# 1   HUD Welcome - Goodbye Strategy – CGEA1.3

1.1   Functional Description

The HUD wakes up on detecting the approach of driver to the vehicle, and process the data required for displaying the welcome screen. At the same time, it reads the stored values of HUD image on/off status, Brightness, vertical position, rotation and keeps the HUD picture generation unit ready for display. Once any door is opened, HUD shall display the welcome screen (Only Blank screen for MY D544/U554).

1.2   Interfaces

1.2.1   Interface Context Diagram (I/O Block Diagram)

Welcome Goodbye Strategy Context Diagram
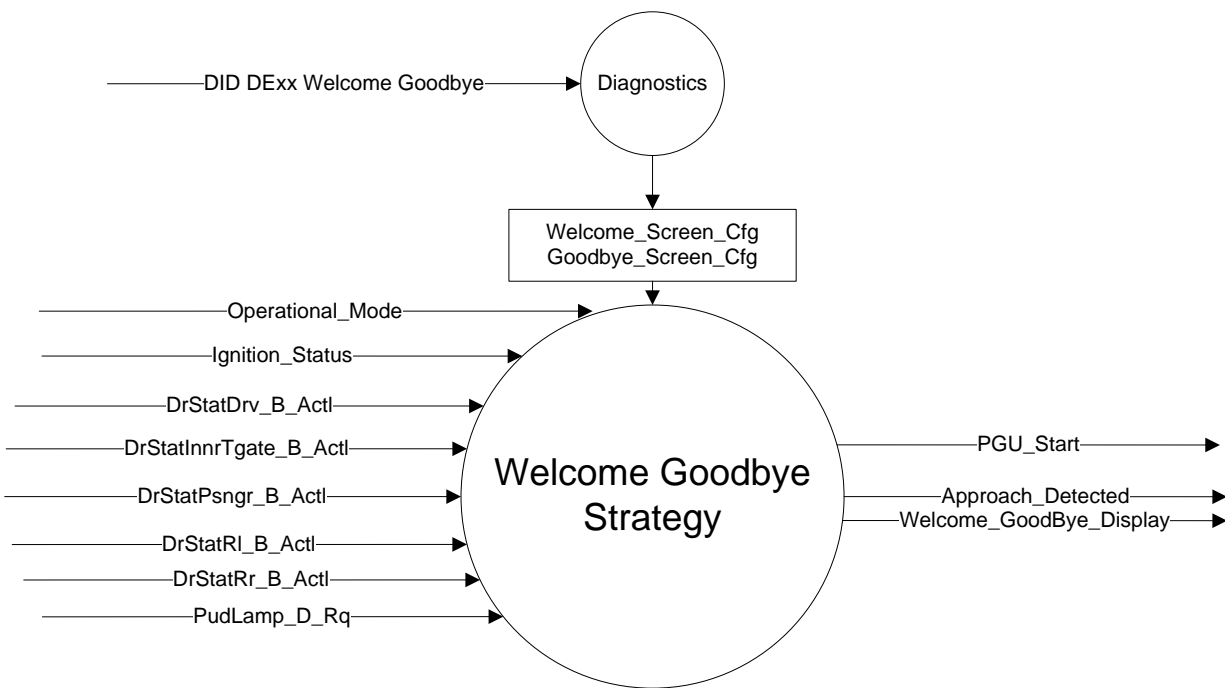
1.2.2   Inputs

1.2.2.1   IR-REQ-304477/A-INTERNAL:

- Operational_Mode

1.2.2.2   MUX messages

1.2.2.2.1   SIG-REQ-304465/A-Ignition_Status Signal

Signal Name	Size (bits)	Detail	Units	Res.	Offset	State Encoded	Min	Max
Ignition_Status	4		SED	1	0		0 (0x0)	15 (0xF)

	Unknown				0x0		
	Off				0x1		
	Accessory				0x2		
	Run				0x4		
	Start				0x8		
	Invalid				0xF		

1.2.2.2.2 SIG-REQ-304466/A-PudLamp_D_Rq Signal

Signal Name	Size (bits)	Detail	Units	Res.	Offset	State Encoded	Min	Max
PudLamp_D_Rq	8		SED	1	0		0 (0x0)	3 (0x03)
		OFF				0x0		
		ON				0x1		
		RAMP_UP				0x2		
		RAMP_DOWN				0x3		

1.2.2.2.3 SIG-REQ-304467/A-DrStatDrv_B_Actl (HS_CAN) Signal

Signal Name	ID	Size (bits)	Pos. (bits)	Detail	Units	Res.	Offset	State Encoded	Min	Max
DrStatDrv_B_Actl	0x3AE	1	0		SED	1	0		0 (0x0)	1 (0x1)
				Closed				0x0		
				Ajar				0x1		

