Navigation Based Pilot

Subsystem Technology Specific Specification (STSS)

Version 1.3

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FORD CONFIDENTIAL

Table of Contents

Terms and Definitions

Abbreviation	Description
NBP	Navigation Based Pilot
ALC	Assisted Lane Change
TJA	Traffic Jam Assist

1. Navigation Based Pilot

1.1 Functional Description

This STSS handles the functions associated with the Navigation Based Pilot feature, hereafter called NBP feature or NBP.

When a user is driving a vehicle with ALC, the user will be indicated by a lane change suggestion if it's determined to be helpful. Following a turn signal initiated by driver, the vehicle will perform a lane change.

Based on ALC, NBP will add the ability for vehicle to provide lane change suggestions according Navigation indication.
Currently, NBP scenarios are below:

- Highway Exit
- Y-shaped Road
- Lane End

Depending on the vehicle location relative to lane position and the distance to target road section and objects, this feature will:

- Signal to driver for a lane change suggestion
- Signal to driver for taking over steering control

Starting with MY2024 CX771/CX821, Navigation Based Pilot (NBP) has been introduced to the suite of Highway Assist feature with the support of new introduced IPMB_EPC module. NBP enriches the capability providing lane change suggestion against additional scenarios (means Highway Exit) compared with that supported by ALC.

Navigation Based Pilot correlates the personalization signals from the IPMB, several signals from IPMB_EPC and the Operation Mode to determine when to activate additional appropriate displays.

1.2 Interfaces

1.2.1 Interface Context Diagram (I/O Block Diagram)

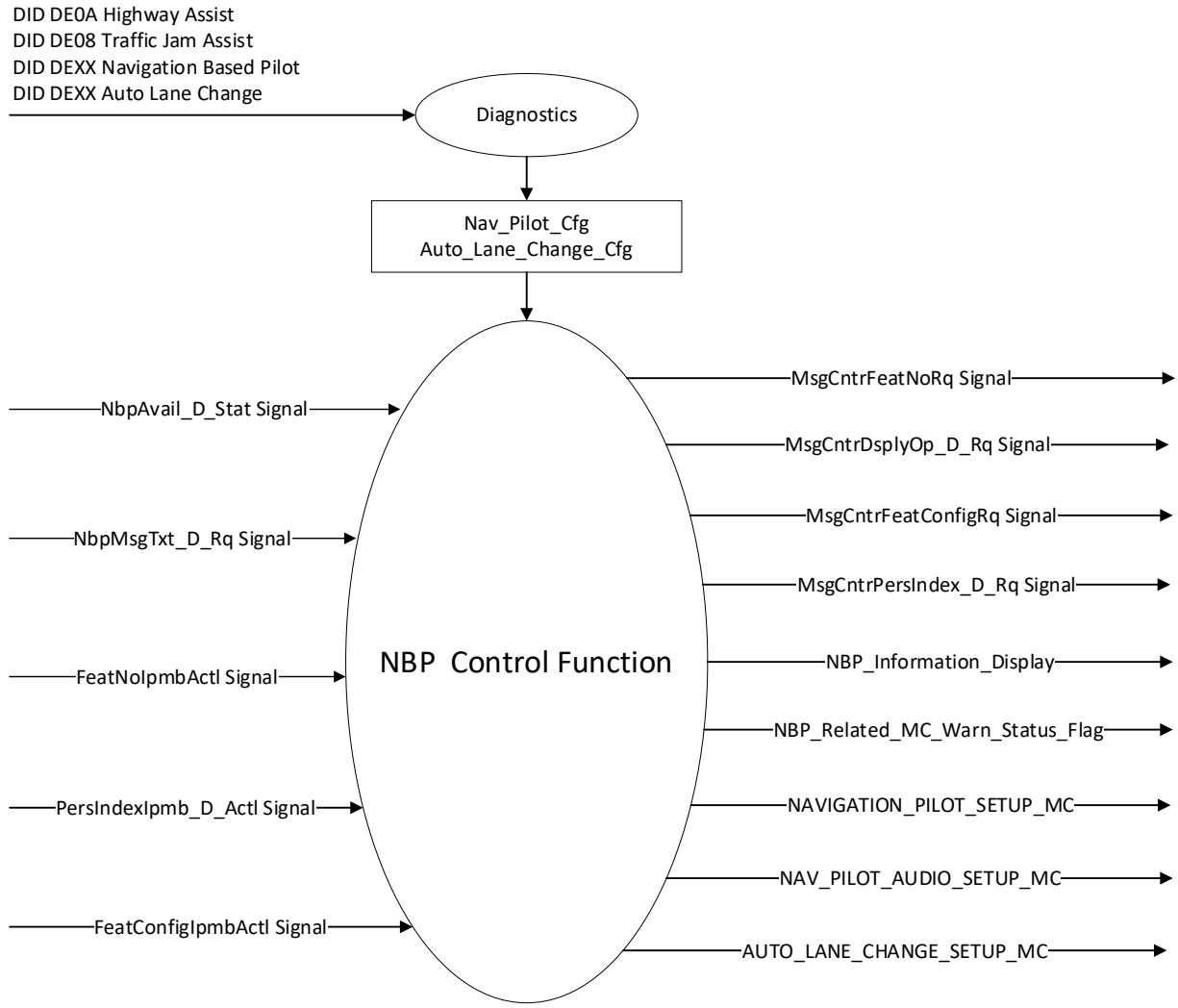


Figure 2 NBP Context Diagram

1.2.2 Inputs

1.2.2.1 Internal

- Hwy_Assist_Cfg – Feature Cfg
- Traffic_Jam_Assist_Cfg – Feature Cfg
- Nav_Piolot_Cfg
- Auto_Lane_Change_Cfg

1.2.2.2 MUX signals on the CAN Bus from IPMB (2nd ECU)

1.2.2.2.1 FeatConfigIpmbActl Signal

Signal Name	Size (bits)	Detail	Units	Res.	Offset	State Encoded	Min	Max
FeatConfigIpmbActl	16	-	Undefined	1	0		0 (0x0)	65535 (0xFFFF)

1.2.2.2.2 FeatNoIpmbActl Signal

Signal Name	Size (bits)	Detail	Units	Res.	Offset	State Encoded	Min	Max
FeatNoIpmbActl	16	-	Number	1	0		0 (0x0)	65535 (0xFFFF)

1.2.2.2.3 PersIndexIpmb_D_Actl Signal

Signal Name	Size (bits)	Detail	Units	Res.	Offset	State Encoded	Min	Max
PersIndexIpmb_D_Actl	3		SED	1	0		0 (0x0)	7 (0x7)
		PERS_1				0x0		
		PERS_2				0x1		
		PERS_3				0x2		
		PERS_4				0x3		
		Vehicle				0x4		
		Unused				0x5		
		Unused				0x6		
		Unused				0x7		

