Research & Vehicle Technology
"Infotainment Systems Product Development"

Feature – Electro Mechanical Registers

Infotainment Subsystem Part Specific Specification (SPSS)

Version 1.3
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FORD CONFIDENTIAL

Revision History

Date	Version	Notes	
September 1, 2021	1.0	**Initial Release**	
December 3, 2021	1.1		
		MD-REQ-420274/B-Register_RHOB	nmajjiga: fixed table format
		MD-REQ-420275/B-Register_RHIB	nmajjiga: corrected typo
		MD-REQ-420276/B-Register_LHOB_Horizontal	nmajjiga: update requirement
		MD-REQ-420277/B-Register_LHIB_Horizontal	nmajjiga: update requirement
		MD-REQ-420278/B-Register_RHOB_Horizontal	nmajjiga: update requirement
		MD-REQ-420279/B-Register_RHIB_Horizontal	nmajjiga: update requirement
		MD-REQ-420280/B-Register_LHOB_Vertical	nmajjiga: update requirement
		MD-REQ-420281/B-Register_LHIB_Vertical	nmajjiga: update requirement
		MD-REQ-420282/B-Register_RHOB_Vertical	nmajjiga: update requirement
		MD-REQ-420283/B-Register_RHIB_Vertical	nmajjiga: update requirement
		MD-REQ-420285/B-ActiveButtonsRHS_Rq	nmajjiga: corrected typo in state encodings
		MD-REQ-420289/B-HMIFeedback_RHIB_Horizontal	nmajjiga: corrected typo
		MD-REQ-420293/B-HMIFeedback_RHIB_Vertical	nmajjiga: corrected typo
		STR-907947/B-General Requirements	nmajjiga: updated requirements
		EMR-REQ-421158/B-Electro Mechanical Registers dependency on Climate System	nmajjiga: updated signal details
		EMR-REQ-435217/B-Coordinate system for each Electro Mechanical Register	nmajjiga: updated requirement
		EMR-REQ-435218/B-Electro Mechanical Registers while vehicle in Driver Focus Mode	nmajjiga: updated signal details
		EMR-REQ-466723/A-Feature Configuration	nmajjiga: added feature configuration details
		EMR-REQ-466724/A-Electro Mechanical Registers Configuration	nmajjiga: added number of EM air registers configuration details
		EMR-REQ-470348/A-Electro Mechanical Registers HMI Screen	nmajjiga: added new requirement
		EMR-FUN-REQ-410841/B-Electro Mechanical Register position changed manually	nmajjiga: updated requirement
		EMR-REQ-421164/B-Electro Mechanical Register position changed manually	nmajjiga: updated requirement
		EMR-FUN-REQ-421209/B-Electro Mechanical Register Close/Open	nmajjiga: update requirement
		EMR-REQ-421172/B-Closing Electro Mechanical Register	nmajjiga: update requirement
		EMR-REQ-421173/B-Opening a closed Electro Mechanical Register	nmajjiga: update requirement
		STR-846940/B-Appendix: Reference Documents	nmajjiga: updated reference spec
March 4, 2022	1.2		
		MD-REQ-420284/B-ActiveButtonsLHS_Rq	nmajjiga: updated note as Air Motion Selection is supported
		MD-REQ-420285/C-ActiveButtonsRHS_Rq	nmajjiga: updated note as Air Motion Selection is supported
		EMR-REQ-421158/C-Electro Mechanical Registers dependency on Climate System	nmajjiga: updated requirement
		STR-846937/B-Functional Definition	nmajjiga: added Air Motion Selection section
		EMR-FUN-REQ-421295/A-Air Motion Selection	nmajjiga: new section for Air Motion Selection
		STR-908052/A-Requirements	nmajjiga: new requirements to support Air Motion Selection
		EMR-REQ-421167/A-Air Motion option selection	nmajjiga: new requirement to support Air Motion Selection
		EMR-REQ-421168/A-Air Motion pattern not selected – Multiple Patterns	nmajjiga: new requirement to support Air Motion Selection
		EMR-REQ-421169/A-Exit/Cancel Air Motion pattern	nmajjiga: new requirement to support Air Motion Selection
		STR-908051/A-Use Cases	nmajjiga: new usecases to support Air Motion Selection
		EMR-UC-REQ-421180/A-User selects Left side Air Motion Pattern	nmajjiga: new usecase to support Air Motion Selection

EMR-UC-REQ-421181/A-Left side Air Motion pattern not selected – Multiple Patterns		nmajjiga: new usecase to support Air Motion Selection
EMR-UC-REQ-421182/A-User cancels Left side Air Motion selection		nmajjiga: new usecase to support Air Motion Selection
EMR-UC-REQ-421183/A-User selects Right side Air Motion Pattern		nmajjiga: new usecase to support Air Motion Selection
EMR-UC-REQ-421184/A-Right side Air Motion pattern not selected – Multiple Patterns		nmajjiga: new usecase to support Air Motion Selection
EMR-UC-REQ-421185/A-User cancels Right side Air Motion selection		nmajjiga: new usecase to support Air Motion Selection
EMR-STR-908053/A-White Box Views		nmajjiga: new diagrams to support Air Motion Selection
EMR-STR-908054/A-Activity Diagrams		nmajjiga: new activity diagrams to support Air Motion Selection
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EMR-SD-REQ-421230/A-Left Side Air Motion - Multiple Patterns		nmajjiga: new sequence diagram to support Air Motion Selection
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EMR-SD-REQ-482480/A-Left Side Air Motion - One Pattern		nmajjiga: new sequence diagram to support Air Motion Selection
EMR-SD-REQ-482481/A-Right Side Air Motion - One Pattern		nmajjiga: new sequence diagram to support Air Motion Selection

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	STR-846936/B-Logical Signal Mapping		nmajjiga: added active buttons status signals
	IIR-REQ-406769/B-EMR Client _Rx		nmajjiga: added active buttons status signals
	MD-REQ-420290/B-HMIFeedback_LHOB_Vertical		nmajjiga: added clarification for close position
	MD-REQ-420291/B-HMIFeedback_LHIB_Vertical		nmajjiga: added clarification for close position
	MD-REQ-420292/B-HMIFeedback_RHOB_Vertical		nmajjiga: added clarification for close position
	MD-REQ-420293/C-HMIFeedback_RHIB_Vertical		nmajjiga: added clarification for close position
	MD-REQ-421154/A-ActiveButtonsLHS_St		nmajjiga: Left side registers active buttons status
	MD-REQ-421156/A-ActiveButtonsRHS_St		nmajjiga: Right side registers active buttons status
	STR-907947/C-General Requirements		nmajjiga: revised to update coordinate system requirement
	EMR-REQ-435217/C-Coordinate system for each Electro Mechanical Register		nmajjiga: updated requirement with wireframe including lower registers
	EMR-REQ-421170/B-On Body option selection		nmajjiga: updated requirement to add active button status signal
	EMR-REQ-421171/B-Off Body option selection		nmajjiga: updated requirement to add active button status signal
	EMR-SD-REQ-421234/B-Left Side On Body Selection		nmajjiga: updated sequence diagram to add active button status signal
	EMR-SD-REQ-421235/B-Right Side On Body Selection		nmajjiga: updated sequence diagram to add active button status signal
	EMR-SD-REQ-421238/B-Left Side Off Body Selection		nmajjiga: updated sequence diagram to add active button status signal
	EMR-SD-REQ-421239/B-Right Side Off Body Selection		nmajjiga: updated sequence diagram to add active button status signal
	EMR-REQ-421172/C-Closing Electro Mechanical Register		nmajjiga: added clarification for close position
	EMR-REQ-421167/B-Air Motion option selection		nmajjiga: updated requirement to add active button status signal
	EMR-SD-REQ-421230/B-Left Side Air Motion - Multiple Patterns		nmajjiga: updated sequence diagram to add active button status signal
	EMR-SD-REQ-421231/B-Right Side Air Motion - Multiple Patterns		nmajjiga: updated sequence diagram to add active button status signal
	EMR-SD-REQ-482480/B-Left Side Air Motion - One Pattern		nmajjiga: updated sequence diagram to add active button status signal

	EMR-SD-REQ-482481/B-Right Side Air Motion - One Pattern	nmajjiga: updated sequence diagram to add active button status signal

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1 Architectural Design

1.1 Overview

This feature allows the user to control Electro Mechanical air registers position and cycling settings through HMI. This feature shall also provide visual feedback of registers aim directions, air motion and shut off/on.

The requirements on the functionality are described either as use cases or as conventional functional decomposition.

1.2 CLD-REQ-406767/A-EMR Client

EMR (Electro Mechanical Registers) Client will take input for EM register position, air flow from user via HMI and transmit it to EMR (Electro Mechanical Registers) Server for implementation.

1.3 CLD-REQ-406768/A-EMR Server

EMR (Electro Mechanical Registers) Server will take the commands from EMR (Electro Mechanical Registers) Client and make changes to EM register position, airflow as needed and gives feedback of updates made.

1.4 Physical Mapping of Classes

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

Logical Class	Physical Module (ECU)
EMRClient	APIM PDC
EMRServer	RCCM

1.5 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.

Logical Name	CAN Signal Name
Register_LHOB	RgstrSetObl_D_Rq
Register_LHIB	RgstrSetIbl_D_Rq
Register_RHOB	RgstrSetObr_D_Rq
Register_RHIB	RgstrSetIbr_D_Rq
Register_LHOB_Horizontal	RgstrHzntlObl_An_Rq
Register_LHIB_Horizontal	RgstrHzntlIbl_An_Rq
Register_RHOB_Horizontal	RgstrHzntlObr_An_Rq
Register_RHIB_Horizontal	RgstrHzntlIbr_An_Rq
Register_LHOB_Vertical	RgstrVertObl_An_Rq
Register_LHIB_Vertical	RgstrVertIbl_An_Rq
Register_RHOB_Vertical	RgstrVertObr_An_Rq
Register_RHIB_Vertical	RgstrVertIbr_An_Rq
ActiveButtonsLHS_Rq	ActvButtnLeft_D_Rq
ActiveButtonsRHS_Rq	ActvButtnRight_D_Rq
HMIFeedback_LHOB_Horizontal	RgstrHzntlObl_An_Actl
HMIFeedback_LHIB_Horizontal	RgstrHzntlIbl_An_Actl
HMIFeedback_RHOB_Horizontal	RgstrHzntlObr_An_Actl
HMIFeedback_RHIB_Horizontal	RgstrHzntlIbr_An_Actl

HMIFeedback_LHOB_Vertical	RgstrVertObl_An_Actl
HMIFeedback_LHIB_Vertical	RgstrVertIbl_An_Actl
HMIFeedback_RHOB_Vertical	RgstrVertObr_An_Actl
HMIFeedback_RHIB_Vertical	RgstrVertIbr_An_Actl
ActiveButtonsLHS_St	ActvButtnLeft_D_Stat
ActiveButtonsRHS_St	ActvButtnRight_D_Stat

Table: Logical name/CAN signal mapping

1.6 IIR-REQ-406771/A-EMR Client _Tx

1.6.1 MD-REQ-420272/A-Register_LHOB

Message Type: Request
This signal shall be sent by the EMRClient as request to the EMRServer to change Aim Command for Lefthand Outboard Register

Name	Literals	Value	Description
Register_LHOB	-	-	Change Air Command for Lefthand Outboard Register
	noChange	0x0	
	manualChange	0x1	
	featureManualChange	0x2	
	featureButtonChange	0x3	
	open	0x4	
	close	0x5	
	Not Used	0x6-0x7	

0x2 & 0x3 encodings are associated with request from another feature to control airflow. Currently there are no features identified which will trigger EMRClient to transmit these values, so the requirements/ use cases are not captured in this SPSS.

1.6.2 MD-REQ-420273/A-Register_LHIB

Message Type: Request
This signal shall be sent by the EMRClient as request to the EMRServer to change Aim Command for Lefthand Inboard Register

Name	Literals	Value	Description
Register_LHIB	-	-	Change Air Command for Lefthand Inboard Register
	noChange	0x0	
	manualChange	0x1	
	featureManualChange	0x2	
	featureButtonChange	0x3	
	open	0x4	
	close	0x5	
	Not Used	0x6-0x7	

0x2 & 0x3 encodings are associated with request from another feature to control airflow. Currently there are no features identified which will trigger EMRClient to transmit these values, so the requirements/ use cases are not captured in this SPSS.

1.6.3   MD-REQ-420274/B-Register_RHOB

Message Type: Request
This signal shall be sent by the EMRClient as request to the EMRServer to change Aim Command for Righthand Outboard Register

Name	Literals	Value	Description
Register_RHOB	-	-	Change Air Command for Righthand Outboard Register
	noChange	0x0	
	manualChange	0x1	
	featureManualChange	0x2	
	featureButtonChange	0x3	
	open	0x4	
	close	0x5	
	Not Used	0x6-0x7	

0x2 & 0x3 encodings are associated with request from another feature to control airflow. Currently there are no features identified which will trigger EMRClient to transmit these values, so the requirements/ use cases are not captured in this SPSS.

1.6.4   MD-REQ-420275/B-Register_RHIB

Message Type: Request
This signal shall be sent by the EMRClient as request to the EMRServer to change Aim Command for Righthand Inboard Register

Name	Literals	Value	Description
Register_RHIB	-	-	Change Air Command for Righthand Inboard Register
	noChange	0x0	
	manualChange	0x1	
	featureManualChange	0x2	
	featureButtonChange	0x3	
	open	0x4	
	close	0x5	
	Not Used	0x6-0x7	

0x2 & 0x3 encodings are associated with request from another feature to control airflow. Currently there are no features identified which will trigger EMRClient to transmit these values, so the requirements/ use cases are not captured in this SPSS.

1.6.5   MD-REQ-420276/B-Register_LHOB_Horizontal

Message Type: Request
This signal shall be sent by the EMRClient as request to the EMRServer to Command Position of Horizontal Vanes for Lefthand Outboard Register

Name	Literals	Value	Description
Register_LHOB_Horizontal	-	0x00 – 0xFF	Command Position of Horizontal Vanes for Lefthand Outboard Register

The actual range of values that EMRClient transmits is 0x00 to 0x64 (0% to 100%) with resolution 1.

1.6.6   MD-REQ-420277/B-Register_LHIB_Horizontal

Message Type: Request
This signal shall be sent by the EMRClient as request to the EMRServer to Command Position of Horizontal Vanes for Lefthand Inboard Register

Name	Literals	Value	Description
Register_LHIB_Horizontal	-	0x00 – 0xFF	Command Position of Horizontal Vanes for Lefthand Inboard Register

The actual range of values that EMRClient transmits is 0x00 to 0x64 (0% to 100%) with resolution 1.

1.6.7   MD-REQ-420278/B-Register_RHOB_Horizontal

Message Type: Request
This signal shall be sent by the EMRClient as request to the EMRServer to Command Position of Horizontal Vanes for Righthand Outboard Register

Name	Literals	Value	Description
Register_RHOB_Horizontal	-	0x00 – 0xFF	Command Position of Horizontal Vanes for Righthand Outboard Register

The actual range of values that EMRClient transmits is 0x00 to 0x64 (0% to 100%) with resolution 1.

1.6.8   MD-REQ-420279/B-Register_RHIB_Horizontal

Message Type: Request
This signal shall be sent by the EMRClient as request to the EMRServer to Command Position of Horizontal Vanes for Righthand Inboard Register

Name	Literals	Value	Description
Register_RHIB_Horizontal	-	0x00 – 0xFF	Command Position of Horizontal Vanes for Righthand Inboard Register

The actual range of values that EMRClient transmits is 0x00 to 0x64 (0% to 100%) with resolution 1.

1.6.9   MD-REQ-420280/B-Register_LHOB_Vertical

Message Type: Request
This signal shall be sent by the EMRClient as request to the EMRServer to Command Position of Vertical Vanes for Lefthand Outboard Register

Name	Literals	Value	Description
Register_LHOB_Vertical	-	0x00 – 0xFF	Command Position of Vertical Vanes for Lefthand Outboard Register

The actual range of values that EMRClient transmits is 0x00 to 0x64 (0% to 100%) with resolution 1.

1.6.10 MD-REQ-420281/B-Register_LHIB_Vertical

Message Type: Request

This signal shall be sent by the EMRClient as request to the EMRServer to Command Position of Vertical Vanes for Lefthand Inboard Register

Name	Literals	Value	Description
Register_LHIB_Vertical	-	0x00 – 0xFF	Command Position of Vertical Vanes for Lefthand Inboard Register

The actual range of values that EMRClient transmits is 0x00 to 0x64 (0% to 100%) with resolution 1.