1.2.2.2.4 SIG-REQ-304468/A-DrStatInnrTgate_B_Actl (HS_CAN) Signal

Signal Name	ID	Size (bits)	Pos. (bits)	Detail	Units	Res.	Offset	State Encoded	Min	Max
DrStatInnrTgate_B_Actl	0x3AE	1	2		SED	1	0		0 (0x0)	1 (0x1)
				Closed				0x0		
				Ajar				0x1		

1.2.2.2.5 SIG-REQ-304469/A-DrStatPsngr_B_Actl (HS_CAN) Signal

Signal Name	ID	Size (bits)	Pos. (bits)	Detail	Units	Res.	Offset	State Encoded	Min	Max
DrStatPsngr_B_Actl	0x3AE	1	3		SED	1	0		0 (0x0)	1 (0x1)
				Closed				0x0		
				Ajar				0x1		

1.2.2.2.6 SIG-REQ-304470/A-DrStatRl_B_Actl (HS_CAN) Signal

Signal Name	ID	Size (bits)	Pos. (bits)	Detail	Units	Res.	Offset	State Encoded	Min	Max
DrStatRl_B_Actl	0x3AE	1	4		SED	1	0		0 (0x0)	1 (0x1)
				Closed				0x0		
				Ajar				0x1		

1.2.2.2.7   SIG-REQ-304471/A-DrStatRr_B_Actl (HS_CAN) Signal

Signal Name	ID	Size (bits)	Pos. (bits)	Detail	Units	Res.	Offset	State Encoded	Min	Max
DrStatRr_B_Actl	0x3AE	1	5		SED	1	0		0 (0x0)	1 (0x1)
				Closed				0x0		
				Ajar				0x1		

1.2.3   <u>IR-REQ-304482/A-Outputs</u>
- Approach_Detected
- Welcome_Goodbye_Display
- PGU_Start

1.3   Function/Performance

1.3.1   F-REQ-304481/A-Operational Modes

Mode	Differentiating Vehicle Conditions
Sleep Mode	Not Active
Limited Mode	Active
Normal Mode	Active
Crank Mode	Active

1.3.2   Voltage Levels

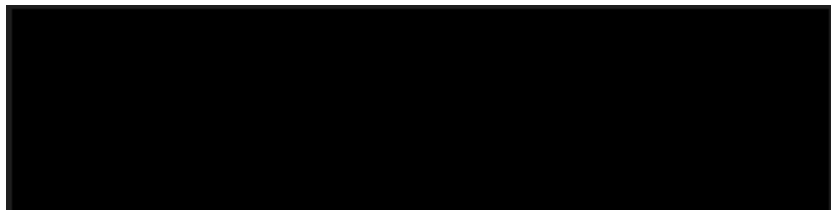Refer to the HUD Features table located in the Operational Modes and Voltage Range Strategies Section of this SPSS.

1.3.3   Human-Machine Interface

1.3.3.1   Visual

1.3.3.1.1   <u>REQ-304472/A-Indicator Graphics / Display Format</u>

(Graphics shown are typical examples, use correct images from Studio VAPS model)

Indicative Graphics for the Welcome and Good bye screen. For D544/U554, it is a blank display.

1.3.3.1.2   Indicator Color Coordinates

Refer to the COLOR & ILLUMINATION REQUIREMENTS (GRAPHICS) Section of the Master SPSS File.