1.2.2.2.4 NbpAvail_D_Stat Signal

Signal Name	Size (bits)	Detail	Units	Res.	Offset	State Encoded	Min	Max
NbpAvail_D_Stat	3		SED	1	0		0 (0x0)	7 (0x7)
		Off				0x0		
		Standby				0x1		
		AvailableLnChngSuggstnOnly				0x2		
		AvailableDrvLnChng				0x3		
		AvailableVehLnChng				0x4		
		NbpFailure				0x5		
		NotUsed_1				0x6		
		NotUsed_2				0x7		

1.2.2.2.5 SIG-REQ-XXXXXX/A- NbpMsgTxt_D_Rq Signal

Signal Name	Size (bits)	Detail	Units	Res.	Offset	State Encoded	Min	Max
NbpMsgTxt_D_Rq	4		SED	1	0		0 (0x0)	15 (0xF)
		NoMessage				0x0		
		LnChngSuggstnLeftFaterLn				0x1		
		LnChngSuggstnRightFaterLn				0x2		
		AlcOn				0x3		
		AlcOff				0x4		
		TurnOffIndicator				0x5		
		LnChngSuggstnLeftNav				0x6		
		LnChngSuggstnRightNav				0x7		
		HandOver				0x8		
		MissingExitAlert				0x9		
		LnChngSuggstnLeftManual				0xA		
		LnChngSuggstnRightManual				0xB		
		NotUsed_1				0xC		
		NotUsed_2				0xD		
		NotUsed_3				0xE		
		NotUsed_4				0xF		

1.2.3 Outputs

1.2.3.1 Internal

- NBP_Information_Display displays the Navigation Based Pilot information in the ADAS metaphor.
- NAVIGATION_PILOT_SETUP_MC, controls the setting menu display output for Navigation Based Pilot.
- NAV_PILOT_AUDIO_SETUP_MC, controls the setting menu display output for Navigation Based Pilot audio selection.
- AUTO_LANE_CHANGE_SETUP_MC, controls the setting menu display output for Auto Lane Change.
- NBP_Related_MC_Warn_Status_Flag, which is used to control the state of the text warning message including those MC_Warn_Status_Flag below:
    1) Navigation_Pilot_Unavailable_MC_Warn_Status_Flag
    2) Lane_Change_Suggested_For_Faster_Lane_Left_MC_Warn_Status_Flag
    3) Lane_Change_Suggested_For_Faster_Lane_Right_MC_Warn_Status_Flag
    4) Lane_Change_Suggested_Following Navigation Left_MC_Warn_Status_Flag
    5) Lane_Change_Suggested_Following Navigation Right_MC_Warn_Status_Flag
    6) LnChngSuggstnLeftManual_MC_Warn_Status_Flag
    7) LnChngSuggstnRightManual_MC_Warn_Status_Flag
    8) HandOver_MC_Warn_Status_Flag
    9) Missing_Exit_Alert_MC_Warn_Status_Flag

1.2.3.2 MUX signals on the CAN Bus to IPMB (2nd ECU)

1.2.3.2.1 MsgCntrFeatNoRq Signal

Signal Name	Size (bits)	Detail	Units	Res.	Offset	State Encoded	Min	Max
MsgCntrFeatNoRq	16	-	Number	1	0		0 (0x0)	65535 (0xFFFF)

1.2.3.2.2 MsgCntrDsplyOp_D_Rq Signal

Signal Name	Size (bits)	Detail	Units	Res.	Offset	State Encoded	Min	Max
MsgCntrDsplyOp_D_Rq	3		SED	1	0		0 (0x0)	7 (0x7)
		NULL				0x0		
		QUERY				0x1		
		SET				0x2		
		UPLOAD				0x3		
		RESTORE				0x4		
		COPY				0x5		
		Unused				0x6		
		Unused				0x7		

1.2.3.2.3 MsgCntrFeatConfigRq Signal

Signal Name	Size (bits)	Detail	Units	Res.	Offset	State Encoded	Min	Max
MsgCntrFeatConfigRq	16	-	Undefined	1	0		0 (0x0)	65535 (0xFFFF)

1.2.3.2.4 MsgCntrPersIndex_D_Rq Signal

Signal Name	Size (bits)	Detail	Units	Res.	Offset	State Encoded	Min	Max
MsgCntrPersIndex_D_Rq	3		SED	1	0		0 (0x0)	7 (0x7)
		PERS_1				0x0		
		PERS_2				0x1		
		PERS_3				0x2		
		PERS_4				0x3		
		Vehicle				0x4		
		Unused				0x5		
		Unused				0x6		
		Unused				0x7		

1.3 Function/Performance

1.3.1 Operational Modes

Mode	Differentiating Vehicle Conditions
Sleep Mode	NBP Control Function Text Message Disabled
Limited Mode	NBP Control Function Text Message Disabled
Normal Mode	NBP Control Function Text Message Enabled / Disabled
Crank Mode	NBP Control Function Text Message Enabled / Disabled

1.3.2 Voltage Levels

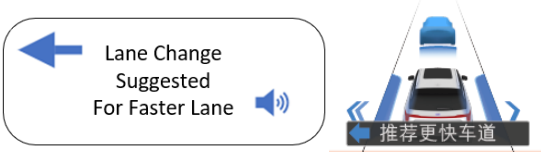
Refer to the Cluster Features table located in the Operational Modes and Voltage Range Strategies.

1.3.3 Human-Machine Interface

1.3.3.1 Visual

1.3.3.1.1 Indicator Graphics / Display Format

Example Graphic (final graphics to be provided by HMI wallpaper)



Message Center Text Warning Message as defined in section 1.3.3.5.12 of this document. Actual wording may vary based on Program Translation table.
Please refer to the program specific menu structure for exact graphics.

Example Menu Structure:

Menu level 0	Menu level 1	Menu level 2	Comments
Driver Assist	Cruise Control	With Lane Centering □	Traffic_Jam_Assist_Cfg = 0x1 (Enabled) Hwy_Assist_Cfg = 0x0 (Disabled) Nav_Pilot_Cfg = X (Don't Care) Auto_Lane_Change_Cfg = X (Don't Care)
		With Lane Centering (Blue Cruise) □ With Smart Offerings □ Lane Biasing Assist Lane Change	Hwy_Assist_Cfg = 0x1 (Enabled) Traffic_Jam_Assist_Cfg = X (Don't Care) Nav_Pilot_Cfg = 0x0 (Disabled) Auto_Lane_Change_Cfg = X (Don't Care)
		With Lane Centering (Blue Cruise) □ With Smart Offerings □ Lane Biasing Assist Lane Change • Navigation Based Pilot • Audio On	Hwy_Assist_Cfg = 0x1 (Enabled) Traffic_Jam_Assist_Cfg = X (Don't Care) Nav_Pilot_Cfg = 0x1 (Enabled) Auto_Lane_Change_Cfg = 0x0 (Disabled)
		With Lane Centering (Blue Cruise) □ With Smart Offerings □ Lane Biasing Assist Lane Change • Navigation Based Pilot	Hwy_Assist_Cfg = 0x1 (Enabled) Traffic_Jam_Assist_Cfg = X (Don't Care) Nav_Pilot_Cfg = 0x1 (Enabled) Auto_Lane_Change_Cfg = 0x1 (Enabled)

		• Audio On • Auto Lane Change	

Menu display logic in above list:

1. About the menu of Lane Biasing and Assist Lane Change (Pre-condition: Hwy_Assist_Cfg = 0x1 (Enabled))

Menu display of Lane Biasing and Assisted Lane Change depends on the customer selection of Blue Cruise (Ford Brand)/Active Glide (Lincoln Brand) feature. LB and ALC shall appear when Blue Cruise is selected on, while disappear when Blue Cruise is selected off.