1.6.11 MD-REQ-420282/B-Register_RHOB_Vertical

Message Type: Request

This signal shall be sent by the EMRClient as request to the EMRServer to Command Position of Vertical Vanes for Righthand Outboard Register

Name	Literals	Value	Description
Register_RHOB_Vertical	-	0x00 – 0xFF	Command Position of Vertical Vanes for Righthand Outboard Register

The actual range of values that EMRClient transmits is 0x64 (0% to 100%) with resolution 1.

1.6.12 MD-REQ-420283/B-Register_RHIB_Vertical

Message Type: Request

This signal shall be sent by the EMRClient as request to the EMRServer to Command Position of Vertical Vanes for Righthand Inboard Register

Name	Literals	Value	Description
Register_RHIB_Vertical	-	0x00 – 0xFF	Command Position of Vertical Vanes for Righthand Inboard Register

The actual range of values that EMRClient transmits is 0x00 to 0x64 (0% to 100%) with resolution 1.

1.6.13 MD-REQ-420284/B-ActiveButtonsLHS_Rq

Message Type: Request

This signal shall be sent by the EMRClient as request to the EMRServer for Subfeature Selection Commands for Left Side Registers

Name	Literals	Value	Description
ActiveButtonsLHS_Rq	-	-	Subfeature Selection Commands for Left Side Registers
	nonePressed	0x0	
	onBodyLHS	0x1	
	offBodyLHS	0x2	

	presetOneLHS	0x3	
	presetTwoLHS	0x4	
	presetOneSaveLHS	0x5	
	presetTwoSaveLHS	0x6	
	cycle_8_LHS	0x7	
	cycle_C_LHS	0x8	
	cycle_O_LHS	0x9	
	cycle_--_LHS	0xA	
	cycle_I_LHS	0xB	
	Not Used	0xC-0xF	

Note: 0x3 through 0x6 encodings are associated for button presses for presets which are not applicable to NA APIM so the requirements/use cases are not captured in this SPSS.

1.6.14 MD-REQ-420285/C-ActiveButtonsRHS_Rq

Message Type: Request

This signal shall be sent by the EMRClient as request to the EMRServer for Subfeature Selection Commands for Right Side Registers

Name	Literals	Value	Description
ActiveButtonsRHS_Rq	-	-	Subfeature Selection Commands for Right Side Registers
	nonePressed	0x0	
	onBodyRHS	0x1	
	offBodyRHS	0x2	
	presetOneRHS	0x3	
	presetTwoRHS	0x4	
	presetOneSaveRHS	0x5	
	presetTwoSaveRHS	0x6	
	cycle_8_RHS	0x7	
	cycle_C_RHS	0x8	
	cycle_O_RHS	0x9	
	cycle_--_RHS	0xA	
	cycle_I_RHS	0xB	
	Not Used	0xC-0xF	

Note: 0x3 through 0x6 encodings are associated for button presses for presets which are not applicable to NA APIM so the requirements/use cases are not captured in this SPSS.

1.7 IIR-REQ-406769/B-EMR Client _Rx

1.7.1 MD-REQ-420286/A-HMIFeedback_LHOB_Horizontal

Message Type: Status
This signal shall be sent by the EMRServer to the EMRClient for Aim Status of Lefthand Outboard Register Horizontal Vanes

Name	Literals	Value	Description
HMIFeedback_LHOB_Horizontal	-	0x00 – 0xFF	Aim Status of Lefthand Outboard Register Horizontal Vanes

1.7.2 MD-REQ-420287/A-HMIFeedback_LHIB_Horizontal

Message Type: Status
This signal shall be sent by the EMRServer to the EMRClient for Aim Status of Lefthand Inboard Register Horizontal Vanes

Name	Literals	Value	Description
HMIFeedback_LHIB_Horizontal	-	0x00 – 0xFF	Aim Status of Lefthand Inboard Register Horizontal Vanes

1.7.3 MD-REQ-420288/A-HMIFeedback_RHOB_Horizontal

Message Type: Status
This signal shall be sent by the EMRServer to the EMRClient for Aim Status of Righthand Outboard Register Horizontal Vanes

Name	Literals	Value	Description
HMIFeedback_RHOB_Horizontal	-	0x00 – 0xFF	Aim Status of Righthand Outboard Register Horizontal Vanes

1.7.4 MD-REQ-420289/B-HMIFeedback_RHIB_Horizontal

Message Type: Status
This signal shall be sent by the EMRServer to the EMRClient for Aim Status of Righthand Inboard Register Horizontal Vanes

Name	Literals	Value	Description
HMIFeedback_RHIB_Horizontal	-	0x00 – 0xFF	Aim Status of Righthand Inboard Register Horizontal Vanes

1.7.5 MD-REQ-420290/B-HMIFeedback_LHOB_Vertical

Message Type: Status
This signal shall be sent by the EMRServer to the EMRClient for Aim Status of Lefthand Outboard Register Vertical Vanes

Name	Literals	Value	Description
HMIFeedback_LHOB_Vertical	-	0x00 – 0xFE	Aim Status of Lefthand Outboard Register Vertical Vanes
		0xFF	Register Closed

1.7.6 MD-REQ-420291/B-HMIFeedback_LHIB_Vertical

Message Type: Status
This signal shall be sent by the EMRServer to the EMRClient for Aim Status of Lefthand Inboard Register Vertical Vanes

Name	Literals	Value	Description

HMIFeedback_LHIB_Vertical	-	0x00 – 0xFE	Aim Status of Lefthand Inboard Register Vertical Vanes
		0xFF	Register Closed

1.7.7 MD-REQ-420292/B-HMIFeedback_RHOB_Vertical

Message Type: Status

This signal shall be sent by the EMRServer to the EMRClient for Aim Status of Righthand Outboard Register Vertical Vanes

Name	Literals	Value	Description
HMIFeedback_RHOB_Vertical	-	0x00 – 0xFE	Aim Status of Righthand Outboard Register Vertical Vanes
		0xFF	Register Closed

1.7.8 MD-REQ-420293/C-HMIFeedback_RHIB_Vertical

Message Type: Status

This signal shall be sent by the EMRServer to the EMRClient for Aim Status of Righthand Inboard Register Vertical Vanes

Name	Literals	Value	Description
HMIFeedback_RHIB_Vertical	-	0x00 – 0xFE	Aim Status of Righthand Inboard Register Vertical Vanes
		0xFF	Register Closed

1.7.9 MD-REQ-421154/A-ActiveButtonsLHS_St

Message Type: Status

This signal shall be sent by the EMRServer to the EMRClient for Subfeature Selection Status for Left Side Registers

Name	Literals	Value	Description
ActiveButtonsLHS_St	-	-	Subfeature Selection Status for Left Side Registers
	nonePressed	0x0	
	onBodyLHS	0x1	
	offBodyLHS	0x2	
	presetOneLHS	0x3	
	presetTwoLHS	0x4	
	cycle_8_LHS	0x5	
	cycle_C_LHS	0x6	
	cycle_O_LHS	0x7	
	cycle_--_LHS	0x8	
	cycle_I_LHS	0x9	
	Not Used	0xA-0xF	

Note: 0x3 and 0x4 encodings are associated for button presses for presets which are not applicable to NA APIM so the requirements/use cases are not captured in this SPSS.

1.7.10 MD-REQ-421156/A-ActiveButtonsRHS_St

Message Type: Status

This signal shall be sent by the EMRServer to the EMRClient for Subfeature Selection Status for Right Side Registers

Name	Literals	Value	Description
ActiveButtonsRHS_St	-	-	Subfeature Selection Status for Right Side Registers
	nonePressed	0x0	
	onBodyRHS	0x1	
	offBodyRHS	0x2	
	presetOneRHS	0x3	
	presetTwoRHS	0x4	
	cycle_8_RHS	0x5	
	cycle_C_RHS	0x6	
	cycle_O_RHS	0x7	
	cycle_--_RHS	0x8	
	cycle_I_RHS	0x9	
	Not Used	0xA-0xF	

Note: 0x3 and 0x4 encodings are associated for button presses for presets which are not applicable to NA APIM so the requirements/use cases are not captured in this SPSS.

2 General Requirements

2.1 EMR-REQ-421157/A-Electro Mechanical Registers while Ignition not in Run

When Ignition ≠ Run, HMI display shall disable EM registers display. Airflow lines and grabbers are not visible as well. User cannot make any selection to control registers via touchscreen.

2.2 EMR-REQ-421158/C-Electro Mechanical Registers dependency on Climate System

When the climate system display is turned off, it shall disable airflow lines and grabbers.
When the climate system blower is in Auto mode, HMI Screen shall show EM register airflow lines in "greyed" coloring. Grabbers, aiming, presets and dynamic modes will work as normal.
When the climate system is in manual mode, EM registers shall only show as active on HMI if PANEL VENTS is selected by itself or in any combination with the other manual mode buttons (FLOOR VENTS and DEFROSTER VENTS).
When the climate system is in manual mode and the PANEL VENTS are deselected then the display shall not show airflow lines nor grabbers.
The climate system blower Auto Mode shall be determined by signal Front_ AUTO_Label = Blower or Full transmitted by EMRServer.
The climate system Manual Mode shall be determined by signal Front_AUTO_Label = Off or Blower
transmitted by EMRServer.
Please refer Climate Control APIM AOS SPSS for signal and Climate Mode details.

2.3 EMR-REQ-421159/A-HMI requirements for Electro Mechanical Registers, Grabbers and Airflow lines

The details of how the grabbers are moved, how the airflow lines move/change direction are covered in HMI specification document (X26k_EM Registers).

2.4 EMR-REQ-435217/C-Coordinate system for each Electro Mechanical Register

The EMRClient shall provide a "range of coverage" box around each register on the HMI screen. This box provides the area of coverage for each register relative to the Cockpit as depicted by the Wireframe image. EMRClient shall provide coordinate tracking of the grabbers within these zones in (X,Y) format, where X is the cross car component of the grabber and Y is the up down component of the grabber. The origin (0%,0%) will be in the lower left corner of each box. The maximum values shall be (100%, 100%) in the upper right corner of each box. HMI shall return a linearly proportional position of the grabber anywhere within the box that it is positioned. The nominal units of the grabber shall be percentage which coincide with the register vane rotations required to provide air to the relative position as depicted on the Cockpit HMI wireframe image.
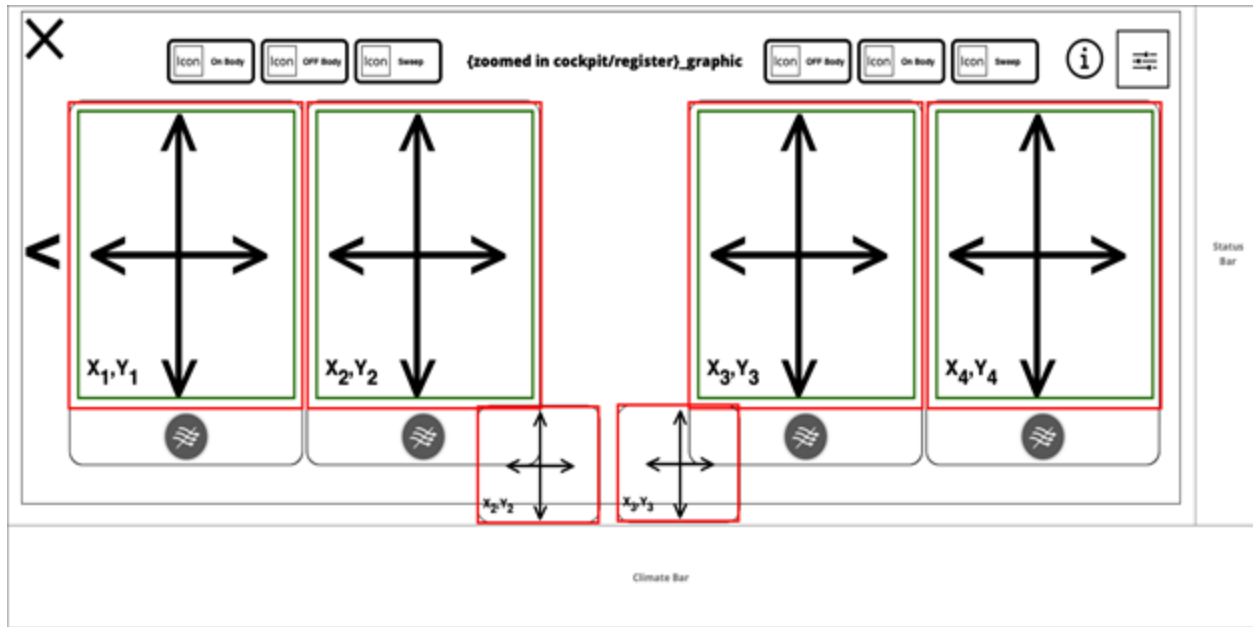
Diagram: Range of coverage of Upper Registers

2.5 EMR-REQ-438186/A-Memorizing Coordinates

When user touches grabber and starts moving it, EMRClient shall memorize the coordinates for the first position of grabber movement.

If the EM Register is closed, EMRClient shall transmit the memorized position to EMRServer as the last known position before close.

2.6 EMR-REQ-421160/A-Rejuvenate Control of Electro Mechanical Registers

EM register Control will be passed from EMRClient to Rejuvenate Feature when commanded.

There will be 2 sweep patterns available for EM registers while in Rejuvenate mode which are defined and controlled by EMRServer.

If Register HMI is accessed during Rejuvenate feature execution, control shall exit Rejuvenate mode and revert EM Registers to last known position. HMI shall send Manual Change request.

2.7 EMR-REQ-435218/B-Electro Mechanical Registers while vehicle in Driver Focus Mode

When Driver Focus Mode (DFM) initiates, EMRServer shall move the passenger side EM Registers to CLOSED position.

When DFM is active EMRClient shall show passenger side EM Registers as inactive (No airflow lines & no grabbers).

Driver side EM Registers function normally while DFM is initiated or active.

If passenger side EM Registers are adjusted or opened, DFM shall be deactivated.

If driver side EM Registers are adjusted or closed, DFM shall not be deactivated.

When DFM is exited by a finger touch to either passenger side EM Registers or other method, both passenger Side EM Registers will become active, return to Last Static Position with airflow lines and grabbers aligned. After that, passenger side EM Registers can be adjusted as needed.

When DFM is exited by any other preset button push, EM Registers shall respond as expected for the preset.

The Driver Focus Mode shall be determined by signal DrvrFcsdMde_Btn_Stt = Enabled Active transmitted by EMRServer.

Please refer Climate Control APIM AOS SPSS for further details about signal and DFM.

Note: For left hand drive vehicles (ex: NA region) right side EM Registers are passenger side EM Registers and left side EM Registers are driver side EM Registers; for right hand drive vehicles (ex: EU region) left side EM Registers are passenger side EM Registers and right side EM Registers are driver side EM Registers.

2.8   EMR-REQ-421161/A-Response time for Electro Mechanical Register change request

Time for the system to respond (Registers start movement) to button pushed or movement of the grabber shall not be more than 150 milli-seconds. Time for Display to update from Register movement shall not be more than 250 milli-seconds.

2.9   EMR-REQ-466723/A-Feature Configuration

The EMRClient shall have a configurable parameter to determine whether the vehicle supports operation of EM Registers via HMI touchscreen.

- If the parameter indicates the vehicle supports EM Registers via HMI touchscreen, then all the functionality and signals defined in this SPSS shall be supported.
- If the parameter indicates the vehicle does not support EM Registers via HMI touchscreen, then none of the functionality defined in this SPSS shall be supported.

Refer to Infotainment Diagnostics Specification for config parameter details.

2.10   EMR-REQ-466724/A-Electro Mechanical Registers Configuration

The EMRClient shall have a configurable parameter to determine whether the vehicle supports 4 EM Registers or 6 EM Registers.
Depending on the configuration the HMI display shall show 4 EM Registers or 6 EM Registers.

Refer to Infotainment Diagnostics Specification for config parameter details.

In case of 4 Registers configuration, they are classified as Left Hand Out Board (LHOB), Left Hand In Board (LHIB), Right Hand Out Board (RHOB), Right Hand In Board (RHIB) Registers. The CAN signals related to EM Registers are defined as per this classification. All these 4 EM Registers can be manipulated individually as defined in the functional requirements below.

In case of 6 Registers configuration, the upper 4 EM Registers are same as the 4 EM Registers defined in 4 Registers configuration and the additional 2 EM Registers are located below them on the HMI.
The additional lower EM Registers shall have airflow lines and closed graphics but cannot be operated individually as the other 4 EM Registers.

The left side Lower In Board Register is linked to Left Hand In Board (LHIB) Register and right side Lower In Board Register is linked to Right Hand In Board (RHIB) Register.

Please note, there are no Lower Out Board Registers.

In case if the upper In Board Register is moved manually the lower linked In Board Register shall move accordingly.
In case if the upper In Board Register is closed/opened it shall close/open the lower linked In Board Register accordingly.
In case of On Body/Off Body selection, the lower In Board Register shall move to same position as its linked upper In Board Register.
The lower In Board Register shall follow the airflow pattern as its linked upper In Board Register.
For further details please refer HMI specification document (X26k_EM Registers).

