1 HUD – Upshift/Downshift Indicator RTT – CGEA1.3

1.1 Functional Description

The purpose of the Upshift/Downshift Indicator RTT is to inform the driver that a gear shift needs to be made for fuel efficient operation of a manual transmission powertrain.

For the IPC, traditionally it has been required on certain programs in North America to help achieve higher CAFÉ numbers. Per EU regulation 661/2009/EC, however, for homologation application dates after 1 Nov 2012 homologations, and registrations after 1 Nov 2014, the upshift indicator is now required for EU applications as part of greenhouse gas regulation. Per EU regulation the Upshift Indicator shall also function for automatic transmission applications when in select shift mode. It is recommended this feature be disabled where not required per regulation or as required per powertrain to help CAFÉ numbers in order to prevent TGW. This telltale has been shown to generate between 1 – 2 TGW in North American Markets.

The HUD should follow the indication in IPC in synchronous manner. In HUD, even though it is not a regulation for Upshift/ Downshift indication, similar behavior is retained. The Upshift recommendations could be deactivated via HUD Menu in the cluster, so the risk of TGWs is reduced.

The HUD_Upshift_RTT correlates the TrnManShif_D_IndDrv signal and the Operational_Mode to activate or deactivate the Upshift RTT in HUD. The HUD_Downshift_RTT correlates the TrnManShif_D_IndDrv signal and the Operational_Mode to activate or deactivate the Down Shift RTT. The Gear_Indication correlates the module configuration, the TrnManShif_D_IndDrv and TrnManShifGear_D_IndDrv signals and the Operational_Mode to activate or deactivate the Gear_Indication. The Gear_Indication is for vehicles with Manual Transmission and also for automatic vehicles, when put in Manual mode using Select Shift. If the Gear Indication config is enabled, the Shift Indication and the gear indication should be in sync within HUD.

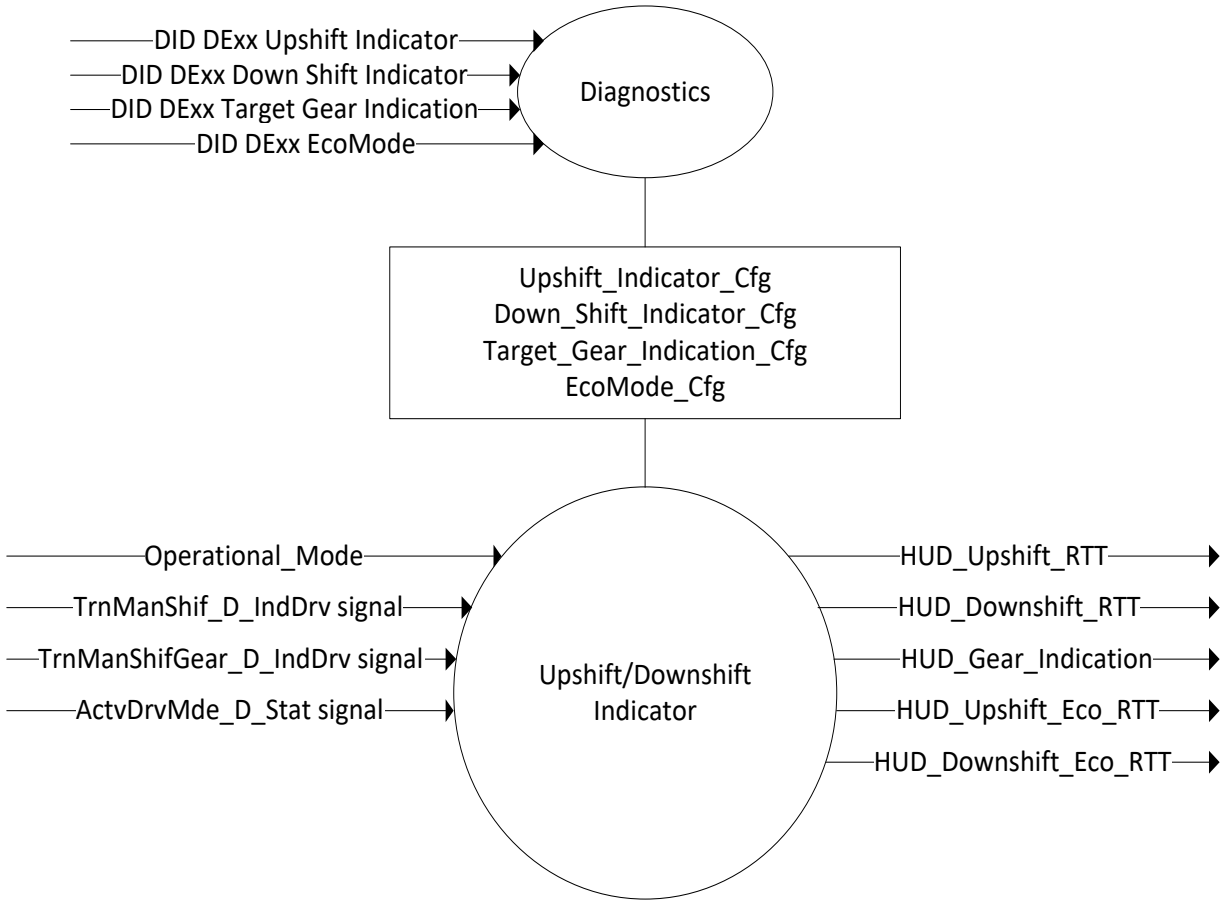
The HUD_Upshift_RTT shall provide an iconic representation that will illuminate or extinguish to inform the driver of a possibility that the Upshift indicator is on.
The Upshift Indicator shall be implemented in a Fixed/Dedicated RTT in IPC to ensure regulation is met. A synchronous RTT illumination is implemented in the HUD on the dedicated location.