1.3.3.2   Audio
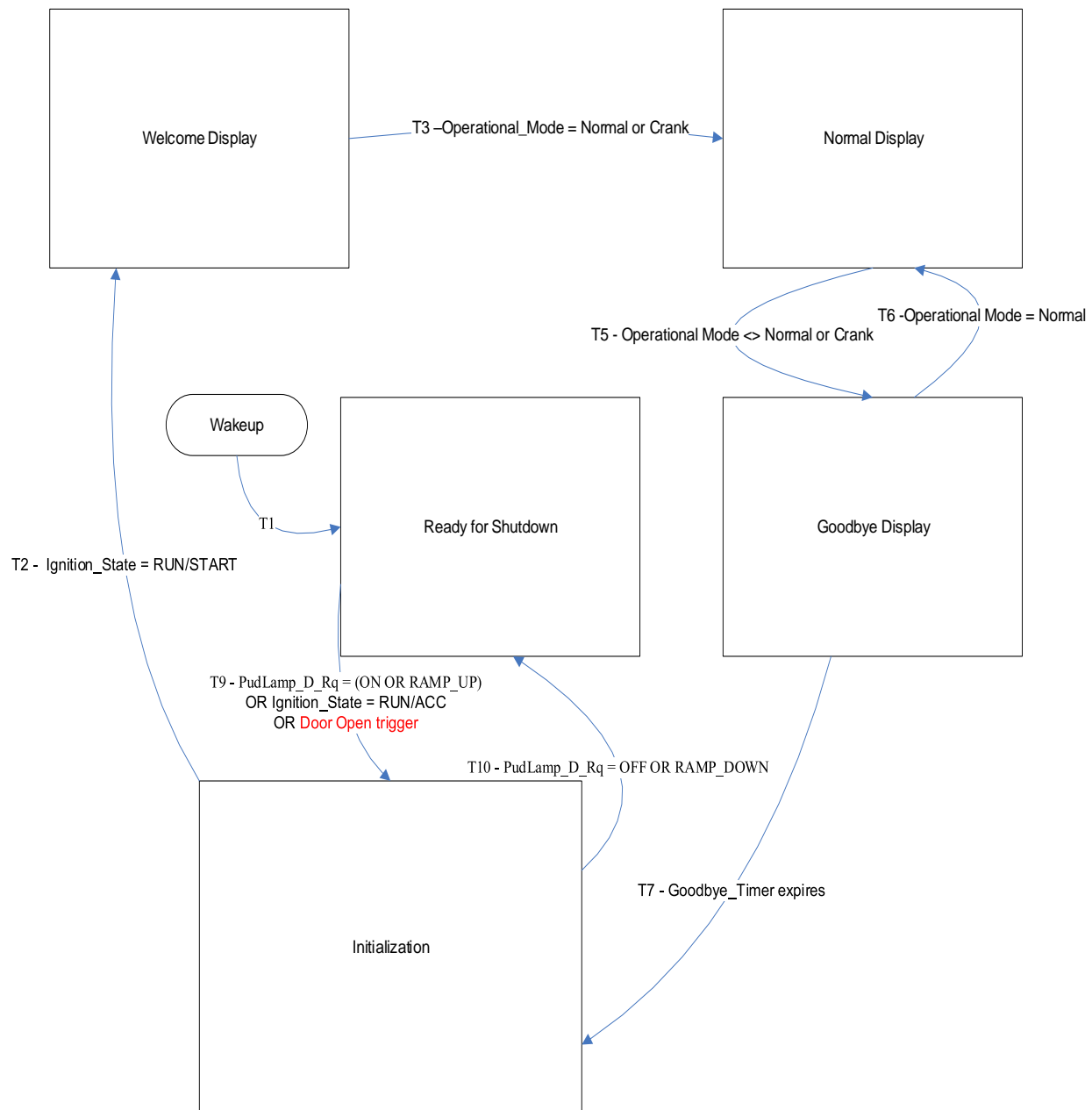
None.

1.3.3.3   Switch Control Logic

None

1.3.4   <u>PFM-REQ-304480/A-System Accuracy</u>

HUD shall change the state of the Startup-Shutdown Sequence, per 1.3.5.1 Subsystem Algorithm Flowchart State Diagram, and complete any consequential display updates, all within 100msec

1.3.5   Operation: Performance and Functional

1.3.5.1   Subsystem Algorithm Flowchart / State Diagram

Welcome Display

T3 –Operational_Mode = Normal or Crank

Normal Display

T6 -Operational Mode = Normal

T5 - Operational Mode <> Normal or Crank

Wakeup

Ready for Shutdown

Goodbye Display

T1

T2 - Ignition_State = RUN/START

T9 - PudLamp_D_Rq = (ON OR RAMP_UP)
OR Ignition_State = RUN/ACC
OR Door Open trigger

T10 - PudLamp_D_Rq = OFF OR RAMP_DOWN

Initialization

T7 - Goodbye_Timer expires

1.3.5.1.1   F-REQ-304459/A-State Transition

Transition	Trigger	Action On Transition	Comments
T1	Default	None	
T2	(Any_Door_Ajar_Status transition to AJAR) OR (Ignition_Status= RUN)	Reset Welcome_Timer	- T2 takes priority over T10.
T3	(Operational_Mode = (NORMAL OR CRANK)	Reset Stage_3_Delay_Timer	
T4	Deleted	None	
T5	Operational_Mode <> (NORMAL OR CRANK)	Reset Goodbye_Timer Reset Shutdown_Anim_Delay_Timer	
T6	Operational_Mode = NORMAL	Reset Stage_3_Delay_Timer	
T7	Goodbye_Timer expires	None	

Transition	Trigger	Action On Transition	Comments
T9	(PudLamp_D_Rq ==(ON OR RAMP_UP)) OR (Ignition_Status= RUN/ACC) OR (Any_Door_Ajar_Status transition to AJAR)	None	Clarification: "*Any_Door_Ajar_Status transition to AJAR* " means if the value changes while in the *Initialization* state or the Door Open trigger was true during T9 transition. Door open during T7 shall not be considered as trigger for T2.
T10	PudLamp_D_Rq == (OFF OR RAMP_DOWN)	PGU_Start = False	

Note: If there are multiple state transition paths from a state, the transition shall happen on the first occurred trigger. Simultaneous triggers can take any path unless priority is specifically mentioned.