2.11   EMR-REQ-470348/A-Electro Mechanical Registers HMI Screen

User can access EM Registers from climate screen in following 2 methods:

1.   Single tap the EM Register button:

If user single taps (press the button for less than 500 ms and release) the left side or right side EM Register button it shall open the page which allows user to manipulate all the vents manually. Please refer section "EMR-FUN-REQ-410841/B-Electro Mechanical Register position changed manually" for further details of manually operating vents, refer section "EMR-FUN-REQ-421209/B-Electro Mechanical Register Close/Open" for further details of how to open/close vents.

2. Long press the EM Register button:

If user long presses (press the button for at least 500 ms) the left side or right side EM Register it shall open the bloom button for that side.

The bloom button shall have On Body/Off Body/Close options on it.

If the user lifts the finger from screen or places finger on "X" on bloom button, it shall exit and go back to climate screen.

If the user drags the finger to one of the options and then releases the finger it shall activate that function accordingly.

When user selects On Body or Off Body option the airflow shall be towards or away from the user respectively. Please refer section "EMR-FUN-REQ-421204/A-On Body/Off Body selection" for details on how On Body & Off Body function.

When user selects to close the EM Registers it shall close both the registers on that side. EMRClient shall send request to EMRServer to close both the registers on that side. Please refer to section "EMR-REQ-421172/B-Closing Electro Mechanical Register" for details on close registers function.

If one register is closed and one open when the user selected close from bloom button, then it shall close the register that was open and the register that was previously closed shall remain close.

If both the registers were already closed and user selected close from bloom button, then the registers shall remain closed.

3 Functional Definition

3.1 EMR-FUN-REQ-410841/B-Electro Mechanical Register position changed manually

3.1.1 Requirements

3.1.1.1 EMR-REQ-421164/B-Electro Mechanical Register position changed manually

EMRClient shall allow the user to select position of any individual EM register manually by moving its grabber as desired. Airflow lines will follow the grabber as it is moved.

When user moves grabber on the HMI, EMRClient shall send following request to EMRServer:
Register_LHOB = 0x1 (manualChange),
Register_LHOB_Horizontal = 0x00 – 0x64 (0% to 100%),
Register_LHOB_Vertical = 0x00 – 0x64 (0% to 100%) if user moves Lefthand Outboard Register
Or
Register_LHIB = 0x1 (manualChange),
Register_LHIB_Horizontal = 0x00 – 0x64 (0% to 100%),
Register_LHIB_Vertical = 0x00 – 0x64 (0% to 100%) if user moves Lefthand Inboard Register
Or
Register_RHOB = 0x1 (manualChange),
Register_RHOB_Horizontal = 0x00 – 0x64 (0% to 100%),
Register_RHOB_Vertical = 0x00 – 0x64 (0% to 100%) if user moves Righthand Outboard Register
O
Register_RHIB = 0x1 (manualChange),
Register_RHIB_Horizontal = 0x00 – 0x64 (0% to 100%),
Register_RHIB_Vertical = 0x00 – 0x64 (0% to 100%) if user moves Righthand Inboard Register

When EMRServer gets the manual move register request it shall process the request and send actual position of EM register to the EMRClient in real time as follows:
HMIFeedback_LHOB_Horizontal = 0x00 – 0xFF,
HMIFeedback_LHOB_Vertical = 0x00 - 0xFE if user moves Lefthand Outboard Register
Or
HMIFeedback_LHIB_Horizontal = 0x00 – 0xFF,
HMIFeedback_LHIB_Vertical = 0x00 - 0xFE if user moves Lefthand Inboard Register
Or
HMIFeedback_RHOB_Horizontal = 0x00 – 0xFF,
HMIFeedback_RHOB_Vertical = 0x00 - 0xFE if user moves Righthand Outboard Register
Or
HMIFeedback_RHIB_Horizontal = 0x00 – 0xFF,
HMIFeedback_RHIB_Vertical = 0x00 - 0xFE if user moves Righthand Inboard Register

EMRClient shall send out horizonal and vertical position signals as frequently as possible.
Manual change shall not be sent for longer than 60 seconds.
The EM register will function for this position until request is made to change it.

3.1.2 Use Cases

3.1.2.1 EMR-UC-REQ-421178/A-User adjusts EM register to desired position manually

| Actors	EMRClient, User
Pre-conditions	Power mode is ON. EMRClient is active. EMRClient screen is ON.
Scenario Description	User touch grabber adjacent to EM register and drag it to any location within a periphery to aim.

Post-conditions	Airflow lines follows grabber as Louvers move. EM register move to new position as requested by user through HMI resulting in the airflow change within cabin. HMI displays the new EM register position.
List of Exception Use Cases	
Interfaces	HMI, CAN

3.1.3 White Box Views
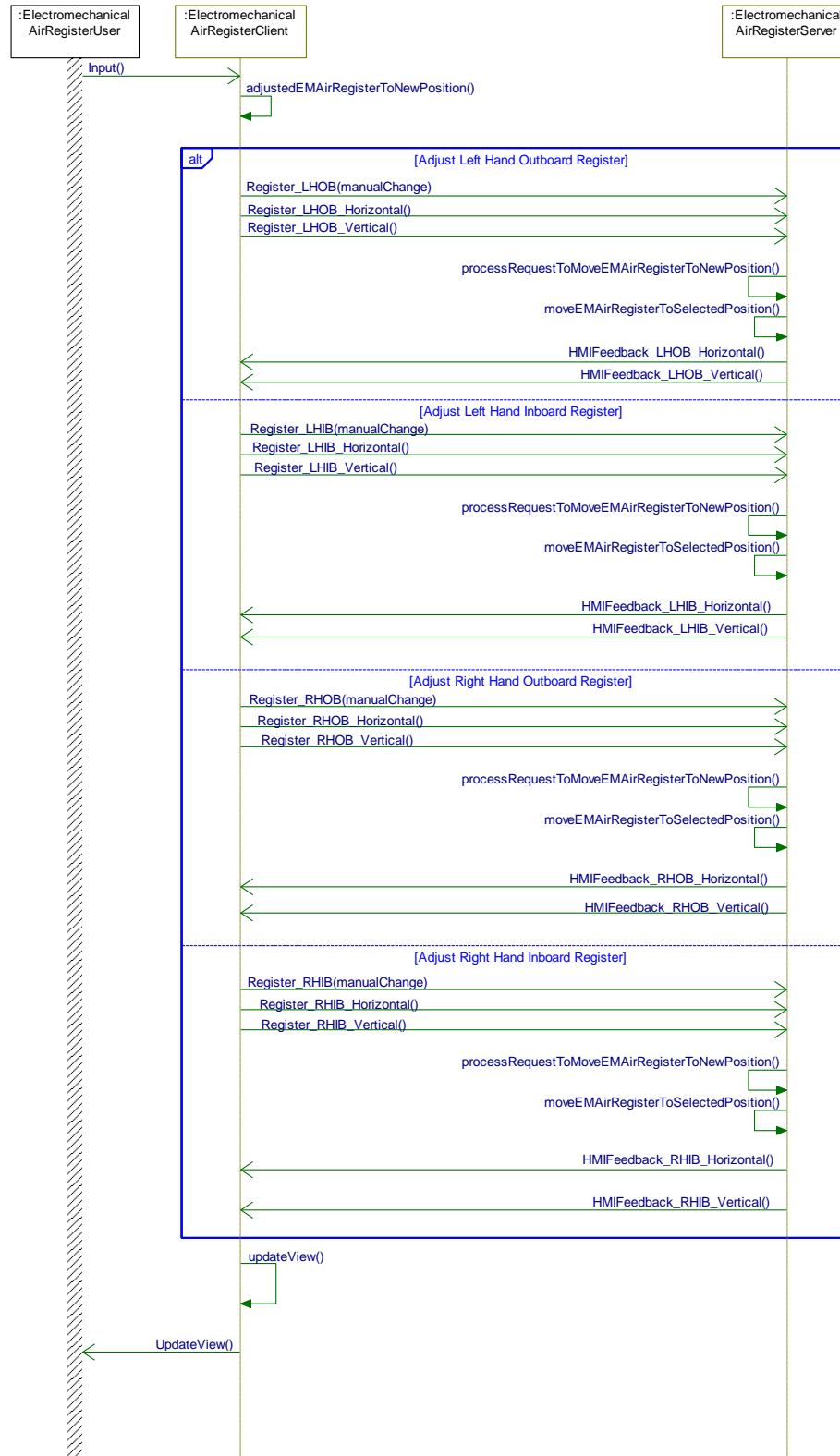
3.1.3.1 Activity Diagrams

3.1.3.1.1 EMR-ACT-REQ-421222/A-User Adjusts Register
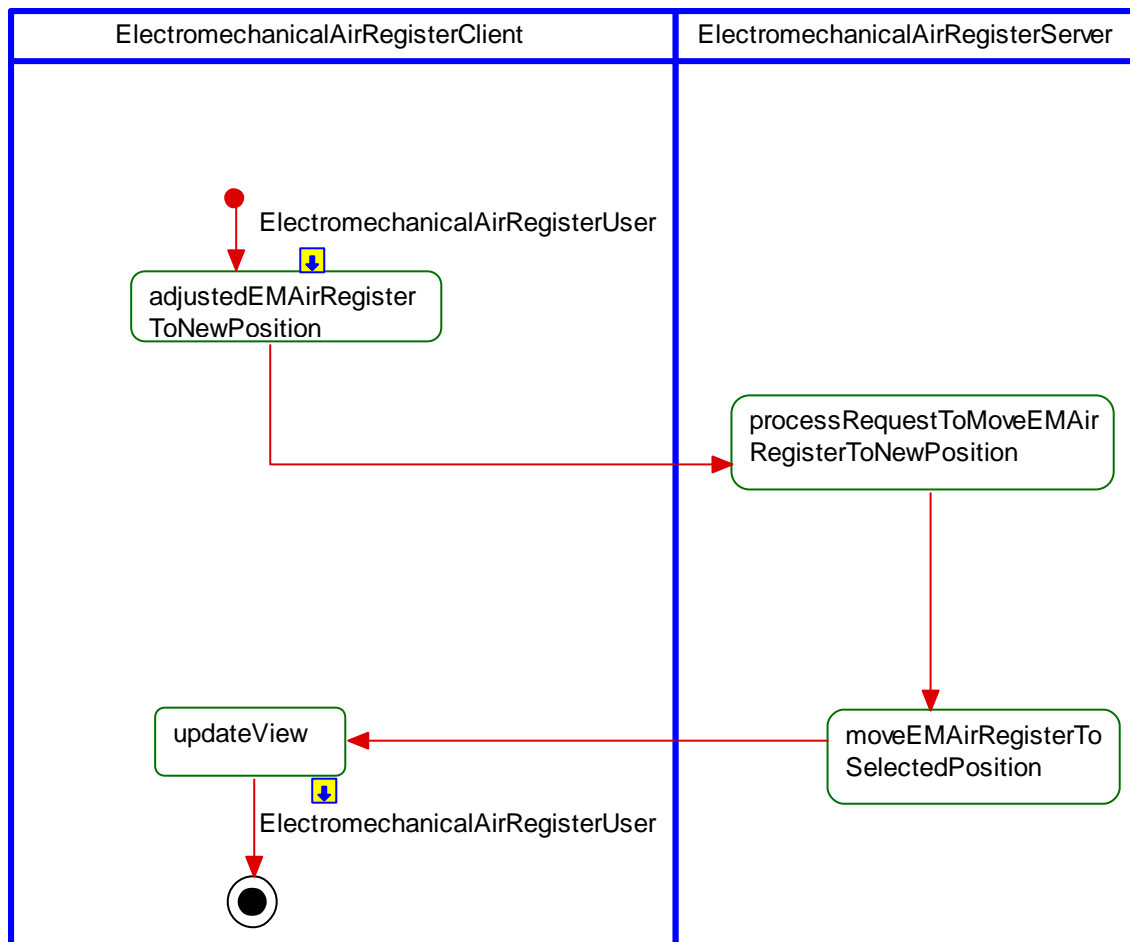
3.1.3.2   Sequence Diagrams

3.1.3.2.1   EMR-SD-REQ-421223/A-User Adjusts Register

3.2   EMR-FUN-REQ-421204/A-On Body/Off Body selection

3.2.1   Requirements

3.2.1.1   *EMR-REQ-421170/B-On Body option selection*

EMRClient shall allow the user to aim airflow from Left side or Right side EM registers pointing towards occupant on that side of vehicle.

When user touches On Body button on the HMI, EMRClient shall send following request to EMRServer:

ActiveButtonsLHS_Rq = 0x1 (onBodyLHS) if user selects Left side On Body

Or

ActiveButtonsRHS_Rq = 0x1 (onBodyRHS) if user selects Right side On Body

EMRServer upon receiving request from EMRClient shall position the Left side or Right side EM registers to the pre-defined fixed values and update EMRClient as follows:

HMIFeedback_LHOB_Horizontal = 0x00 – 0xFF,

HMIFeedback_LHOB_Vertical = 0x00 - 0xFE,

HMIFeedback_LHIB_Horizontal = 0x00 – 0xFF,

HMIFeedback_LHIB_Vertical = 0x00 - 0xFE if user selects Left side On Body

Or

HMIFeedback_RHOB_Horizontal = 0x00 – 0xFF,

HMIFeedback_RHOB_Vertical = 0x00 - 0xFE,

HMIFeedback_RHIB_Horizontal = 0x00 – 0xFF,

HMIFeedback_RHIB_Vertical = 0x00 - 0xFE if user selects Right side On Body

Along with position signals EMRServer shall send status signal to EMRClient continuously indicating the On Body is active:

ActiveButtonsLHS_St = 0x1 (onBodyLHS) for Left side On Body

Or

ActiveButtonsRHS_St = 0x1 (onBodyRHS) for Right side On Body

When EMRClient receives the status signal as follows, it shall understand that On Body should be exited and the HMI is updated accordingly:

ActiveButtonsLHS_St ≠ 0x1 (onBodyLHS) when Left side On Body exited

Or

ActiveButtonsRHS_St ≠ 0x1 (onBodyRHS) when Right side On Body exited

EMRClient upon receiving the status from EMRServer shall move both the EM registers on that side for the fixed preset.

3.2.1.2   *EMR-REQ-421171/B-Off Body option selection*

EMRClient shall allow the user to aim airflow from Left side or Right side EM registers pointing away from occupant on that side of vehicle.

When user touches Off Body button on the HMI, EMRClient shall send following request to EMRServer:

ActiveButtonsLHS_Rq = 0x2 (offBodyLHS) if user selects Left side Off Body

Or

ActiveButtonsRHS_Rq = 0x2 (offBodyRHS) if user selects Right side Off Body

EMRServer upon receiving request from EMRClient shall position the Left side or Right side registers to the pre-defined fixed values and send status to the EMRClient as follows:

HMIFeedback_LHOB_Horizontal = 0x00 – 0xFF,

HMIFeedback_LHOB_Vertical = 0x00 - 0xFE,

HMIFeedback_LHIB_Horizontal = 0x00 – 0xFF,

HMIFeedback_LHIB_Vertical = 0x00 - 0xFE if user selects Left side Off Body

Or

HMIFeedback_RHOB_Horizontal = 0x00 – 0xFF,

HMIFeedback_RHOB_Vertical = 0x00 - 0xFE,

HMIFeedback_RHIB_Horizontal = 0x00 – 0xFF,

HMIFeedback_RHIB_Vertical = 0x00 - 0xFE if user selects Right side Off Body

Along with position signals EMRServer shall send status signal to EMRClient continuously indicating the Off Body is active:
ActiveButtonsLHS_St = 0x2 (offBodyLHS) for Left side Off Body
Or
ActiveButtonsRHS_St = 0x2 (offBodyRHS) for Right side Off Body

When EMRClient receives the status signal as follows, it shall understand that Off Body should be exited and the HMI is updated accordingly:
ActiveButtonsLHS_St ≠ 0x2 (offBodyLHS) when Left side Off Body exited
Or
ActiveButtonsRHS_St ≠ 0x2 (offBodyRHS) when Right side Off Body exited

EMRClient upon receiving the status from EMRServer shall move both the EM registers on that side for the fixed preset.

