1 HUD Image Adjustment Function – CGEA1.3

1.1 Functional Description

The HUD Image adjustment function deals with the following settings:

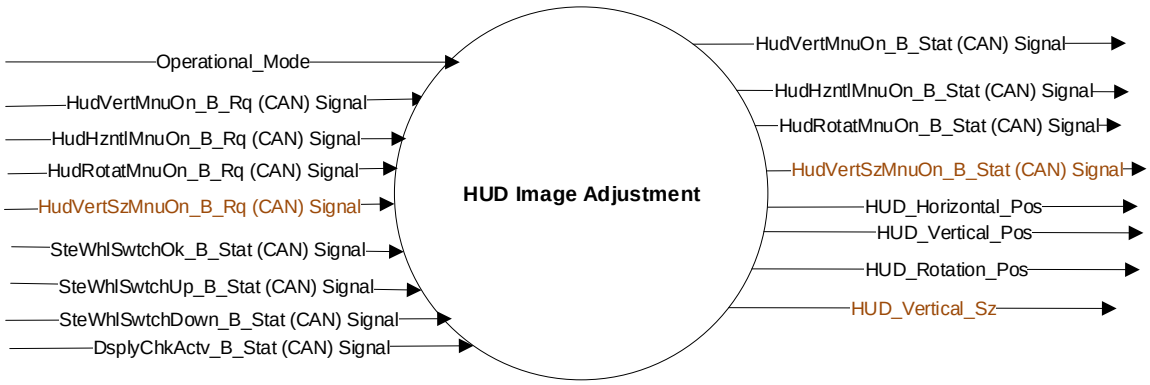
- HUD Vertical Position – Adjust the vertical position of the image
- HUD Horizontal Position – Adjust the Horizontal position of the image
- HUD Rotation – Adjust the tilt of the image by rotating the image
- HUD Vertical Size – Adjust the vertical size of the image between three options: small, medium and big

The available options for Image adjustment are based on the program. For example, HUD Vertical Size is currently available for Combiner HUD based vehicle programs. Horizontal Position and Rotational Position will be available for Advanced HUD. Refer to the program details for actual options that are available. The CAN signals will be available accordingly.

1.2 Interfaces

1.2.1 Interface Context Diagram (I/O Block Diagram)

HUD Image Adjustment Function Context Diagram



1.2.2 Inputs

1.2.2.1 IR-REQ-300095/A-INTERNAL:

- Operational_Mode

1.2.2.2 MUX message on the CAN Bus

1.2.2.2.1 SIG-REQ-300096/A-HudVertMnuOn_B_Rq Signal

Signal Name	Size (bits)	Detail	Units	Res.	Offset	State Encoded	Min	Max
HudVertMnuOn_B_Rq	1		SED	1	0		0x0	0x1
		No				0 (0x0)		
		Yes				1 (0x1)		

1.2.2.2.2 SIG-REQ-300097/B-HudHzntlMnuOn_B_Rq Signal

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Signal Name	Size (bits)	Detail	Units	Res.	Offset	State Encoded	Min	Max
HudHzntlMnuOn_B_Rq	1		SED	1	0		0x0	0x1
		No				0 (0x0)		
		Yes				1 (0x1)		

1.2.2.2.3 SIG-REQ-300098/A-HudRotatMnuOn_B_Rq Signal

Signal Name	Size (bits)	Detail	Units	Res.	Offset	State Encoded	Min	Max
HudRotatMnuOn_B_Rq	1		SED	1	0		0x0	0x1
		No				0 (0x0)		
		Yes				1 (0x1)		

1.2.2.2.4 SIG-REQ-300099/B-SteWhlSwtchOk_B_Stat Signal

Signal Name	Size (bits)	Detail	Units	Res.	Offset	State Encoded	Min	Max
SteWhlSwtchOk_B_Stat	1		SED	1	0		0 (0x0)	1 (0x1)
		Button_Not_Pressed				(0x0)		
		Button_Pressed				(0x1)		

1.2.2.2.5 SIG-REQ-300100/A-DsplyChkActv_B_Stat Signal

Signal Name	Size (bits)	Detail	Units	Res.	Offset	State Encoded	Min	Max
DsplyChkActv_B_Stat	1		SED	1	0		0 (0x0)	1 (0x1)
		Inactive				0x0		
		Active				0x1		

1.2.2.2.6 SIG-REQ-300123/A-SteWhlSwtchUp_B_Stat Signal

Signal Name	Size (bits)	Detail	Units	Res.	Offset	State Encoded	Min	Max
SteWhlSwtchUp_B_Stat	1		SED	1	0		0 (0x0)	1 (0x1)
		Button_Not_Pressed				(0x0)		
		Button_Pressed				(0x1)		

1.2.2.2.7 SIG-REQ-300124/A-SteWhlSwtchDown_B_Stat Signal

Signal Name	Size (bits)	Detail	Units	Res.	Offset	State Encoded	Min	Max
SteWhlSwtchDown_B_Stat	1		SED	1	0		0 (0x0)	1 (0x1)
		Button_Not_Pressed				(0x0)		
		Button_Pressed				(0x1)		

1.2.2.2.8 SIG-REQ-342134/A-HudVertSzMnuOn_B_Rq Signal

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Signal Name	Size (bits)	Detail	Units	Res.	Offset	State Encoded	Min	Max
HudVertSzMnuOn_B_Rq	1		SED	1	0		0x0	0x1
		No				0 (0x0)		
		Yes				1 (0x1)		

1.2.3 Outputs

1.2.3.1 IR-REQ-300104/C-INTERNAL:

- HUD_Vertical_Pos
- HUD_Horizontal_Pos
- HUD_Rotation_Pos
- HUD_Vertical_Sz

1.2.3.2 Mux messages

1.2.3.2.1 SIG-REQ-300101/A-HudVertMnuOn_B_Stat Signal

Signal Name	Size (bits)	Detail	Units	Res.	Offset	State Encoded	Min	Max
HudVertMnuOn_B_Stat	1		SED	1	0		0	1
		Not Active				0 (0x0)		
		Active				1 (0x1)		

1.2.3.2.2 SIG-REQ-300102/A-HudRotatMnuOn_B_Stat Signal

Signal Name	Size (bits)	Detail	Units	Res.	Offset	State Encoded	Min	Max
HudRotatMnuOn_B_Stat	1		SED	1	0		0	1
		Not Active				0 (0x0)		
		Active				1 (0x1)		

1.2.3.2.3 SIG-REQ-300103/B-HudHzntlMnuOn_B_Stat Signal

Signal Name	Size (bits)	Detail	Units	Res.	Offset	State Encoded	Min	Max
HudHzntlMnuOn_B_Stat	1		SED	1	0		0	1
		Not Active				0 (0x0)		
		Active				1 (0x1)		