When EcoMode is Active, the Upshift and Downshift RTT will be filled in (solid arrow) to make the shift indicator more visible. For C519 Program, it is most likely that Eco Mode is deactivated. Please refer to the program for exact config information.

1.2 Interfaces

1.2.1 Interface Context Diagram (I/O Block Diagram)

Upshift/Downshift/Gear Indication



1.2.2 Inputs

1.2.2.1 IR-REQ-309276/A-INTERNAL:

- Operational_Mode
- Upshift_Indicator_Cfg
- Down_Shift_Indicator_Cfg
- Target_Gear_Indication_Cfg
- EcoMode_Cfg

1.2.2.2 MUX message on the CAN Bus

1.2.2.2.1 SIG-REQ-309278/A-TrnManShif_D_IndDrv Signal

Signal Name	Size (bits)	Detail	Units	Res	Offset	State Encoded	Min.	Max.
TrnManShif_D_IndDrv	3			1	0		0 (0x0)	7 (0x7)
		No_indication				0x0		
		Upshift_Fuel_Economy _recommendation				0x1		
		Upshift_Performance_ Recommendation				0x2		

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		Upshift_warning (fuel cut imminent and reaching rev limit)				0x3		
		Downshift_recommendation				0x4		
		Undefined				0x5		
		Undefined				0x6		
		Undefined				0x7		

1.2.2.2.2 SIG-REQ-309279/A-TrnManShifGear_D_IndDrv Signal

Signal Name	Size (bits)	Detail	Units	Res	Offset	State Encoded	Min.	Max.
TrnManShifGear_D_IndDrv	3			1	0		0 (0x0)	7 (0x7)
		No Indication				0x0		
		Indicate gear 1 (1)				0x1		
		Indicate gear 2 (2)				0x2		
		Indicate gear 3 (3)				0x3		
		Indicate gear 4 (4)				0x4		
		Indicate gear 5 (5)				0x5		
		Indicate gear 6 (6)				0x6		
		Indicate Reversed Gear (R)				0x7		