3.2.2   Use Cases

3.2.2.1   EMR-UC-REQ-421186/A-User selects Left side On Body option

Actors	EMRClient, User
Pre-conditions	Power mode is ON. EMRClient is active. EMRClient screen is ON.
Scenario Description	User selects Left side On Body option.
Post-conditions	Left side EM registers move to aim airflow directly onto Left side. HMI displays the Left side EM registers airflow lines pointing towards the occupant.
List of Exception Use Cases	
Interfaces	HMI, CAN

3.2.2.2   EMR-UC-REQ-421187/A-User selects Right side On Body option

Actors	EMRClient, User
Pre-conditions	Power mode is ON. EMRClient is active. EMRClient screen is ON.
Scenario Description	User selects Right side On Body option.
Post-conditions	Right side EM registers move to aim airflow directly onto Right side. HMI displays the Right side EM registers airflow lines pointing towards the occupant.
List of Exception Use Cases	
Interfaces	HMI, CAN

3.2.2.3   EMR-UC-REQ-421188/A-User selects Left side Off Body option

Actors	EMRClient, User
Pre-conditions	Power mode is ON. EMRClient is active. EMRClient screen is ON.

Scenario Description	User selects Left side Off Body option.
Post-conditions	Left side EM registers move to aim airflow away from Left side. HMI displays the Left side EM registers airflow lines pointing away from the occupant.
List of Exception Use Cases	
Interfaces	HMI, CAN

3.2.2.4 EMR-UC-REQ-421189/A-User selects Right side Off Body option

| Actors	EMRClient, User
Pre-conditions	Power mode is ON. EMRClient is active. EMRClient screen is ON.
Scenario Description	User selects Right side Off Body option.
Post-conditions	Right side EM registers move to aim airflow away from Right side. HMI displays the Right side EM registers airflow lines pointing away from the occupant.
List of Exception Use Cases	
Interfaces	HMI, CAN

3.2.3 White Box Views

3.2.3.1 Activity Diagrams

3.2.3.1.1 EMR-ACT-REQ-421232/A-Left Side On Body Selection
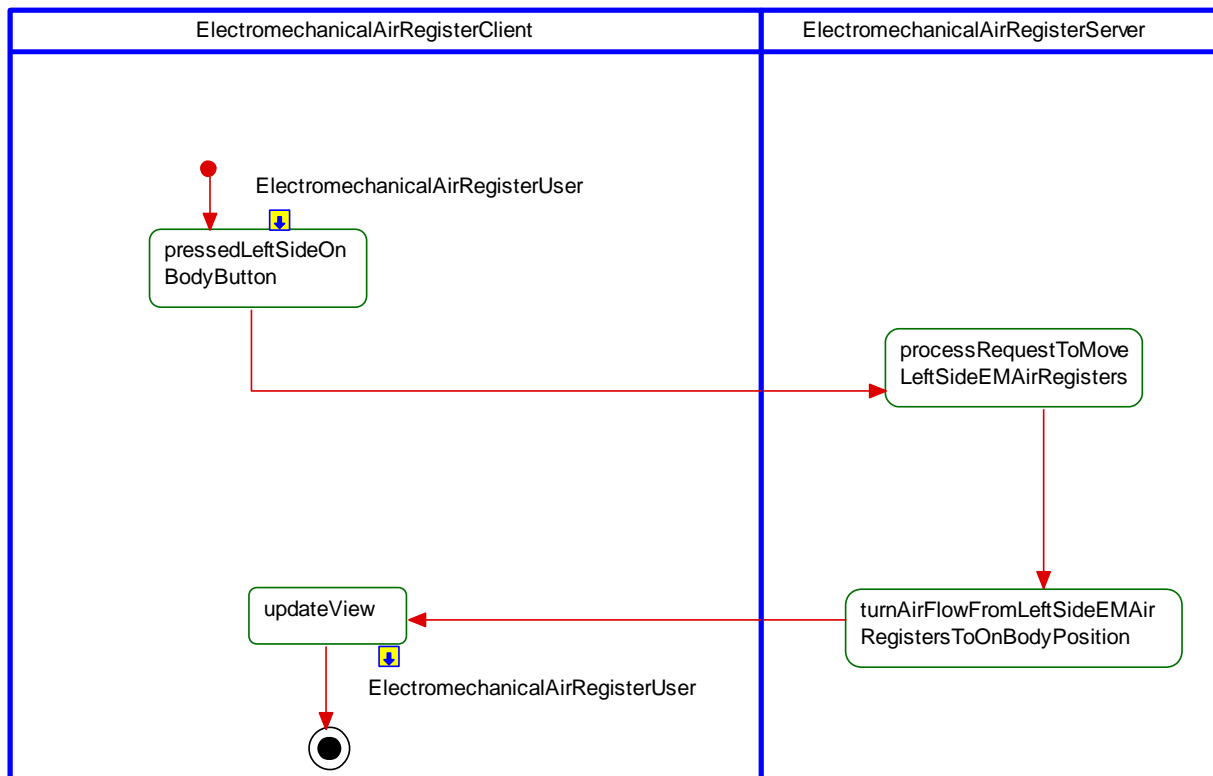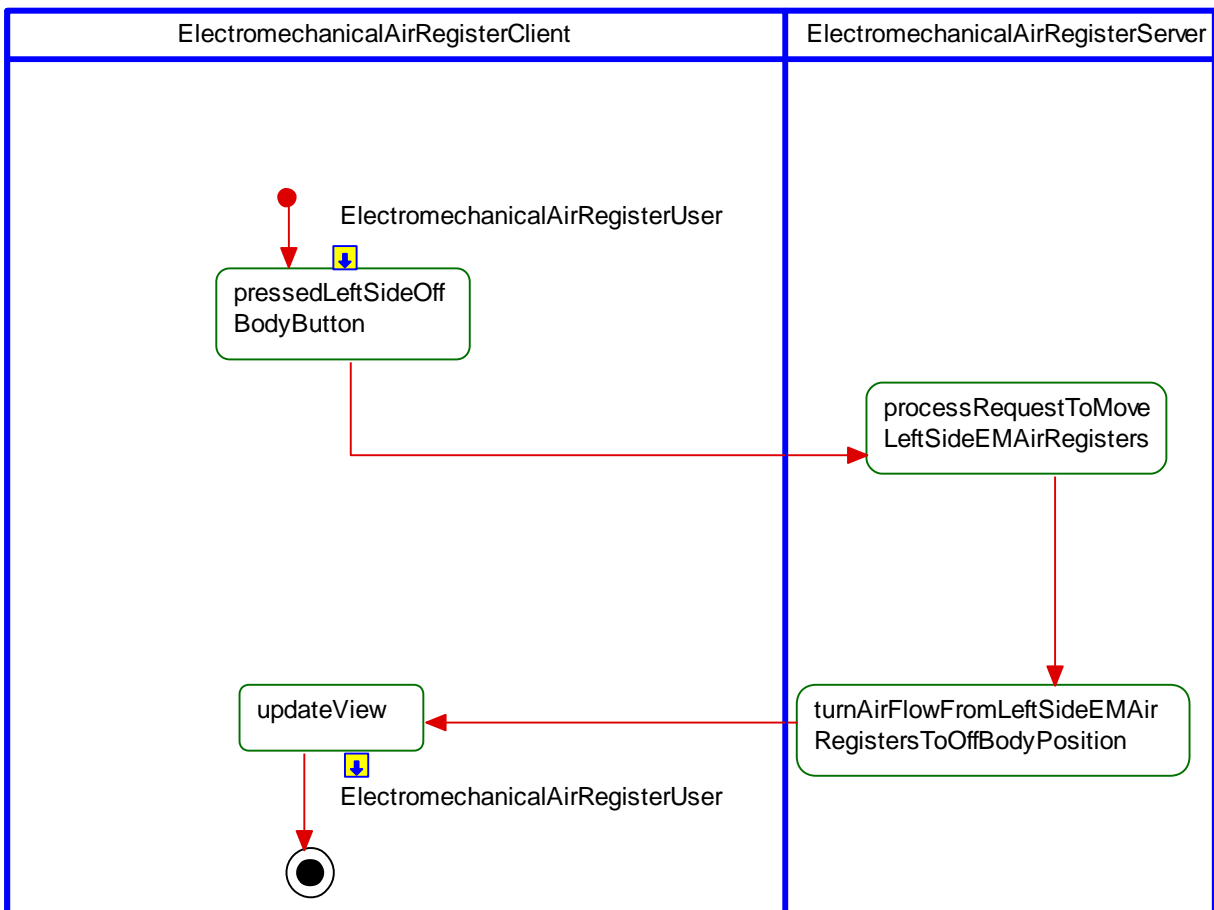
3.2.3.1.2   EMR-ACT-REQ-421233/A-Right Side On Body Selection
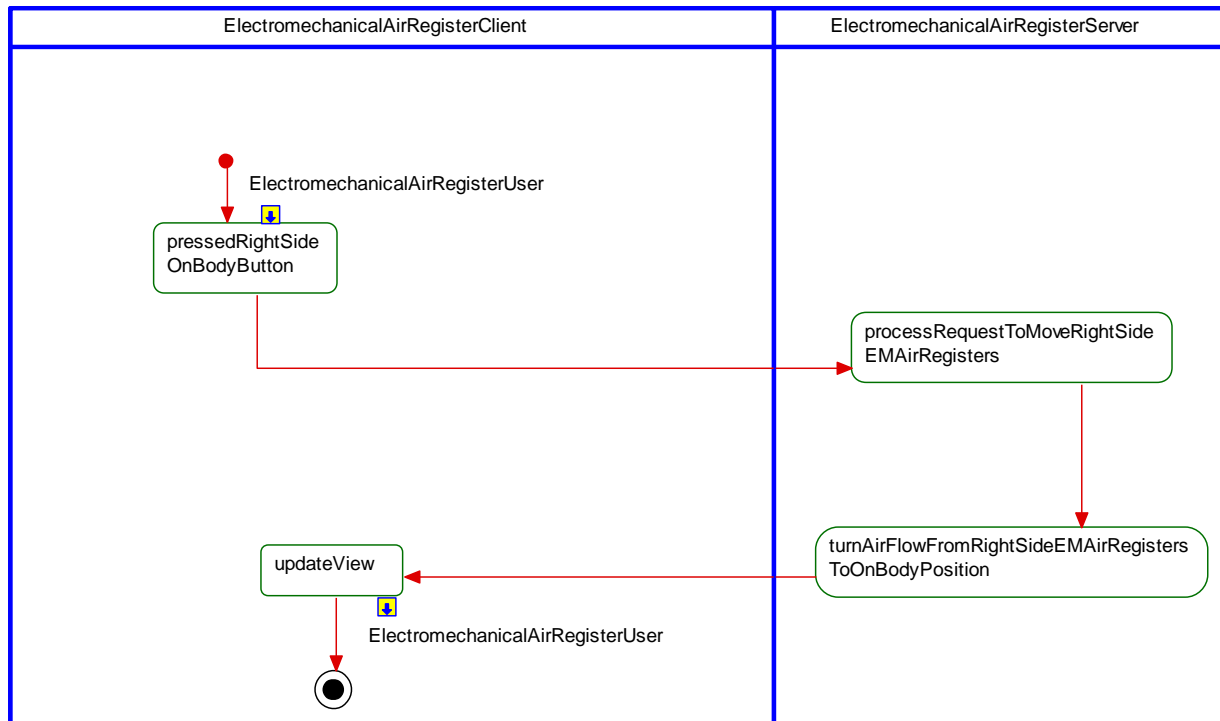
3.2.3.1.3   EMR-ACT-REQ-421236/A-Left Side Off Body Selection

3.2.3.1.4 EMR-ACT-REQ-421237/A-Right Side Off Body Selection

ElectromechanicalAirRegisterClient	ElectromechanicalAirRegisterServer

ElectromechanicalAirRegisterUser

pressedRightSideOff
BodyButton

processRequestToMoveRightSideEM
AirRegisters

turnAirFlowFromRightSideEMAirRegistersTo
OffBodyPosition

updateView

ElectromechanicalAirRegisterUser
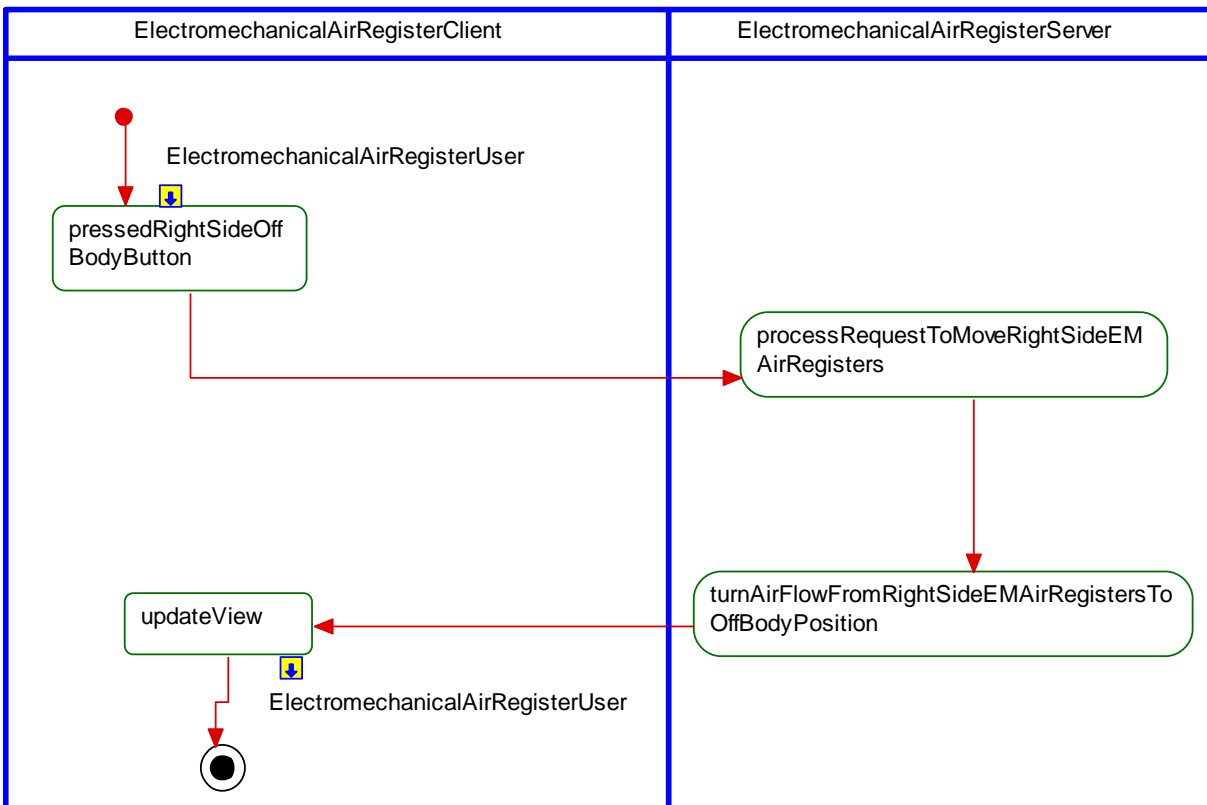
3.2.3.2 *Sequence Diagrams*

