Lincoln Embrace / Ford Welcome-Farewell
Feature Specification

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1 INTRODUCTION

1.1 Purpose

This document specifies the electrical system function requirements for the determination of welcome/farewell states and the desired response(s) from different vehicle lighting elements during those states.

1.2 Scope

The following set of features from the Global Feature & Function List is described in this FD.

Feature ID	Feature Name	Owner
F000416/A	Approach Detection	Elton Jamoua (EESE)
F000308/A	Welcome Mat	Ahmet Cinar (EESE)
F000309/A	Illuminated Door Handle Pockets	Elton Jamoua (EESE)
F000148/C	Auto Fold Mirrors	Ahmet Cinar (EESE)
Fn001857/J	Center Stack Animation/Graphic	Nicholar Frazier (SYNC)
Fn00335/C	Instrument Cluster Animation/Graphic - Needle	Scott Watkins (EESE)
F000317/A	Tail Lamp Static Fade	Terrence Wilson (Ext Lighting)
F000317/A	Rear Corner Lamp/Rear Side Marker Fade	Terrence Wilson (Ext Lighting)
F000315/A	Dynamic (Sequential) Signature DRL's	Terrence Wilson (Ext Lighting)
F000315/A	Fog/Fascia Lamp Static Fade	Terrence Wilson (Ext Lighting)
F000061/D	Pulsing Push to Start Switch	TBD
F000063/C	Static Sequential Ambient Lighting	Steven Antilla (Int Lighting)
F000061/D	Door Switch Backlighting	John Ricks (EESE)
F000059/C	Courtesy Lamps	Steven Antilla (Int Lighting)
F000061/D	I/P and Overhead Console Button Backlighting	Steven Antilla (Int Lighting)
F000061/D	Sync & Radio Control Button Backlighting	Dinh Tran (SYNC)
F000061/D	Headlamp Switch Backlighting	Steven Antilla (Int Lighting)
F000061/D	Instrument Cluster Backlighting	Scott Watkins (EESE)
F000059/C	Illuminated Scuff Plates	Steven Antilla (Int Lighting)
Fn003250/B	aHUD Animation	Aneesh Mathai (EESE)
F000315/A	Lit Lincoln Star	Farhan Ehsan (EESE)
F000317/A	Illuminated Deployable Runningboards	Farhan Ehsan (EESE)
F000316/A	Illuminated Seatbelt Buckles	Matt Majkowski (Int Lighting)
Fn000335/C	Instrument Cluster Animation/Graphic - Starfield	Scott Watkins (EESE)
F001002/A	Ford Welcome/Farewell	Farhan Ehsan (EESE)
F001003/A	Lincoln Welcome/Farewell	Farhan Ehsan (EESE)
F001004/A	Ford Signature Light	Frank Aust
F001005/A	Lincoln Signature Light	John Barrs (EESE)
F000052/C	Courtesy Lighting	John Barrs (EESE)
F000053/B	Courtesy Lighting Delay	John Barrs (EESE)
F000054/B	Illuminated Entry/Exit	John Barrs (EESE)

Table 1: Features described in this FD

1.3 Reference Specifications

Sub-system	Specification
aHUD welcome farewell	HUD_Welcome_Goodbye_Strategy_-_CGEA1.3_v1.10
Gen 1M Body Control Module FS	FS-LU5T-14B476-AA*
Gen 2 Body Control Module FS	FS-JU5T-14B476-AA*
cHUD welcome farewell	cHUD_Welcome_Goodbye_Strategy_-_CGEA1.3_v1.2
Cluster welcome farewell	Welcome-Goodbye Strategy - CGEA1.3_vX.X
Ford Welcome Farewell ARL	RQT-002004-021878 DNA WELCOME-FAREWELL STRATEGY REV. 1
Lincoln Embrace ARL	RQT-002004-022094 LINCOLN EMBRACE WELCOME AND FAREWELL BEHAVIOR REV. 1
SYNC welcome farewell	H22g_SYNC3_Welcome_Power_Modes_RELEASED_v2_20
Auto-fold mirrors	Mirror fold and door lock strategy.pptx
Approach Detection Functional Spec	Approach Detection ReqSTD-2013-04-11-16-09

