Ford Engineering Specification

PART NAME: SPEC - ELECTRICAL & ELECTRONIC SYSTEM	PART NUMBER
ICE BLUE™ and LINCOLN WHITE INTERIOR ILLUMINATION WITH DAYTIME DIMMING	ES-DS7T-1A278-BE

LET	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
FR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
LET	E	E	E	E	E														
FR	20	21	22	23	24														

	LET	FR	REVISIONS	DR	CK	REFERENCE
	A	1-19	Release ES-DS7T-1A278-BA	DV	DV	
20110307			AE00-E-12394067-156			PREPARED/APPROVED BY
		3	Sections 1.1 and 1.2 changed White to Lincoln White			David VanAmberg
		6	Section 3.2.3 changed White to Lincoln White			CHECKED BY — DETAILED BY
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		8	Table 1, Section 3.4.2 and 3.4.3 changed White to Lincoln White			CONCURRENCE/APPROVAL SIGNATURES
		9	Section 4.1.1 changed White to Lincoln White			EESE Interior Harmony Supervisor
		9	Added dual display and single large display cluster in Table 2			Sherri Bettendorf
		10	Table 3 and Sections 4.3.1 and 4.3.3 changed White to Lincoln White			EESE System Engrg Director
		13	Updated details in Table 5 for BacklitLEDCmd signal			Parrish Hanna
		14	Updated details in Tables 7 and 9 for BacklitLEDCmd signal			Manufacturing Engrg.
	B	1-19	Release ES-DS7T-1A278-BB	DV	DV	Quality Control
20120410			AE00-E-12416946-255			Purchasing Supervisor
		9	Table 2: added line item for switches in rear quarter panel			
		13	Table 6: updated note 3 and added note 5			Supplier Quality Assistance
		15	Table 11: updated notes 2 and 8, added note 10; added row to Table			
	C	1-19	Release ES-DS7T-1A278-BC	DV	DV	
20120725			AE00-E-12416946-361			
		3	Updated Figure 1			
		13	Table 6: added rows for network wakeup & clarified notes			
		15	Table 11: added rows for network wakeup & clarified notes			
	D	1-19	Release ES-DS7T-1A278-BD	DV	DV	
20130620			AE00-E-12416946-539			
		8	Updated Section 3.4.5 for Next Gen full color LCDs			
		11	Section 5.2: Removed HS3 and MS1 message IDs.			
		13	Table 6: replaced 0x3B3 with Dimming_Lvl; updated Notes 3 and 4			
		15	Table 11: replaced 0x3B3 with Dimming_Lvl; updated Notes 8 and 9			
		16	Added Section 5.6			
		20-24	Added Appendices I and II			
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20140428			AE00-E-12818413-000			

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June 2004   **3947a1e**   (Previous editions may **NOT** be used)

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1.0   INTRODUCTION

1.1   Purpose and Scope

This specification is solely for those 2013 MY and beyond Ford vehicle programs with the Common Global Electrical Architecture (CGEA) version 1.3. This specification defines the targets of the Ice Blue™ and Lincoln White interior illumination system that have both nighttime and daytime illuminated/dimmable components.

1.2   Document Intent

This specification is intended as a guideline for components that require Ice Blue™ and Lincoln White interior illumination and is a supplement to ES-DS7T-1A278-A. It covers several different lighting technologies and defines the common requirements for these differing applications. Due to the dynamic nature of Ice Blue™ and Lincoln White lighting, this specification will serve as a supplement to the Interior Harmony Subsystem Design Specification requirements.

2.0   INTERIOR ILLUMINATION SUBSYSTEM OVERVIEW

2.1   Subsystem Components

Figure 1 shows a generic block diagram for the interior illumination dimming subsystem. The main components of this system include the Light Switch Module, Ambient Light Sensor (ALS), BCM (Body Control Module), DFDCD (Driver Front Door Control Unit), PFDCU (Passenger Front Door Control Unit) and the illuminated components. Illuminated components include, but are not limited to: instrument cluster (including ePRNDL), Electronic Control Panel (ECP) or Electronic Finish Panel (EFP), trailer brake module, shifter, door trim switches, steering wheel switches, IP switches, Overhead console and floor console components.
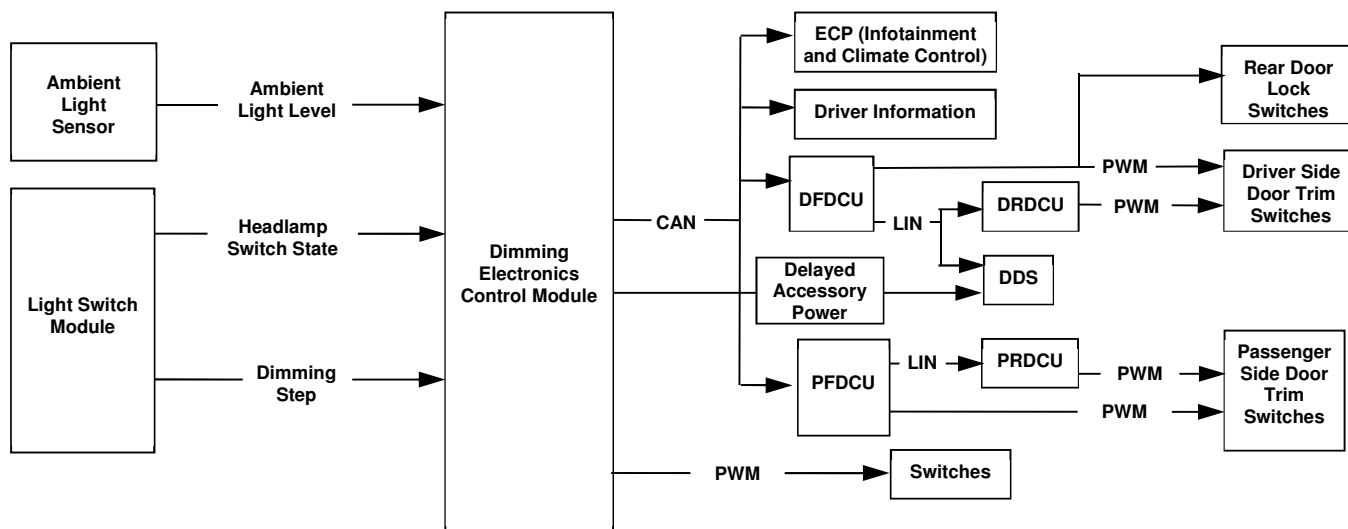

Figure 1. Interior Illumination Subsystem Dimming Block Diagram

2.2   Functional Description

The main function of the interior illumination system is to provide legible, illuminated graphics for all controls and displays in all ambient lighting conditions. All component illumination will either be controlled by the BCM, via hardwire Pulse Width Modulated (PWM) signal or Controller Area Network (CAN) Communication protocol.