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1.2.3.2.4 SIG-REQ-342137/A-HudVertSzMnuOn_B_Stat Signal

Signal Name	Size (bits)	Detail	Units	Res.	Offset	State Encoded	Min	Max
HudVertSzMnuOn_B_Stat	1		SED	1	0		0	1
		Not Active				0 (0x0)		
		Active				1 (0x1)		

1.3 Function/Performance

1.3.1 F-REQ-300117/A-Operational Modes

Mode	Differentiating Vehicle Conditions
Sleep Mode	HUD Image Adjustment Function Disabled
Limited Mode	HUD Image Adjustment Function Disabled
Normal Mode	HUD Image Adjustment Function Enabled/Disabled
Crank Mode	HUD Image Adjustment Function Enabled/Disabled

1.3.2 Voltage Levels

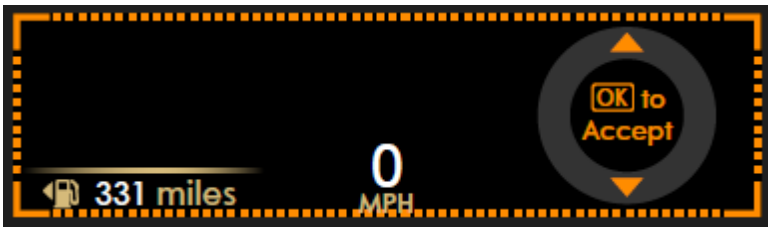
Refer to Cluster Features Table located in the Operational Modes and Voltage Range Strategies section in this SPSS.

1.3.3 Human-Machine Interface

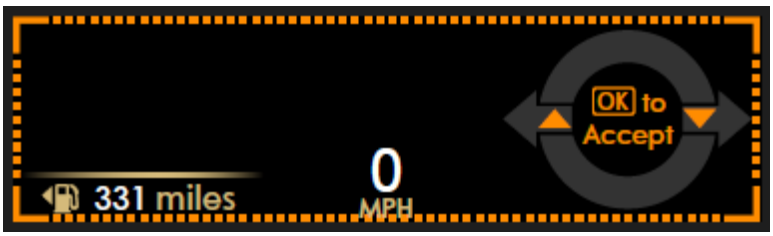
1.3.3.1 Visual

1.3.3.1.1 HMI-REQ-300120/C-Indicator Graphics / Display Format

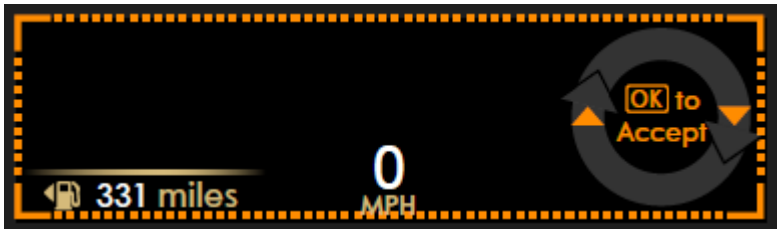
Vertical Position (AHUD and CHUD, respectively):



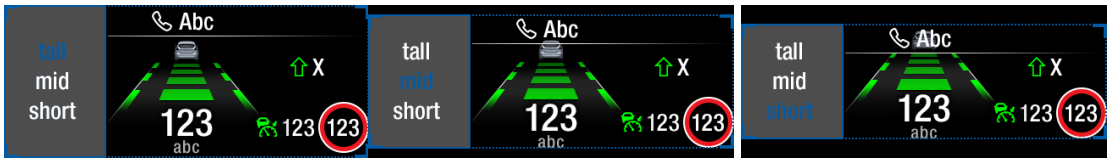
Horizontal Position:



Rotate Position:



Options for CHUD Vertical Size (Tall, Mid, and Short):



The exact graphics will be part of HMI specification.

1.3.3.2 Audio

None

1.3.3.3 Switch Control Logic

Consumer access to the HUD Image Adjustment function shall be as specified in instrument cluster requirements.

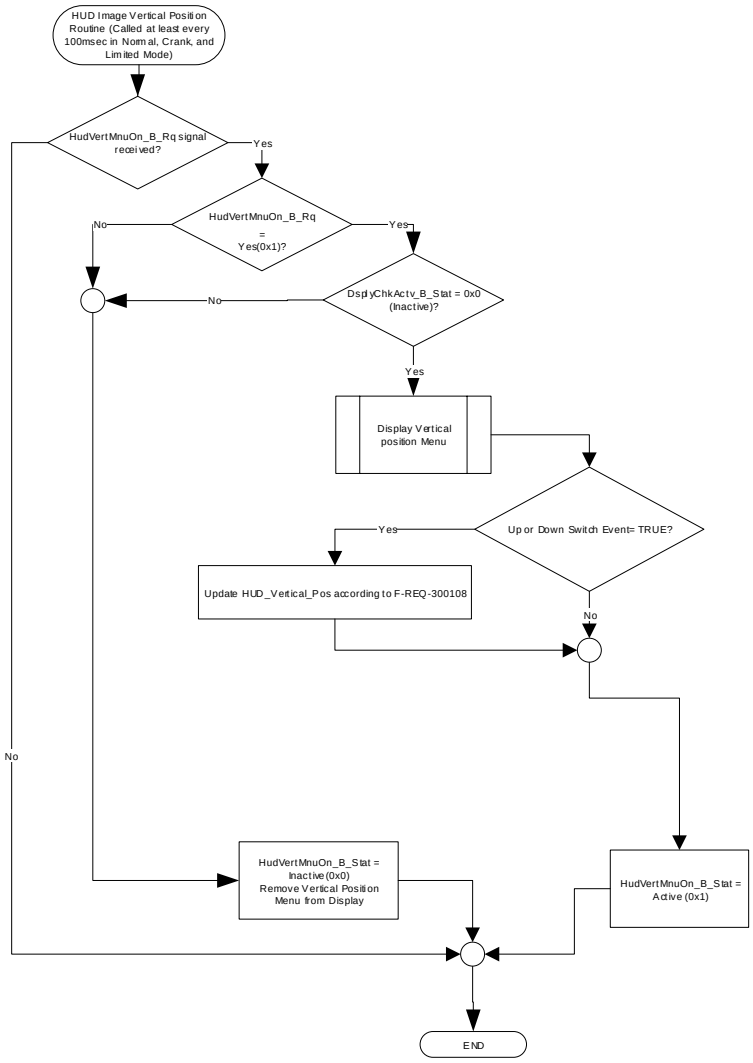
1.3.4 PFM-REQ-300118/A-System Accuracy

Within a 100msec of receiving a message that results in a change of state the HUD will update the display to the proper status.

