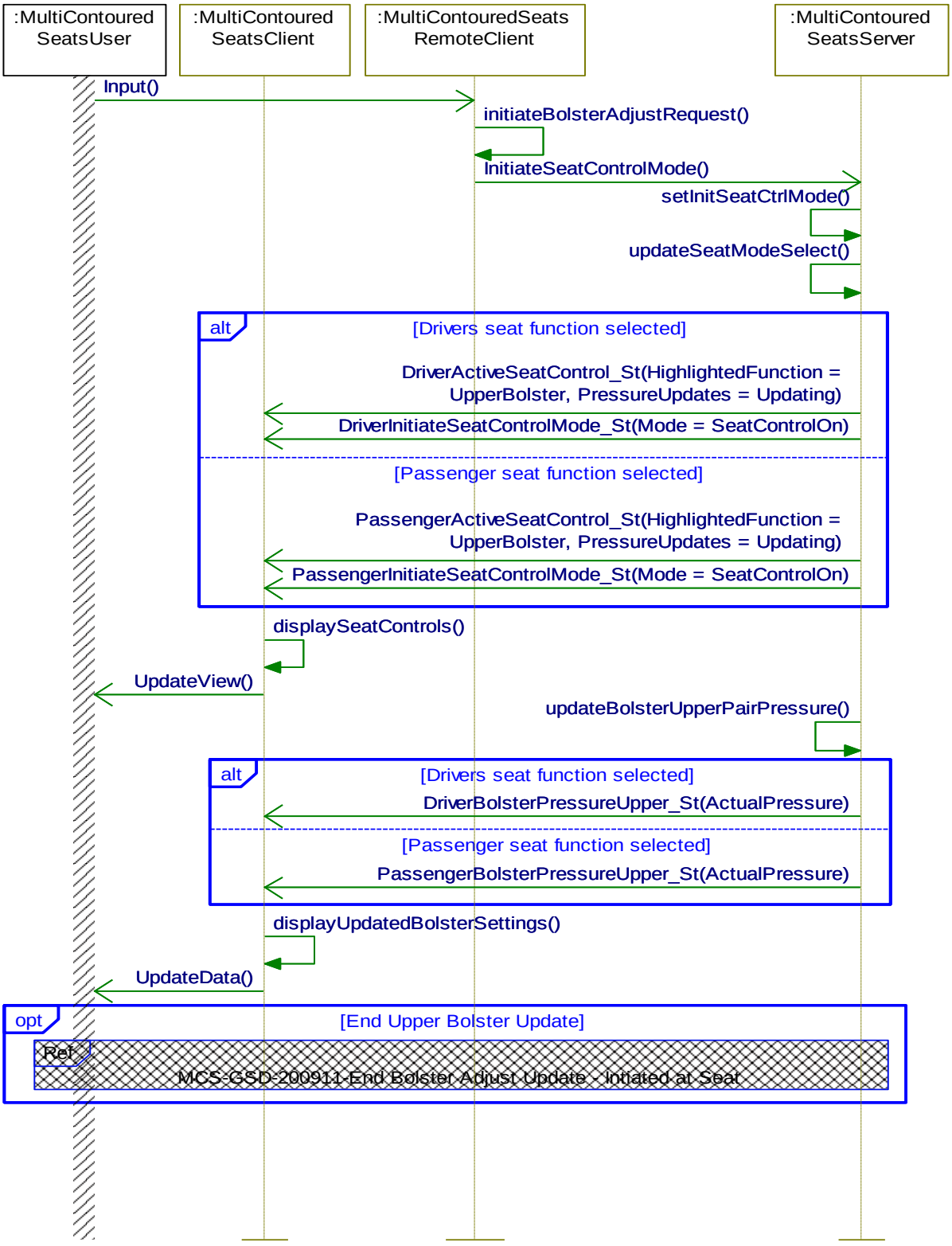
Pre-condition

Display is ON

Post-condition

HMI indicates {change Actual Pressure Settings as Seat Bladder pressure changes}

Sequence Diagram



2.3.2.8 MCS-SD-REQ-021375/A-Increase Bolster Upper Bladders from Touch Screen (TcSE ROIN-199118-1)

Scenarios

Normal Usage

User <selects increase Bolster Upper Pair of Bladders> via touch screen HMI

Constraints

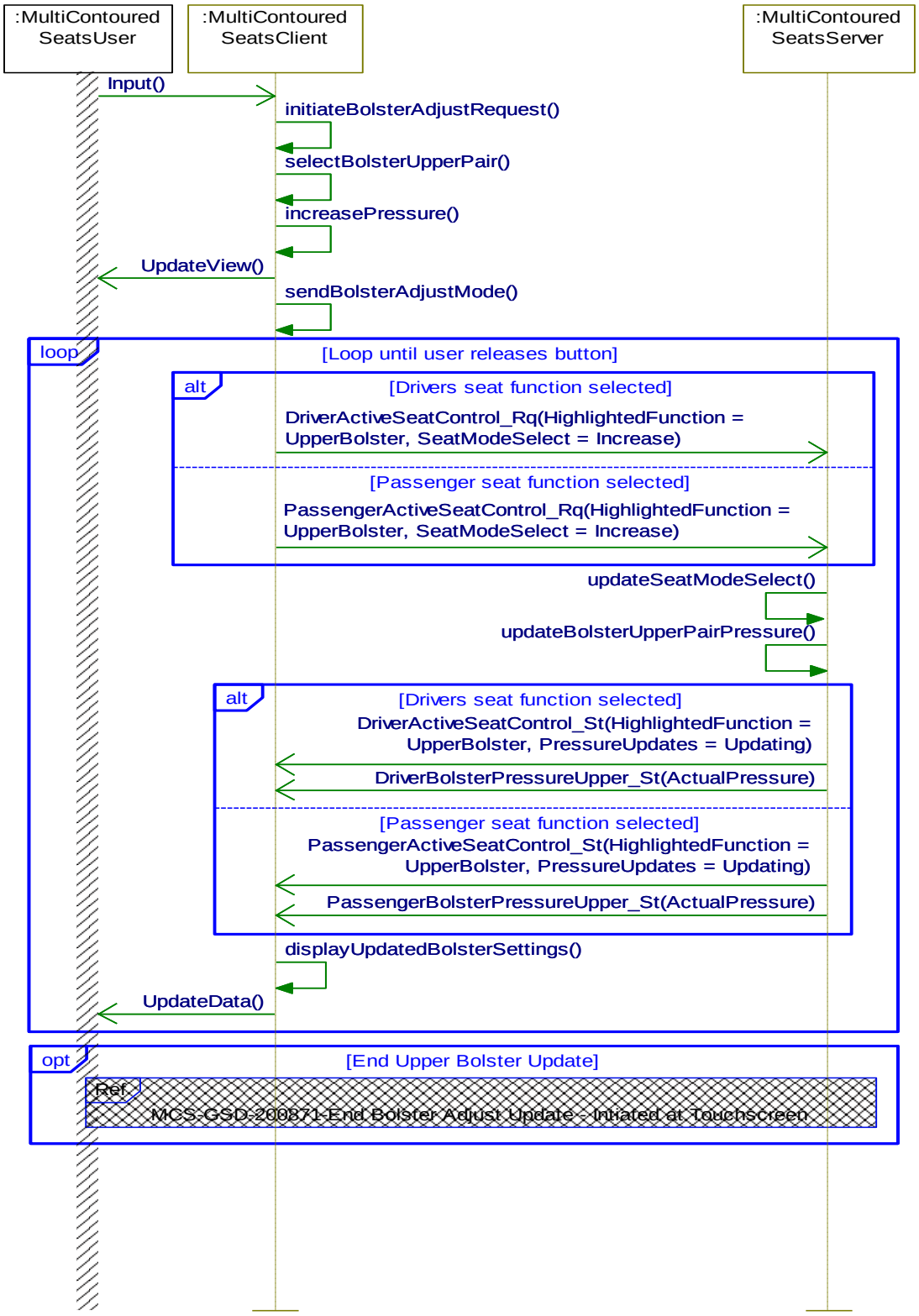
Pre-condition

Display is ON

Post-condition

HMI indicates {change Actual Pressure Settings as Seat Bladder pressure changes}

Sequence Diagram



2.3.2.9 MCS-SD-REQ-021376/A-Select Bolster Upper Bladders at Touch Screen - No pressure updates (TcSE ROIN-200177-1)

Scenarios

Normal Usage

User <selects Set Bolster Upper Bladders> via touchscreen HMI, but does not make any changes to the actual pressure

