1 HUD_Left Turn / Right Turn / Hazard Telltale – CGEA1.3

1.1 Functional Description

The purpose of the Turn signal Indicator (left and right) is to inform the driver that an indication to make a turn is being made by the exterior indication lamps. This is a redundant feature that exists in the cluster and duplicated in the HUD.
This feature is present in the HUD through animation. Also, the same telltales are used to inform the driver that the exterior hazard lamps are active. The Hazard signal consists of flashing both Right and Left Turn signals at the same time.

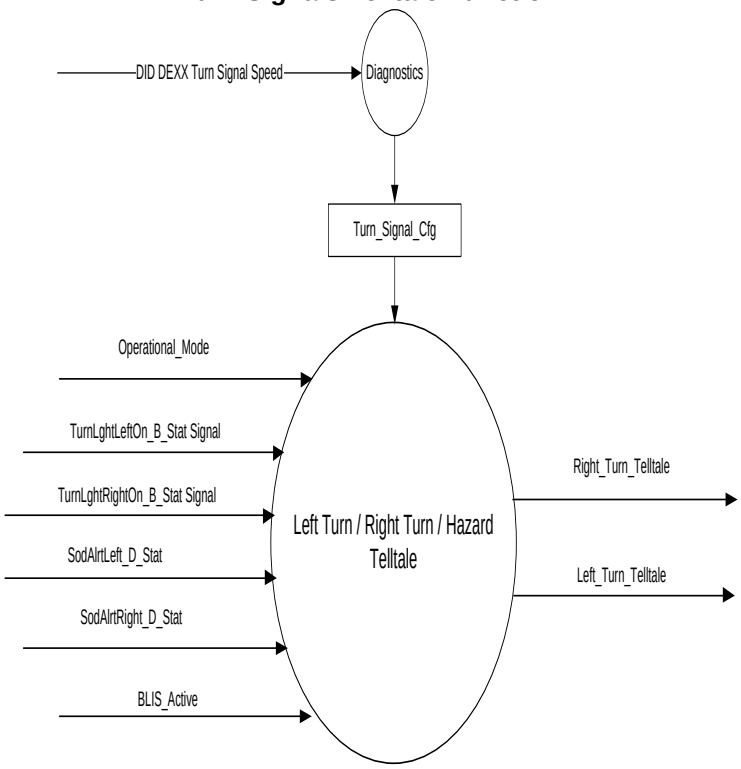
The graphic segments of both Turn signal telltales (left and Right) are shared between Turn signals and Blind Spot Alert telltales although the activation logic, the graphics (such as the color and animation) are different. Blind Spot Alert always takes precedent.

The Left Turn / Right Turn / Hazard Telltale correlates the TurnLghtLeftOn_B_Stat signal, the TurnLghtRightOn_B_Stat signal and the Operational_Mode to illuminate, flash or extinguish the Turn signals indicator.

1.2 Interfaces

1.2.1 Interface Context Diagram (I/O Block Diagram)

Turn Signals Telltale Function



1.2.2 Inputs

1.2.2.1 IR-REQ-304290/A-INTERNAL:

- Operational_Mode
- BLIS_ Active

1.2.2.2 MUX message on the CAN Bus from the BCM.

1.2.2.2.1 SIG-REQ-304281/A-TurnLghtLeftOn_B_Stat Signal

Signal Name	Size (bits)	Detail	Units	Res.	Offset	State Encoded	Min	Max
TurnLghtLeftOn_B_Stat	1			1	0		0 (0x0)	1 (0x1)
		Off				0x0		
		On				0x1		

1.2.2.2.2 SIG-REQ-304282/A-TurnLghtRightOn_B_Stat Signal

Signal Name	Size (bits)	Detail	Units	Res.	Offset	State Encoded	Min	Max
TurnLghtRightOn_B_Stat	1			1	0		0 (0x0)	1 (0x1)
		Off				0x0		
		On				0x1		