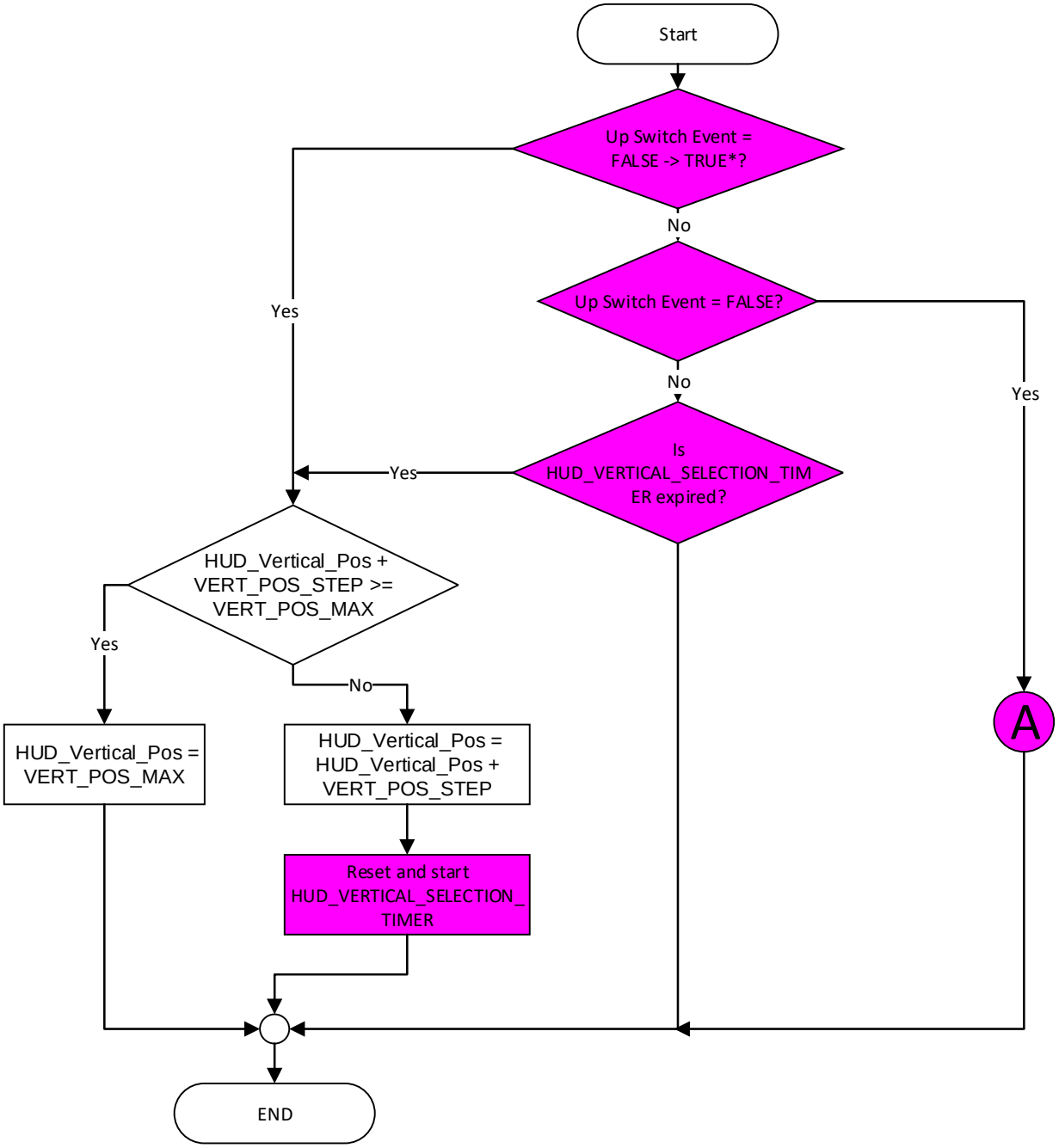
1.3.5 Operation: Performance and Functional

1.3.5.1 Subsystem Algorithm Flowchart / State Diagram

1.3.5.1.1 F-REQ-300107/B-HUD Image Vertical Position Function Flowchart



1.3.5.1.2 F-REQ-300108/C-HUD_Vertical_Pos update Flowchart



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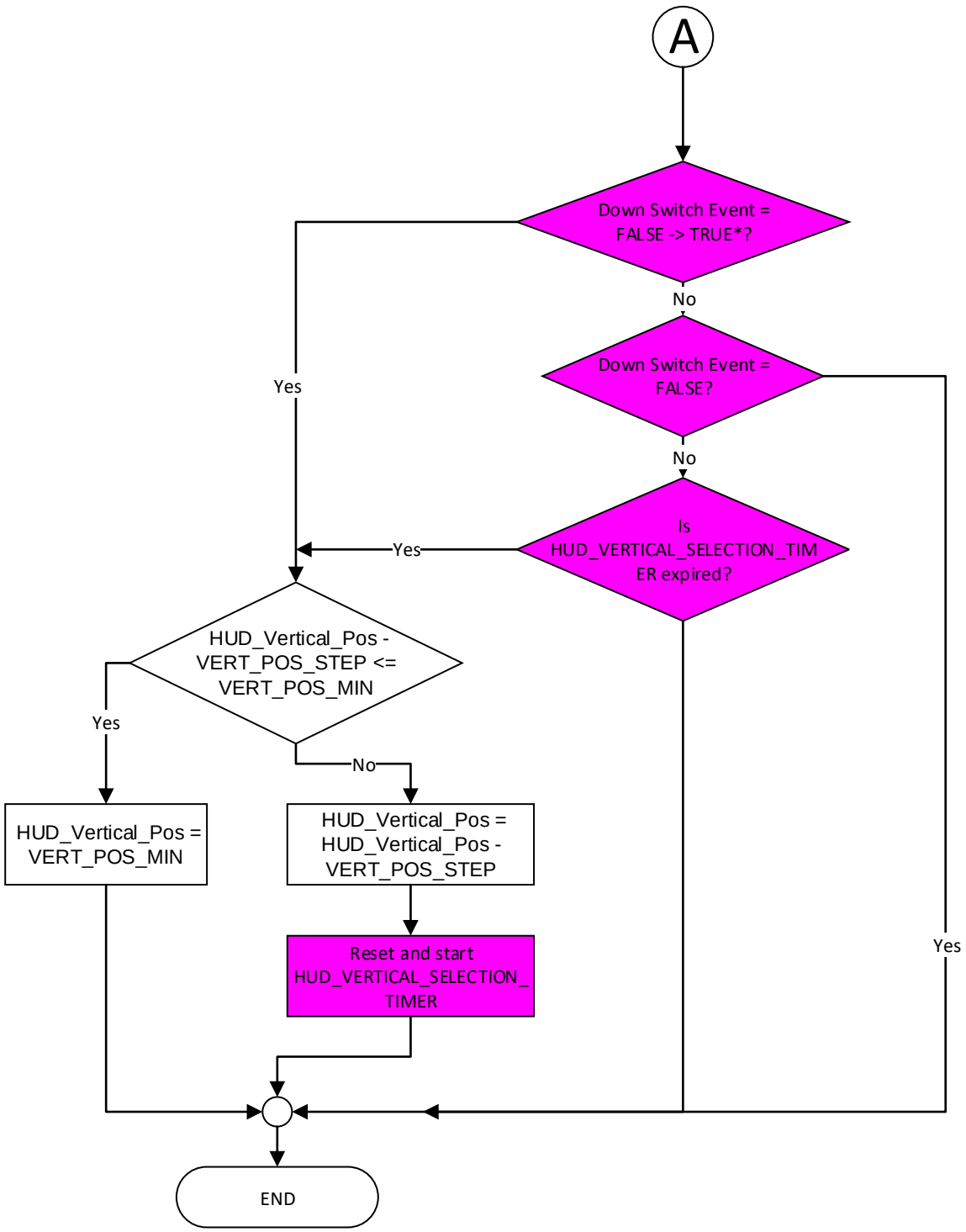