Constraints

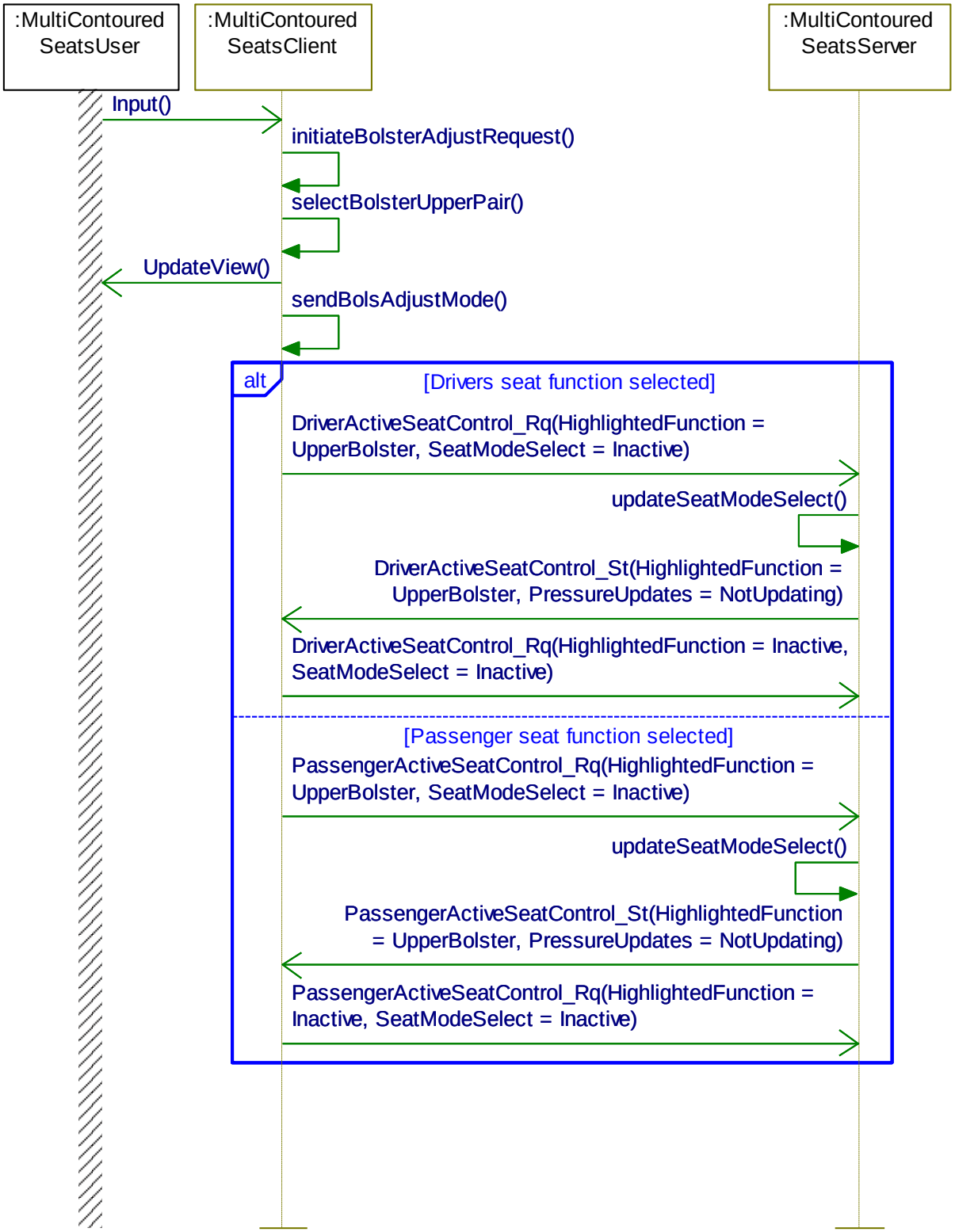
Pre-condition

Display is ON

Post-condition

HMI indicates {changes to Bolster Adjust Mode}

Sequence Diagram



2.3.2.10 MCS-SD-REQ-021377/A-Initiate Bolster Adjust at Seat - No pressure updates (TcSE ROIN-200184-1)

Scenarios

Normal Usage

User <selects Set Boslter Lower or Upper Bladders> via seat HMI, but does not make any changes to the actual pressure.