2.2.1 Daytime

The illumination subsystem is in daytime mode when: 1) the Parklamps are ON and the ALS senses daytime or 2) the Parklamps are OFF and Ignition is in Run or Start. All electronic displays in the instrument cluster and centerstack illuminate at their daytime brightness levels. The ePRNDL primary gear indicator and all Climate Control indicators will also illuminate at their daytime illumination level.

If Parklamps are ON and the ALS senses daytime, all components that are not daytime dimmable illuminate at their minimum nighttime lighting level. If Parklamps are OFF, all components that are not daytime dimmable are completely OFF. The driver cannot adjust or dim these illumination levels.

For those components that are daytime dimmable, the initial daytime illumination setting for the graphics, symbols and/or text, stored in the BCM, will be maximum daytime brightness. Using the dimmer switch, the driver can then adjust or "dim" these graphics, symbols and/or text to his/her preferred illumination level for optimum visibility. This new daytime lighting level or set point will replace the initial default setting stored in the BCM. The next daytime drive cycle, all daytime dimmable graphics, symbols and/or text will illuminate to this new daytime illumination level.

Currently, the Instrument Cluster and some ECPs or EFPs are daytime dimmable, therefore, they are the only components that will dim during the Daytime.

If Parklamps are ON and the vehicle is without an ALS, the driver has the option to revert the subsystem into daytime mode by entering the User Selectable Daytime mode. If the driver continuously depresses the dim up button on the dimmer switch until the last nighttime dimming level is attained, the very next dim up press will put the subsystem into daytime mode. The BCM will transmit a predetermined daytime illumination level for the daytime dimmable component(s) to use. All other illuminated components will remain at maximum nighttime brightness while all electronic displays, the ePRNDL primary gear indicator and all Climate Control indicators will illuminate at their daytime brightness levels.

2.2.2 Nighttime

When the Parklamps are ON in dusk/dawn or nighttime conditions, the illumination subsystem is in nighttime mode. The initial default nighttime setting, stored in the BCM, for all illuminated components will be maximum nighttime brightness. Using the dimmer switch, the driver can then adjust or "dim" the illuminated components to his/her

preferred illumination level for optimum visibility. This new nighttime lighting level or set point will replace the initial default setting stored in the BCM. The next nighttime drive cycle, all illuminated components will illuminate to this new nighttime illumination level.

3.0 DAYTIME APPEARANCE

Color chromaticity design targets are based on the 1931 CIE Standard. All target data is based on applying 12.5 Volts to the dimming circuit of standalone/hardwired (non-intelligent) components or 13.5 Volts to the voltage supply pins of Electronic Control Units (ECUs) which control dimming internally (intelligent components).

3.1 Non-Illuminated Daytime Components

The daytime appearance for all components that do not illuminate in the daytime must match color Masters defined in the Ford Color Trax database and approved by Ford Color & Trim.

3.2 Daytime Illuminated Graphics, Text and Symbols

3.2.1 Non Illuminated Color Target

The daytime appearance for all components that illuminate in the daytime must match color Masters defined in the Ford Color Trax database and approved by Ford Color & Trim.

3.2.2 Ice Blue™ Illuminated Color Target

Illuminated graphics for backlit component graphics, i.e. bezels, switches and instrument clusters, must match the following target color coordinates for Ice Blue™:

$$x = 0.187 \text{ with Tolerance based on Figure 2}$$
$$y = 0.275 \text{ with Tolerance based on Figure 2}$$
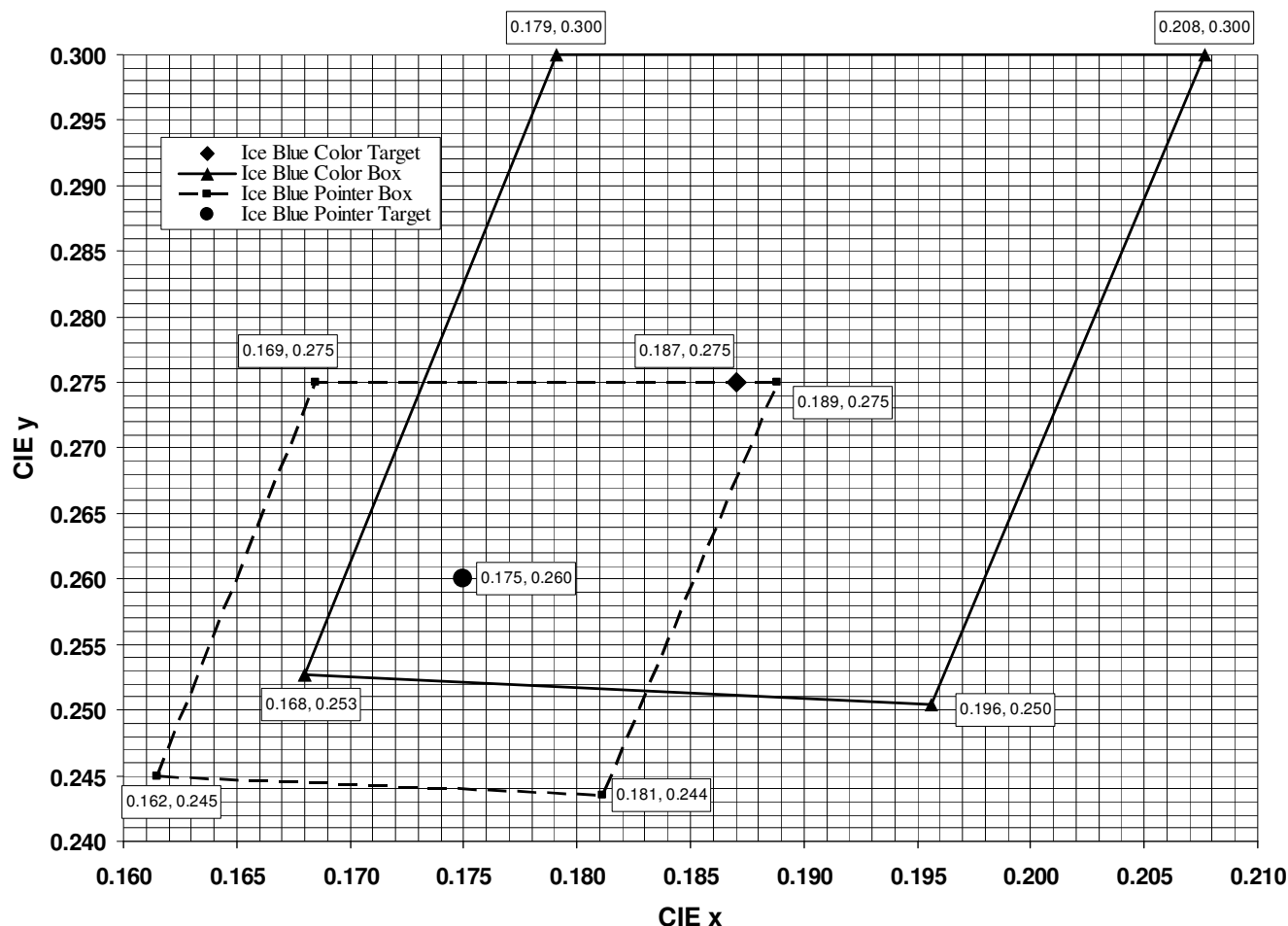
Figure 2. Color Box Tolerance for ICE BLUE™ Interior Illumination