2. About the menu of Navigation Based Pilot (Pre-condition: Hwy_Assist_Cfg = 0x1 (Enabled))

Menu display of Navigation Based Pilot depends on the customer selection of ALC feature. Navigation Based Pilot shall appear when ALC is selected on, while disappear when ALC is selected off.
And the two sub menus: Audio On and Auto Lane Change can be checked or unchecked independently.

3. IVI/SYNC+ should query Navigation Based Pilot menu every time after bootup and get response and display last remembered settings (follow HA menu strategy). Last remembered settings are saved on IPMB.

1.3.3.1.2 Indicator Color Coordinates

Refer to program specific HMI requirements for styling direction.

1.3.3.1.3 Indicator Characteristics

As per program specific HMI theme.

1.3.3.2 Audio– 待修改

F-REQ-XXXXXX (NBP indication and cancellation).
Note that both Graphic and Voice indication could be provided during NBP operation while voice broadcast can be enabled/disabled by customer in the setting menu.
When both supported, voice broadcast should show synchronously with the graphic text. The voice content needs to be broadcasted once till the signal transits to a new state.
Note that considering the similarity between NBP voice broadcast and Navigation broadcast, NBP shows a higher priority. Hence, arbitration between these two should be supported.

1.3.3.3 Switch Control Logic

Consumer access to NBP Module Configuration shall be as specified in the message center basic functionality display as specified in Message Center X Display_Y Button Interface Section, where X and Y are appropriate values in this document.

13.4 System Accuracy

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

1.3.5 Operation: Performance and Functional

1.3.5.1 Subsystem Algorithm Flowchart / State Diagram

1.3.3.5.1 Highway Assist with Navigation Pilot Diagnostic Configuration Flowchart

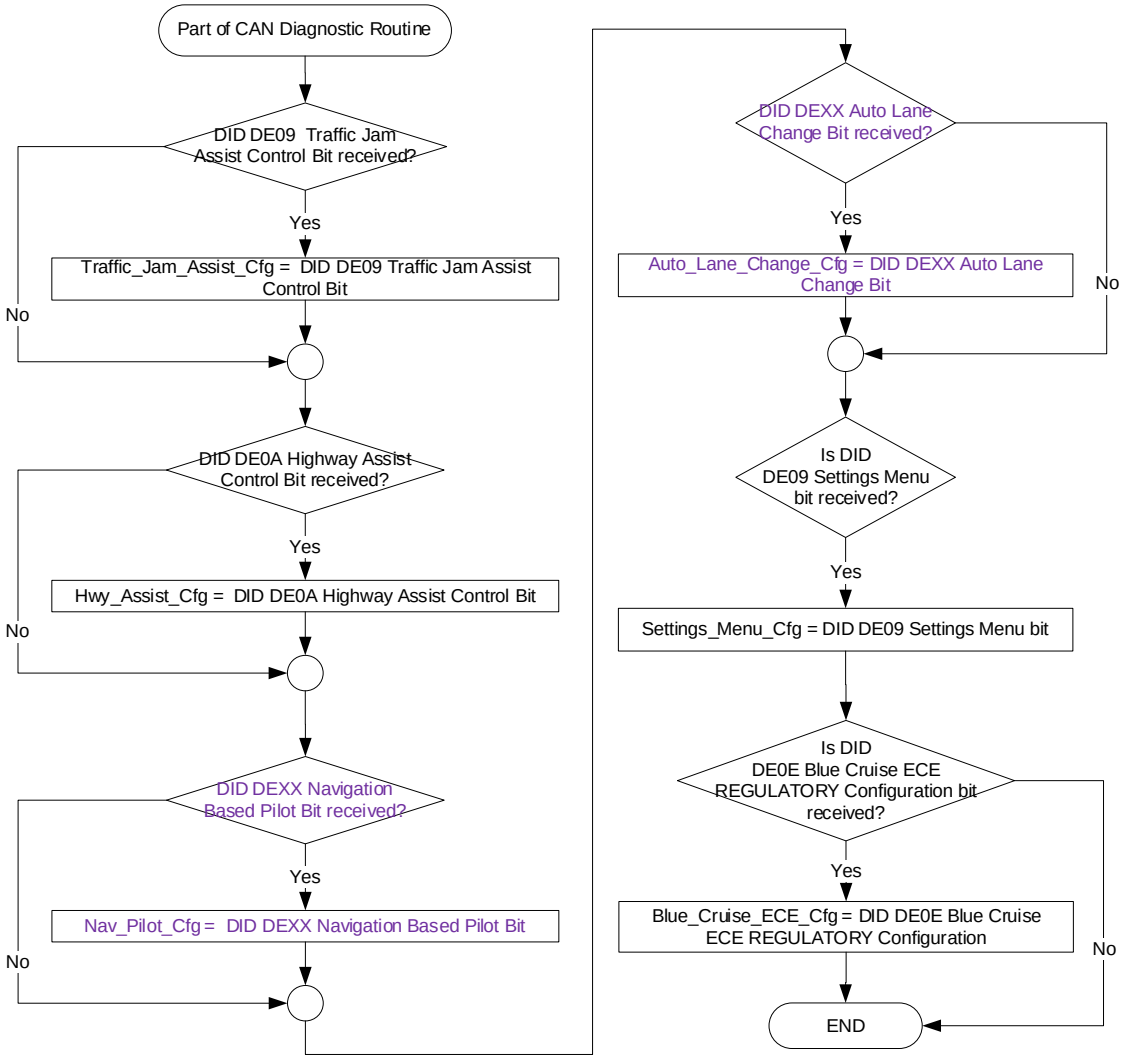


Figure 3.1 Diagnostic Configuration Flowchart

Figure3.1 is based on F-REQ-343087/A-Highway Assist and Lane Centering Diagnostic Configuration Flowchart in < Highway Assist with Lane Centering Control Function and Warnings - FNV2.docm>. The purple content is added for NBP.