1.3.5.1.2 F-REQ-304460/A-Action on States

State	Action On state	Comments
Wakeup	Default transition	
Initialization	Refer 1.3.5.1.1 flowchart	
Welcome Display	Refer 1.3.5.1.2 flowchart	
Normal Display	Welcome_Goodbye_Display = TRUE Execute 1.3.5.1.3 flowchart	
Goodbye Display	Refer 1.3.5.1.4 flowchart	
Ready to Shutdown	Approach_Detected= False	

1.3.5.1.3   F-REQ-304461/A-Initialization Flow chart

```
                        ┌──────────────┐
                        │    Start     │
                        └──────┬───────┘
                               │
                               ▼
          ┌────────────────────────────────────────────┐
          │ Read the HUD image on/off status,          │
          │ Brightness, vertical/horizontal position,  │
          │ rotation, density and ADAS on/off status   │
          │ from storage memory                        │
          └────────────────────┬───────────────────────┘
                               │
                               ▼
          ┌────────────────────────────────────────────┐
          │ PGU_Start = TRUE                           │
          │ Approach_Detected= True                    │
          │ Welcome_Goodbye_Display = FALSE            │
          └────────────────────┬───────────────────────┘
                               │
                               ▼
                          (   ○   )◄──────┐
                               │          │
                               ▼          │
                    ┌────────────────┐    │
                    │   Do Nothing   │    │
                    └───────┬────────┘    │
                            │             │
                            ▼             │
                        (   ○   )─────────┘
```
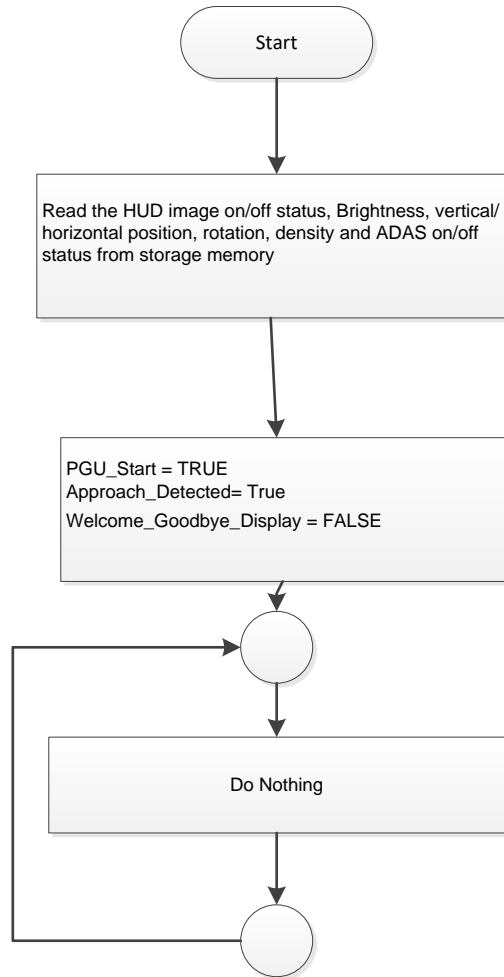
1.3.5.1.4   F-REQ-304462/A-Welcome Display Flow chart

```
                    ┌─────────┐
                    │  Start  │
                    └────┬────┘
                         │
         ┌──────────────▶◯◀──────────────────┐
         │               │                   │
         │               ▼                   │
  ┌─────────────┐   ◇ Is HUD On/Off ◇         │
  │Display Blank│◀─No─  status On?            │
  └─────────────┘        │                    │
                        Yes                   │
                         ▼                    │
          ┌──────────────────────────────┐   │
          │ Welcome_Goodbye_Display = TRUE│   │
          │                               │   │
          │ Display welcome screen        │   │
          └──────────────┬────────────────┘   │
                         │                    │
                         ▼                    │
          ┌──────────────────────────────┐   │
          │ Apply the computed brightness,│  │
          │ vertical/horizontal position  │  │
          │ and rotation to the display * │  │
          └──────────────┬────────────────┘  │
                         └───────────────────┘
```
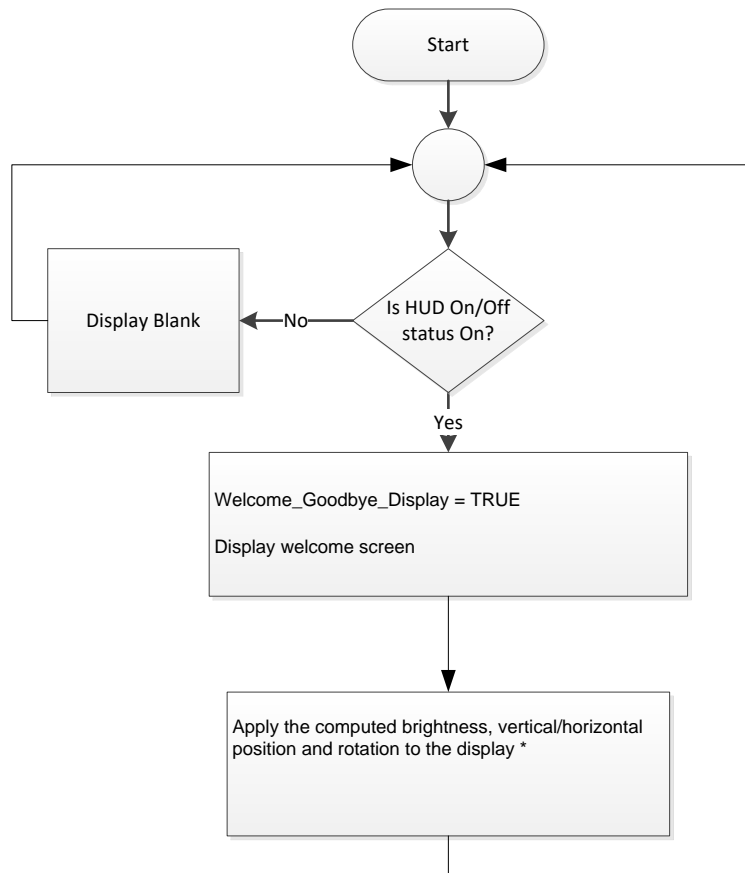
* Do not switch on illumination if welcome
screen is blank for the program. HUD shall switch
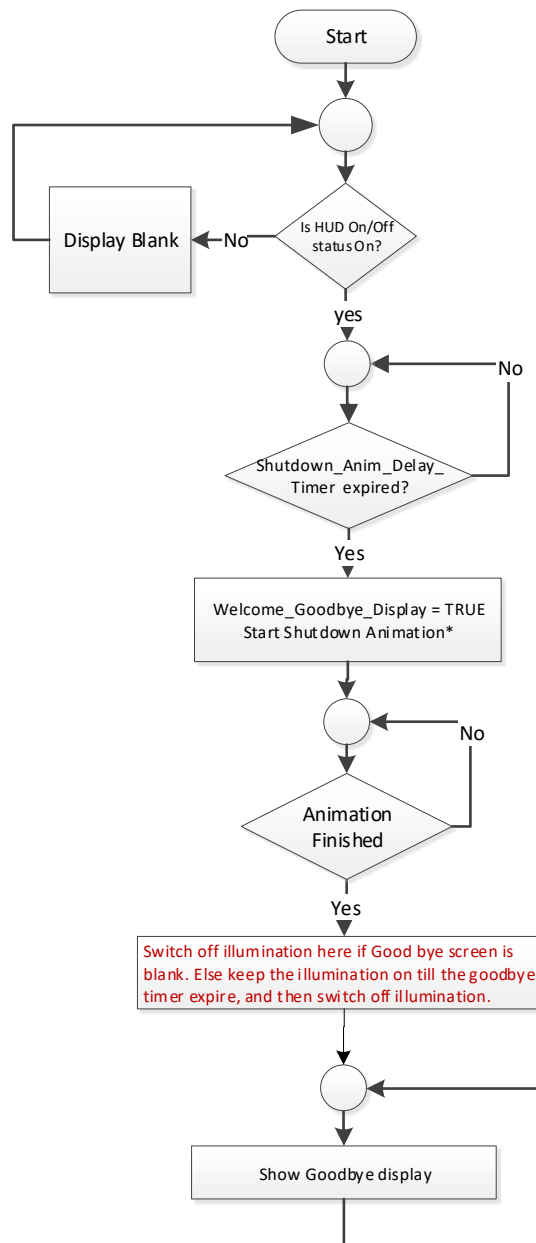on illumination here only if welcome screen have
content