Table 2: Reference Specification

2 FEATURE DESCRIPTION

2.1 Theory of Operation

Ford Welcome Farewell

The vehicle's Exterior, Interior lights, and Displays shall respond by either fading ON/OFF or turning ON/OFF based on user interaction with the vehicle – Approaching it with a valid PK, locking or unlocking a vehicle, opening or closing vehicle doors, and cycling the ignition between OFF and RUN/Start.

Lincoln Embrace

A variant of Ford Welcome Farewell which was adapted for Lincoln vehicles, with aesthetic level differences and the total number of lighting/display elements being impacted.

Feature Context Diagram

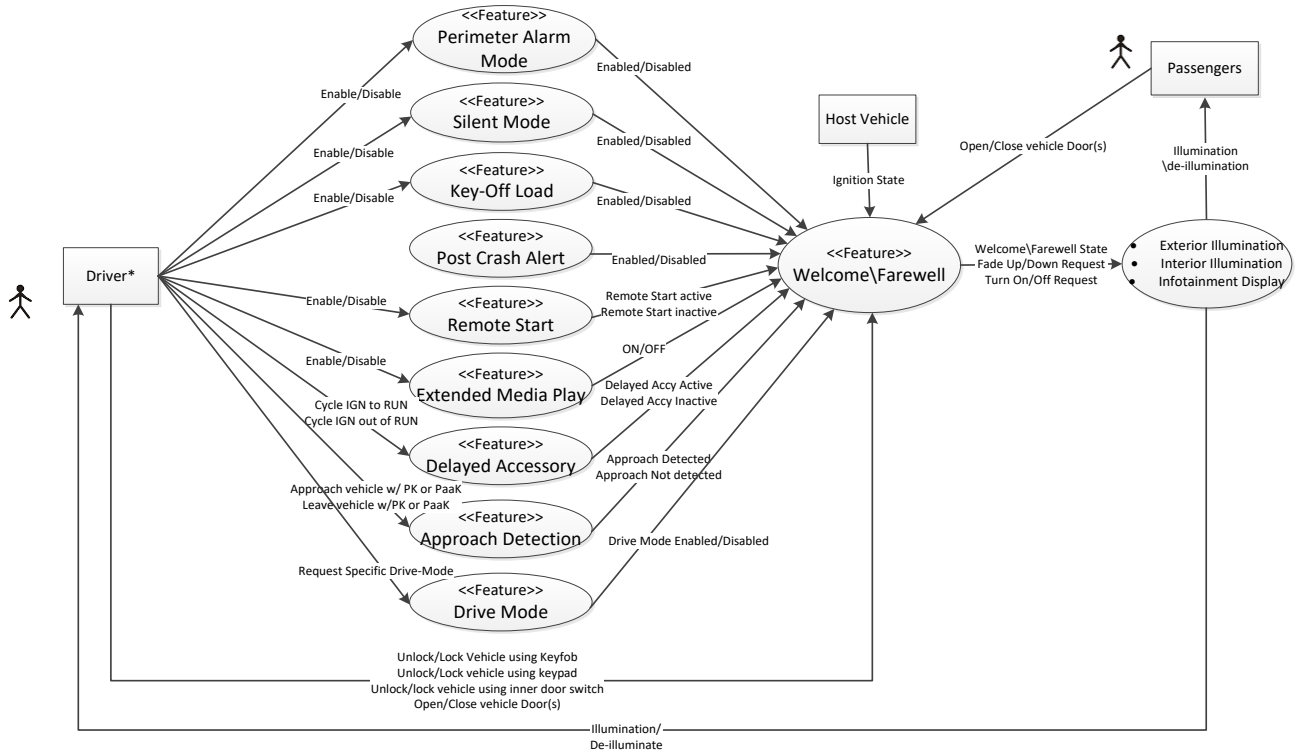


Figure 1: Welcome Farewell Feature Context Diagram

3 FEATURE REQUIREMENTS

3.1 Feature Level Requirements

3.1.1 Feature Requirements

The feature is intended to be able to either “Welcome” or bid “Farewell” to the Driver based off how he/she interacts with the vehicle. The manner in which the vehicle shall interact with the Driver is by controlling the Exterior Lights, Interior Lights, or Vehicle Displays (turn then ON or OFF)

- The feature shall require Exterior Illumination, Interior Illumination and Vehicle Display’s for Ford specific vehicles to Fade ON, Fade OFF, Turn On or Turn OFF based off of the state tables in ARL “RQT-002004-021878 DNA WELCOME-FAREWELL STRATEGY REV. XX”
- The feature shall require Exterior Illumination, Interior Illumination and Vehicle Display’s for Lincoln specific vehicles to Fade ON, Fade OFF, Turn On or Turn OFF based off of the state tables in ARL “RQT-002004-022094 LINCOLN EMBRACE WELCOME AND FAREWELL BEHAVIOR REV. XX”
- The feature shall be partitioned into three specific portions: “Welcome”, “In-Drive”, and “Farewell”; which exhibit unique behaviors for Exterior Illumination, Interior Illumination, and Vehicle Displays as per the previously mentioned ARL documents
- The feature’s “Welcome” portion shall include the following states:
    - Approach Detection (if equipped): Detects if a Keyfob or Phone-as-a-key (PaaK) Device is within a certain distance away from the vehicle while the ignition is OFF
    - Illuminated Entry: The vehicle is unlocked using either a Key-Fob, PaaK. Door Keypad code, or any other means from the exterior of the vehicle while the ignition is OFF