1.2.2.2.3 SIG-REQ-304283/A-SodAlrtLeft_D_Stat Signal

Signal Name	Size (bits)	Detail	Units	Res.	Offset	State Encoded	Min	Max
SodAlrtLeft_D_Stat	2		SED	1	0		0 (0x0)	1 (0x3)
		Off				0x0		
		On				0x1		
		Flash				0x2		
		Bulb_Proveout				0x3		

1.2.2.2.4 SIG-REQ-304284/A-SodAlrtRight_D_Stat Signal

Signal Name	Size (bits)	Detail	Units	Res.	Offset	State Encoded	Min	Max
SodAlrtRight_D_Stat	2		SED	1	0		0 (0x0)	1 (0x3)
		Off				0x0		
		On				0x1		
		Flash				0x2		
		Bulb_Proveout				0x3		

1.2.3 IR-REQ-304292/A-Outputs

Left_Turn_Telltale, which is used to control the state of the Telltale

Right_Turn_Telltale, which is used to control the state of the Telltale

1.3 Function/Performance

1.3.1 F-REQ-304293/A-Operational Modes

Mode	Differentiating Vehicle Conditions
Sleep Mode	Turn Signals TT OFF Hazard OFF
Limiting Mode	Turn Signals TT OFF Hazard OFF
Normal Mode	Turn Signals TT ON / OFF Hazard ON/ OFF
Crank Mode	Turn Signals TT ON / OFF Hazard ON / OFF

1.3.2 Voltage Levels

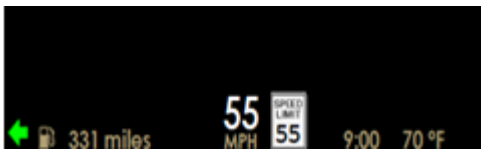
Refer to the HUDs Features Table located in the Operational Mode and Voltage Range Strategies section of this SPSS.

1.3.3 Human-Machine Interface

1.3.3.1 Visual

1.3.3.1.1 Indicator Graphics / Display Format

Refer to Graphics Section in the Master Document Section in this SPSS.
Example shown below for the Right Turn only, green animation from left to right.



1.3.3.1.2 Indicator Color Coordinates

Green – Reference SDS IL-0017/IS-0379

1.3.3.1.3 Indicator Characteristics

Animated in the HUD display – Turn Signal Indicators

1.3.3.2 Audio

None.

1.3.3.3 Switch Control Logic

Determined by BCM.