1.3.3.5.2 Highway Assist and Lane Centering and Navigation Based Pilot Menu Display Determination Matrix

Hwy_Assist_Cfg	Traffic_Jam_Assist_Cfg	Nav_Pilot_Cfg	"With Lane Centering" Displayed in menu?	"With Smart Offering" Displayed in menu?	"With Nav Pilot" Displayed in menu?
Enabled (0x1)	Enabled (0x1)	Enabled (0x1)	Yes	Yes	Yes
Enabled (0x1)	Enabled (0x1)	Disabled (0x0)	Yes	Yes	No
Enabled (x1)	Disabled (0x0)	Enabled (0x1)	Yes	Yes	Yes
Enabled (0x1)	Disabled (0x0)	Disabled (0x0)	Yes	Yes	No
Disabled (0x0)	Enabled (0x1)	Enabled (0x1)	Yes	No	No
Disabled (0x0)	Enabled (0x1)	Disabled (0x0)	Yes	No	No
Disabled (0x0)	Disabled (0x0)	Enabled (0x1)	No	No	No
Disabled (0x0)	Disabled (0x0)	Disabled (0x0)	No	No	No

1.3.3.5.3 Highway Assist with Navigation Pilot input request Flowchart

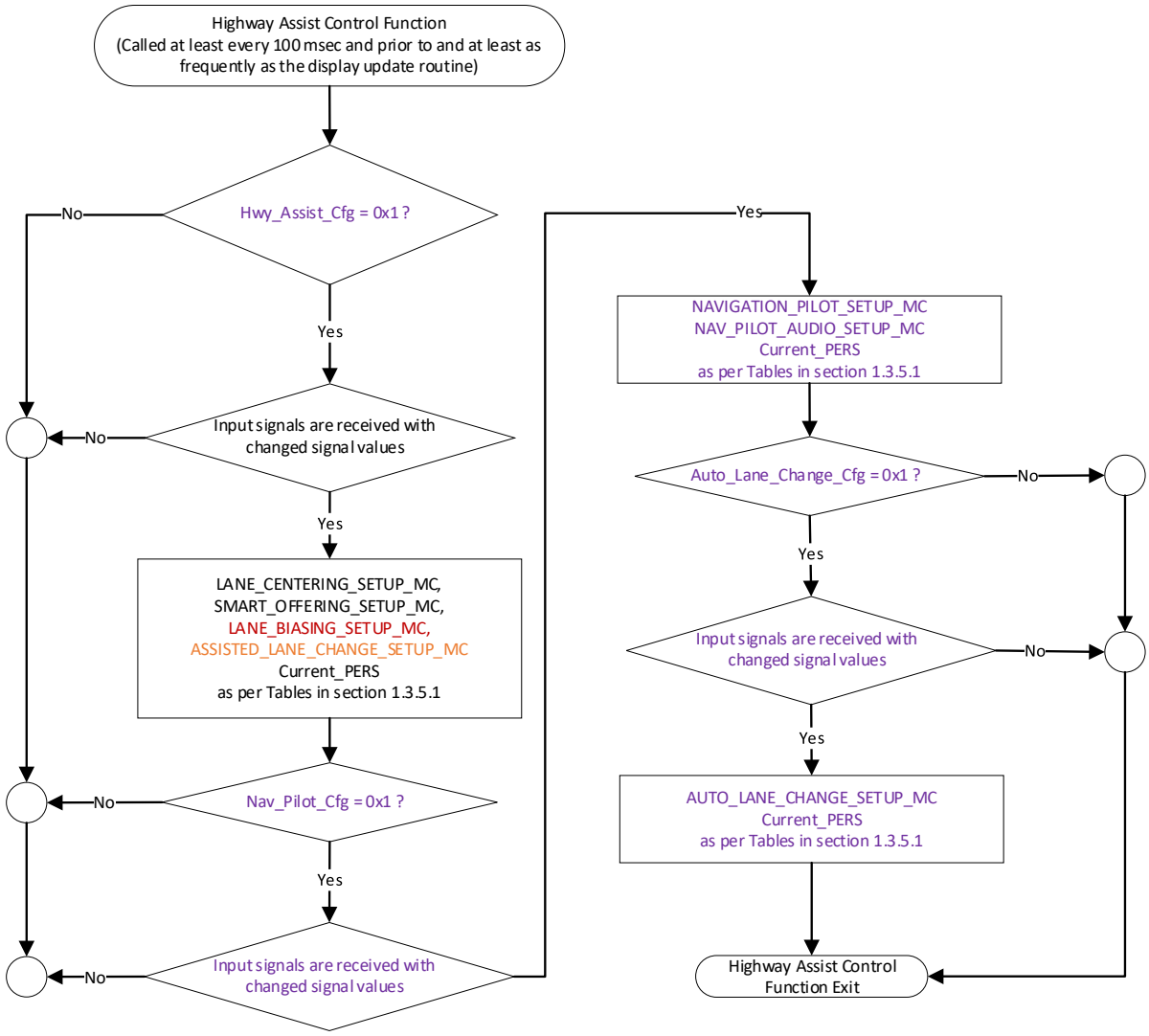


Figure 3.2 Input Request Flowchart

Figure3.2 is based on F-REQ-343089/D-Highway Assist and Lane Centering input request Flowcharts in < Highway Assist with Lane Centering Control Function and Warnings - FNV2.docm>. The purple content is added or modified for NBP.

Input signals are received in a message from IPMB (2nd ECU), including FeatNoIpmbActl Signal, FeatConfigIpmbActl Signal, PersIndexIpmb_D_Actl Signal that is described in IO inputs.