1.3.5.1.5   F-REQ-304463/A-Normal Display Flow chart

```
                          ┌─────────┐
                          │  Start  │
                          └────┬────┘
                               ▼
        ┌──────────────────►( O )
        │                     │
   ┌──────────┐          ◇ Is HUD On/Off
   │ Display  │◄── No ──   status On? ◇
   │  Blank   │               │
   └──────────┘              yes
                               ▼
                             ( O )◄── No ──┐
                               │           │
                        ◇ Stage_3_Delay_Timer
                            expired? ◇──────┘
                               │
                              Yes
                               ▼
                             ( O )◄────── No ──┐
                               │               │
                    ◇ Ambient_Light_Delay_Timer
                          expired? ◇───────────┘
                               │
                              Yes
                               ▼
        ┌──────────────────────────────────┐
        │ Switch on illumination here, if  │
        │ Illumination was switched off at │
        │ this time                        │
        └──────────────────┬───────────────┘
                               ▼
        ┌──────────────────────────────┐
        │ Start Startup Animation       │
        │ applying Density/ADAS status  │
        └──────────────┬────────────────┘
                               ▼
                             ( O )◄── No ──┐
                               │           │
                        ◇ Animation        │
                          Finished* ◇──────┘
                               │
                              Yes
                               ▼
                             ( O )◄──────────┐
                               │             │
        ┌──────────────────────────────┐     │
        │ Show the normal screen with   │─────┘
        │ Density and ADAS settings      │
        │ applied.                       │
        └────────────────────────────────┘
```
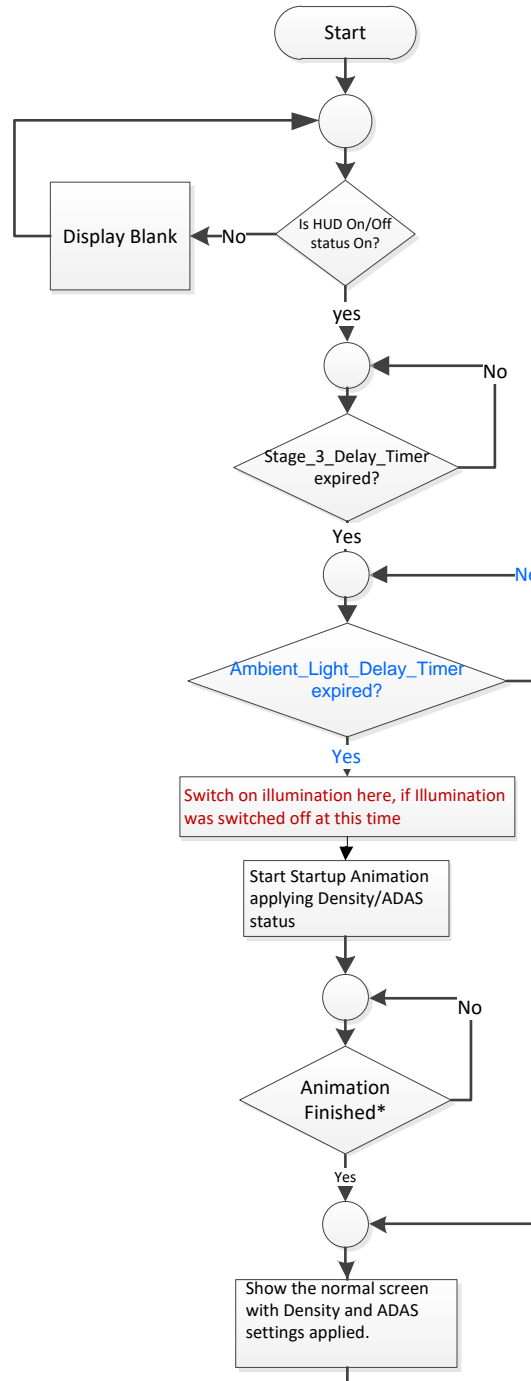
* 1. If HUD on/off status changes to off during startup animation, the animation shall be cancelled and considered finished.