3.2.3 Lincoln White Illuminated Color Target

Illuminated graphics for all backlit component graphics, i.e. bezels, switches and instrument clusters, must match the following target color coordinates for Lincoln White:

$x = 0.338$ with Tolerance based on Figure 3
$y = 0.335$ with Tolerance based on Figure 3
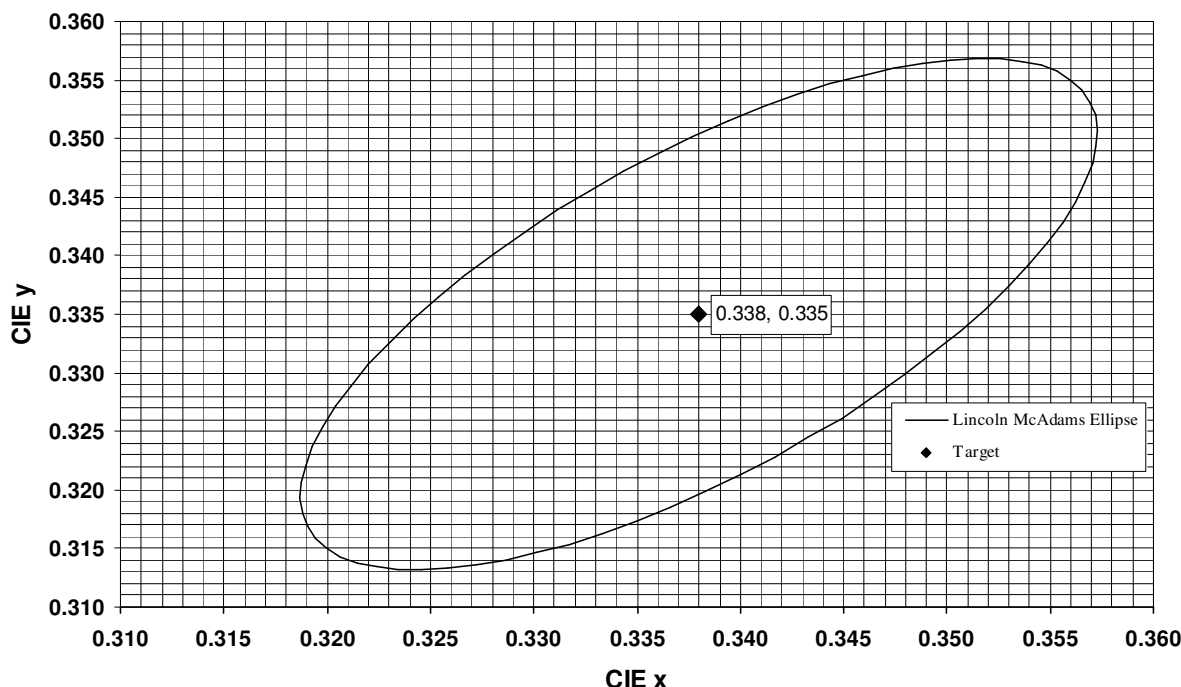
Figure 3. Lincoln White McAdams Ellipse

3.2.4 Intensity Target for Symbols, Graphics and Text

The target maximum daytime intensity for illuminated Instrument Clusters graphics and/or text behind a neutral density lens is 50.0 ftL (171.3 cd/m^2) ± 12.5 ftL (42.8 cd/m^2). The target maximum daytime intensity for deadfront illuminated Infotainment and Climate Control graphics, text or symbols is 146.0 ftL (500.0 cd/m^2) ± 36.5 ftL (125 cd/m^2). Maximum daytime intensity is defined as Parklamps OFF and dimmer switch at Daytime step 6.

3.3 Instrument Cluster Pointer Illumination

3.3.1 Color Target

The target color for a Lincoln White instrument cluster pointer is described in Section 3.2.3. The target color for a red instrument cluster pointer is described by the following x and y color chromaticity coordinates: (0.69, 0.27), (0.69, 0.31), (0.73, 0.27). The equivalent dominant wavelength is 630 ± 10 nm. The target color for an Ice Blue™ instrument cluster pointer is:

> x = 0.175 with Tolerance based on Figure 2
> y = 0.260 with Tolerance based on Figure 2

3.3.2 Intensity Target

The daytime target intensity for all pointers is detailed in Table 1.

Table 1. Instrument Cluster Pointer Daytime Intensities

Pointer Color	Daytime Pointer Intensity	
	(ftL)	(cd/m^2)
Red	35.5 ± 8.8	121.6 ± 30.1
Lincoln White	50.0 ± 12.5	171.3 ± 42.8
Ice Blue™	50.0 ± 12.5	171.3 ± 42.8

3.4   Displays

3.4.1 Ice Blue™ Color Target for Vacuum Fluorescent Displays

The Ice Blue™ target color coordinates for all monochrome, negative mode VF Displays is:

x = 0.20 with ± 0.02 tolerance
y = 0.30 with ± 0.02 tolerance

3.4.2 Lincoln White Color Target for Vacuum Fluorescent Displays

The Lincoln White target color coordinates for all monochrome, negative mode VF Displays is:

x = 0.31 with ± 0.02 tolerance
y = 0.35 with ± 0.02 tolerance

3.4.3 Color Targets for Monochrome Liquid Crystal Displays

The target color coordinates for all monochrome, negative mode LCDs are described in Sections 3.2.2 and 3.2.3 for Ice Blue™ and Lincoln White, respectively.

3.4.4 Intensity Target

The target daytime intensity for all monochrome, negative mode Displays is 42.0 ftL (144.0 cd/m^2) ± 10.5 ftL (36.0 cd/m^2).

3.4.5 Intensity Target for Full Color Liquid Crystal Displays

The bare display white luminance target for the current generation full color LCDs is 146.0 ftL (500.0 cd/m^2). No other active areas of the display shall be less than 85% of the bare display white luminance target.

For the Next Gen Centerstack Display with a full color LCD and Touch Panel, the bare display white luminance target is 350.0 ftL (1200.0 cd/m^2). No other active areas of the display shall be less than 85% of the bare display white luminance target.

For the Next Gen Instrument Cluster with a Single Large full color LCD, the bare display white luminance target is 219.0 ftL (750.0 cd/m^2). No other active areas of the display shall be less than 85% of the bare display white luminance target.