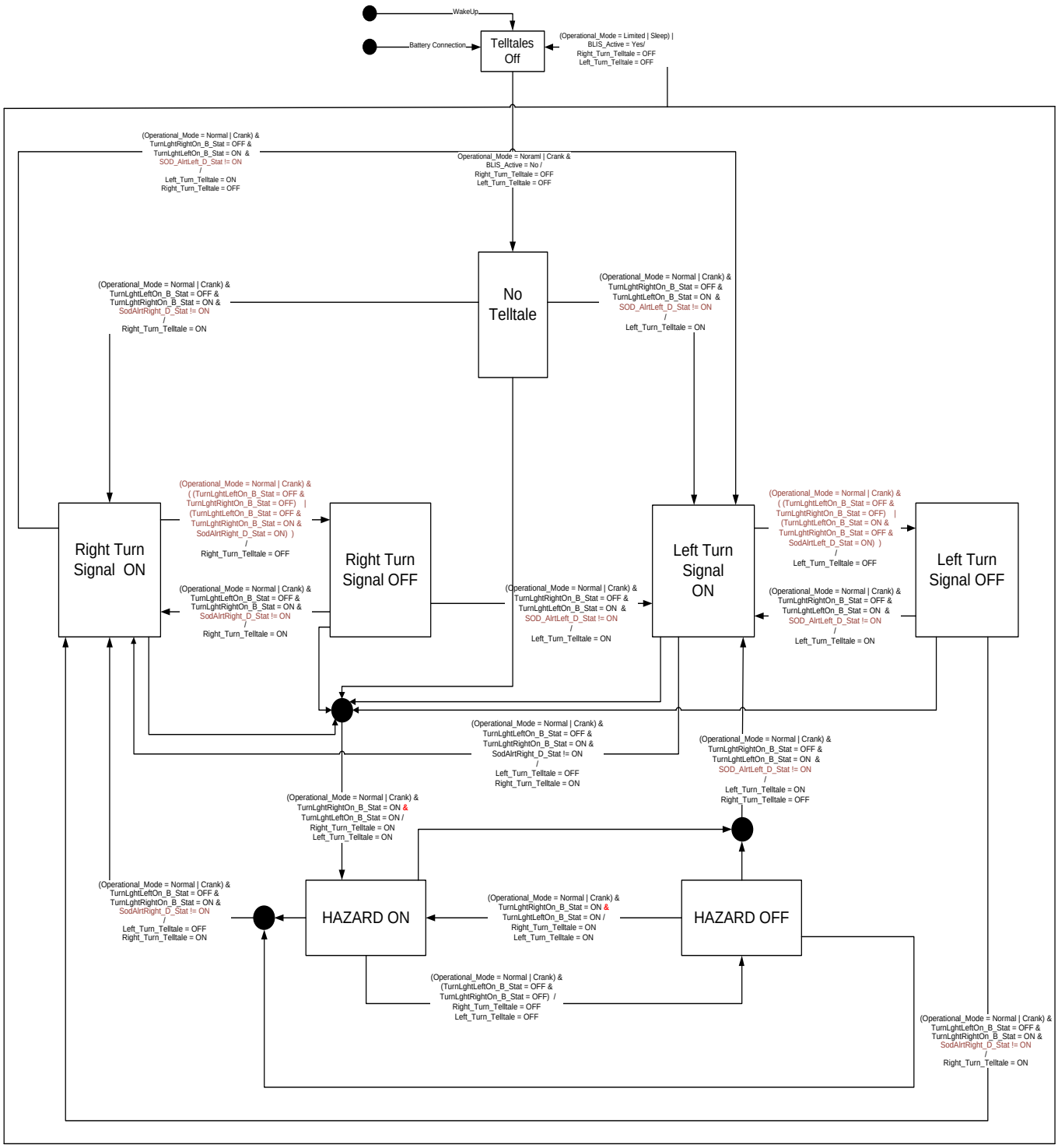
1.3.4 PFM-REQ-304294/A-System Accuracy

The Left Turn / Right Turn / Hazard Telltale shall change the state of theTelltale within 35 msec 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-304285/A-Left Turn / Right Turn / Hazard Flowchart



Note: A similar Figure exists in the Turn Signal/Hazard Telltale STSS of IPC . Any change to this figure should be evaluated for its impact on that similar figure for IPC.