Constraints

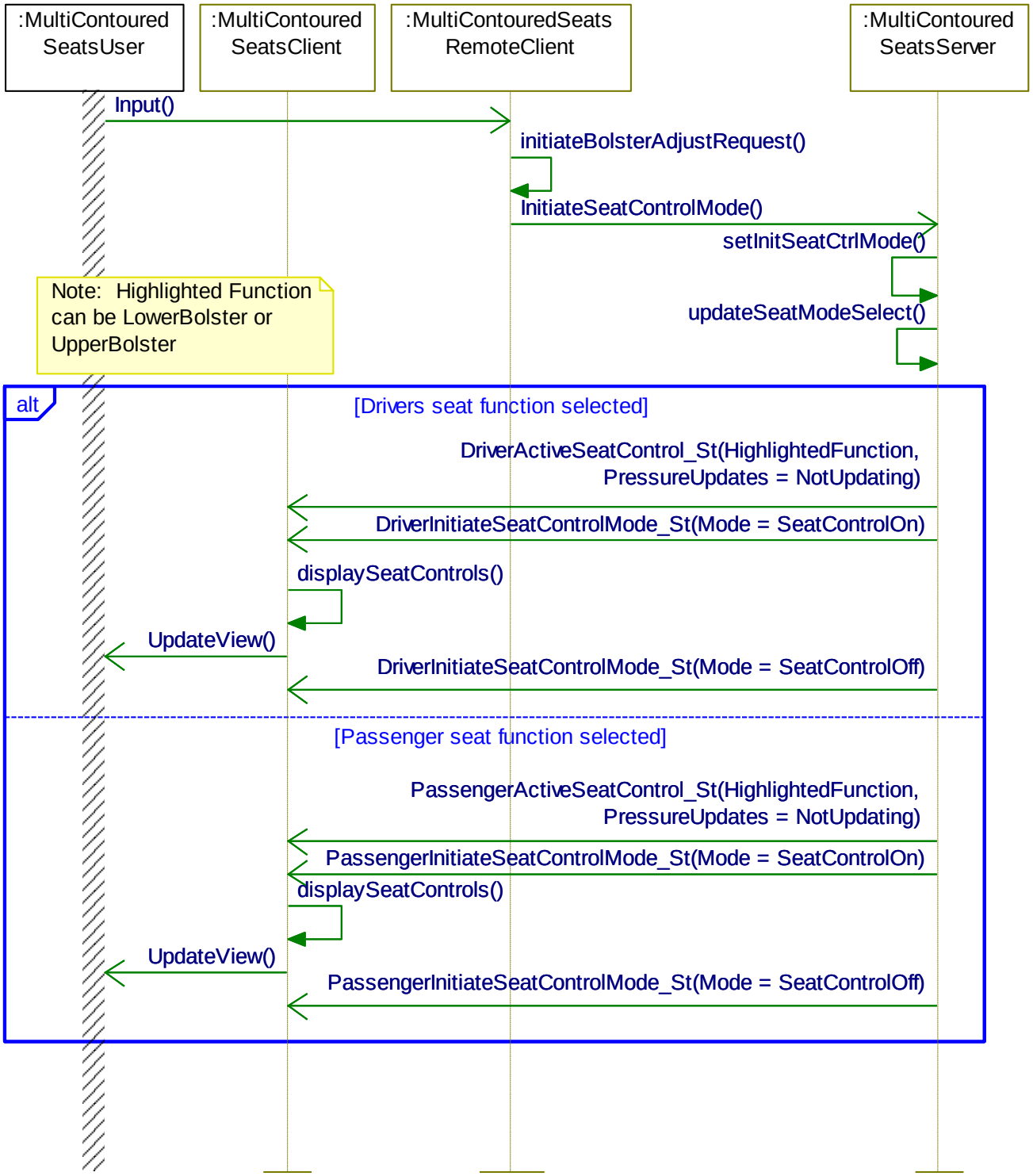
Pre-condition

Display is ON

Post-condition

HMI indicates {changes to Bolster Adjust Mode}

Sequence Diagram



2.3.2.11 MCS-SD-REQ-021378/A-Select Bolster Lower Bladders at Touch Screen - No pressure updates (TcSE ROIN-200815-1)

Scenarios

Normal Usage

User <selects Set Bolster Lower Bladders> via touchscreen HMI, but does not make any changes to the actual pressure