4.0   NIGHTTIME APPEARANCE

Color chromaticity design targets are based on the 1931 CIE Standard. All target data is based on applying 12.5 Volts to the dimming circuit of standalone/hardwired (non-intelligent) components or 13.5 Volts to the voltage supply pins of Electronic Control Units (ECUs) which control dimming internally (intelligent components).

4.1   Backlit Components

4.1.1   Color Target

Illuminated nighttime graphics for all backlit component graphics, i.e. bezels, switches and instrument clusters, must match the target color coordinates described in Sections 3.2.2 and 3.2.3 for Ice Blue™ and Lincoln White, respectively.

4.1.2   Intensity Target

The target maximum nighttime intensity for all bezels and switches is defined in Table 2. Maximum nighttime intensity is defined as Parklamps ON and dimmer switch at dimming step 12.

Table 2. Nighttime Intensity Targets

Component	Nighttime Intensity Target	
	(ftL)	**(cd/m^2)**
Instrument Cluster Graphics	3.5 ±1.0	12.0 ± 3.4
Instrument Cluster Acrylic Chaplets, Glow Rings, etc. (same color as illuminated graphics)	6.0 ± 1.5	20.5 ± 5.1
Instrument Cluster Graphics, Acrylic Chaplets, Glow Rings, etc. in Dual Display Cluster or Single Large Display Cluster	10.0 ± 2.5	34.3 ± 8.6
Deadfront Infotainment and Climate Control Bezels	10.0 ± 2.5	34.3 ± 8.6
Non-Deadfront Infotainment, Climate Control and Shifter Bezels	1.75 ± 0.4	6.0 ± 1.4
Dimmable Steering Wheel and Overhead Console Switches	1.1 ± 0.3	3.8 ± 1.0
Dimmable Instrument Panel and Door Trim Switches	1.75 ± 0.4	6.0 ± 1.4
All Rear Seat Controls	1.75 ± 0.4	6.0 ± 1.4
Non-Dimmable Switches Door Trim Switches	0.75 ± 0.2	2.5 ± 0.7
Non-Dimmable Switches located in the rear quarter panel (behind the last row of seats)	1.75 ± 0.4	6.0 ± 1.4
Red or Yellow Color Zones or Graduations (Instrument Cluster)	1.4 ± 0.3	4.8 ± 1.0
Hot (Red) Temperature Selection (Climate Control) & Red Hazard Symbol	1.1 ± 0.3	3.8 ± 1.0
Cool (Blue) Temperature Selection (Climate Control)	0.8 ± 0.2	2.7 ± 0.7

4.2 **Instrument Cluster Pointer Illumination**

4.2.1 Color Target

See Section 3.3.1.

4.2.2 Intensity Target

The target nighttime intensity for all pointers is detailed in Table 3.

Table 3. Instrument Cluster Pointer Nighttime Intensities

Pointer Color	Nighttime Pointer Intensity	
	(ftL)	(cd/m^2)
Red	2.5 ± 0.6	8.5 ± 2.0
Ice Blue™	3.5 ± 1.0	12.0 ± 3.4
Lincoln White	7.0 ± 1.8 [1]	24.0 ± 6.2
Red [2]	7.0 ± 1.8	24.0 ± 6.2
Ice Blue™ [2]	10.0 ± 2.5	34.3 ± 8.6
Lincoln White[2]	20.0 ± 5.0	68.6 ± 17.1

1. For pointers where the pointer blade is encapsulated. If not encapsulated, pointer intensity
   would be 12.0 ± 3.0 ftL (41.1 ± 10.3 cd/m^2)
2. For Dual Display Instrument clusters

4.3 **Displays**

4.3.1 Color Target

The target color coordinates for all monochrome, negative mode VF Displays are described in Sections 3.4.1 and 3.4.2 for Ice Blue™ and white, respectively. The target color coordinates for all monochrome, negative mode LCDs are described in Sections 3.2.2 and 3.2.3 for Ice Blue™ and Lincoln White, respectively.

4.3.2 Ice Blue™ Intensity Target

The target nighttime intensity for all Ice Blue™ monochrome, negative mode VF Displays and LCDs is 14.0 ftL (48.0 cd/m^2) ± 3.5 ftL (12.0 cd/m^2) with Parklamps On and dimmer control at nighttime dimming step 12.

4.3.3 Lincoln White Intensity Target

The target nighttime intensity for all Lincoln White monochrome, negative mode VF Displays is 17.0 ftL (58.2 cd/m^2) ± 4.3 ftL (14.7 cd/m^2) with Parklamps On and dimmer control at dimming step 12. The target nighttime intensity for all white monochrome, negative mode LCDs is 14.0 ftL (48.0 cd/m^2) ± 3.5 ftL (12.0 cd/m^2) with Parklamps On and dimmer control at nighttime dimming step 12.

4.3.4 Intensity Target for Full Color Liquid Crystal Displays

The bare display white luminance target in Night mode for all full color LCDs is 67.2 ftL (230.0 cd/m^2) with Parklamps On and dimmer control at nighttime dimming step 12. No other active areas of the display shall be less than 85% of the bare display white luminance target.

5.0 DIMMING STRATEGY

The BCM controls dimming for all of the Interior Illumination Subsystem components defined in Section 2.1 using Standard Dimming. All hardwired components are controlled directly by the BCM or one of four Door Modules; therefore, their responses are predetermined.

5.1 BCM Configurations

5.1.1 Ambient Light Sensor Present

In order for Daytime Dimming to function properly, the BCM must correctly configure the following parameter:

AmbientLightSensorPresent_Cfg = [Present, Not_Present]

This parameter determines the presence of an ALS which is used to determine the value of the Day_Night_Status signal.

5.1.2 User Selectable Daytime Level

In order for User Selectable Daytime Mode to function properly, the BCM must correctly configure the following parameter:

Dim_UserDayLevel_Cfg = [Night_12 or Day_3]

If there is an ALS present then configure to Night_12, otherwise, Day_3.

5.2 Network Signals

The BCM will send CAN signals to communicate the dimming level to all illuminated components on the network. Daytime and Nighttime illumination are controlled by the Parklamp_Status, Backlit_LED_Status, Dimming_Lvl, Litval and Day_Night_Status signals. All illuminated components on CAN need to respond to any changes in dimming within 100 milliseconds to prevent any customer perceived latency. Details of the CAN signals are shown in Table 4 below.