1.2.2.2.3 SIG-REQ-309280/A-ActvDrvMde_D_Stat Signal

Signal Name	Size (bits)	Detail	Units	Res	Offset	State Encoded	Min.	Max.
ActvDrvMde_D_Stat	4			1	0		0 (0x0)	F (0xF)
		SelDrvMde01				0x0		
		SelDrvMde02				0x1		
		SelDrvMde03				0x2		
		SelDrvMde04				0x3		
		SelDrvMde05				0x4		
		SelDrvMde06				0x5		
		SelDrvMde07				0x6		
		SelDrvMde08				0x7		
		SelDrvMde09				0x8		
		SelDrvMde10				0x9		
		SelDrvMde11				0xA		
		SelDrvMde12				0xB		
		SelDrvMde13				0xC		
		SelDrvMde14				0xD		
		SelDrvMde15				0xE		
		SelDrvMde16				0xF		

1.2.3 IR-REQ-309281/A-Outputs

HUD_Upshift_RTT, which is used to control the state of the Reconfigurable Telltale Indication
HUD_Downshift_RTT, which is used to control the state of the Reconfigurable Telltale Indication
HUD_Gear_Indication, which is used to control the numerical portion of the Reconfigurable Telltale Indication
HUD_Upshift_Eco_RTT, which is used to control the state of the Reconfigurable Telltale Indication
HUD_Downshift_Eco_RTT, which is used to control the state of the Reconfigurable Telltale Indication

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1.3 Function/Performance

1.3.1 F-REQ-309283/A-Operational Modes

Mode	Differentiating Vehicle Conditions
Sleep Mode	HUD_Upshift_RTT/ HUD_Downshift_RTT/ HUD_Gear_Indication/ HUD_Upshift_Eco_RTT/ HUD_Downshift_Eco_RTT OFF
Limited Mode	HUD_Upshift_RTT/ HUD_Downshift_RTT/ HUD_Gear_Indication/ HUD_Upshift_Eco_RTT/ HUD_Downshift_Eco_RTT OFF
Normal Mode	HUD_Upshift_RTT/ HUD_Downshift_RTT/ HUD_Gear_Indication/ HUD_Upshift_Eco_RTT/ HUD_Downshift_Eco_RTT ON/OFF
Crank Mode	HUD_Upshift_RTT/ HUD_Downshift_RTT/ HUD_Gear_Indication/ HUD_Upshift_Eco_RTT/ HUD_Downshift_Eco_RTT ON/OFF

1.3.2 Voltage Levels

Not Applicable

1.3.3 Human-Machine Interface

1.3.3.1 Visual

1.3.3.1.1 Indicator Graphics / Display Format

Warning ID	RTT	Icon	Message Color	For Reference Only
W1863	Upshift ECO ON Indication	tbd.99	Green	
W1864	Downshift ECO ON Indication	tbd.100	Green	
W1865	Upshift Warning	h.900	Green	
W1866	Downshift Warning	tbd.10	Green	

For actual symbol definition see pixel definition section in the message center section.
The pixel representation is based upon the symbol definition database of the 03-0685 ARL requirement.
HMI Example for an up/down shift recommendation to the nearest gear.

1.3.3.1.2 HMI-REQ-309288/A-Indicator Color Coordinates

Green

1.3.3.1.2.1 Indicator Color Coordinates Reference

Reference SDS IL-0017 (RTT)

1.3.3.1.3 HMI-REQ-309290/A-Indicator Characteristics

Pixel Display in Message Center Display – HUD_Upshift_RTT (#TBD)

1.3.3.2 Audio

None.