Constraints

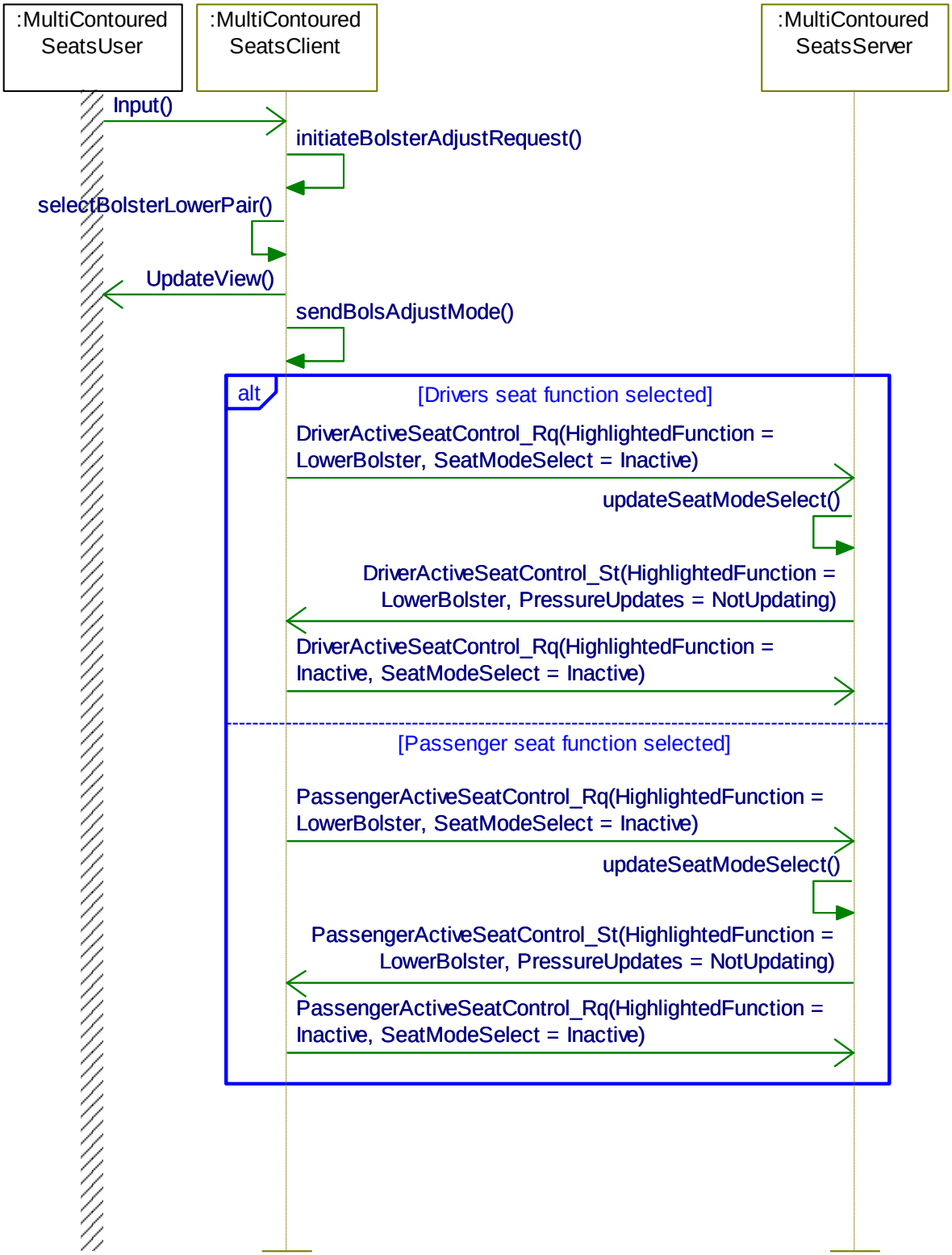
Pre-condition

Display is ON

Post-condition

HMI indicates {changes to Bolster Adjust Mode}

Sequence Diagram



2.3.2.12 MCS-SD-REQ-021379/A-End Bolster Adjust Update - Intiated at Touchscreen (TcSE ROIN-200871-1)

Scenarios

Normal Usage

The user ends Bolster Adjust Mode update.