Table 4. CAN Dimming Signal Details

Description	Length	Detailed Meaning	State Encoded	Min	Max	Comment
Parklamp_Status	2			0 (0x0)	3 (0x3)	
		Off	0x0			
		On	0x1			
		Unknown [1]	0x2			
		Invalid [1]	0x3			
Day_Night_Status	2			0 (0x0)	2 (0x2)	
		Null	0x0			
		Day	0x1			
		Night	0x2			
Dimming_Lvl	8			0 (0x0)	253 (0xFD)	
		Off	0x0			
		Night_1	0x1			
		Night_2	0x2			
		Night_3	0x3			
		Night_4	0x4			
		Night_5	0x5			
		Night_6	0x6			
		Night_7	0x7			
		Night_8	0x8			
		Night_9	0x9			
		Night_10	0xA			
		Night_11	0xB			
		Night_12	0xC			
		Day_1	0xD			
		Day_2	0xE			
		Day_3	0xF			
		Day_4	0x10			
		Day_5	0x11			
		Day_6	0x12			
		Unknown [1]	0xFE			
		Invalid [1]	0xFF			
Litval	8			0 (0x0)	253 (0xFD)	
		Night	0x0			
		Twilight_1	0x1			
		Twilight_2	0x2			
		Twilight_3	0x3			
		Twilight_4	0x4			
		Day	0x5			
		Unknown [1]	0xFE			
		Invalid [1]	0xFF			
Backlit_LED_Status	4			0 (0x0)	253 (0xFD)	
		Off	0x0			Illumination Off
		Night_1	0x1			Barely Discernible
		Night_2	0x2			
		Night_3	0x3			
		Night_4	0x4			
		Night_5	0x5			
		Night_6	0x6			
		Night_7	0x7			
		Night_8	0x8			
		Night_9	0x9			
		Night_10	0xA			
		Night_11	0xB			
		Night_12	0xC			Max Nighttime Brightness
Delay_Accy	1			0 (0x0)	1 (0x1)	
		Off	0x0			
		On	0x1			

1. **NEVER** sent by BCM

The DFDCU will send LIN signals to the Driver Rear Door Control Unit (DRDCU) to communicate the dimming levels to the illuminated components on the driver side doors. The PFDCU will send LIN signals to the Passenger Rear Door Control Unit (PRDCU) to communicate the dimming levels to the illuminated components on the passenger side doors. Nighttime illumination will be controlled by the IndicationIllumCmd and BacklitLEDCmd

signals. All illuminated components that use a these signals to control their dimming need to respond to any changes in dimming within 100 milliseconds to prevent any customer perceived latency. Details of the LIN signals are shown in Table 5 below.

Table 5. LIN Dimming Signal Details

Signal Name	Length	Description	Hex	Comment
IndicationIllumCmd				Indicator Illumination Level
		Day	0x1	Daytime
		Night	0x2	Nighttime
BacklitLEDCmd				Graphic Illumination Level
		Off	0x0	Illumination Off
		Night_12	0xC	Nighttime Dimming Step 12

5.3 Components without Daytime Dimming

5.3.1 CAN Controlled Components

Components on CAN that do not have daytime dimming shall use the Backlit_LED_Status signal to control their LED illumination and Dimming_Lvl signal to control their display and Indicator illumination and respond as describe in Table 6.

Table 6. Expected Dimming Responses for CAN Components without Daytime Dimming

Dimming Inputs			Illumination Outputs			Comments
Dimming_Lvl	Backlit_LED_Status	Day_Night_Status or Litval	Backlit Graphics	Display	Indicators & Telltales[1,2]	
OFF	OFF	Don't Care	OFF	OFF	OFF	
OFF	OFF	Don't Care	Night_12[3,5]	Night_12[4,5]	OFF	For Infotainment Components only
Day_1 – Day_6	OFF	Don't Care	OFF	Day_1 – Day_6	Daytime	
Day_1 – Day_6	Night_1 – Night_12	Don't Care	Night_1 – Night_12	Day_1 – Day_6	Daytime	
Night_1 – Night_12	Night_1 – Night_12	Don't Care	Night_1 – Night_12	Night_1 – Night_12	Nighttime	
Dimming_Lvl or Backlit_LED_Status not received[6] for < 5 seconds since battery ON			OFF	OFF	OFF	
On Network Wake-Up, retain last received values			No State Change	No State Change	No State Change	Network Wake-up
Dimming_Lvl or Backlit_LED_Status Missing for < 5 seconds			No State Change	No State Change	No State Change	
Dimming_Lvl or Backlit_LED_Status Missing for ≥ 5 seconds			Night_12	Night_12	Nighttime	Ignition=Run/Start
Dimming_Lvl or Backlit_LED_Status Missing for ≥ 5 seconds			OFF	OFF	OFF	Ignition=OFF/ACC

1. Telltales illuminate a symbol or words to alert the customer about a feature condition. Indicators illuminate to indicate feature activation without the use of symbols or words. If telltales or indicators are not capable of step-down dimming, use Nighttime Brightness for all Daytime Brightness responses. For chromaticity and luminance, see Interior Harmony SDS.
2. If Ignition_Status ≠ Run or Start, Indicators will be OFF.
3. For CGEA 1.3: Illumination response when (Multimedia_System OR HMI_HMIMode_St = ON) AND (last received value of Dimming_Lvl=OFF) AND Ignition_Status = OFF, ACC or RUN
4. For CGEA 1.3: Illumination response when (Multimedia_System OR HMI_HMIMode_St = ON) AND (last received value of Dimming_Lvl=OFF) OR if Warning is present
5. For Police Vehicles, all illumination is OFF if Dimming_Lvl = OFF AND Backlit_LED_Status = OFF.
6. Not Received = No message received and missing message timer not yet expired

5.3.2 LIN Controlling Components

The DFDCU and PFDCU on CAN control illumination of some components over LIN. The DFDCU and PFDCU shall use the Delay_Accy, Parklamps_Status, Backlit_LED_Status and Day_Night_Status signals to send the BacklitLEDCmd and IndicationIllumCmd signals as described in Tables 7 and 8. All door trim switch illumination should reflect what is broadcast in the BacklitLEDCmd LIN signal.

Table 7. BacklitLEDCmd Output

CAN Dimming Inputs		LIN Output
Delay_Accy	**Backlit_LED_Status**	**BacklitLEDCmd**
OFF	OFF	OFF
OFF	Night_1 – Night_12	OFF
ON	Night_1 – Night_12	Night_12

Table 8. IndicationIllumCmd Output

CAN Dimming Inputs		LIN Output	Comments
Parklamp_Status	**Day_Night_Status**	**IndicationIllumCmd**	
Don't Care	Night	Night	Sensor Present
Don't Care	Day	Day	
OFF	Null	Day	Sensor Not Present
ON	Null	Night	

5.3.3 LIN Controlled Components

Components on LIN that do not have daytime dimming shall use the BacklitLEDCmd signal to control their illuminated graphics, text or symbols as described in Table 9.

Table 9. Expected LED Illumination Response for LIN Components

BacklitLEDCMD LIN Input Signal	Illuminated Graphics, Text or Symbols Response	Comments
OFF	OFF	Ignition Off
Night_12	Night_12	Nighttime Brightness

The IndicationIllumCmd signal shall be used to control the illumination level of any functional indicators or jewels as described in Table 10.