1.3.4 PFM-REQ-309292/A-System Accuracy

The HUD_Upshift_RTT/ HUD_Downshift_RTT/ HUD_Gear_Indication/ HUD_Upshift_Eco_RTT/ HUD_Downshift_Eco_RTT shall change the state of the RTT within 100msec of a state change as indicated in the state matrix reference 1.3.5.1 Subsystem Algorithm Flowchart/ State Diagram

1.3.5 Operation: Performance and Functional

1.3.5.1 Subsystem Algorithm Flowchart / State Diagram

1.3.5.1.1 F-REQ-309295/A-State Matrix for HUD_Upshift_RTT Flag

Operational_Mode	Upshift_Indicator_Cfg	EcoMode_Cfg	TrnManShif_D_IndDrv	ActvDrvMde_D_Stat	HUD_Upshift_RTT	HUD_Upshift_Eco_RTT
Normal Or Crank	Enabled	Disabled	Upshift_Fuel_Economy_recommendation (0x1) | Upshift_Performance_Recommendation (0x2) | Upshift_warning (fuel cut imminent and reaching rev limit) (0x3)	X	Active	Inactive
		Enabled		SelDrvMde07 (0x6)	Inactive	Active
				! SelDrvMde07 (0x6)	Active	Inactive
				Missing as per 1.4.1	Active	Inactive
		X	Missing as per 1.4.1	X	Inactive	Inactive
All Other Cases					Inactive	Inactive

X=Don't Care

1.3.5.1.2 F-REQ-309296/A-State Matrix for HUD_Downshift_RTT Flag

Operational_Mode	Down_Shift_Indicator_Cfg	EcoMode_Cfg	TrnManShif_D_IndDrv Signal	ActvDrvMde_D_Stat Signal	HUD_Downshift_RTT	HUD_Downshift_Eco_RTT
Normal or Crank	Enabled	Disabled	Downshift_recommendation (0x4)	X	Active	Inactive
		Enabled		SelDrvMde07 (0x6)	Inactive	Active

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				! SelDrvMde07 (0x6)	Active	Inactive
				Missing as per 1.4.1	Active	Inactive
		X	Missing as per 1.4.1	X	Inactive	Inactive
All Other Cases					Inactive	Inactive

X=Don't Care

1.3.5.1.3 F-REQ-309297/A-State Matrix for Gear_Indication

Operational_Mode	Target_Gear_ Indication_Cfg	TrnManShif_D_IndDrv Signal	TrnManShifGear_ D_IndDrv Signal	HUD_Gear_ Indication
Normal or Crank	Enabled	Upshift_Fuel_Economy_ recommendation (0x1) | Upshift_Performance_ Recommendation (0x2) | Upshift_warning (fuel cut imminent and reaching rev limit) (0x3)	Indicate gear 1 (0x1)	2
			Indicate gear 2 (0x2)	3
			Indicate gear 3 (0x3)	4
			Indicate gear 4 (0x4)	5
			Indicate gear 5 (0x5)	6
		Downshift_recommendation (0x4)	Indicate gear 2 (0x2)	1
			Indicate gear 3 (0x3)	2
			Indicate gear 4 (0x4)	3
			Indicate gear 5 (0x5)	4
			Indicate gear 6 (0x6)	5
		Missing as per 1.4.1	X	Inactive
		X	Missing as per 1.4.1	Inactive
All Other Cases				Inactive

X=Don't Care
Note: Upshift Indicator Cfg and/or Down Shift Indicator Cfg must be Enabled for thisTarget Gear Indication Cfg bit to be Enabled. This bit should be Disabled on vehicles with Automatic transmissions.

1.3.5.2 Operation Description (supports algorithm flowchart /state diagram)

1.3.5.2.1 Operation Description Actual RTT Display Location

The actual RTT display operational modes are displayed in the Message Center Section of this SPSS.

1.3.5.2.2 F-REQ-309300/A-Upshift Indicator Implementation Type

The Upshift Indicator may be implemented in a Fixed/Dedicated RTT to proactively be ready for future regulations. Refer Program HMI for actual graphics and location for display.