3.2.3.2.1 **EMR-SD-REQ-421234/B-Left Side On Body Selection**

3.2.3.2.2 EMR-SD-REQ-421235/B-Right Side On Body Selection

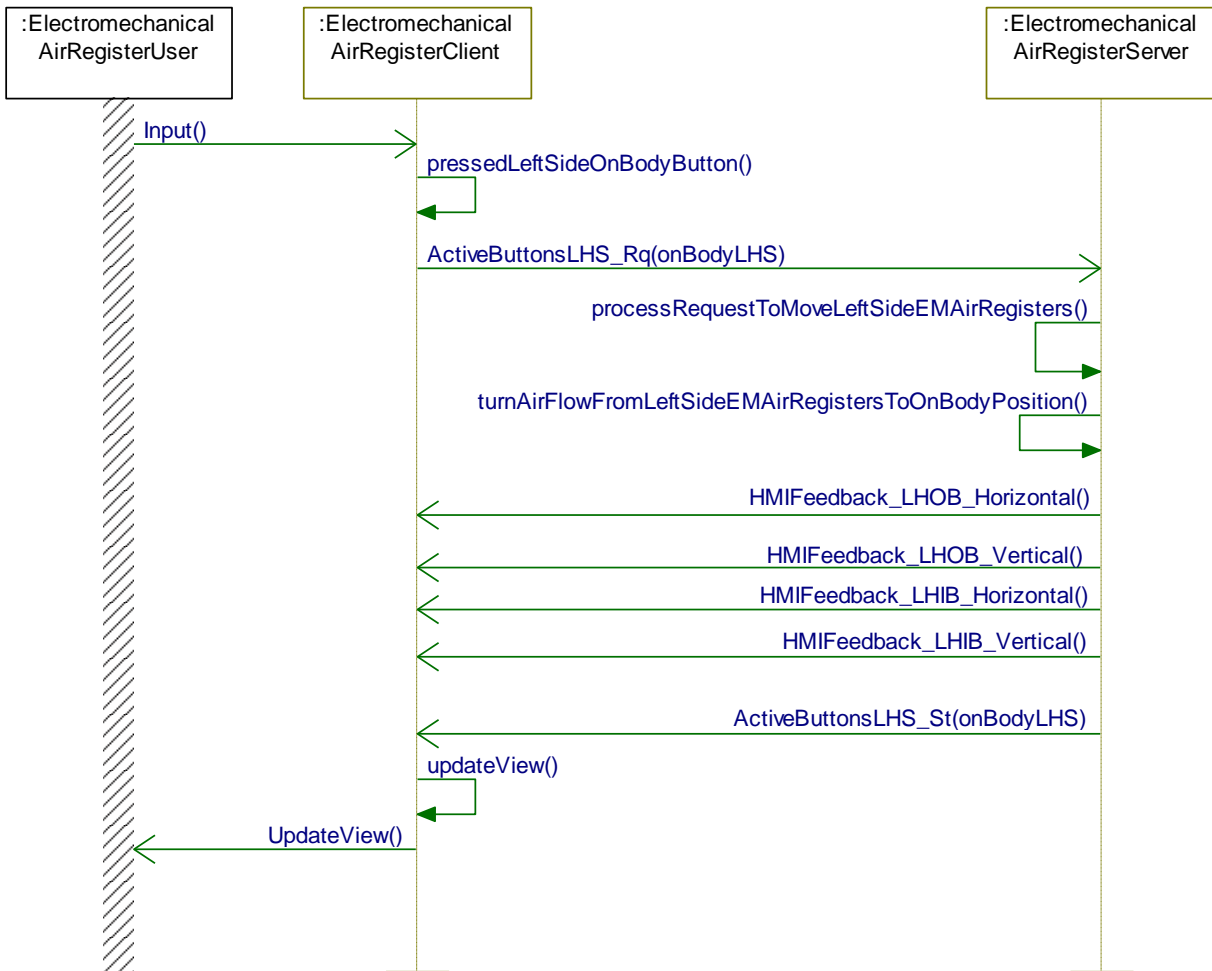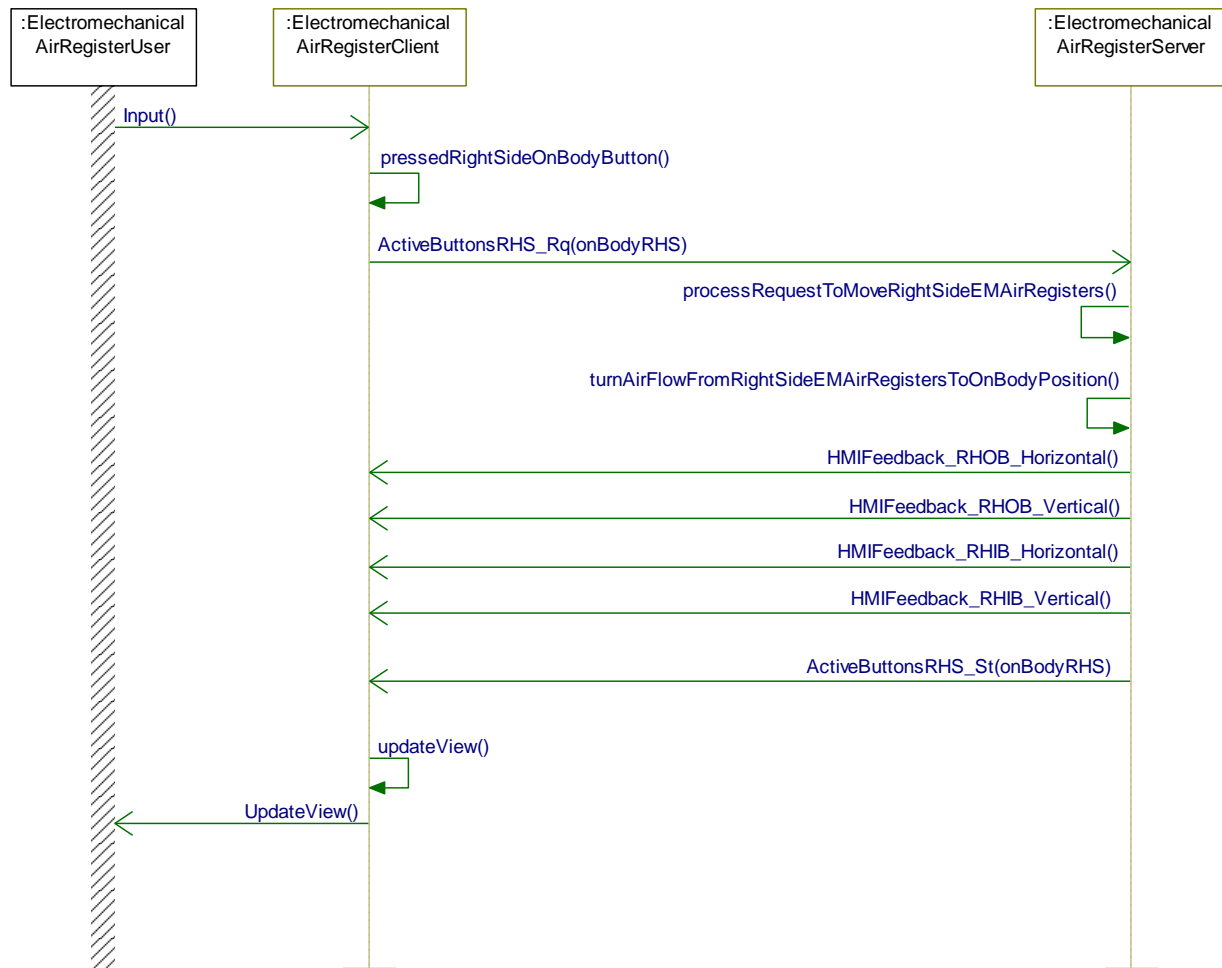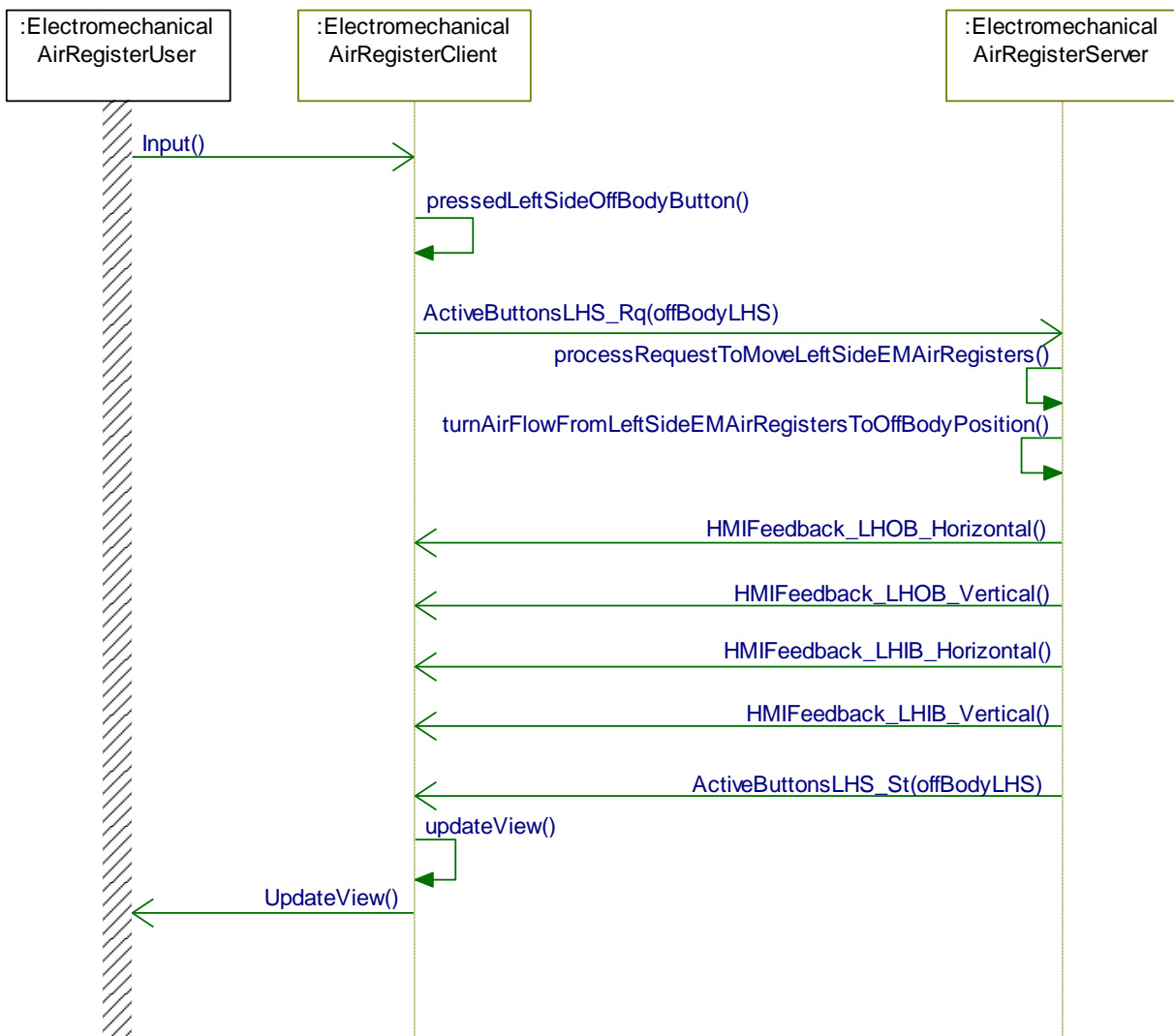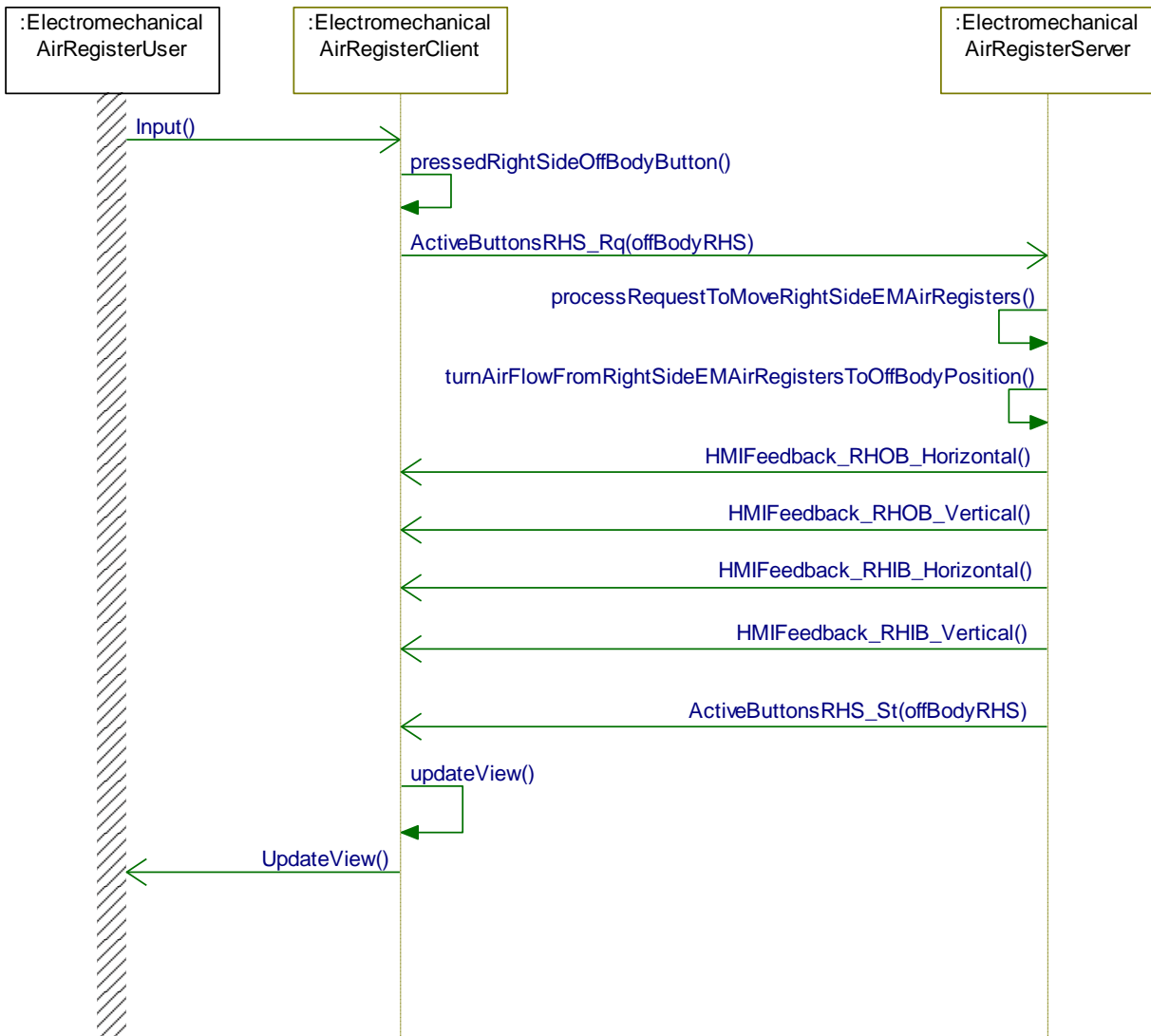### 3.2.3.2.3 EMR-SD-REQ-421238/B-Left Side Off Body Selection

3.2.3.2.4 EMR-SD-REQ-421239/B-Right Side Off Body Selection

3.3 EMR-FUN-REQ-421209/B-Electro Mechanical Register Close/Open

3.3.1 Requirements

3.3.1.1 *EMR-REQ-421172/C-Closing Electro Mechanical Register*

EMRClient shall allow the user to turn off airflow from any individual EM register.

When user selects to close any individual EM register by moving the grabber over the close vent icon EMRClient shall send following request to EMRServer:

Register_LHOB = 0x1 (manualChange),
Register_LHOB_Horizontal = 0x00 – 0x64 (0% to 100%),
Register_LHOB_Vertical = 0x00 – 0x64 (0% to 100%) if user closing Lefthand Outboard Register
Or
Register_LHIB = 0x1 (manualChange),
Register_LHIB_Horizontal = 0x00 – 0x64 (0% to 100%),
Register_LHIB_Vertical = 0x00 – 0x64 (0% to 100%) if user closing Lefthand Inboard Register
Or

Register_RHOB = 0x1 (manualChange),
Register_RHOB_Horizontal = 0x00 – 0x64 (0% to 100%),
Register_RHOB_Vertical = 0x00 – 0x64 (0% to 100%) if user closing Righthand Outboard Register
Or
Register_RHIB = 0x1 (manualChange),
Register_RHIB_Horizontal = 0x00 – 0x64 (0% to 100%),
Register_RHIB_Vertical = 0x00 – 0x64 (0% to 100%) if user closing Righthand Inboard Register

When grabber reaches the close region, EMRClient identifies that register shall be closed.

At this point EMRClient shall send coordinates for first position of this movement of grabber along with Manual Change signal so that EMRServer shall store it as last know value before receiving Close request.

If user closes Lefthand Outboard Register:
Register_LHOB = 0x1 (manualChange),
Register_LHOB_Horizontal = 0x00 – 0x64 (0% to 100%),
Register_LHOB_Vertical = 0x00 – 0x64 (0% to 100%) coordinates for first position of grabber movement before closing Lefthand Outboard Register
Followed by
Register_LHOB = 0x5 (close)

If user closes Lefthand Inboard Register:
Register_LHIB = 0x1 (manualChange),
Register_LHIB_Horizontal = 0x00 – 0x64 (0% to 100%),
Register_LHIB_Vertical = 0x00 – 0x64 (0% to 100%) coordinates for first position of grabber movement before closing Lefthand Inboard Register
Followed by
Register_LHIB = 0x5 (close)

If user closes Righthand Outboard Register:
Register_RHOB = 0x1 (manualChange),
Register_RHOB_Horizontal = 0x00 – 0x64 (0% to 100%),
Register_RHOB_Vertical = 0x00 – 0x64 (0% to 100%) coordinates for first position of grabber movement before closing Righthand Outboard Register
Followed by
Register_RHOB = 0x5 (close)

If user closes Righthand Inboard Register
Register_RHIB = 0x1 (manualChange),
Register_RHIB_Horizontal = 0x00 – 0x64 (0% to 100%),
Register_RHIB_Vertical = 0x00 – 0x64 (0% to 100%) coordinates for first position of grabber movement before closing Righthand Inboard Register
Followed by
Register_RHIB = 0x5 (close)

EMRServer upon receiving request from EMRClient shall process it and send response as follows:

HMIFeedback_LHOB_Vertical = 0xFF (Closed) for Lefthand Outboard Register
Or
HMIFeedback_LHIB_Vertical = 0xFF (Closed) for Lefthand Inboard Register
Or
HMIFeedback_RHOB_Vertical = 0xFF (Closed) for Righthand Outboard Register
Or
HMIFeedback_RHIB_Vertical = 0xFF (Closed) for Righthand Inboard Register

EMRClient shall change vent icon to close vent, remove airflow lines and moves the grabber to first position of this grabber movement.