Table 10. Expected Indicator Response for LIN Components

IndicationIllumCmd	Indicators[1,2]
Night	Nighttime Brightness
Day	Daytime Brightness

1. Indicators or jewels illuminate to indicate feature activation without the use of symbols or words. If indicators are not capable of step-down dimming, use Nighttime Brightness for all Daytime Brightness responses. For chromaticity and luminance, see Interior Harmony SDS
2. If Ignition_Status ≠ Run or Start, Indicators will be OFF.

5.4   Components with Daytime Dimming

Any component that has daytime dimming shall use the Dimming_Lvl and Day_Night_Status signals over CAN and respond to the dimming inputs as described in Table 11.

Table 11. Expected Dimming Responses for Components with Daytime Dimming

Dimming Inputs			Dimming Response				Comments
Dimming_Lvl	Day_Night_Status	Litval	Illuminated Graphics, Text or Symbols	Display[1]	ePRNDL Indicators[2]	Dimmable Indicators & Telltales[3]	
OFF	Don't Care	Don't Care	OFF[10]	Night_12[4,10]	OFF	OFF	Instrument Cluster Only
OFF	Don't Care	Don't Care	Night_12[8,10]	Night_12[9,10]	OFF	OFF	For Infotainment Components only when Ignition = OFF/ACC
Day_1 – Day_6	Don't Care	Don't Care	Day_1 – Day_6	Daytime Brightness	Daytime Brightness	Daytime Brightness	Maximum Daytime Brightness & AutoDim = Off
Day_1 – Day_6	Null[5]	Don't Care	Day_1 – Day_6	Daytime Brightness	Daytime Brightness	Daytime Brightness	AutoDim = On
Day_1 – Day_6	≠ Null[6]	Night[6]	Night_6	Night_6	Night_6	Nighttime Brightness	AutoDim = On
Day_1 – Day_6	≠ Null	≠ Night	Day_1 – Day_6	Daytime Brightness	Daytime Brightness	Daytime Brightness	AutoDim = On
Night_1 – Night_12	Don't Care	Don't Care	Night_1 – Night_12	Night_1 – Night_12	Night_1 – Night_12	Nighttime Brightness	Nighttime Dimming Mode
Dimming_Lvl not received[7] for < 5 seconds since battery ON			OFF	OFF	OFF	OFF	
On Network Wake-Up, retain last received values			No State Change	No State Change	No State Change	No State Change	Network Wake-Up
Dimming_Lvl Missing for < 5 seconds			No State Change	No State Change	No State Change	No State Change	
Dimming_Lvl Missing for ≥ 5 seconds			Night_12	Night_12	Night_12	Nighttime Brightness	Ignition = Run/Start
Dimming_Lvl Missing for ≥ 5 seconds			OFF	Night_12[4]	OFF	OFF	Ignition = OFF/ACC

1. SST Display should turn Off when there is no SST display commanded.
2. Primary ePRNDL gear indicator. For chromaticity and luminance, see Interior Harmony SDS requirements. ePRNDL indicators can only turn OFF under certain vehicle conditions, see Electronic PRNDL specification , EPRNDL ES v2011.1 or later.
3. Telltales illuminate a symbol or words to alert the customer about a feature condition. Indicators illuminate to indicate feature activation without the use of symbols or words. If Telltales or Indicators are not capable of step-down dimming, use Nighttime Brightness for all Daytime Brightness responses. For chromaticity and luminance, see Interior Harmony SDS.
4. If Dimming_Lvl = OFF, Instrument Cluster Display illuminated only if Warning or Odometer present
5. If AutoDim is configured On and Day_Night_Status = Null, AutoDim feature is ignored. AutoDim feature only pertains to illuminated components in the instrument cluster.
6. If AutoDim is configured On, then must use Litval to determine Night. AutoDim feature only pertains to illuminated components in the instrument cluster.
7. Not Received = No message received and missing message timer not yet expired
8. For CGEA 1.3: Illumination response when (Multimedia_System OR HMI_HMIMode_St = ON) AND (last received value of Dimming_Lvl=OFF) AND Ignition_Status = OFF, ACC or RUN
9. For CGEA 1.3: Illumination response when (Multimedia_System OR HMI_HMIMode_St = ON) AND (last received value of Dimming_Lvl=OFF) OR if Warning is present
10. For Police Vehicles, all illumination is OFF if Dimming_Lvl = OFF

5.5   Network and Module Sleep with Illumination Active

For Components with Daytime Dimming, active dimming/illumination, Dimming_Lvl ≠ OFF, is a local sleep inhibitor. Modules on the network will allow the network(s) to sleep but illumination will remain ON indefinitely, no timeouts allowed. Local sleep is allowed when Dimming_Lvl = OFF.

For Components without Daytime Dimming, active dimming/illumination, Backlit_LED_Status ≠ OFF, is a local sleep inhibitor. Modules on the network will allow the network(s) to sleep but illumination will remain ON indefinitely, no timeouts allowed. Local sleep is allowed when Backlit_LED_Status = OFF.

Network sleep means the network is powered down but the module may still be awake. Local sleep means the network is asleep (powered down) and the module is in sleep mode (powered down).

5.6   Welcome Farewell Strategy

The Welcome Farewell strategy is a sequence of illumination events that occur as the customer approaches, enters, starts and then exits the vehicle. The strategy controls all exterior and interior illumination just prior to the Ignition transitioning to RUN or START. The master control for the strategy resides in the BCM. For those components hardwired to the BCM or one of the Door Modules, their illumination response during Welcome Farewell is predetermined; therefore, no further definition is required. However, for those components on CAN, separate illumination strategies have been developed to manage their behavior during Welcome Farewell. The Instrument Cluster specific Welcome Farewell strategy is described in a separate Welcome_Goodbye Strategy – CGEA 1.3 Subsystem Product Specific Specification (SPSS). The Centerstack Controls specific Welcome Farewell strategy is summarized in Appendix I. The Centerstack Display specific Welcome Farewell strategy is summarized in Appendix II. The overall Welcome Farewell strategy is defined in ES-DS7T-1A278-C.

6.0   DIMMING RESPONSE

6.1   Daytime Dimming

The BCM controls dimming for all of the Interior Illumination Subsystem components defined in Section 2.1. When the Parklamps are OFF, the BCM will receive a signal from the Dimmer Switch then output the appropriate CAN message. All daytime dimmable components on CAN will use the Dimming_Lvl signal to control component dimming. Tables 12 and 13 detail the nominal daytime intensity targets for the different illumination technologies at various dimming levels:

Table 12. Instrument Cluster Daytime Dimming Intensity Targets

Dimming_Lvl	*Illuminated Graphics & Acrylic Chaplets/Rings		*White or Ice Blue™ Instrument Cluster Pointer		*Red Instrument Cluster Pointer	
	(ftL)	(cd/m^2)	(ftL)	(cd/m^2)	(ftL)	(cd/m^2)
OFF	OFF	OFF	OFF	OFF	OFF	OFF
Day_1	6.0	17.1	6.0	17.1	3.5	12.0
Day_2	10.0	34.3	10.0	34.3	7.0	24.0
Day_3	20.0	68.5	20.0	68.5	14.0	48.0
Day_4	30.0	102.8	30.0	102.8	21.0	71.9
Day_5	40.0	137.0	40.0	137.0	28.0	95.9
Day_6	50.0	171.3	50.0	171.3	35.5	121.6

*Subject to change based on Jury Evaluation.