1.3.3.5.4 Highway Assist with Navigation Pilot output SET request Flowchart

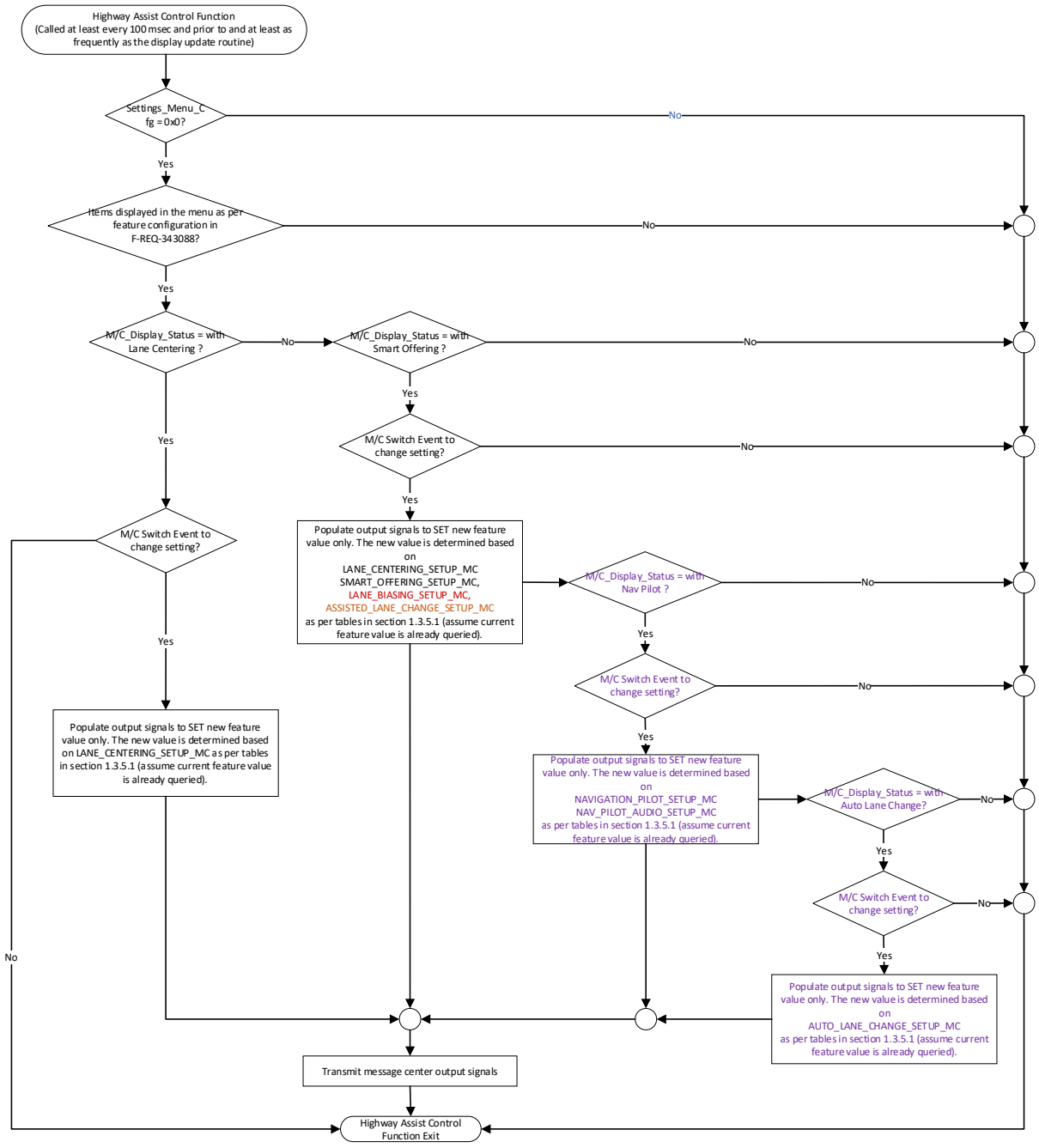


Figure 3.3 Output SET Request Flowchart

Figure3.3 is based on F-REQ-343090/D-Highway Assist and Lane Centering Output SET request Flowchart in < Highway Assist with Lane Centering Control Function and Warnings - FNV2.docm>. The purple content is added for NBP.

Output signals are sent in a message to IPMB (2nd ECU), including MsgCntrDsplyOp_D_Rq Signal, MsgCntrFeatNoRq Signal, MsgCntrFeatConfigRq Signal and MsgCntrPersIndex_D_Rq Signal that is described in Setup Request Messages.

1.3.3.5.5 Navigation Based Pilot Setup State Assignment

FeatNoIpmb Actl Signal	FeatConfigIpmbActl Signal	PersIndexIpmb_D_Actl Signal	NAVIGATION_PILOT_ SETUP_MC	Current_PERS (3)
0x0880 (1)	0x0000 (Off)	0x0 – 0x4	0x00	0x0 – 0x4
	0x0001 (On)	0x0 – 0x4	0x01	0x0 – 0x4
	Other (2)		Error (0x2)	Last Known
Missing per Section 1.4.1 (2)				

(1) Navigation Based Pilot Feature Number. Reference is Feat Num table in "Vehicle Personalization FS"
(2) Message Response is Faulted
(3) Equal to the received "PersIndex<--->" signal value. When faulted Keep last known value.

1.3.3.5.6 Navigation Based Pilot Setup Request Messages based upon NAVIGATION_PILOT_SETUP_MC

ASSISTED_ LANE_CHANGE_ SETUP_MC	Display Menu	M/C Switch Selection Event	MsgCntrDsplyOp_ D_Rq Signal	MsgCntrFeatNoRq Signal	MsgCntrFeatConfigRq Signal	MsgCntrPersIndex _D_Rq Signal
0x00 or 0x02	☐ (Off)	Up/Down + OK (Select On)	SET (0x2)	0x0880	0x0001 (If On is selected)	Current_PERS
0x01	☑ (On)	Up/Down + OK (Select Off)	SET (0x2)	0x0880	0x0000 (If Off is selected)	Current_PERS

1.3.3.5.7 Navigation Pilot Audio Setup State Assignment

FeatNoIpmb Actl Signal	FeatConfigIpmbActl Signal	PersIndexIpmb_D_Actl Signal	NAVIGATION_PILOT_ SETUP_MC	Current_PERS (3)
0x0881 (1)	0x0000 (Off)	0x0 – 0x4	0x00	0x0 – 0x4
	0x0001 (On)	0x0 – 0x4	0x01	0x0 – 0x4
	Other (2)		Error (0x2)	Last Known
Missing per Section 1.4.1 (2)				

(1) Navigation Pilot Audio Feature Number. Reference is Feat Num table in "Vehicle Personalization FS"
(2) Message Response is Faulted
(3) Equal to the received "PersIndex<--->" signal value. When faulted Keep last known value.

1.3.3.5.8 Navigation Pilot Audio Setup Request Messages based upon NAV_PILOT_AUDIO_SETUP_MC

ASSISTED_ LANE_CHANGE_ SETUP_MC	Display Menu	M/C Switch Selection Event	MsgCntrDsplyOp_ D_Rq Signal	MsgCntrFeatNoRq Signal	MsgCntrFeatConfig Rq Signal	MsgCntrPersIndex _D_Rq Signal
0x00 or 0x02	☐ (Off)	Up/Down + OK (Select On)	SET (0x2)	0x0881	0x0001 (If On is selected)	Current_PERS
0x01	☑ (On)	Up/Down + OK (Select Off)	SET (0x2)	0x0881	0x0000 (If Off is selected)	Current_PERS

1.3.3.5.9 Auto Lane Change Setup State Assignment

FeatNoIpmbActl Signal	FeatConfigIpmbActl Signal	PersIndexIpmb_D_Actl Signal	NAVIGATION_PILOT_ SETUP_MC	Current_PERS (3)
0x0882 (1)	0x0000 (Off)	0x0 – 0x4	0x00	0x0 – 0x4
	0x0001 (On)	0x0 – 0x4	0x01	0x0 – 0x4
	Other (2)		Error (0x2)	Last Known
Missing per Section 1.4.1 (2)				

1.3.3.5.10 Auto Lane Change Setup Request Messages based upon AUTO_LANE_CHANGE_SETUP_MC

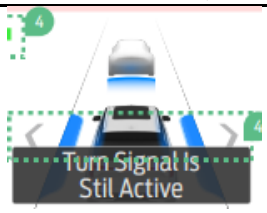
ASSISTED_ LANE_CHANGE_ SETUP_MC	Display Menu	M/C Switch Selection Event	MsgCntrDsplyOp_ D_Rq Signal	MsgCntrFeatNoRq Signal	MsgCntrFeatConfig Rq Signal	MsgCntrPersIndex_ D_Rq Signal
0x00 or 0x02	☐ (Off)	Up/Down + OK (Select On)	SET (0x2)	0x0882	0x0001 (If On is selected)	Current_PERS
0x01	☑ (On)	Up/Down + OK (Select Off)	SET (0x2)	0x0882	0x0000 (If Off is selected)	Current_PERS

1.3.3.5.11 State Matrix Update for Assisted Lane Change Information with NBP

Assisted Lane Change Information will be shown whenever Navigation Based Pilot is not available (either because Navigation Based Pilot is configured off or even if equipped but not activated due to driver deselection or without Navigation route).