Note: Only Vertical Vane Feedback signals determine that Register is Closed. Horizontal Vane Feedback signals shall not have impact on Register close position.

3.3.1.2 EMR-REQ-421173/B-Opening a closed Electro Mechanical Register
EMRClient shall allow the user to turn on airflow from any closed EM register.

When user single-taps grabber or moves the grabber of closed EM register, EMRClient shall send following request to EMRServer:

If user opens closed Lefthand Outboard Register:
Register_LHOB = 0x4 (open) if user single-tap closed Lefthand Outboard Register
Or
Register_LHOB = 0x1 (manualChange),
Register_LHOB_Horizontal = 0x00 – 0x64 (0% to 100%),
Register_LHOB_Vertical = 0x00 – 0x64 (0% to 100%) if user moves grabber of closed Lefthand Outboard Register

If user opens closed Lefthand Inboard Register
Register_LHIB = 0x4 (open) if user single-tap closed Lefthand Inboard Register
Or
Register_LHIB = 0x1 (manualChange),
Register_LHIB_Horizontal = 0x00 – 0x64 (0% to 100%),
Register_LHIB_Vertical = 0x00 – 0x64 (0% to 100%) if user moves grabber of closed Lefthand Inboard Register

If user opens closed Righthand Outboard Register
Register_RHOB = 0x4 (open) if user single-tap closed Righthand Outboard Register
Or
Register_RHOB = 0x1 (manualChange),
Register_RHOB_Horizontal = 0x00 – 0x64 (0% to 100%),
Register_RHOB_Vertical = 0x00 – 0x64 (0% to 100%) if user moves grabber of closed Righthand Outboard Register

If user opens closed Righthand Inboard Register
Register_RHIB = 0x4 (open) if user single-tap closed Righthand Inboard Register
Or
Register_RHIB = 0x1 (manualChange),
Register_RHIB_Horizontal = 0x00 – 0x64 (0% to 100%),
Register_RHIB_Vertical = 0x00 – 0x64 (0% to 100%) if user moves grabber of closed Righthand Inboard Register

A single tap is when user presses and releases the grabber upon which the EMRClient would send the request to the EMRServer.

When EMRServer gets open register request it shall provide last known position of EM register to the EMRClient as follows:
HMIFeedback_LHOB_Horizontal = 0x00 – 0xFF,
HMIFeedback_LHOB_Vertical = 0x00 - 0xFE for Lefthand Outboard Register
Or
HMIFeedback_LHIB_Horizontal = 0x00 – 0xFF,
HMIFeedback_LHIB_Vertical = 0x00 - 0xFE for closed Lefthand Inboard Register
Or
HMIFeedback_RHOB_Horizontal = 0x00 – 0xFF,
HMIFeedback_RHOB_Vertical = 0x00 - 0xFE for closed Righthand Outboard Register
Or
HMIFeedback_RHIB_Horizontal = 0x00 – 0xFF,
HMIFeedback_RHIB_Vertical = 0x00 - 0xFE for closed Righthand Inboard Register

When EMRServer provides confirmation that the closed EM register is opened EMRClient shall change icon to open vent and display airflow lines.

3.3.2   Use Cases

3.3.2.1   EMR-UC-REQ-421190/A-User shuts off air flow from EM register

Actors	EMRClient, User
Pre-conditions	Power mode is ON. EMRClient is active. EMRClient screen is ON.
Scenario Description	User moves grabber of EM register over the close vent icon to close the EM register.
Post-conditions	EM register is closed and airflow shuts off from that EM register. Grabber moves to the first position of this grabber movement.
List of Exception Use Cases	
Interfaces	HMI, CAN

3.3.2.2   EMR-UC-REQ-421191/A-User turns on the closed EM register

Actors	EMRClient, User
Pre-conditions	Power mode is ON. EMRClient is active. EMRClient screen is ON. Air EM register is closed.
Scenario Description	User taps one time on the grabber or moves the grabber of the closed EM register.
Post-conditions	EM register is open for airflow. Note: See "Electro Mechanical Register position changed manually" section if user moved the grabber.
List of Exception Use Cases	
Interfaces	HMI, CAN

3.3.3   White Box Views

3.3.3.1   Activity Diagrams

3.3.3.1.1   EMR-ACT-REQ-421240/A-User Shuts Off Register
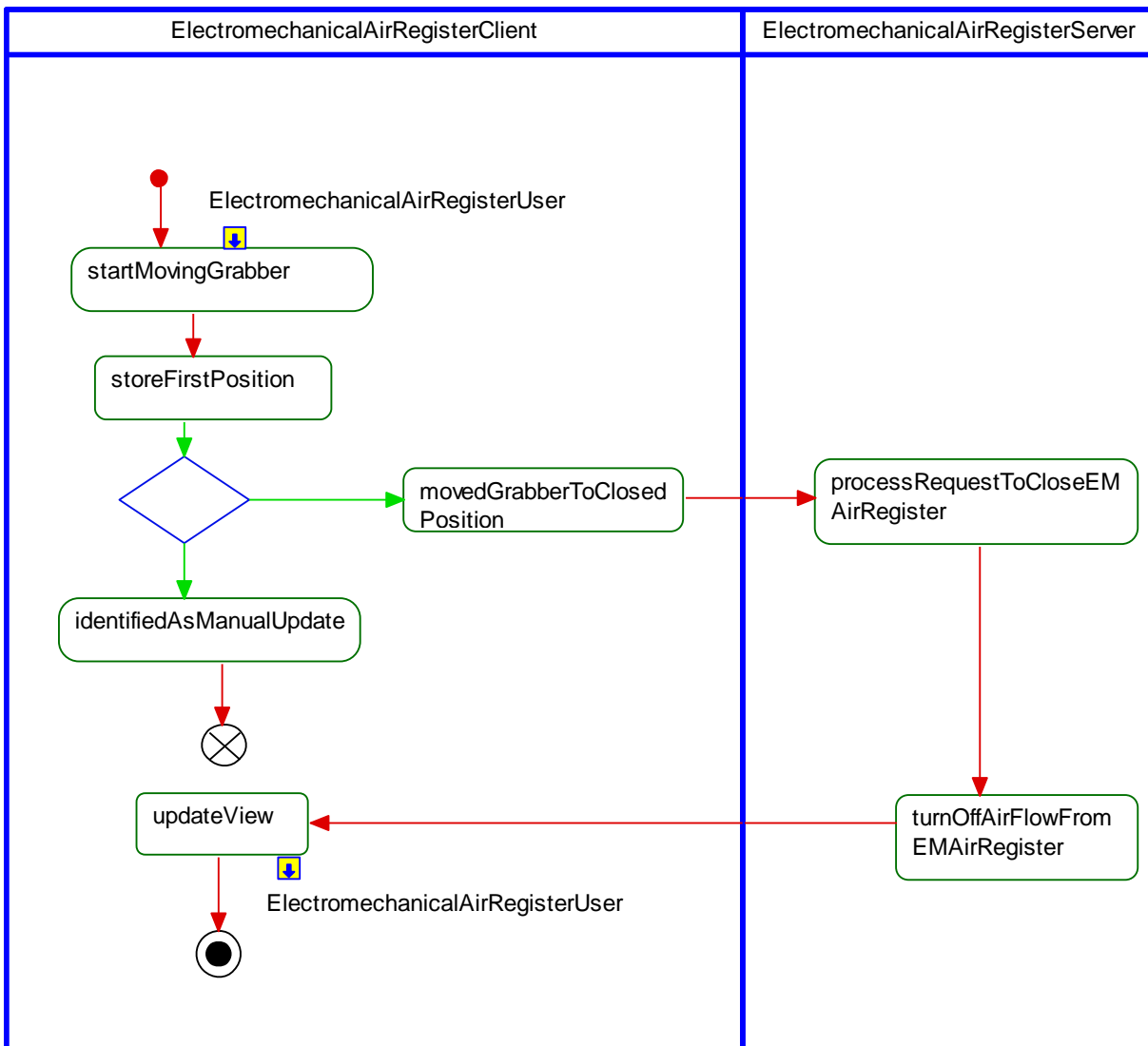
3.3.3.1.2 EMR-ACT-REQ-421241/A-User Turns On Closed Register by Single-Tap Action

3.3.3.2 *Sequence Diagrams*

3.3.3.2.1 **EMR-SD-REQ-421242/A-User Shuts Off Register**

3.3.3.2.2 EMR-SD-REQ-421243/A-User Turns On Closed Register by Single-Tap Action

3.4   EMR-FUN-REQ-421295/A-Air Motion Selection

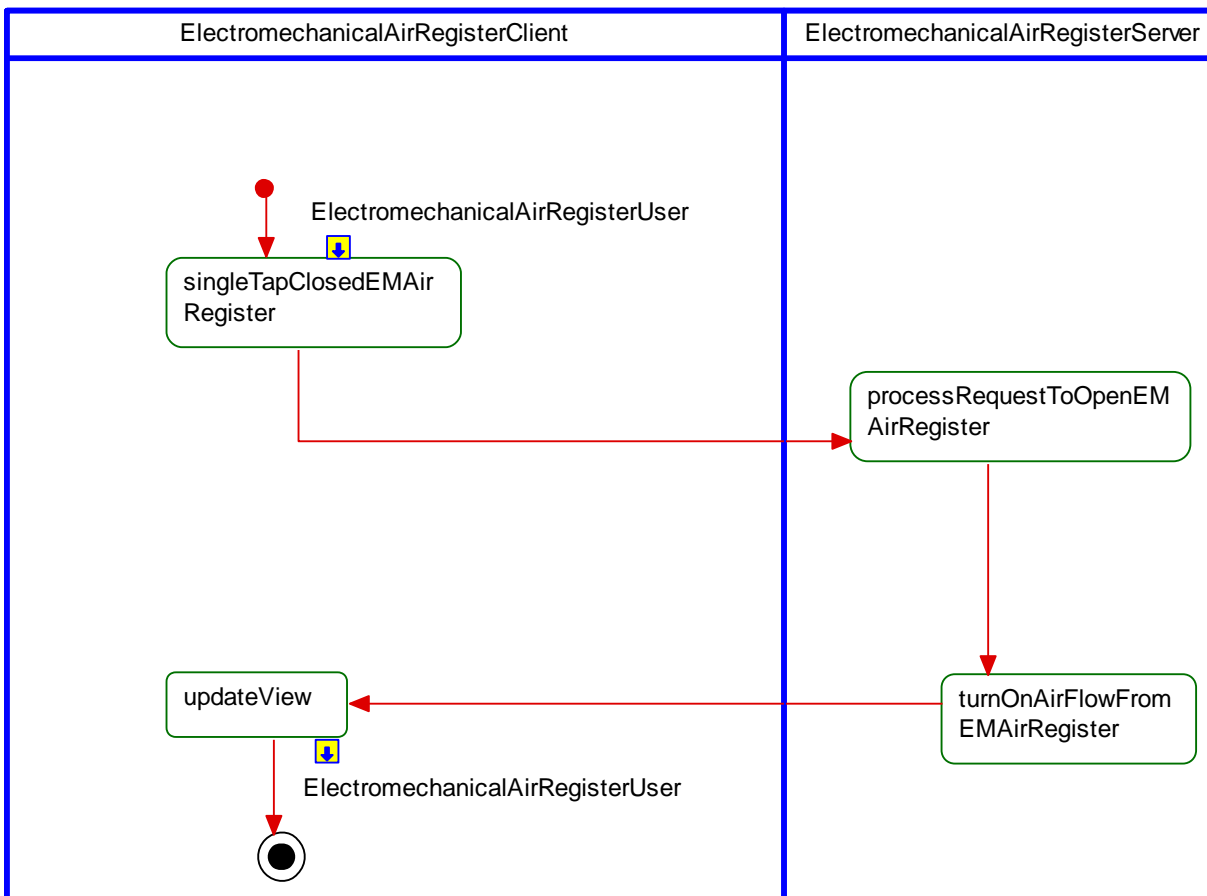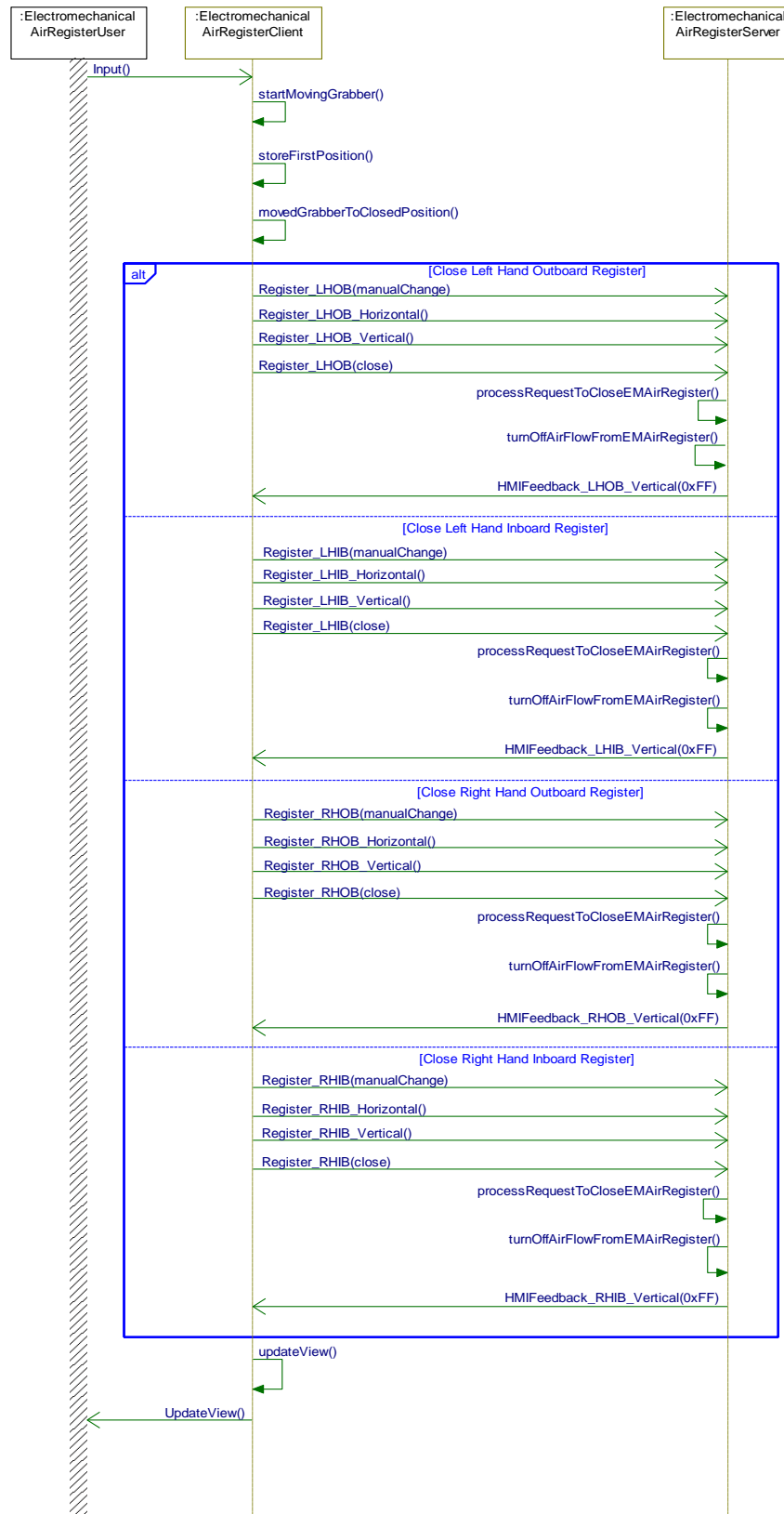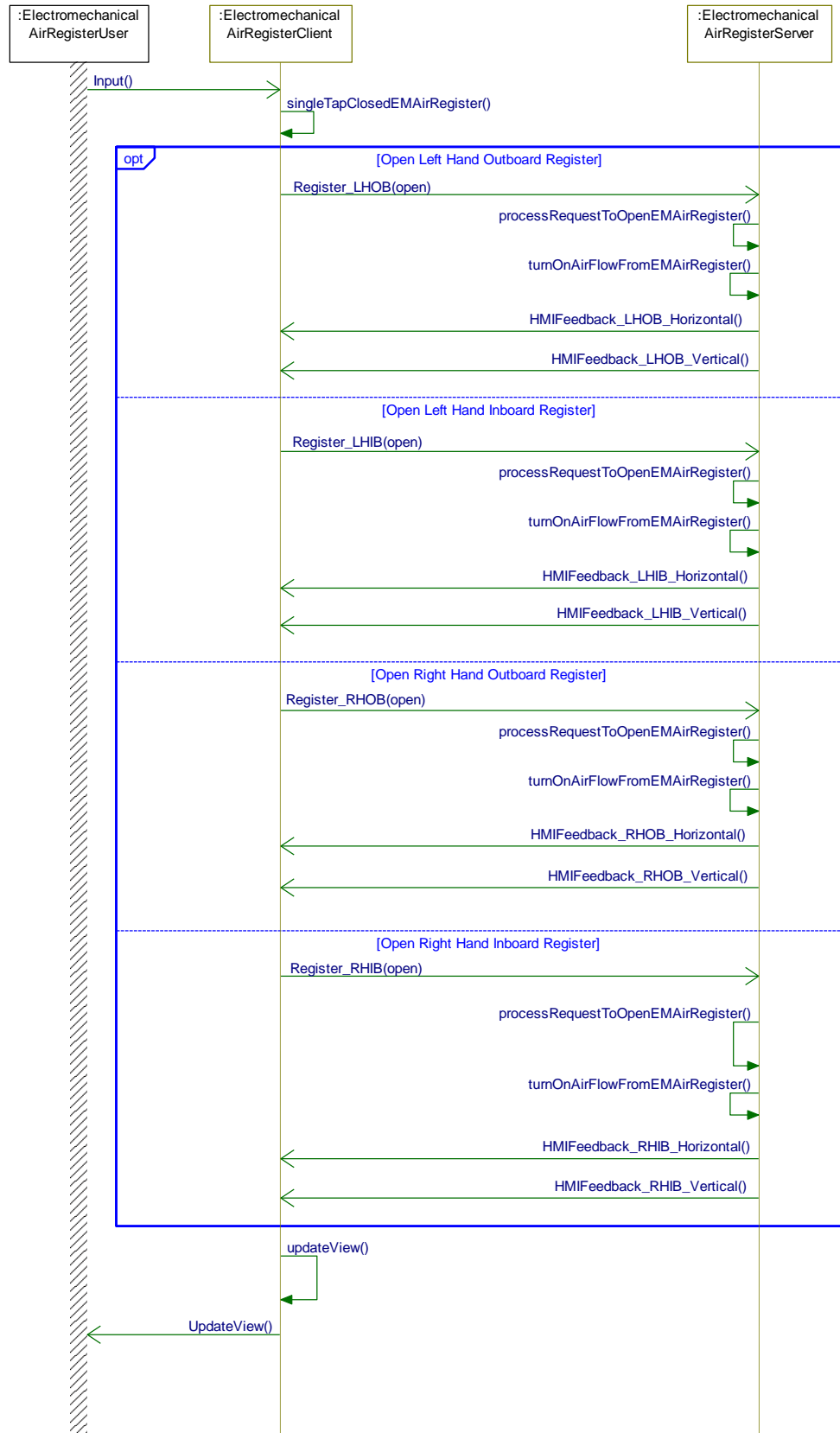### 3.4.1   Requirements