***Note: '→' denotes 'transition to'.**

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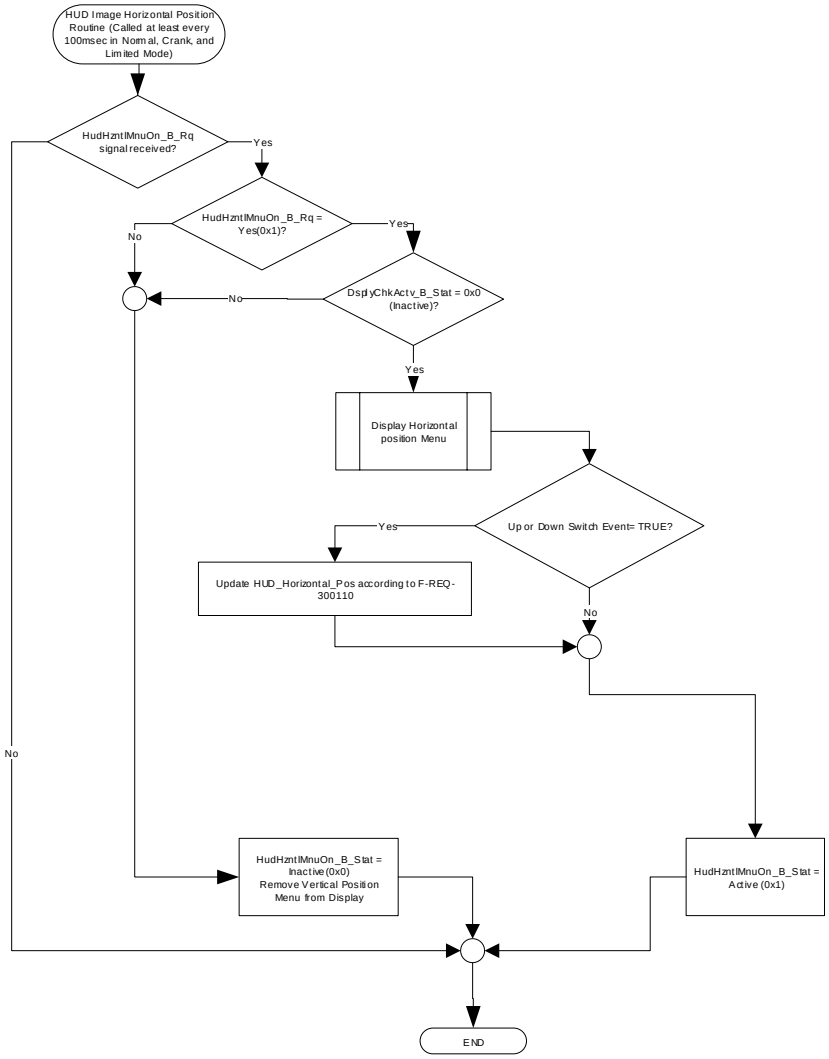
1.3.5.1.3 F-REQ-300109/B-HUD Image Horizontal Position Function Flowchart