Operational_Mode	Feature Config	NbpAvail_D_Stat Signal	Blue_Cruise_ECE_ Cfg	TjaLc_D_Stat Signal	TjaLcWarn_D_Rq Signal	TjaLcMsgTxt_D_Rq	ALC_Information_ Display (Example Graphics)		Chime Status Flag
Normal or Crank	Traffic_Jam_Assist_Cfg = 0x1 (Enabled) OR Hwy_Assist_Cfg = 0x1 (Enabled) AND Nav_Pilot_Cfg = X (Don't Care) AND Auto_Lane_Change_Cfg = X (Don't Care)	0x0 (Off) Or 0x1 (Standby) Or 0x5 (Nbp Failure) Or Missing	X (Don't Care)	0x1 (Standby)	X (Don't Care)	X (Don't Care)	Active	 ((under speed threshold or no lanes detected) chevrons have less contrast and line thickness)	None
				0x2 (AvailableLeft)				 (Grey chevron on the left only)	None
				0x3 (AvailableRight)				 (Gray chevron on the right only)	None
				0x4 (AvailableLeftRight)				 (Grey Chevron on both sides, example graphic of HA in limited mode)	None
				0x5 (PreparingLeft)				 (Blue Chevron on the Left, none Right, example graphic of HA in extended mode)	None

				0x6 (PreparingRight)				 (Blue Chevron on the Right, none Left)	None
				0x7 (LcActiveLeft)				 (part of animation Indicating a lane change to the left, final static image is displayed as long as signal is active)	None
				0x8 (LcActiveRight)				 part of animation Indicating a lane change to the right, final static image is displayed as long as signal is active)	None
			0x1 (Enabled)	X (Don't Care)	0x1 (DriverCancel)	X (Don't Care)	Active	Canceled by Driver* (GML ID: A13)	TJA_Low_Priority_ Chime_Status_Flag
			X (Don't Care)		0x2 (SystemCancel)			Not Available (GML ID: A21)	
					0x3 (CancelNoLane)			Not Available No Lane Seen* (GML ID: A15)	
					0x4 (CancelLaneBusy)			Not Available Lane Busy* (GML ID: A14)	
					0x5 (CancelSpeedTooLow)			Not Available Low Speed* (GML ID: A16)	

Normal or Crank	Traffic_Jam_Assist_Cfg = 0x1 (Enabled) OR Hwy_Assist_Cfg = 0x1 (Enabled) AND Nav_Pilot_Cfg = X (Don’ t Care) AND Auto_Lane_Change_Cfg = X	0x0 (Off) Or 0x1 (Standby) Or 0x5 (Nbp Failure) Or Missing	X (Don’t Care)	X (Don’t Care)	X (Don’t Care)	0x1 (LcSuggestionLeft)	Active	 (above text or “Lane Change Possible, Use Left Turn Signal to make lane change” based on application HMI)	None
						0x2 (LcSuggestionRight)		 (above text or “Lane Change Possible, Use Left Turn Signal to make lane change” based on application HMI Example graphic of HA in Extended mode)	None
						0x5 (TurnOffIndicator)		 (Text: Turn Signal is Still Active)	None
All Other Cases							Inactive	(No indication)	None

The ADAS controller will arbitrate and populate the 3 input signals above, cluster simply displays information based on signal states received.
Note *: The generic “Cancelation (GML ID: A1)” notification shall be displayed only if application display does not have space to display reason text.
For Assisted Lane Change, “Not Available” (GML ID: A21) notification shall be displayed only if an application display does not have space to display reason text.
Note: The Lane_Centering_Assist_Canceled_MC_Warn_Status_Flag shall have higher priority over any and all ALC cancelation messages.

Blue_Cruise_ECE_Cfg – Determines if certain notifications need to be displayed on the cluster per ECE regulations. Required to be enabled on ECE regions.

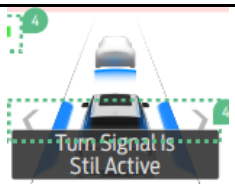
Above State Matrix for Assisted Lane Change Information is based on F-REQ-438184/B-State Matrix for Assisted Lane Change Information in < Highway Assist with Lane Centering Control Function and Warnings - FNV2.docm>. The purple content is added for NBP.

1.3.3.5.12 State Matrix for Navigation Based Pilot Information

Navigation Based Pilot Information will only be shown when the feature is active.

Operational_Mode	Feature Config	NbpAvail_D_Stat Signal	Blue_Cruise_ECE_Cfg	TjaLc_D_Stat Signal	TjaLcWarn_D_Rq Signal	NbpLcMsgTxt_D_Rq	NBP_Information_Display (Example Graphics)		Chime Status Flag
Normal or Crank	Traffic_Jam_Assist_Cfg = 0x1 (Enabled) OR Hwy_Assist_Cfg = 0x1 (Enabled) AND Nav_Pilot_Cfg = X (Don't Care) AND Auto_Lane_Change_Cfg = X (Don't Care)	0x2 (AvailableLnChngSuggstnOnly) Or 0x3 (Available DrvLnChng) Or 0x4 (Avaialble VehLnChng)	X (Don't Care)	0x1 (Standby)	X (Don't Care)	X (Don't Care)	Active	 ((under speed threshold or no lanes detected) chevrons have less contrast and line thickness)	None
				0x2 (AvailableLeft)				 (Grey chevron on the left only)	None
				0x3 (AvailableRight)				 (Gray chevron on the right only)	None
				0x4 (AvailableLeftRight)				 (Grey Chevron on both sides, example graphic of HA in limited mode)	None

				0x5 (PreparingLeft)				 (Blue Chevron on the Left, none Right, example graphic of HA in extended mode)	None
				0x6 (PreparingRight)				 (Blue Chevron on the Right, none Left)	None
				0x7 (LcActiveLeft)				 (part of animation Indicating a lane change to the left, final static image is displayed as long as signal is active)	None
				0x8 (LcActiveRight)				 part of animation Indicating a lane change to the right, final static image is displayed as long as signal is active)	None
			0x1 (Enabled)	X (Don't Care)	0x1 (DriverCancel)	X (Don't Care)	Active	Canceled by Driver* (GML ID: A13)	TJA_Low_Priority_Chime_Status_Flag
			X (Don't Care)		0x2 (SystemCancel)			Not Available (GML ID: A21)	

					0x3 (CancelNoLane)			Not Available No Lane Seen* (GML ID: A15)	
					0x4 (CancelLaneBusy)			Not Available Lane Busy* (GML ID: A14)	
					0x5 (CancelSpeedTooLow)			Not Available Low Speed* (GML ID: A16)	
Normal or Crank	Hwy_Assist_Cfg = 0x1 (Enabled) OR Traffic_Jam_Assist_Cfg = X (Don’ t Care) AND Nav_Pilot_Cfg = 0x1 (Enabled) AND Auto_Lane_Change_Cfg = X	0x2 (AvailableLnChngSuggstnOnly) Or 0x3 (Available DrvLnChng) Or 0x4 (Avaialble VehLnChng)	X (Don’t Care)	X (Don’t Care)	X (Don’t Care)	0x1 (LnChngSuggstonLeftFasterLn)	Active		None
						0x2 (LnChngSuggstonRightFasterLn)			None
						0x5 (TurnOffIndicator)		 (Text: Turn Signal is Still Active)	None
						0x6 (LnChngSuggstonLeftNav)			None
						0x7 (LnChngSuggstonRightNav)			None