Table 13. Deadfront Infotainment and Climate Control Bezel Daytime Dimming Intensity Targets

Dimming_Lvl	* White or Ice Blue™ Illuminated Graphics, Text or Symbols (ftL)	
	(ftL)	(cd/m^2)
OFF	OFF	OFF
Day_1	14.6	50.0
Day_2	29.2	100.0
Day_3	58.4	200.0
Day_4	87.6	300.0
Day_5	116.8	400.0
Day_6	146.0	500.0

*Subject to change based on Jury Evaluation

6.2   Nighttime Dimming

The BCM controls dimming for all of the Interior Illumination Subsystem components defined in Section 2.1. When the Parklamps are ON, the BCM will receive a signal from the Dimmer Switch and ALS then output the appropriate PWM signal(s) or CAN message to the illumination subsystem components. All subsystem components on CAN will use the Dimming_Lvl, Backlit_LED_Status and Day_Night_Status signals to control component dimming.

The tables that follow indicate the nominal intensity targets for the different illumination technologies at various dimming levels:

Table 14. Nighttime Dimming Intensity Targets for Displays and Instrument Cluster Graphics

Dimming_Lvl	*Monochrome Ice Blue™ Displays (14.0 ftL)	*Monochrome White Displays (17.0 ftL)	*Full Color LCDs (ftL)	*Instrument Cluster Graphics (3.5 ftL)	Instrument Cluster Glow Rings /Acyrlic Chaplets (6.0 ftL)	*Red Instrument Cluster Pointer (2.5 ftL)	*White Instrument Cluster Pointer (7.0 ftL)
0	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Night_1	0.280	0.340	3.50	0.070	0.120	0.050	0.140
Night_2	0.980	1.190	9.29	0.245	0.420	0.175	0.490
Night_3	1.498	1.819	15.08	0.375	0.642	0.268	0.749
Night_4	2.100	2.550	20.86	0.525	0.900	0.375	1.050
Night_5	2.800	3.400	26.65	0.700	1.200	0.500	1.400
Night_6	3.486	4.233	32.44	0.872	1.494	0.623	1.743
Night_7	4.410	5.355	38.23	1.103	1.890	0.788	2.205
Night_8	5.320	6.460	44.01	1.330	2.280	0.950	2.660
Night_9	6.342	7.701	49.80	1.586	2.718	1.133	3.171
Night_10	7.756	9.418	55.59	1.939	3.324	1.385	3.878
Night_11	10.122	12.291	61.37	2.531	4.338	1.808	5.061
Night_12	14.000	17.000	67.16	3.500	6.000	2.500	7.000
Day_1 – Day_6	42.000	42.000	146.00	See Table 12	See Table 12	See Table 12	See Table 12

*Subject to change based on Jury Evaluation.

Table 15. Nighttime Dimming Intensity Targets for Instrument Cluster with Dual Displays

Dimming_Lvl	*Instrument Cluster Graphics, Glow Rings/Acrylic Chaplets & Deadfront Infotainment and Climate Control Bezels (10.0 ftL)	*White Instrument Cluster Pointer (20.0 ftL)
0	OFF	OFF
Night_1	0.200	0.400
Night_2	0.700	1.400
Night_3	1.070	2.140
Night_4	1.500	3.000
Night_5	2.000	4.000
Night_6	2.490	4.980
Night_7	3.150	6.300
Night_8	3.800	7.600
Night_9	4.530	9.060
Night_10	5.540	11.080
Night_11	7.230	14.460
Night_12	10.000	20.000
Day_1 – Day_6	See Table 12	See Table 12

*Subject to change based on Jury Evaluation.

Table 16. Nighttime Dimming Intensity Targets for LED Backlighting

Backlit_LED_Status	*LED Backlighting (1.75 ftL)	*LED Backlighting (1.4 ftL)	*LED Backlighting (1.1 ftL)	*LED Backlighting (0.8 ftL)
0	OFF	OFF	OFF	OFF
Night_1	0.035	0.028	0.022	0.016
Night_2	0.122	0.098	0.077	0.056
Night_3	0.188	0.150	0.118	0.086
Night_4	0.263	0.210	0.165	0.120
Night_5	0.350	0.280	0.220	0.160
Night_6	0.435	0.349	0.274	0.199
Night_7	0.552	0.441	0.347	0.252
Night_8	0.665	0.532	0.418	0.304
Night_9	0.792	0.634	0.498	0.362
Night_10	0.969	0.776	0.609	0.443
Night_11	1.265	1.012	0.795	0.578
Night_12	1.7500	1.400	1.100	0.800

*Subject to change based on Jury Evaluation.

7.0   LIST OF REFERENCES

- Interior Harmony SDS
- Vehicle Interior Illumination with Daytime Dimming, ES-DS7T-1A278-A
- Blue Oval DNA Welcome Farewell, ES-DS7T-1A278-B
- Welcome_Goodbye Strategy – CGEA 1.3v$_{x.x}$ Subsystem Product Specific Specification (SPSS)

APPENDIX I. CGEA Centerstack Controls Welcome Farewell Strategy

CGEA Centerstack Controls[1] Welcome Farewell Strategy

STAGE 0 – APPROACHING VEHICLE
Signal States: Dimming_Lvl = OFF; Ignition_Status = OFF[2]; HMI_HMIMode_St or Multimedia_System = OFF

Centerstack Control Illumination must be OFF.

STAGE 1 – ENTERING/EXITING VEHICLE
Signal States: Dimming_Lvl ≠ OFF; Ignition_Status = OFF or ACC[2], HMI_HMIMode_St or Multimedia_System = OFF

Centerstack Control Illumination Strategy:
   A. Illuminate Centerstack Controls to Intensity_1[3].
   B. If HMI_HMIMode_St or Multimedia_System transitions to ON, maintain illumination of Centerstack Controls at Intensity_1[3].
   C. If Dimming_Lvl transitions to OFF AND HMI_HMIMode_St or Multimedia_System = OFF, Centerstack Control illumination should extinguish.
   D. If Dimming_Lvl transitions to OFF AND HMI_HMIMode_St or Multimedia_System = ON, maintain illumination at Intensity_1[3].
   E. If Ignition transitions to RUN or START, skip to Step H in Stage 3.