1.3.5.1.2 F-REQ-304286/A-Truth Table supporting above flowchart

TurnLghtLeftOn_B_Stat	TurnLghtRightOn_B_Stat	SodAlrtLeft_D_Stat	SodAlrtRight_D_Stat	Left TT State	Right TT State	Hazard State
Off	Off	Off	Off	No Telltale	No Telltale	HAZARD_OFF
Off	Off	Off	On	No Telltale	No Telltale	HAZARD_OFF
Off	Off	Off	Flash	No Telltale	No Telltale	HAZARD_OFF
Off	Off	Off	ProveOut	No Telltale	No Telltale	HAZARD_OFF
Off	Off	On	Off	No Telltale	No Telltale	HAZARD_OFF
Off	Off	On	On	No Telltale	No Telltale	HAZARD_OFF
Off	Off	On	Flash	No Telltale	No Telltale	HAZARD_OFF
Off	Off	On	ProveOut	No Telltale	No Telltale	HAZARD_OFF
Off	Off	Flash	Off	No Telltale	No Telltale	HAZARD_OFF
Off	Off	Flash	On	No Telltale	No Telltale	HAZARD_OFF
Off	Off	Flash	Flash	No Telltale	No Telltale	HAZARD_OFF
Off	Off	Flash	ProveOut	No Telltale	No Telltale	HAZARD_OFF
Off	Off	ProveOut	Off	No Telltale	No Telltale	HAZARD_OFF
Off	Off	ProveOut	On	No Telltale	No Telltale	HAZARD_OFF
Off	Off	ProveOut	Flash	No Telltale	No Telltale	HAZARD_OFF
Off	Off	ProveOut	ProveOut	No Telltale	No Telltale	HAZARD_OFF
Off	On	Off	Off	Left TT OFF	Right TT ON	HAZARD_OFF
Off	On	Off	On	Left TT OFF	Right TT OFF	HAZARD_OFF
Off	On	Off	Flash	Left TT OFF	Right TT OFF	HAZARD_OFF
Off	On	Off	ProveOut	Left TT OFF	Right TT ON	HAZARD_OFF
Off	On	On	Off	Left TT OFF	Right TT ON	HAZARD_OFF
Off	On	On	On	Left TT OFF	Right TT OFF	HAZARD_OFF
Off	On	On	Flash	Left TT OFF	Right TT OFF	HAZARD_OFF
Off	On	On	ProveOut	Left TT OFF	Right TT ON	HAZARD_OFF
Off	On	Flash	Off	Left TT OFF	Right TT OFF	HAZARD_OFF
Off	On	Flash	On	Left TT OFF	Right TT OFF	HAZARD_OFF
Off	On	Flash	Flash	Left TT OFF	Right TT OFF	HAZARD_OFF
Off	On	Flash	ProveOut	Left TT OFF	Right TT OFF	HAZARD_OFF
Off	On	ProveOut	Off	Left TT OFF	Right TT ON	HAZARD_OFF
Off	On	ProveOut	On	Left TT OFF	RIGHT TT OFF	HAZARD_OFF
Off	On	ProveOut	Flash	Left TT OFF	RIGHT TT OFF	HAZARD_OFF
Off	On	ProveOut	ProveOut	Left TT OFF	Right TT ON	HAZARD_OFF
On	Off	Off	Off	Left TT ON	Right TT OFF	HAZARD_OFF
On	Off	Off	On	Left TT ON	Right TT OFF	HAZARD_OFF
On	Off	Off	Flash	Left TT OFF	Right TT OFF	HAZARD_OFF
On	Off	Off	ProveOut	Left TT ON	Right TT OFF	HAZARD_OFF
On	Off	On	Off	Left TT OFF	Right TT OFF	HAZARD_OFF
On	Off	On	On	Left TT OFF	Right TT OFF	HAZARD_OFF
On	Off	On	Flash	Left TT OFF	Right TT OFF	HAZARD_OFF

On	Off	On	ProveOut	Left TT OFF	Right TT OFF	HAZARD_OFF
On	Off	Flash	Off	Left TT OFF	Right TT OFF	HAZARD_OFF
On	Off	Flash	On	Left TT OFF	Right TT OFF	HAZARD_OFF
On	Off	Flash	Flash	Left TT OFF	Right TT OFF	HAZARD_OFF
TurnLghtLeftOn_B_Stat	**TurnLghtRightOn_B_Stat**	**SodAlrtLeft_D_Stat**	**SodAlrtRight_D_Stat**	**Left TT State**	**Right TT State**	**Hazard State**
On	Off	Flash	ProveOut	Left TT OFF	Right TT OFF	HAZARD_OFF
On	Off	ProveOut	Off	Left TT ON	Right TT OFF	HAZARD_OFF
On	Off	ProveOut	On	Left TT ON	Right TT OFF	HAZARD_OFF
On	Off	ProveOut	Flash	Left TT OFF	Right TT OFF	HAZARD_OFF
On	Off	ProveOut	ProveOut	Left TT ON	Right TT OFF	HAZARD_OFF
On	On	Off	Off	Left TT ON	Right TT ON	HAZARD_ON
On	On	Off	On	Left TT ON	Right TT ON	HAZARD_ON
On	On	Off	Flash	Left TT OFF	Right TT OFF	HAZARD_OFF
On	On	Off	ProveOut	Left TT ON	Right TT ON	HAZARD_ON
On	On	On	Off	Left TT ON	Right TT OFF	HAZARD_OFF
On	On	On	On	Left TT ON	Right TT ON	HAZARD_ON
On	On	On	Flash	Left TT OFF	Right TT OFF	HAZARD_OFF
On	On	On	ProveOut	Left TT ON	Right TT ON	HAZARD_ON
On	On	Flash	Off	Left TT OFF	Right TT OFF	HAZARD_OFF
On	On	Flash	On	Left TT OFF	Right TT OFF	HAZARD_OFF
On	On	Flash	Flash	Left TT OFF	Right TT OFF	HAZARD_OFF
On	On	Flash	ProveOut	Left TT OFF	Right TT OFF	HAZARD_OFF
On	On	ProveOut	Off	Left TT ON	Right TT ON	HAZARD_ON
On	On	ProveOut	On	Left TT ON	Right TT ON	HAZARD_ON
On	On	ProveOut	Flash	Left TT OFF	Right TT OFF	HAZARD_OFF
On	On	ProveOut	ProveOut	Left TT ON	Right TT ON	HAZARD_ON