  2. if the trigger T5 occur during startup animation, HUD shall wait to finish the Startup animation and then transition to Goodbye state .

1.3.5.1.6   F-REQ-304464/A-Goodbye Display Flow chart

```
                              ┌─────────┐
                              │  Start  │
                              └────┬────┘
                                   │
                    ┌──────────────○
                    │              │
              ┌─────┴───────┐   ◇ Is HUD On/Off ◇ ──No──┐
              │Display Blank│◄─No─ status On?           │
              └─────────────┘      │                    │
                                  yes                   │
                                   │                    │
                                   ○◄──────────No───────┘
                                   │
                          ◇ Shutdown_Anim_Delay_ ◇──No──┐
                            Timer expired?              │
                                   │                    │
                                  Yes                   │
                                   │                    │
                     ┌─────────────────────────────┐   │
                     │ Welcome_Goodbye_Display = TRUE│◄─┘
                     │ Start Shutdown Animation*     │
                     └─────────────┬───────────────┘
                                   │
                                   ○◄──────────No───────┐
                                   │                    │
                            ◇ Animation ◇───────No──────┘
                               Finished
                                   │
                                  Yes
```

Switch off illumination here if Good bye screen is blank. Else keep the illumination on till the goodbye timer expire, and then switch off illumination.

```
                                   ○◄───────────────────┐
                                   │                    │
                     ┌─────────────────────────────┐   │
                     │    Show Goodbye display      │───┘
                     └─────────────────────────────┘
```

1.3.5.1.7   F-REQ-304451/A-Any_Door_Ajar_Status

Door Status	Any_Door_Ajar_Status
DrStatInnrTgate_B_Actl = 0x1 (Ajar) | DrStatDrv_B_ Actl = 0x1 (Ajar) | DrStatPsngr_B_ Actl = 0x1 (Ajar) | DrStatRl_B_ Actl = 0x1 (Ajar) | DrStatRr_B_ Actl = 0x1 (Ajar)	0x1 (Ajar)
DrStatInnrTgate_B_Actl = 0x0 (Closed) & DrStatDrv_B_ Actl = 0x0 (Closed) &	0x0 (Closed)

| DrStatPsngr_B_ Actl = 0x0 (Closed) &
DrStatRl_B_ Actl = 0x0 (Closed) &
DrStatRr_B_ Actl = 0x0 (Closed) | |

1.3.5.2   Operation Description (supports algorithm flowchart /state diagram)

1.3.5.2.1   Animation clarifications:

1.3.5.2.1.1   F-REQ-304452/A-Starting point and snapshot

The animation starting points are based on the snapshot of the current screen (animation data are frozen at this point even the application data may still changing during the animation)

1.3.5.2.1.2   F-REQ-304453/A-Startup and shutdown

The startup and shutdown animations take precedency over any other display content.