1.3.5.2.3 F-REQ-309301/A-Upshift and Downshift RTT indicators are mutually exclusiveness

The HUD_Upshift_RTT, HUD_Downshift_RTT, HUD_Upshift_Eco_RTT, HUD_Downshift_Eco_RTT indicators are mutually exclusive and should share the same space.

1.3.5.2.4 F-REQ-309302/A-Gear Indication with Shift Indication

The HUD_Gear_Indication requires an Active Upshift/Down Shift indication to be displayed.

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1.3.5.3 FS-REQ-309320/A;1-Function Safety Classification (EMC)

B

1.3.5.4 Memory Storage

1.3.5.4.1 NVM-REQ-309305/A-Memory Storage Functional Parameters Table

Parameter Name	Description	Value at Battery Connect	Value at Module Wake-up
HUD_Upshift_RTT	Used to control the state of the RTT	Inactive (0x0)	Inactive (0x0)
HUD_Downshift_RTT	Used to control the state of the RTT	Inactive (0x0)	Inactive (0x0)
Gear_Indication	Used to control the state of the Gear Indication portion of the RTT	Inactive (0x0)	Inactive (0x0)
Upshift_Indicator_Cfg	Encoded indicator of feature presence controlled via CAN at EOL at VO plant.	Use Stored Value	Use Stored Value
Down_Shift_Indicator_Cfg	Encoded indicator of feature presence controlled via CAN at EOL at VO plant.	Use Stored Value	Use Stored Value
Gear_Indication_Cfg	Encoded indicator of feature presence controlled via CAN at EOL at VO plant.	Use Stored Value	Use Stored Value
TrnManShif_D_IndDrv Signal	CAN Signal sent from the PCM	No_Indication (0x0)	Do Not Init
TrnManShifGear_D_IndDrv Signal	CAN Signal sent from the PCM	No_Indication (0x0)	Do Not Init
Operational_Mode	4 state indicator for cluster operational mode	Limited	Limited, Normal or Crank
HUD_Upshift_Eco_RTT	Used to control the state of the RTT	Inactive (0x0)	Inactive (0x0)
HUD_Downshift_Eco_RTT	Used to control the state of the RTT	Inactive (0x0)	Inactive (0x0)
EcoMode_Cfg	Encoded indicator of feature presence controlled via CAN at EOL at VO plant.	Use Stored Value	Use Stored Value
ActvDrvMde_D_Stat Signal	CAN Signal sent from ABS	SelDrvMde01 (0x0)	SelDrvMde01 (0x0)

1.3.5.5 Prove Out

No

1.3.5.6 F-REQ-309307/A-Reconfigurable Telltale

Yes

1.3.5.7 F-REQ-309308/A-Message Center Msg

See Message Center Section for displaying RTT based upon state of RTT flag.
W1863 is associated with the HUD_Upshift_Eco_RTT.
W1864 is associated with the HUD_Downshift_Eco_RTT.
W1865 is associated with the HUD_Upshift_RTT.
W1866 is associated with the HUD_Downshift_RTT.

1.4 Error Handling

1.4.1 Missing Message Strategy

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

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

1.4.1.1 SR-REQ-309321/A-EngineData_7_HS3 missing

Only signals from CAN frame 0x179 EngineData_7_HS3 shall be declared missing and only this frame shall cause logging of a DTC.

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-REQ-309315/A-Supported Diagnostic DIDs (Service $22 and $2F)

Number	PID / CommonID Name	PID Type
None	None	None

1.5.3.2 DTC-REQ-309316/A-Supported Diagnostic Trouble Codes (DTCs)

DTC	Description
C10000	Lost communication with ECM/PCM

1.5.3.3 DCR-REQ-309317/A-Supported Configurations ($DExx) DIDs

DID DExx:

Block Num	Block Description	Byte(s)	Bits	State: Description	"0"	"1"	Default	Comments/ Information
PACKETED BLOCKS								
$xx	Option Content (B&A)	*	*	Upshift Indicator	Disabled	Enabled	0 (Disabled)	Disabled means the feature is not available.
$xx	Option Content (B&A)	*	*	Down shift Indicator	Disabled	Enabled	0 (Disabled)	Disabled means the