Constraints

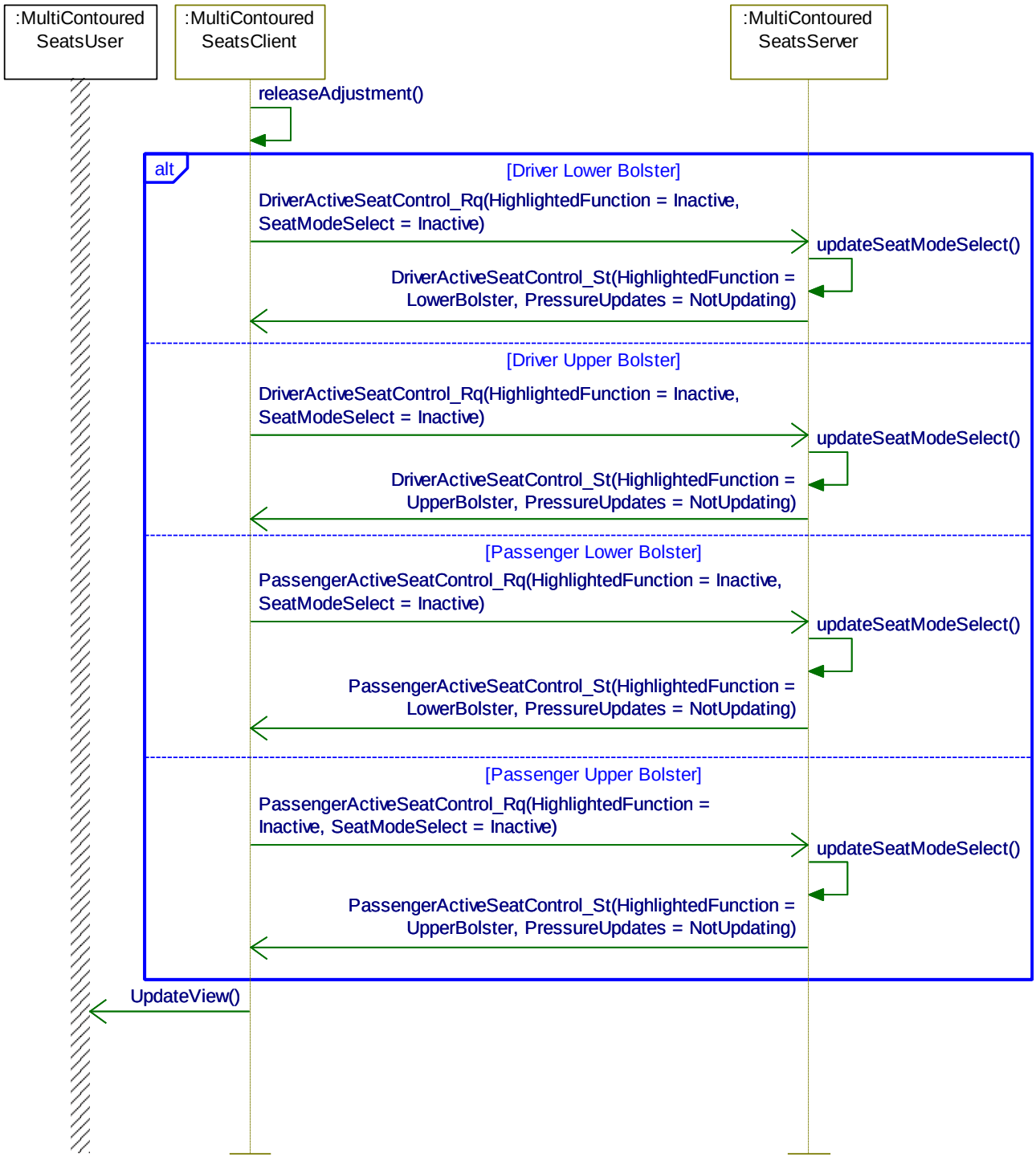
Pre-condition

Bolster Adjust is currently being updated by the user via the touchscreen HMI

Post-condition

Bolster Adjust is no longer being updated by the user via the touchscreen HMI

Sequence Diagram



2.3.2.13 MCS-SD-REQ-021380/A-End Bolster Adjust Update - Intiated at Seat (TcSE ROIN-200911-1)

Scenarios

Normal Usage

The user ends Bolster Adjust Mode update.