1.3.5.2.1.3   F-REQ-304454/A-Following are the objects that shall be available in the startup/shutdown animation if available   during the

- Accent Bar
- Fuel icon
- DTE/(DTE for PHEV)
- DTE Units
- Gear shift/SSI
- Vehicle Speed
- Vehicle speed unit
- Speed Limit/TSR
- Time
- OAT
- OAT Units
- Compass
- ACC/iACC/TJA/ASLD/DI (Any graphics related to CADS spec)
- LKA/LKS
- Navigation/EH

1.3.5.2.1.4   F-REQ-304455/A-DI Startup Animation

ACC/iACC/TJA/ASLD/DI graphics other than DI not applicable for Startup animation. Graphic objects related to features not in the list shall be removed from the display during animation, if being shown.

1.3.5.2.2   Configuration Disabled:

1.3.5.2.2.1   F-REQ-304456/A-Welcome/Goodbye screen configurations

When Welcome_Screen_Cfg or Goodbye_Screen_Cfg are "Disabled", HUD shall still follow the state diagram in section 1.3.5.1.

1.3.5.2.2.2   F-REQ-304457/A-Welcome screen configuration disabled

When Welcome_Screen_Cfg is disabled, do not show startup animation. HUD shall directly switch to normal display once the Stage_3_Delay_Timer expired in the Normal display flowchart (sec: 1.3.5.1.3)

1.3.5.2.2.3   F-REQ-304458/A-Goodbye screen disabled

When Goodbye_Screen_Cfg is disabled, do not show shutdown animation. The Shutdown_Anim_Delay_Timer also shall be ignored.

1.3.5.2.3   F-REQ-304473/A-Ambient Light timer handling

Ambient_Light_Delay_Timer shall reset with the timer value and start timer, whenever Ignition_Status transition to RUN from any Ignition value irrespective of the current state.

1.3.5.3   FS-REQ-304607/A;1-Function Safety Classification (EMC)

A

1.3.5.4   FS-REQ-304484/A;1-Memory Storage

1.3.5.4.1   NVM-REQ-304474/A-Memory Storage Table 1

Parameter Name	Description	Value at Battery Connect	Value at Module Wake-up
Operational_Mode	4 state indicator for cluster operational mode	Limited	Limited, Normal or Crank
Ignition_Status	CAN Signal	Unknown (0x0)	Unknown (0x0)
DrStatInnrTgate_B_Actl	CAN Signal	Closed (0x0)	Closed (0x0)
DrStatDrv_B_ Actl	CAN Signal	Closed (0x0)	Closed (0x0)
DrStatPsngr_B_ Actl	CAN Signal	Closed (0x0)	Closed (0x0)
DrStatRl_B_ Actl	CAN Signal	Closed (0x0)	Closed (0x0)
DrStatRr_B_ Actl	CAN Signal	Closed (0x0)	Closed (0x0)
Any_Door_Ajar_Status	Indicates if any of the vehicle doors are ajar.	Closed (0x0)	Closed (0x0)
Approach_Detected	Indicates if driver approached the vehicle	FALSE	FALSE
Welcome_Goodbye_Display	Indicates Welcome or Goodbye display is active	Not Active	Not Active
PGU_Start	Attribute to trigger the Start of Picture Generation Unit of the HUD	False	False

1.3.5.4.2   NVM-REQ-304475/A-Memory Storage Table 2

Parameter Name	Description	Value at Battery Connect	Value at Module Wake-up
Welcome_Timer	Duration of the time in Welcome Screen during Limited Mode before shutdown	Expired	Expired
Goodbye_Timer	Duration of the time in Goodbye screen before shutdown	Expired	Expired
Stage_3_Delay_Timer	Timer to delay stage 3 of the Cluster Welcome strategy. This is to start the animation synchronized with Cluster	Expired	Expired
Shutdown_Anim_Delay_ Timer	Timer to delay Shutdown animation to synchronize with Cluster	Expired	Expired
Ambient_Light_Delay_Timer	A valid ambient light value is assured only after approximatly 250ms from Ignition_status = RUN. This timer is to make sure startup animation is started only after 250ms from transitioning to RUN.	Reset	Reset