Note : This table is provided to help understand the flowchart. Prove out states can be ignored as HUD is not needed to take any action

1.3.5.2 Operation Description (supports algorithm flowchart /state diagram)

1.3.5.2.1 F-REQ-304287/A-Default

- Turn Indicators TT shall default to off upon HUD power up and shall not turn on until the receipt of TurnLghtRightOn_B_Stat signal and TurnLghtLeftOn_B_Stat signal indicating an ON state for any turn indicator.

1.3.5.2.2 F-REQ-304288/A-Turn signal Hazard Mode

- When the Turn signals are both activated (HAZARD mode: TurnLghtRightOn_B_Stat signal equal to 1 and TurnLghtLeftOn_B_Stat signal equal to 1), the Turn Right TT and the Turn Left TT shall move synchronically with input signal

1.3.5.2.3 F-REQ-304289/A-SODalrtXXX_D_Stat

- If SODalrtXXX_D_Stat is ON, then the corresponding turn signal is not enabled even though the TurnLghtxxxOn_Bstat is ON. For Hazard on states, this condition is ignored

1.3.5.3 FS-REQ-304295/A;1-Function Safety Classification (EMC)

Class B

1.3.5.4 NVM-REQ-304291/A-Memory Storage

Parameter Name	Description	Value at Battery Connect	Value at Module Wake-up
Left_Turn_Telltale	Used to control the state of the Telltale	OFF (0x0)	OFF (0x0)
Right_Turn_Telltale	Used to control the state of the Telltale	OFF (0x0)	OFF (0x0)
TurnLghtRightOn_B_Stat Signal	CAN signal sent from the BCM	OFF (0x0)	OFF (0x0)
TurnLghtLeftOn_B_Stat Signal	CAN signal sent from the BCM	OFF (0x0)	OFF (0x0)
Operational_Mode	4 state indicator for HUD operational mode	Limited	Limited or Normal or Crank
BLIS_ Active	State indicator for BLIS	No (0x0)	No (0x0)
SodAlrtRight_D_Stat	Input signal to the HUD	OFF (0x0)	OFF (0x0)
SodAlrtRight_D_Stat	Input signal to the HUD	OFF (0x0)	OFF (0x0)

1.3.5.5 Prove Out

No

1.3.5.6 Reconfigurable Telltale

No

1.3.5.7 Message Center Msg

None

1.4 Error Handling

1.4.1 Missing Message/Undefined Data Strategy

There is no missing message strategy for this message.

1.5 Diagnostics

1.5.1 Self Test

None

1.5.2 Engineering Test Mode

None

1.5.3 Part II Performance

None

1.6 Reference Specification

EF-0032 SAFETY - TURN SIGNAL LEFT ON CHIME WARNING
EF-0058 EXTERIOR LIGHTING – TURN SIGNAL AND HAZARD LIGHTING

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
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	M. Ye	Initial Release	5/15/2014
1.1	R. Chalant	Modifications to add SodAlrtRight_D_Stat and SodAlrtLeft_D_Stat to fix an AIMS issue. CAN Signals info updated Modifications done to flowchart. Supporting truth table provided for clarification. Changes in brown	5/31/2016
1.2	P.Denduku	Initial VSEM RM Release	04/03/2018