						0x8 (HandOver)			None
						0x9 (MissingExitAlert)		 Change to Orange text	TJA_Low_Priority_Chime_Status_Flag
						0xA (LnChngSuggstnLeftManual)		To do added	None
						0xB (LnChngSuggstnRightManual)		To be added	None
All Other Cases							Inactive	(No indication)	None

The ADAS controller will arbitrate and populate the 3 input signals above, cluster simply displays information based on signal states received.
Note *: The generic “Cancelation (GML ID: A1)” notification shall be displayed only if application display does not have space to display reason text.
For Assisted Lane Change, “Not Available” (GML ID: A21) notification shall be displayed only if an application display does not have space to display reason text.
Note: The Lane_Centering_Assist_Canceled_MC_Warn_Status_Flag shall have higher priority over any and all ALC cancelation messages.

Blue_Cruise_ECE_Cfg – Determines if certain notifications need to be displayed on the cluster per ECE regulations. Required to be enabled on ECE regions.

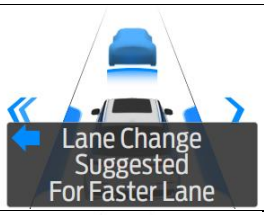
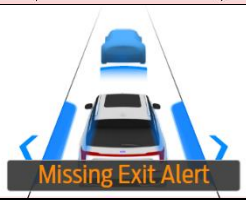
1.3.3.5.13 State Matrix Update for Highway Assist Information Warnings with NBP

Operational_Mode	Feature Config	Driver Assist On-Demand Screen	TjaWarn_D_Rq Signal	TjaMsgTxt_D_Dsply Signal	NbpAvail_D_Stat Signal	Lane_Centering_Assist_Canceled_MC_War	Driver_Resume_Control	Lane_Warning_Right	Lane_Warning_Left_MC_Warn_Status_Fl	Eyes_On_Road_Amber	Eyes_On_Road_Red_MC_Warn_Status_Fl	Lane_Centering_Unavailable	Lane_Centering_Assist_On	Hwy_Assist_Unavailable	Hwy_Assist_On_MC_Warn_Status_Fl	Hwy_Assist_Available	Hwy_Assist_Press_Acc_to	Navigation_Pilot_Un
Normal or Crank	Traffic_Jam_Assist_Cfg = Enabled (0x1) OR Hwy_Assist_Cfg = Enabled (0x1) AND Nav_Pilot_Cfg = 0x1 (Enabled) AND Auto_Lane_Change_Cfg = X	Not Displayed	TrafficJamAssistCancel (0x1)	X (Don't Care)	X (Don't Care)	**Active**	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive
		Actively Displayed				Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive
		X (Don't Care)	HardTakeOverLevel2 (0x3)	X (Don't Care)		Inactive	**Active**	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive
			HaLaneDeptWarningRight (0x4)			Inactive	Inactive	**Active**	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive
			HaLaneDeptWarningLeft (0x5)			Inactive	Inactive	Inactive	**Active**	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive
			SoftTakeOverEyesOff (0x6)			Inactive	Inactive	Inactive	Inactive	**Active**	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive
			HardTakeOverEyesOff (0x7)			Inactive	Inactive	Inactive	Inactive	Inactive	**Active**	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive
			NoWarning (0x0)	TrafficJamAssistUnavailable (0x1)		Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	**Active**	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive
				TrafficJamAssistSelected (0x2)		Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	**Active**	Inactive	Inactive	Inactive	Inactive	Inactive
				HAUnavailable (0x4)		Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	**Active**	Inactive	Inactive	Inactive	Inactive
				HASelected (0x5)		Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	**Active**	Inactive	Inactive	Inactive

Operational_Mode	Feature Config	Driver Assist On-Demand Screen	TjaWarn_D_Rq Signal	TjaMsgTxt_D_Dsply Signal	NbpAvail_D_Stat Signal	Lane_Centering_Assist Canceled_MC_War	Driver_Resume_Control	Lane_Warning_Right	Lane_Warning_Left_MC_Warn_Status_Fl	Eyes_On_Road_Amber	Eyes_On_Road_Red_MC_Warn_Status_Fl	Lane_Centering_Unavailable	Lane_Centering_Assist_On	Hwy_Assist_Unavailable	Hwy_Assist_On_MC_Warn_Status_Fl	Hwy_Assist_Available	Hwy_Assist_Press_Acc_to	Navigation_Pilot_Un
				SmartOffering (0x6)		Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	**Active**	Inactive	Inactive
				Disclaimer (0x7)		Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	**Active**	Inactive
				Declared Missing as per Section 1.4.1		Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive
			X (Don't Care)	X (Don't Care)	NbpFailure (0x5)	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	**Active**
			Declared Missing as per Section 1.4.1	X (Don't Care)	X (Don't Care)	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive
All Other Cases						Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive

Above State Matrix for Assisted Lane Change Information is based on F-REQ-343100/D-State Matrix for Highway Assist Information Warnings in < Highway Assist with Lane Centering Control Function and Warnings - FNV2.docm>. The purple content is added for NBP.

1.3.3.5.14 MC Status Flag to MC Warning Message

MC Warn Status Flag	Reference Text or Graphic (see GML for exact wording)	MC Warning ID	Chime Status Flag
Navigation_Pilot_Unavailable_MC_Warn_Status_Flag			None
Lane_Change_Suggested_For_Faster_Lane_Left_MC_Warn_Status_Flag			None
Lane_Change_Suggested_For_Faster_Lane_Right_MC_Warn_Status_Flag			None
Lane_Change_Suggested_Following Navigation Left_MC_Warn_Status_Flag			None
Lane_Change_Suggested_Following Navigation Right_MC_Warn_Status_Flag			None
HandOver_MC_Warn_Status_Flag			None
Missing_Exit_Alert_MC_Warn_Status_Flag			TJA_Low_Priority_Chime_Status_Flag
LnChngSuggstnLeftManual_MC_Warn_Status_Flag			None
LnChngSuggstnRightManual_MC_Warn_Status_Flag			None

1.3.5.2 Operation Description (supports algorithm flow chart)

NBP settings are at IVI instead of cluster.