3.4.1.1   EMR-REQ-421167/B-Air Motion option selection

EMRClient shall allow the user to select a cycling mode via HMI where in the relevant side EM registers move in predefined pattern for airflow.

When user selects Air Motion pattern (Please refer HMI spec (X26k_EM Registers) for details on how many patterns are available and how to select the pattern), EMRClient shall send to EMRServe the type of Air Motion selected and the current position of the registers:
ActiveButtonsLHS_Rq = 0x7 (cycle_8_LHS) or 0x8 (cycle_C_LHS) or 0x9 (cycle_O_LHS) or 0xA (cycle_--_LHS) or 0xB (cycle_I_LHS) depending on the pattern selected on Left side
Register_LHOB_Horizontal = 0x00 – 0x64 (0% to 100%),
Register_LHOB_Vertical = 0x00 – 0x64 (0% to 100%),
Register_LHIB_Horizontal = 0x00 – 0x64 (0% to 100%),
Register_LHIB_Vertical = 0x00 – 0x64 (0% to 100%)
Or
ActiveButtonsRHS_Rq = 0x7 (cycle_8_RHS) or 0x8 (cycle_C_RHS) or 0x9 (cycle_O_RHS) or 0xA (cycle_--_RHS) or 0xB (cycle_I_RHS) depending on the pattern selected on Right side
Register_RHOB_Horizontal = 0x00 – 0x64 (0% to 100%),
Register_RHOB_Vertical = 0x00 – 0x64 (0% to 100%),
Register_RHIB_Horizontal = 0x00 – 0x64 (0% to 100%),
Register_RHIB_Vertical = 0x00 – 0x64 (0% to 100%)

EMRServer upon receiving request from EMRClient shall remember the current position of Registers to recall when Air Motion is exited and shall process the request and move EM registers in the pre-defined pattern and send update to EMRClient as follows:
HMIFeedback_LHOB_Horizontal = 0x00 – 0xFF,
HMIFeedback_LHOB_Vertical = 0x00 - 0xFE,
HMIFeedback_LHIB_Horizontal = 0x00 – 0xFF,
HMIFeedback_LHIB_Vertical = 0x00 - 0xFE if user selects Left side Air Motion pattern
Or
HMIFeedback_RHOB_Horizontal = 0x00 – 0xFF,
HMIFeedback_RHOB_Vertical = 0x00 - 0xFE,
HMIFeedback_RHIB_Horizontal = 0x00 – 0xFF,
HMIFeedback_RHIB_Vertical = 0x00 - 0xFE if user selects Right side Air Motion pattern

Along with position signals EMRServer shall send status signal to EMRClient continuously indicating the selected air motion is active:
ActiveButtonsLHS_St = 0x5 (cycle_8_LHS) or 0x6 (cycle_C_LHS) or 0x7 (cycle_O_LHS) or 0x8 (cycle_--_LHS) or 0x9 (cycle_I_LHS) depending on the pattern selected on Left side
Or
ActiveButtonsRHS_St = 0x5 (cycle_8_RHS) or 0x6 (cycle_C_RHS) or 0x7 (cycle_O_RHS) or 0x8 (cycle_--_RHS) or 0x9 (cycle_I_RHS) depending on the pattern selected on Right side

When EMRClient receives the status signal with change in value it shall understand that selected air motion is exited and shall update HMI accordingly.

ActiveButtonsLHS_St ≠ 0x5 (cycle_8_LHS) or 0x6 (cycle_C_LHS) or 0x7 (cycle_O_LHS) or 0x8 (cycle_--_LHS) or 0x9 (cycle_I_LHS) depending on the pattern selected on Left side
Or
ActiveButtonsRHS_St ≠ 0x5 (cycle_8_RHS) or 0x6 (cycle_C_RHS) or 0x7 (cycle_O_RHS) or 0x8 (cycle_--_RHS) or 0x9 (cycle_I_RHS) depending on the pattern selected on Right side

EMRClient will continuously move Air Flow lines as EMRServer relays incremental status of moving Air Flow.

3.4.1.2 *EMR-REQ-421168/A-Air Motion pattern not selected – Multiple Patterns*

In case if more than 1 pattern available, when user pushes Air Motion button on Left side or Right side the pattern selection screen for that side appears showing the predefined patterns to select from and if the user doesn't make a selection and menu times out, then EMRClient shall not send any request to EMRServer and the EM registers on that side shall function as they were prior to Air Motion button press.

Note: Air Motion button might be called as Air Pattern button. Please refer HMI spec (X26k_EM Registers) for name of the button.

3.4.1.3 *EMR-REQ-421169/A-Exit/Cancel Air Motion pattern*

EM registers on Left side or Right side will function as per Air Motion pattern selection on that side for the predefined time controlled by EMRServer, after which EM registers shall exit from Air Motion and return to previous position prior to Air Motion button press.
EMRClient shall allow the user to cancel the Air Motion pattern on Left side or Right side by any of the following method:
1. pressing Air Motion button or
2. pressing On Body or Off Body button or
3. closing one of the EM Registers on that side or
4. manually moving one of the EM Register on that side

upon which EM registers shall return to previous position prior to Air Motion button press.

Note: Air Motion button might be called as Sweep button. Please refer HMI spec (X26k_EM Registers) for name of the button.

3.4.2   Use Cases

3.4.2.1   EMR-UC-REQ-421180/A-User selects Left side Air Motion Pattern

Actors	EMRClient, User
Pre-conditions	Power mode is ON. EMRClient is active. EMRClient screen is ON.
Scenario Description	User selects Left Side Air Motion pattern on HMI.
Post-conditions	Left side EM registers keep moving allowing airflow in the predefined cyclical pattern.
List of Exception Use Cases	
Interfaces	HMI, CAN

3.4.2.2   EMR-UC-REQ-421181/A-Left side Air Motion pattern not selected – Multiple Patterns

Actors	EMRClient, User
Pre-conditions	Power mode is ON. EMRClient is active. EMRClient screen is ON. Left side Air Motion button pressed.
Scenario Description	User doesn't make a selection before HMI menu times out.
Post-conditions	Pattern selection screen disappears. Left side EM registers function as per last location prior to Air Motion button press.
List of Exception Use Cases	
Interfaces	HMI, CAN

3.4.2.3 EMR-UC-REQ-421182/A-User cancels Left side Air Motion selection

Actors	EMRClient, User
Pre-conditions	Power mode is ON. EMRClient is active. EMRClient screen is ON. Left side Air Motion pattern selected.
Scenario Description	User pressed on the Air Motion or On Body or Off Body button or manually moved or closed one of the EM register on Left side.
Post-conditions	Left side Air Motion selection is canceled. Left side EM register function as per new selection and other register on same side will point to last location prior to air motion button press.
List of Exception Use Cases	
Interfaces	HMI, CAN

3.4.2.4 EMR-UC-REQ-421183/A-User selects Right side Air Motion Pattern

Actors	EMRClient, User
Pre-conditions	Power mode is ON. EMRClient is active. EMRClient screen is ON.
Scenario Description	User selects Right Side Air Motion pattern on HMI.
Post-conditions	Right side EM registers keep moving allowing airflow in the predefined cyclical pattern.
List of Exception Use Cases	
Interfaces	HMI, CAN

3.4.2.5 EMR-UC-REQ-421184/A-Right side Air Motion pattern not selected – Multiple Patterns

Actors	EMRClient, User
Pre-conditions	Power mode is ON. EMRClient is active. EMRClient screen is ON. Right side Air Motion button pressed.
Scenario Description	User doesn't make a selection before HMI menu times out.
Post-conditions	Pattern selection screen disappears. Right side EM registers function as per last location prior to Air Motion button press.
List of Exception Use Cases	
Interfaces	HMI, CAN

3.4.2.6 EMR-UC-REQ-421185/A-User cancels Right side Air Motion selection

Actors	EMRClient, User
Pre-conditions	Power mode is ON. EMRClient is active. EMRClient screen is ON.

	Right side Air Motion pattern selected.
Scenario Description	User pressed on the Air Motion or On Body or Off Body button or manually moved or closed one of the EM register on Right side.
Post-conditions	Right side Air Motion selection is canceled. Right side EM register function as per new selection and other register on same side will point to last location prior to air motion button press.
List of Exception Use Cases	
Interfaces	HMI, CAN

3.4.3   White Box Views

3.4.3.1   Activity Diagrams

3.4.3.1.1   EMR-ACT-REQ-421228/A-Left Side Air Motion - Multiple Patterns
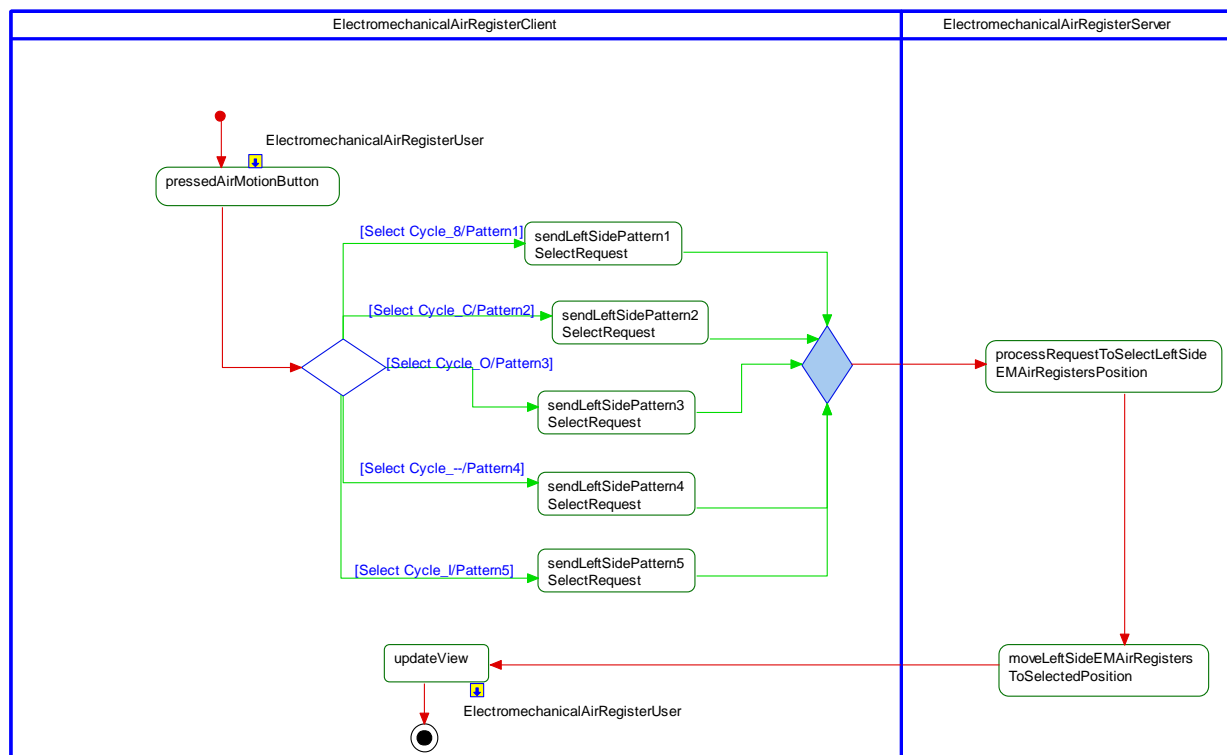
3.4.3.1.2   EMR-ACT-REQ-421229/A-Right Side Air Motion - Multiple Patterns
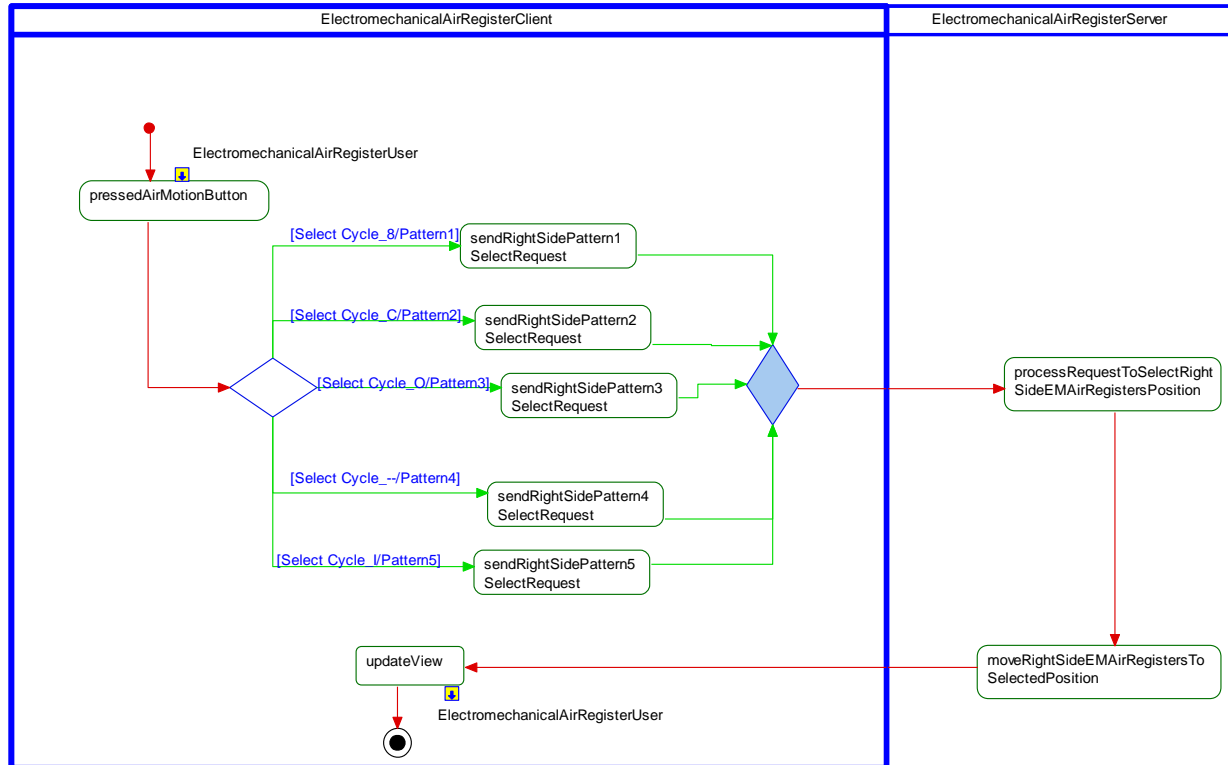
3.4.3.1.3   EMR-ACT-REQ-482477/A-Left Side Air Motion - One Pattern