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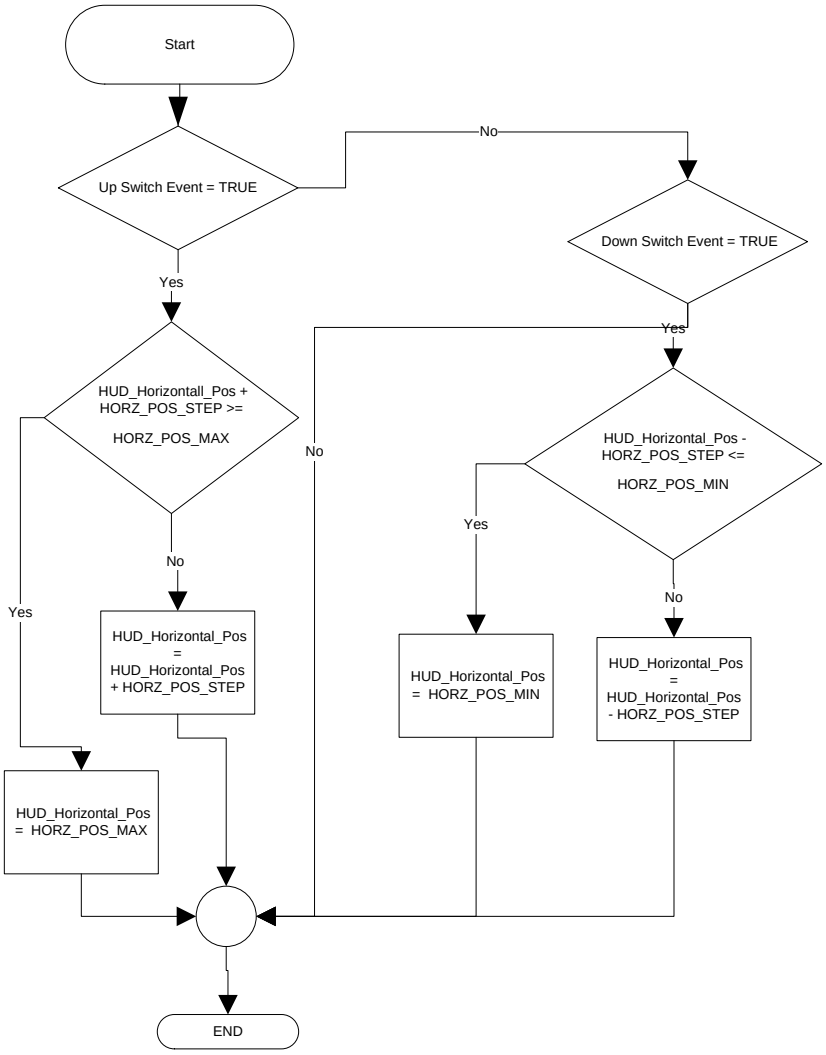
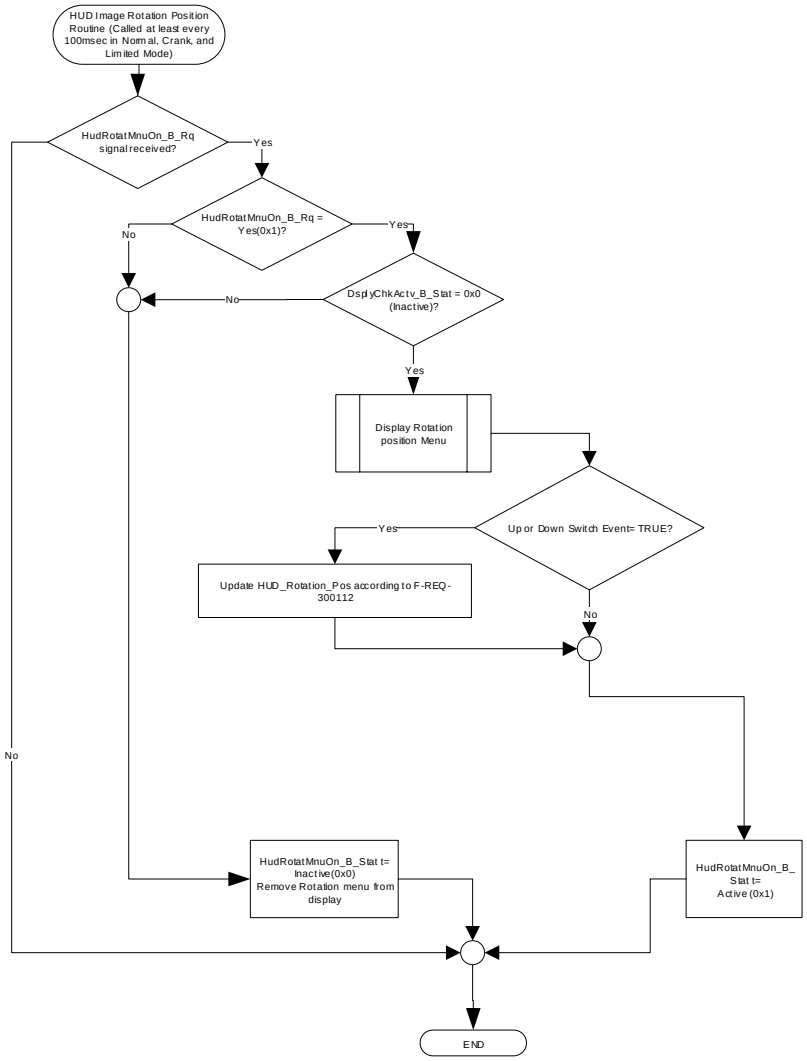
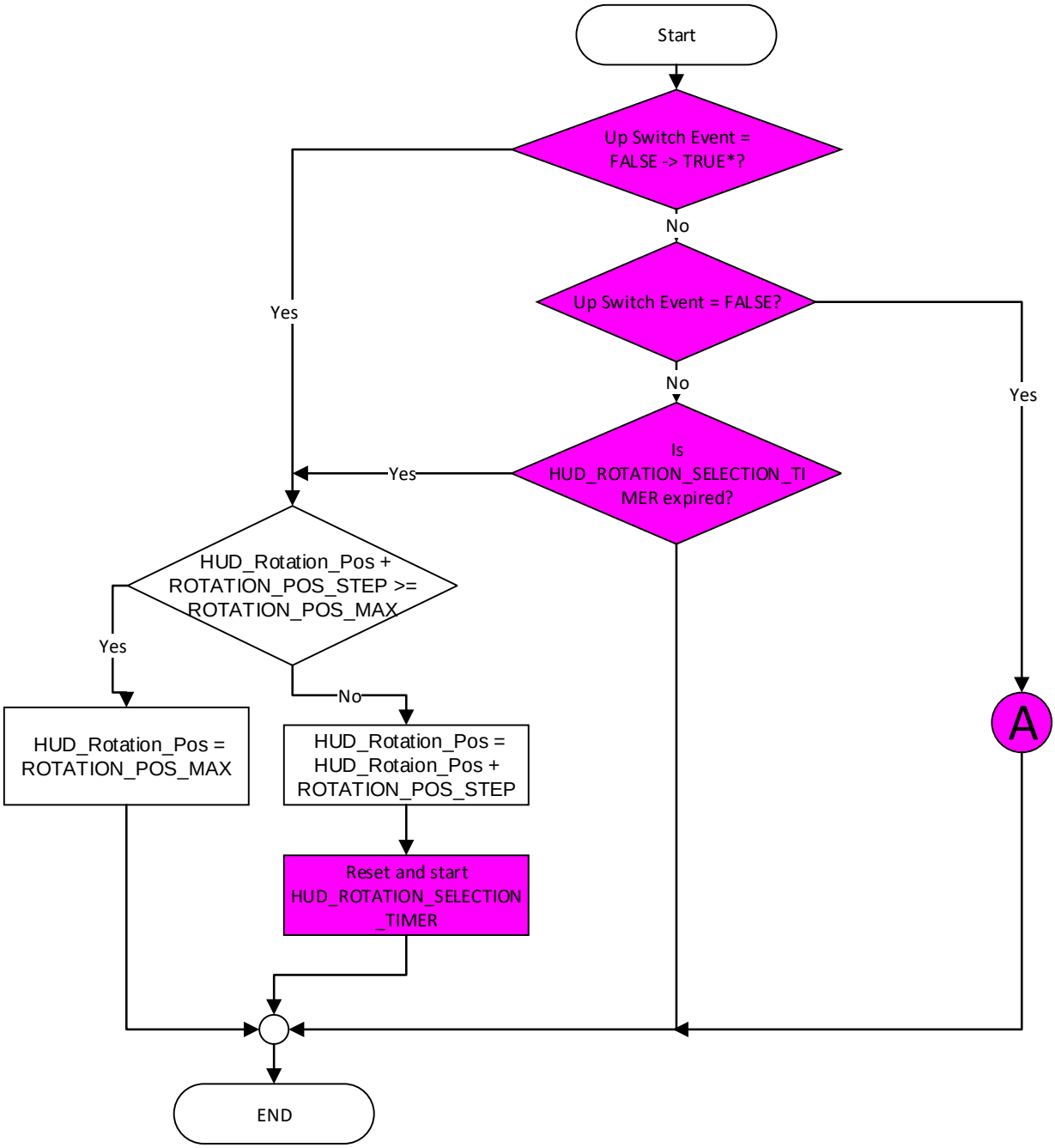
1.3.5.1.4 F-REQ-300110/B-HUD_Horizontal_Pos update Flowchart