STAGE 2 – DRIVER SETTLED IN SEAT
Signal States: Dimming_Lvl ≠ OFF; Ignition_Status = OFF or ACC[2]; HMI_HMIMode_St or Multimedia_System = OFF

Centerstack Control Illumination Strategy:
   F. Maintain Illumination Strategy from Stage 1. If Centerstack Control illumination is OFF, then reexecute Stage 1.
   G. If Ignition transitions to RUN or START, skip to Step H in Stage 3.

STAGE 3 – ENGINE TO RUN or START
Signal States: Ignition_Status transitions to RUN or START[2]

Centerstack Control Illumination Strategy:
   H. Whenever Ignition_Status transitions from OFF or ACC to RUN OR from OFF or ACC to START or RUN to START, the Centerstack Controls should maintain last known valid dimming step for 800 ms, independent of any Ignition_Status state changes, then transition to current dimming step[4].

STAGE 4 – DRIVER REMAINS IN VEHICLE
Signal States: Ignition_Status transitions from RUN or START to OFF or ACC[2]; Dimming_Lvl ≠ OFF; HMI_HMIMode_St or Multimedia_System = ON

Centerstack Control Illumination Strategy:
   I. Transition Centerstack Controls to Intensity_1[3].
   J. If HMI_HMIMode_St or Multimedia_System transitions to OFF AND Dimming_Lvl ≠ OFF, maintain illumination at Intensity_1[3].
   K. If Dimming_Lvl transitions to OFF AND HMI_HMIMode_St or Multimedia_System = OFF, Centerstack Control illumination should extinguish.
   L. If Dimimng_Lvl transitions to OFF AND HMI_HMIMode_St or Multimedia_System = ON, maintain illumination at Intensity_1[3].
   M. If Ignition transitions to RUN or START, skip to Step H in Stage 3

Notes:
   1. Centerstack Controls can include Centerstack Control, EFP, Climate Controls and Audio controls that are on CAN
   2. Treat Ignition_Status = Unknown or Invalid the same as Ignition_Status = OFF.
   3. Intensity_1 = Night_12 (must be easily configurable).
   4. If Dimming_Lvl is Missing, Invalid or Unknown, use last known, valid dimming step. If last known valid = 0, use Night_12.

APPENDIX II. CGEA Centerstack Display Welcome Farewell Strategy

CGEA Centerstack Display Welcome Farewell Strategy

STAGE 0 – APPROACHING VEHICLE [5]
Signal States: Dimming_Lvl = OFF; HMI_HMIMode_St or Multimedia_System = OFF

Centerstack Display Illumination must be OFF.

STAGE 1 – ENTERING VEHICLE
Signal States: Dimming_Lvl ≠ OFF; DrStatDrv_B_Actl or DrStatPsngr_B_Actl transitions from Closed to Ajar;
HMI_HMIMode_St or Multimedia_System = OFF

Centerstack Display Illumination Strategy:
   A. Turn on Centerstack Display to Welcome Scene[1] at Intensity_1[2].
   B. If Driver or Passenger door remains ajar then Centerstack Display should extinguish when Dimming_Lvl transitions to OFF or 25 seconds after last front door went ajar. If HMI_HMIMode_St or Multimedia_System transitions from OFF to ON, go to Step E in Stage 3 or skip to Step G in Stage 4. [5]

STAGE 2 – DRIVER SETTLED IN SEAT
Signal States: Dimming_Lvl ≠ OFF; DrStatDrv_B_Actl **and** DrStatPsngr_B_Actl transitions from Ajar to Closed;
HMI_HMIMode_St or Multimedia_System = OFF

Centerstack Display Illumination Strategy:
   C. Maintain Illumination Strategy from Stage 1. If Centerstack Display is OFF, then reexecute Stage 1.
   D. Centerstack Display should extinguish when Dimming_Lvl transitions to OFF or 25 seconds after last front door transitions to Closed. If HMI_HMIMode_St or Multimedia_System transitions from OFF to ON, go to Step E in Stage 3 or to Step G in Stage 4. [5]

STAGE 3 – MULTIMEDIA SYSTEM TRANSITIONS FROM OFF TO ON [5]
Signal States: HMI_HMIMode_St or Multimedia_System transitions from OFF to ON

Centerstack Display Illumination Strategy:
   E. Centerstack Display should transition to "Vehicle Specific Animation". Total duration of the "Vehicle Specific Animation" must be ≤ 3 seconds.
   F. If Dimming_Lvl = OFF, once "Vehicle Specific Animation" is complete transition display to normal operation at Intensity_1[2]. If Dimming_Lvl ≠ OFF, once "Vehicle Specific Animation" is complete transition display to normal operation at current dimming step.

STAGE 4 – MULTIMEDIA SYSTEM REMAINS ON [5]
Signal States: HMI_HMIMode_St or Multimedia_System transitions = ON

Centerstack Display Illumination Strategy:
   G. If Dimming_Lvl = OFF, transition display to normal operation at Intensity_1[2]. If Dimming_Lvl ≠ OFF, transition display to normal operation at current dimming step.

STAGE 5 – ENGINE TO START [5]
Signal States: Ignition_Status transitions to START

Centerstack Display Illumination Strategy:
   H. Once Ignition_Status transitions to START, the Centerstack Display should maintain last used dimming step for 800 ms, independent of any Ignition_Status state changes, then transition to current dimming step [4,5].

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CGEA Centerstack Display Welcome Farewell Strategy *(con't)*

STAGE 6 – DRIVER REMAINS IN VEHICLE OR EXITS VEHICLE
Signal States: Dimming_Lvl ≠ OFF; HMI_HMIMode_St or Multimedia_System transitions from ON to OFF

Centerstack Display Illumination Strategy:
I. Transition Centerstack Display to Farewell Scene[1] at Intensity_1[2].
J. Centerstack Display should extinguish when Dimming_Lvl transitions to OFF or Veh_Lock_Status transitions to Lock. If HMI_HMIMode_St or Multimedia_System transitions from OFF to ON, go to Step E in Stage 3 or to Step G in Stage 4. [5]

Notes:
1. The Welcome and Farewell Scenes are left to the discretion of the SigHMI team. The "Vehicle Specific Animation" is also left to the discretion of the SigHMI team. For low level displays, the Welcome and Farewell Scenes are generally the clock screen.
2. Intensity_1 = Night_12
3. The "Vehicle Specific Animation" must only be executed the first time the Multimedia_System OR HMI_HMIMode_St transitions to ON. For any further transitions from ON to OFF or OFF to ON, the Centerstack Display should remain in its "normal operation" state.
4. If Dimming_Lvl is Missing, Invalid or Unknown, use last known, valid dimming step. If last known valid = 0, use Night_12.
5. For CGEA 1.3; when Multimedia_System OR HMI_HMIMode_St = ON AND last state of Dimming_Lvl = OFF, the Centerstack Display should transition to Night_12 intensity.