1.3.5.4.3 NVM-REQ-304476/A-Memory Storage Table 3

Timer Name	Duration	Description	Min	Max	Resolution
Welcome_Timer	25 s	Duration of the time in Welcome Screen during Limited Mode before shutdown	0 s	255 s	1 s
Goodbye_Timer	10 s	Duration of the time in Goodbye screen before shutdown	0 s	255 s	1 s
Stage_3_Delay_Timer	800 ms	Timer to delay stage 3 of the Cluster Welcome strategy. This is to start the animation synchronized with Cluster	0 ms	2550 ms	10 ms
Shutdown_Anim_Delay_Timer	0ms	Timer to delay Shutdown animation to synchronize with Cluster	0 ms	2550 ms	10 ms
Ambient_Light_Delay_Timer	250 ms	A valid ambient light value is assured only after approximatly 250ms from Ignition_status = RUN. This timer is to make sure welcome and startup animations is started only after 250ms from transitioning to RUN	0	2550 ms	10 ms

Note: Timers shall be programmable within the shown range, to at least the Max value listed. Higher Max values and finer resolutions are acceptable. This timers shall be programmable through a supplier DID during development, and not expected to be field programmable.

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 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.

1.4.2 Invalid Message Strategy

None.

1.5 Diagnostics

1.5.1 Self Test

None

1.5.2 Engineering Test Mode

None

1.5.3 Part II Performance

1.5.3.1 Supported Diagnostic PIDs (Service $22 and $2F)

None

1.5.3.2 DTC-REQ-304478/A-Supported Diagnostic Trouble Codes (DTCs)

DTC	Description
C14000	Lost Communication With Body Control Module Missing Message

1.5.3.3 DCR-REQ-304479/A-Supported Configuration DIDs

DID DExx:

Block Num	Block Description	Byte(s)	Bits	State: Description	"0"	"1"	Default	Comments/Information
PACKETED BLOCKS								
$xx	Option Content (B&A)	*	*	Welcome_Goodbye_Cfg	Disabled	Enabled	Disabled	Disabled means the feature is not presented in the vehicle

1.6 Reference Specification

None

1.7 Revision History

SPSS Module Revision History

Revision Level	Name	Change Description	Date
1.0	A. Mathai	Initial Draft	07/15/2014
1.1	A. Mathai	Updated after Conti review	07/29/2014

1.2	A. Mathai	Updated T9/T10 transition after the discussion with John Barrs (BCM contact for Puddle lamp signal)	08/22/2014
1.3	A. Mathai	Updated spec due to the decision that D544 have only have Blank welcome display. Also Normal screen will be shown in Park	10/30/2014
1.4	A. Mathai	Updated spec for • Added Normal and Shutdown flow chart to show the start of animation trigger. • Added Stage_3_Delay_Timer and Shutdown_Anim_Delay_Timer for animation synchronization with cluster	3/16/2015
1.5	A. Mathai	Added clarifications for animation behavior in Normal and Goodbye display flowcharts	4/1/2015
1.6	A. Mathai	Added section 1.3.5.2.1 for animation clarifications and 1.3.5.2.2 for behavior on Welcome_Goodbye_Cfg	4/16/2015
1.7	A. Mathai	Updated T9 transition as a Door open trigger so that HUD will go to sleep if Door is kept open and Welcome/Goodbye timer times out.	6/03/2015
1.8	A. Mathai	- Removed "PGU_Start = False" from T8 action on transition - Updated T2 transition also as a Door open trigger similar to T9 - Split Welcome_Goodbye_Cfg to Welcome_Screen_Cfg and Goodbye_Screen_Cfg. Also updated 1.3.5.2.2 for the Cfg behavior and removed DTC inhibit on config out	7/24/2015
1.9	A. Mathai	Welcome_Screen_Cfg and Goodbye_Screen_Cfg behavior updated in section 1.3.5.2.2	8/13/2015
1.10	A. Mathai	Added statements to switch on Illumination only just before startup animation and switch off just after shutdown animation to prevent "Post card" effect in dark. Also added the condition to switch off illumination only for programs have blank welcome screen. Also removed the statement for exclusion of objects in welcome animation and added compass in the list (Not applicable for D544)	3/4/2016
1.11	A. Mathai	Added solution for invalid Ambient light value received during startup: - Added Ambient_Light_Delay_Timer in timer section - Included section 1.3.5.2.3 for Ambient_Light_Delay_Timer handling - Modified 1.3.5.1.3 Normal Display flowchart to include the check for Ambient_Light_Delay_Timer expiry to begin startup animation	9/6/2016
1.12	A.Salameh	Added iACC/TJA/ASLD/DI & DTE for PHEV in the Animation Clarification section	6/9/2017
1.13	A. Salameh	Updated section 1.3.5.1 and Table 1.7 to meet RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior. - T2 was updated by removing the Door Open Trigger T8 Welcome_Timer_Expires has been deleted	8/11/2017
1.14	A. Salameh	Updated 1.3.5.1- removed ACC fromT2. Updated Table 1.7, moved comments from T2 to T9. Removed note referencing T8 in section 1.3.5.1.4. Updated section 1.3.5.4 to include ambient light delay timer for welcome animation. Updated Table 1.8 WG Display = True	1/23/2018
1.15	A. Salameh	Initial VSEM RM Release	3/1/2018