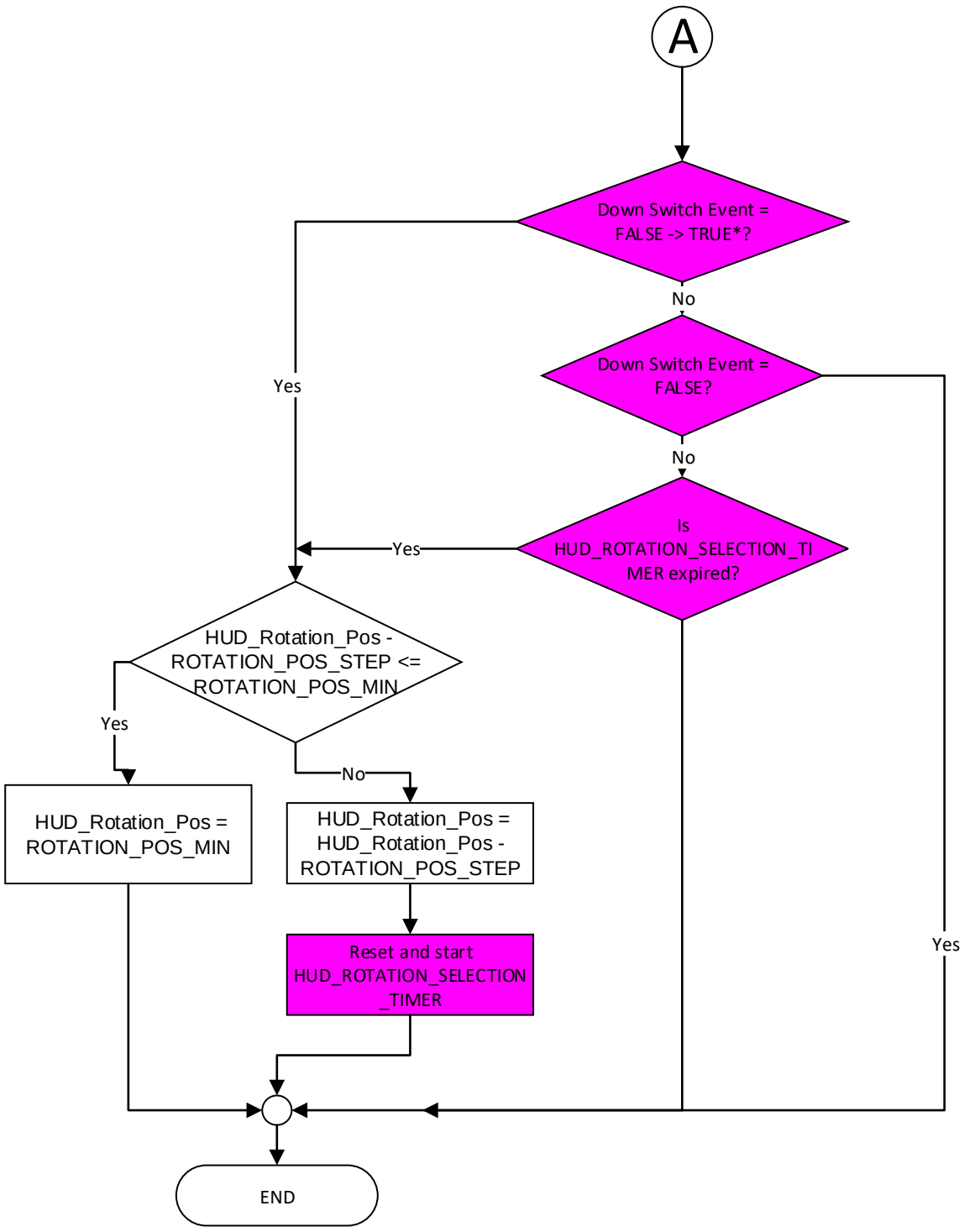
1.3.5.1.5 F-REQ-300111/B- HUD Image Rotation Function Flowchart



1.3.5.1.6 F-REQ-300112/C-HUD_Rotation_Pos update Flowchart



The information contained in this document is Proprietary to Ford Motor Company.