1.3.5.3 Personalization Feature Number Definition

None

1.3.5.4 Function Safety Classification (EMC)

Class B

1.3.5.5 Memory Storage

1.3.5.5.1 Memory Storage Parameters

Parameter Name	Description	Value at Battery Connect	Value at Wake-up
Nav_Piolot_Cfg	Configures cluster to display items in the Settings menu (Set to "cluster" at cluster supplier manufacturer plant.	Use Stored Value	Use Stored Value
Auto_Lane_Change_Cfg	Configures cluster to display items in the Settings menu (Set to "cluster" at cluster supplier manufacturer plant.	Use Stored Value	Use Stored Value
FeatConfigIpmbActl signal	Input signal sent from IPMB to indicate current value of the feature setting for the feature that is being set or queried.	(0x0000)	Do Not Init
FeatNoIpmbActl	Input signal sent from IPMB to indicate Feature Number.	(0x0000)	Do Not Init
PersIndexIpmb_D_Actl	Input signal from IPMB to indicate which personality profile is being reported.	Vehicle (0x4)	Do Not Init
Nbp_D_Stat	Input signal from IPMB to display current status of NBP system.	0x0	0x0
NbpMsgTxt_D_Rq	Input signal from IPMB to display lane change assist notifications to the user.	0x0	0x0
NBP_Information_Display	Output signal to displays the Navigation Based Pilot information in the ADAS metaphor.	Inactive	Inactive
Navigation_Pilot_Unavailable_MC_Warn_Status_Flag	Output signal to control the state of the text warning message.	Inactive	Inactive
Lane_Change_Suggested_For_Faster_Lane_Left_MC_Warn_Status_Flag	Output signal to control the state of the text warning message.	Inactive	Inactive
Lane_Change_Suggested_For_Faster_Lane_Right_MC_Warn_Status_Flag	Output signal to control the state of the text warning message.	Inactive	Inactive
Lane_Change_Suggested_Following Navigation Left_MC_Warn_Status_Flag	Output signal to control the state of the text warning message.	Inactive	Inactive
Lane_Change_Suggested_Following Navigation Right_MC_Warn_Status_Flag	Output signal to control the state of the text warning message.	Inactive	Inactive

Parameter Name	Description	Value at Battery Connect	Value at Wake-up
HandOver_MC_Warn_Status_Flag	Output signal to control the state of the text warning message.	Inactive	Inactive
Missing_Exit_Alert_MC_Warn_Status_Flag	Output signal to control the state of the text warning message.	Inactive	Inactive
LnChngSuggstnRightManua_Status_Flag	Output signal to control the state of the text warning message.	Inactive	Inactive
LnChngSuggstnRightManual_Status_Flag	Output signal to control the state of the text warning message.	Inactive	Inactive
NAVIGATION_PILOT_SETUP_MC	Output signal to control the setting menu display output for Navigation Based Pilot	Inactive	Inactive
NAV_PILOT_AUDIO_SETUP_MC	Output signal to control the setting menu display output for Navigation Based Pilot audio selection.	Inactive	Use Stored Value?
AUTO_LANE_CHANGE_SETUP_MC	Output signal to control the setting menu display output for Auto Lane Change.	Inactive	Inactive

1.3.5.6 Reconfigurable Telltale

None

1.3.5.6 Prove Out

None

1.3.5.7 Message Center Msg

Refer to 1.3.3.5.14 MC Status Flag to MC Warning Message.

1.3.6 Electronic Horizon (EH) Message Handling

Electronic Horizon messages include ElecHorizon_Data1 (0x22E) and ElecHorizon_Data2 (0x22F) and they are originated from ADAS map which resides in In-Vehicle Infotainment System.
With an alternative solution utilizing HD map for EH message creation, as it's stored outside of the IVI system, IVI has no responsibility broadcasting EH messages anymore. Neither does the ADAS map exist. Additionally, since HD map is highly linked with NBP feature, it makes sense to determine IVI EH messages broadcast based on NBP configuration.

- When Nav_Pilot_Cfg = 0x1 (Enabled), IVI should inhibit the broadcast of EH messages and disable any faults caused by ADAS map loss.
- When Nav_Pilot_Cfg = 0x0 (Disabled), IVI should broadcast EH messages based on ADAS map outputs.

**Note: please align with corresponding team who handles the ADAS map and EH message implementation.*

1.4 Error Handling

1.4.1 Missing Message Strategy

Missing message DTC (TBD) shall be logged if signals NbpAvail_D_Stat or NbpMsgTxt_D_Rq is not received for continuous 5s.
If Nav_Pilot_Cfg = Disabled (0x0), the cluster shall never log a missing message DTC for NbpAvail_D_Stat and NbpMsgTxt_D_Rq signals for this feature.

1.5 Diagnostics

1.5.1 Self -Test

None

1.5.2 Engineering Test Mode

Reference section “Dealer / Engineering Test Mode (ETM)”

1.5.3 Part II Performance

1.5.3.1 DID DExx

Block Num	Block Description	Byte(s)	Bits	State: Description	"0"	"1"	Default	Comments/ Information
PACKETED BLOCKS								
$01	Option Content (B&A)	*	1	Navigation Based Pilot	Disabled	Enabled	Disabled	This parameter allows the NBP related menu items and all information pertaining to the feature to be displayed in the vehicle. Disabled means NBP feature is not present in the vehicle.
$02	Option Content (B&A)	*	1	Auto Lane Change	Disabled	Enabled	Disabled	This parameter allows the Auto Lane Change settings menu and all pertaining information to be displayed in the cluster, as well as information. Disabled means Auto Lane Change (that is submenu of NBP) is not present in the vehicle.
*Byte and bit location to be identified in Part II Specification for this cluster								

1.5.3.2 Supported Diagnostic Trouble Codes (DTCs)

DTC	Description
C23B	Lost Communication with IPMB (Image Processing Module “B”)

1.6 Reference Specification

< Highway Assist with Lane Centering Control Function and Warnings - FNV2.docm>

1.7 Revision History

Version	Name	Change Description	Date
1.0	Zhang Wayne Zheng Dong	Initial release	October 31/2022
1.1	Zheng Dong	According < Highway Assist with Lane Centering Control Function and Warnings - FNV2_v3.4_[VDOC075263_N]>, renaming assisted lane change “cancelation” notifications from “Canceled” to “Not Available”. And add Blue_Cruise_ECE_Cfg condition in the chapter of State Matrix Update for Assisted Lane Change Information with NBP and State Matrix for Navigation Based Pilot Information. And add Blue_Cruise_ECE_Cfg condition in Diagnostic Configuration Flowchart. Update DTC ID in 1.5.3.2 chapter Update Highway Assist with Navigation Pilot input request Flowchart Update Feature Config in State Matrix for Navigation Based Pilot Information	November 15/2022
1.2	Zheng Dong	Add output signals of MsgCntrDsplyOp_D_Rq, MsgCntrFeatNoRq, MsgCntrFeatConfigRq, MsgCntrPersIndex_D_Rq in I/O Block Diagram and description in outputs. Add Hwy_Assist_Cfg and Traffic_Jam_Assist_Cfg in I/O Block Diagram. Update for Menu display logic description. Remove function ID such as F-REQ-XXXXXX/A. Update Input Request Flowchart and Output SET Request Flowchart. Delete the chapter of 1.3.5.5.2 Time Constants.	
1.3	Zhang Wayne Zheng Dong	Add 1.3.6 chapter for Electronic Horizon (EH) Message Handling. If this change implementation does not belong to NBP teams, please inform relevant responsible owner.	