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								feature is not available.
$xx	Option Content (B&A)	*	*	Target Gear Indication	Disabled	Enabled	0 (Disabled)	Upshift Indicator Cfg and/or Down Shift Indicator Cfg must be Enabled for this bit to be Enabled. At the time of this release, this bit should be Disabled on vehicles with Automatic transmissions.
$xx	Option Content (B&A)	*	*	EcoMode	Disable	Enable	0 (Disable)	Disabled means the function is not present in the vehicle.
	*Byte and bit location to be identified in Part II Specification for this cluster							

1.6 Reference Specification

IS-0001 WARNINGS/INDICATORS/DISPLAYS PROVEOUT
IS-0046 INSTRUMENTATION MATERIAL RESISTANCE TO CLEANING
IS-0052 OPERATING VOLTAGES - FUNCTIONAL/PERFORMANCE
IS-0069 FUNCTIONAL IMPORTANCE CLASS
IS-0324 WINDSHIELD & OTHER REFLECTIONS
IS-0327 WARNING INDICATOR EVALUATION
IS-0329 FLICKERING OF LAMPS
IS-0379 NORTH AMERICAN WARNINGS AND INDICATORS STRATEGY

IL-0017 TELLTALE AND INTERIOR ILLUMINATION COLOR
IL-0021 CRAFTSMANSHIP - DISPLAYS
IL-0023 CLARITY/LEGIBILITY/READABILITY
IL-0025 INTERIOR ILLUMINATION INTENSITY
IL -0027 VISUAL CONTRAST
IL -0043 OPERATIONAL ENVIRONMENT FUNCTIONALITY
IL -0045 COLOR
IL -0047 TELLTALE; INDICATOR AND DISPLAY LIGHT INTENSITY
IL -0048 ILLUMINATION ACCEPTABILITY

03-0661 PLACEMENT: CONTROL AND DISPLAY LOCATIONS
03-0662 PLACEMENT: LOGICAL GROUPING FUNCTION AND USAGE
03-0664 PLACEMENT: DOWN VISION TO COMPONENTS WITH HIGH VISUAL DEMAND
03-0665 PLACEMENT: EXPECTED LOCATIONS OF CONTROLS AND DISPLAYS VDS
03-0670 INTERIOR VISIBILITY
03-0671 INTERIOR VISIBILITY: REFLECTIONS FROM COMPONENTS & SURFACES

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03-0672 INTERIOR VISIBILITY: REFLECTIONS IN DISPLAYS
03-0673 INTERIOR VISIBILITY: VISUAL OBSCURATIONS
03-0674 INTERIOR VISIBILITY: ILLUMINATION CONTROLS / DISPLAYS
03-0675 INTERIOR VISIBILITY: VEILING GLARE
03-0677 INTERIOR VISIBILITY: SUNLIGHT WASHOUT
03-0681 IDENTIFICATION: CHARACTER AND SYMBOL SIZE
03-0682 IDENTIFICATION: LEGIBILITY
03-0685 IDENTIFICATION: SYMBOLS, ABBREV FOR CONTROL
03-0721 LOGIC OF OPERATION: OPERATIONAL STEREOTYPES
03-0722 LOGIC OF OPERATION: INTERPRETATION
03-0723 LOGIC OF OPERATION: USE OF SYSTEMS WITH VISUAL DISPLAYS

1.7 Revision History

SPSS Module Revision History

Revision Level	Name	Change Description	Date
1.0	R. Chalanti	Initial release for cHUD C519 program, based out of Upshift Downshift Indicator RTT_CGEA1.3_v6.0 B479 Specific Cluster STSS	3/28/2016
1.1	P Khot	Minor Modifications for readability and better interpretation	1/12/2017
1.2	F. Mueller	Initial VSEM RM Release	5/17/2018