***Note: '→' denotes 'transition to'.**

1.3.5.1.7 F-REQ-342153/B-HUD Vertical Size Adjustment update Flowchart

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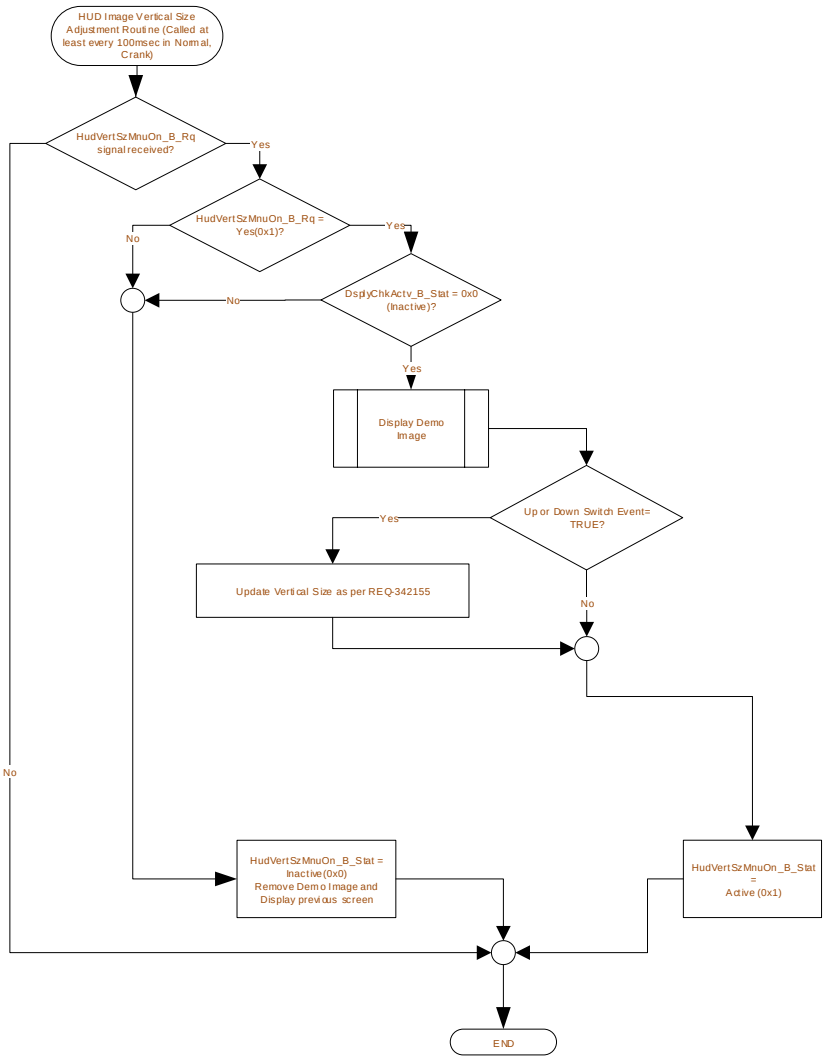
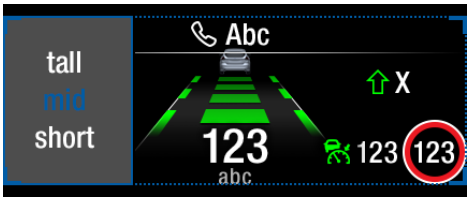
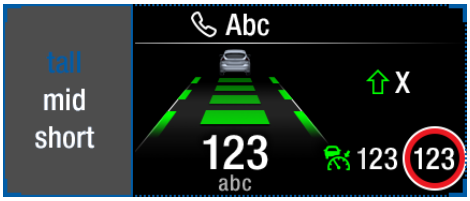
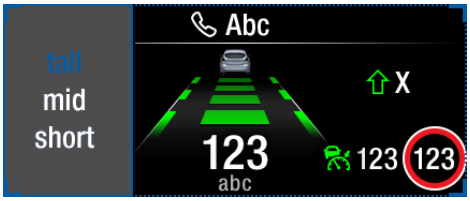
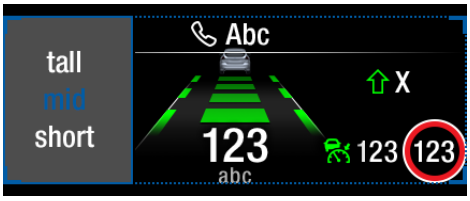

HUD Image Vertical Size Adjustment Routine (Called at least every 100msec in Normal, Crank)
HudVertSzMnuOn_B_Rq signal received?
Yes
No
HudVertSzMnuOn_B_Rq = Yes(0x1)?
Yes
No
DsplyChkActv_B_Stat = 0x0 (Inactive)?
Yes
Display Demo Image
Up or Down Switch Event= TRUE?
Yes
Update Vertical Size as per REQ-342155
No
No
HudVertSzMnuOn_B_Stat = Inactive(0x0) Remove Demo Image and Display previous screen
HudVertSzMnuOn_B_Stat = Active (0x1)
END

1.3.5.1.8 F-REQ-342155/A-Vertical Size Adjustment

HUD_Vertical_Sz	M/C Switch Selection Event	HUD_Vertical_Sz	Sample Graphics
short (0x0)	Up	mid (0x1)	
short (0x0)	Down	tall (0x2)	
mid (0x1)	Up	tall (0x2)	
mid (0x1)	Down	short (0x0)	
tall (0x2)	Up	short (0x0)	
tall (0x2)	Down	mid (0x1)	

Note :
The screen content to be displayed while configuring this size parameter is demo content and not the actual vehicle data. Please refer to the actual HMI Wallpapers for the program. The given images are sample pictures

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1.3.5.2 Operation Description (supports algorithm flowchart/state diagram)

1.3.5.2.1 F-REQ-300113/B-HMI Graphics

The HMI graphics shall show the image corresponding to HUD_Vertical_Pos, HUD_Horizontal_Pos and HUD_Rotation_Pos value for Vertical, Horizontal and Rotation menu. The core logic shall command the HUD Image to the position corresponding to HUD_Vertical_Pos, HUD_Horizontal_Pos and HUD_Rotation_Pos, and HUD_Vertical_Sz.

1.3.5.2.2 F-REQ-300114/B-HUD Attributes

The attributes HUD_On_Off, HUD_Density, HUD_ADAS, HUD_Vertical_Pos, HUD_Rotation_Pos and HUD_Vertical_Sz are part of personalization memory and are stored and recalled by Store/Recall command from Memory Seat module

1.3.5.3 Function Safety Classification (EMC)

Class A

1.3.5.4 NVM-REQ-300115/D-Memory Storage

Parameter Name	Description	Value at Battery connect	Value at Module Wake-up	Initial Design Value
Operational_Mode	4 State indicator for cluster operational mode	Limited	Limited or Normal or Crank	
HudVertMnuOn_B_Rq	CAN signal from IPC to show Vertical position menu in HUD	OFF	OFF	
HudHzntlMnuOn_B_Rq	CAN signal from IPC to show Horizontal position menu in HUD	OFF	OFF	
HudRotatMnuOn_B_Rq	CAN signal from IPC to show Rotation menu in HUD	OFF	OFF	
HudVertSzMnuOn_B_Rq	CAN signal from IPC to show Vertical Size menu in HUD	OFF	OFF	
HudCntntMnuOn_B_Rq	CAN signal from IPC to show Configuration Menu Display in HUD	OFF	OFF	
HUD_Vertical_Pos	The attribute that determines the vertical position	6	Do not Init	6
HUD_Horizontal_Pos	The attribute that determines the horizontal position	6	Do not Init	6
HUD_Rotation_Pos	The attribute that determines the rotation position	6	Do not Init	6
HUD_Vertical_Sz	The attribute that determines the vertical Size of the image	0x2	Do not Init	0x2

VERT_POS_STEP	The step to increment Vertical position on each UP/Down press	1	1	
VERT_POS_MIN	Minimum value for Vertical position	0	0	
VERT_POS_MAX	Maximum value for Vertical position	12	12	
HORIZONTAL_POS_STEP	The step to increment Horizontal position on each UP/Down press	1	1	
HORIZONTAL_POS_MIN	Minimum value for Horizontal position	0	0	
HORIZONTAL_POS_MAX	Maximum value for Horizontal position	12	12	
ROTATION_POS_STEP	The step to increment Rotation position on each UP/Down press	1	1	
ROTATION_POS_MIN	Minimum value for Rotation position	0	0	
ROTATION_POS_MAX	Maximum value for Rotation position	12	12	
DsplyChkActv_B_Stat CAN Signal	0x0 (Inactive) 0x1 (Active)	0x0 (Inactive)	0x0 (Inactive)	0x0 (Inactive)

1.3.5.5 F-REQ-343336/A-Selection Timer

Timer Name	Duration	Description	Min	Max	Resolution
HUD_VERTICAL_SELECTION_TIMER	375 Msec (default)	Duration of the time the Up or Down switch is pressed & held before scrolling up or scrolling down the Vertical Adjustment	150 msec	5000 msec	25 msec
HUD_ROTATION_SELECTION_TIMER	200 Msec (default)	Duration of the time the Up or Down switch is pressed & held before rotating up or rotating down the Rotation Adjustment	150 msec	5000 msec	25 msec

The timer duration for HUD_VERTICAL_SELECTION_TIMER & HUD_ROTATION_SELECTION_TIMER is program specific and will be determined during development. Default values (375ms and 200ms) should be used until program values are determined.