Constraints

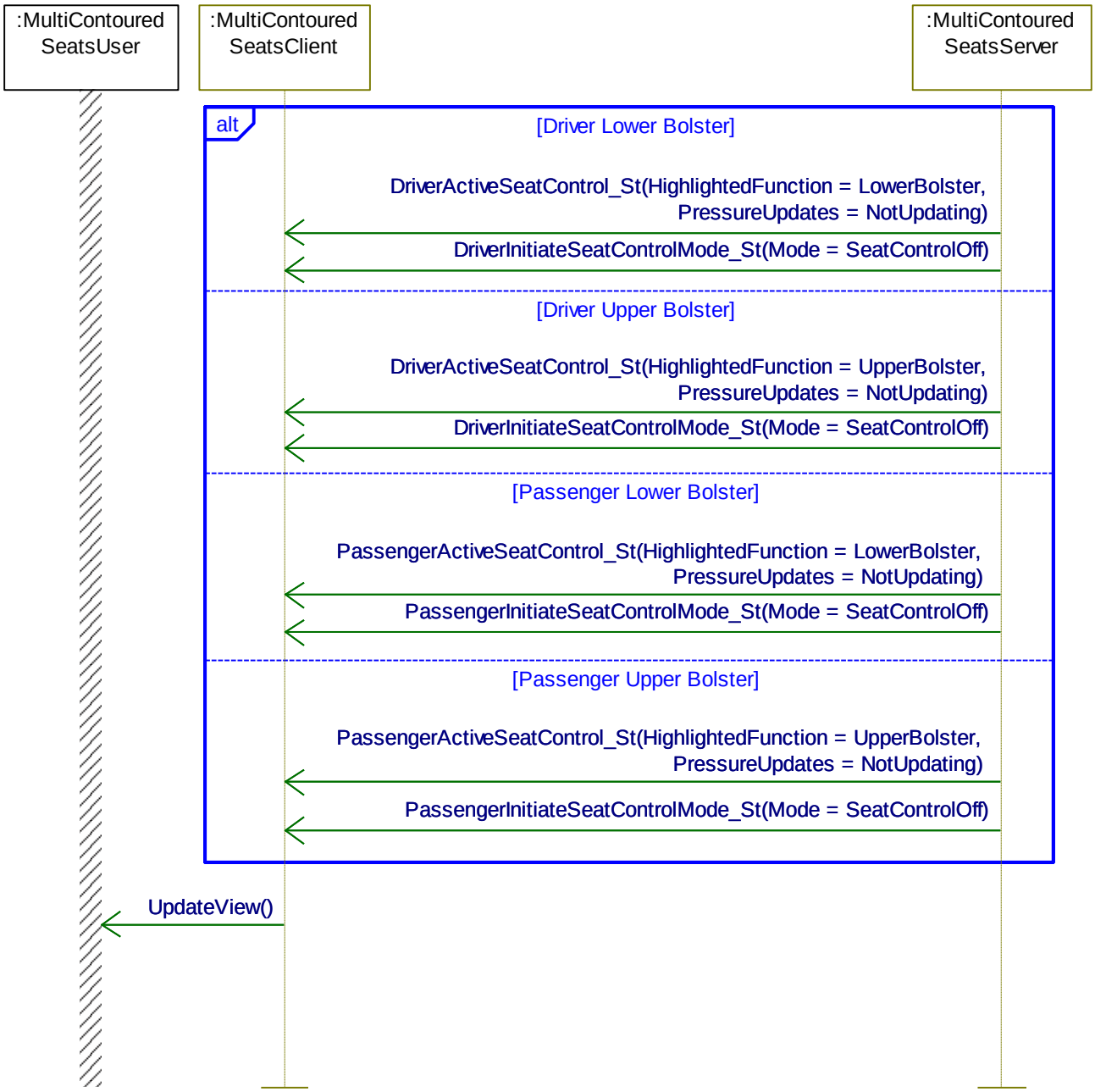
Pre-condition

Bolster Adjust is currently being updated by the user via Seat HMI

Post-condition

Bolster Adjust no longer being updated by the user via Seat HMI.

Sequence Diagram



3 Appendix: Reference Documents

Reference #	Document Title
1	
2	
3	
4	
5	
6	
7	
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