3.4.3.1.4 EMR-ACT-REQ-482478/A-Right Side Air Motion - One Pattern
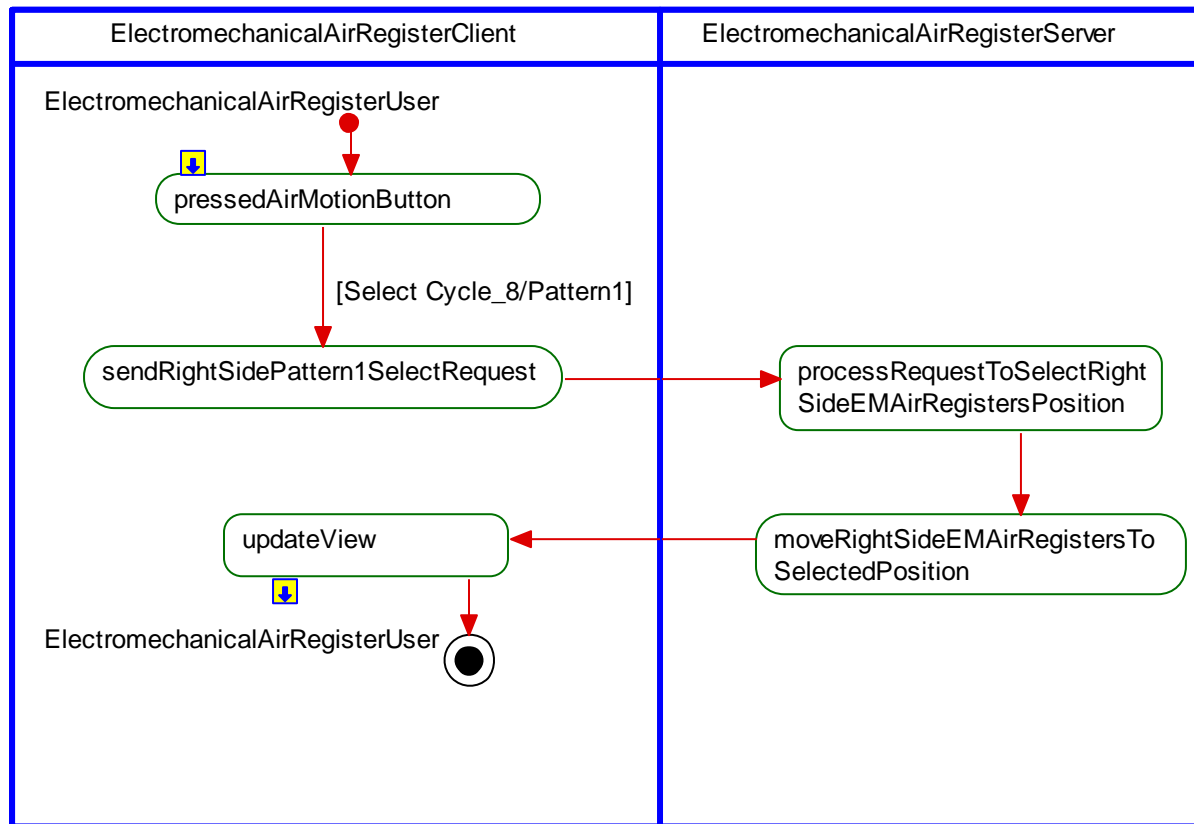
3.4.3.2   Sequence Diagrams

3.4.3.2.1   EMR-SD-REQ-421230/B-Left Side Air Motion - Multiple Patterns

FILE: ELECTRO MECHANICAL REGISTERS SPSS
V1.3 APR 8, 2022

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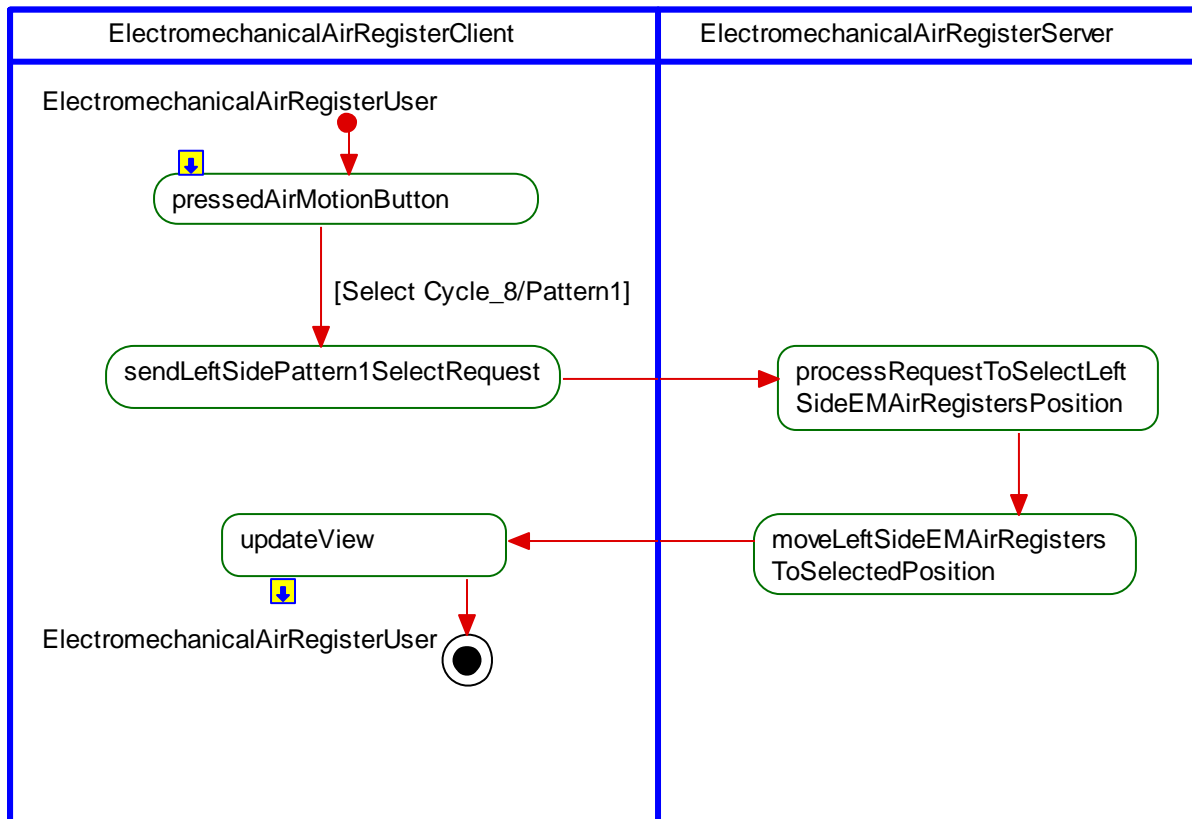### 3.4.3.2.2 EMR-SD-REQ-421231/B-Right Side Air Motion - Multiple Patterns

3.4.3.2.3 EMR-SD-REQ-482480/B-Left Side Air Motion - One Pattern

```
:Electromechanical          :Electromechanical                          :Electromechanical
 AirRegisterUser             AirRegisterClient                           AirRegisterServer

        Input()
       ─────────────────────────▶

                        pressedAirMotionButton()
                        ◀─┐
                          │

                        sendLeftSidePattern1SelectRequest()
                        ◀─┐
                          │

                        ActiveButtonsLHS_Rq(cycle_8_LHS)
                        ───────────────────────────────────────────────▶

                                   processRequestToSelectLeftSideEMAirRegistersPosition()
                                                                           ┌─▶
                                                                           │

                                   moveLeftSideEMAirRegistersToSelectedPosition()
                                                                           ┌─▶
                                                                           │

                                        HMIFeedback_LHOB_Horizontal()
                        ◀───────────────────────────────────────────────

                                        HMIFeedback_LHOB_Vertical()
                        ◀───────────────────────────────────────────────

                                        HMIFeedback_LHIB_Horizontal()
                        ◀───────────────────────────────────────────────

                                        HMIFeedback_LHIB_Vertical()
                        ◀───────────────────────────────────────────────

                                        ActiveButtonsLHS_St(cycle_8_LHS)
                        ◀───────────────────────────────────────────────

                        updateView()
                        ◀─┐
                          │

                        UpdateView()
       ◀────────────────────────
```
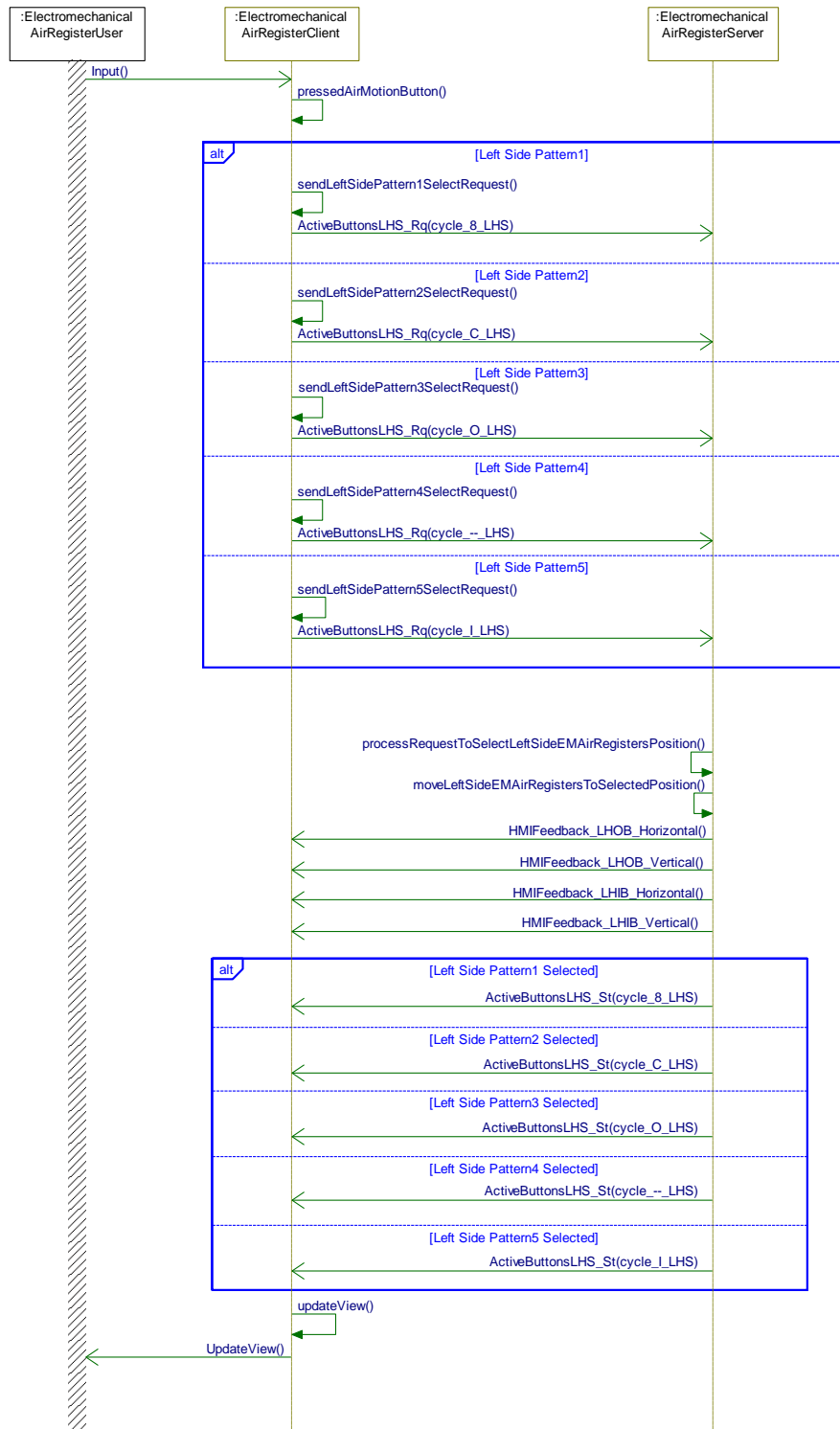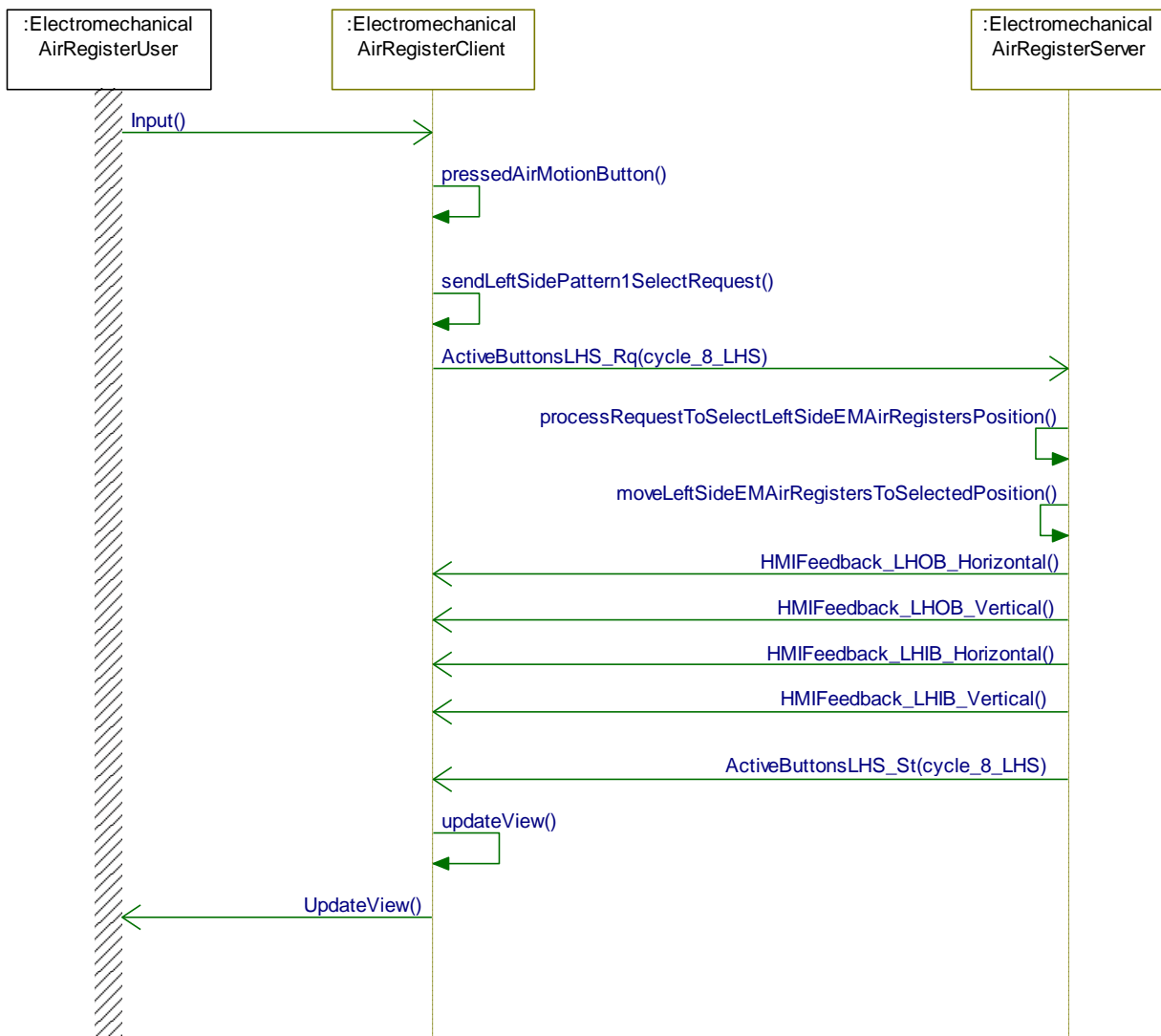
3.4.3.2.4 EMR-SD-REQ-482481/B-Right Side Air Motion - One Pattern

4 Appendix: Reference Documents

Reference #	Document Title
1	Climate Control APIM_AOS SPSS
2	Infotainment Diagnostics Specification
3	X26k_EM Registers
4	
5	
6	
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