1.4 Error Handling

1.4.1 Missing Message Strategy

The signals will be declared missing as per the Diagnostics section of this SPSS.

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DTCs states and history will be determined as per the Diagnostics section of this SPSS.

1.5 Diagnostics

1.5.1 Self Test

None

1.5.2 Engineering Test Mode

1.5.3 Part II Performance

1.5.3.1 DTC-REQ-300116/B-Supported Diagnostic Trouble Codes (DTCs)

DTC	Description
C15500	Lost Communication with IPC
C21200	Lost Communication with SCCM

1.6 Reference Specification

- (c)HUD Custom Settings Control Function - CGEA1.3_v1.0 – IPC
- HUD_Memory_Save_and_Recall_-CGEA1.3

1.7 Revision History

SPSS Module Revision History

Revision Level	Name	Change Description	Date
1.0	A. Mathai	Initial draft	6/15/2014
1.1	A. Mathai	Moved HUD on/off, ADAS, Density settings to Memory/Recall STSS. Changed CAN signal names	8/15/2014
1.2	A. Mathai	Adapted Jim Gregorie's updates Update required to allow active HUD Image Adjustment to return after IPC warning is cleared. Page 1 **Figure 1.1** – Add DsplyChkActv_B_Stat (CAN) Signal. Page 2 **Table 1.1** – New table for DsplyChkActv_B_Stat (CAN) Signal. Page 4 **Figure 1.2** – Add DsplyChkActv_B_Stat decision. Page 6 **Figure 1.3** – Add DsplyChkActv_B_Stat decision. Page 8 **Figure 1.4** – Add DsplyChkActv_B_Stat decision. Page 11 **Section 1.3.5.4** – Add DsplyChkActv_B_Stat (CAN) Signal	6/18/2015
1.3	A. Mathai	Updated the Vertical/Horizontal/Rotation steps to 13 per the DI change control decision on 7/30/2015.	7/30/2015
1.4	A. Salameh	Removed the 5 second timeout from Vertical, Horizontal, Rotational adjustment menus	8/8/2017
1.5	A. Salameh	Initial VSEM RM Release	3/7/2018
1.5merged1	F. Mueller (originally by R. Chalanti)	Merged this VSEM RM doc 513318 with existing VDOC025995/D _v1.4, originally: Modifications to support cHUD Vertical Size adjustment and add the corresponding CAN Signals Figure 1.5 and Table 1.3 added in Operation Description Changes in Brown.	1/22/2019 (originally included on 1/28/2016)
1.5merged2	F. Mueller (originally by R. Chalanti)	Merged this VSEM RM doc 513318 with existing VDOC025995/D __v1.5, originally: Added changes related to Edit Mode for cHUD Corrected Typos in Table 1.4 and Section 1.3.5.4 Changes in Green.	1/22/2019 (originally included on 3/17/2016)
2.0	F. Mueller/ilopezla	Changes made by F.Mueller: Deleted Edit Mode again (cHUD only, shifted to cHUD HMI Handling) Updated VSEM RM Release – VSEM ID 539125, retention period handled by VSEM according to 27.60 Engineering Specification, 35 years, uncontrolled if printed Merging the following changes originally made by Ahmed offline in 4/23/18 and 9/12/2018 *Incorporated Conti's push & hold requirement *Updated HUD_VERTICAL_SELECTION_TIMER from 600msec to 375msec. Updated	2/5/2019

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		*HUD_ROTATION_SELECTION_TIMER from 600msec to 200msec.	
2.1	Ilopezla	Change1: Deleted “OK Switch Event” check in flowchart REQ-300107. Cluster currently checks for the “Ok Switch Event” and if TRUE, it will request HUD to remove the Image Adjustment Box (HUD_VertMnuOn_B_Rq = NO) and HUD will set HudVertMnuOn_B_Stat = Inactive. (Refer AHUD Custom Settings Control Function - CGEA1.3_v2.0 and CHUD Custom Settings Control Function - CGEA1.3) Deleted “OK Switch Event” check in flowchart REQ-300111. Cluster currently checks for the “Ok Switch Event” and if TRUE, it will request HUD to remove the Image Adjustment Box (HUD_RotatMnuOn_B_Rq = NO) and HUD will set HudRotatMnuOn_B_Stat = Inactive. (Refer AHUD Custom Settings Control Function - CGEA1.3_v2.0 and CHUD Custom Settings Control Function - CGEA1.3) Deleted “OK Switch Event” check in flowchart REQ-300109. Cluster currently checks for the “Ok Switch Event” and if TRUE, it will request HUD to remove the Image Adjustment Box (HUD_HzntMnuOn_B_Rq = NO) and HUD will set HudHzntMnuOn_B_Stat = Inactive. (Refer AHUD Custom Settings Control Function - CGEA1.3_v2.0 and CHUD Custom Settings Control Function - CGEA1.3) Deleted “OK Switch Event” check in flowchart REQ-342153. Cluster currently checks for the “Ok Switch Event” and if TRUE, it will request HUD to remove the Demo Image (HUD_VertSzMnuOn_B_Rq = NO) and HUD will set HudVertSzMnuOn_B_Stat = Inactive. (Refer AHUD Custom Settings Control Function - CGEA1.3_v2.0 and CHUD Custom Settings Control Function - CGEA1.3) Change2: Removed the statement “This flowchart does NOT apply to CHUD” in REQ-300108. It will apply to CHUD Change3: Deleted REQ-343337- “HUD Vertical Pos Update for CHUD” since CHUD will follow REQ-3000108 for vertical adjustment.	3/5/2019

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		Change4: Deleted REQ-34338 since CHUD does NOT support Rotation Adjustment Change5: Section 1.3.5.1.7- Replaced Reference to table 1.3 in the flowchart with Reference to REQ-342155. Change6: Removed the statement “This flowchart does NOT apply to CHUD” in REQ-300112.	