    - Courtesy Lighting: A vehicle entry door has transitioned to Ajar while the ignition is OFF
    - Courtesy Lighting Delay: All vehicle entry doors have transitioned to Closed while the ignition is OFF
- During the “In-Drive”, the feature shall not require any unique behavior for Exterior Lighting, Interior Lighting, and In-vehicle displays by allowing them to transition to their legislative/Drive specific behavior.
- The feature’s “Farewell” portion shall include the following states:
    - Illuminated Exit: The vehicle transmission has transitioned from non-OFF to OFF (with all vehicle entry doors closed)
    - Courtesy Lighting: A vehicle entry door has transitioned to Ajar after the ignition transitioned to OFF
    - Courtesy Lighting Delay: All vehicle entry doors have transitioned to Closed after the ignition transitioned to OFF
    - Vehicle Locking: The vehicle is locked using either a Key-Fob, PaaK. Door Keypad code, or any other means from the exterior of the vehicle while the ignition is OFF
- The feature shall also monitor the vehicle’s driver selected “Drive Mode” and use it as an input to drive unique Exterior Illumination, Interior Illumination and Vehicle Display behavior during the “Welcome” and “Farewell” portions
- The feature shall require the Exterior Illumination and Interior Illumination to reverse Fade On or Fade Off illumination behavior instantaneously at the time a new request is received without having to complete the previous Fade request
- The feature shall require all vehicle illumination to not flicker during its “Welcome” and “Farewell” portions.
- The feature shall allow the following features to over-ride or inhibit Exterior Lighting, Interior Lighting, and Vehicle Display behavior if they are active during the “Welcome” or “Farewell” portions:
    - Remote Start (override for specific Exterior Lighting)
    - Delayed Accessory (override for Interior Lighting)
    - Extended Play (override for Vehicle Displays)
    - Perimeter Alarm Mode (override for Exterior Lighting and Interior Lighting)
    - Silent Mode (override for Exterior Lighting, Interior Lighting and Vehicle Displays)
    - Key-Off-Load Mode (override for Exterior Lighting, Interior Lighting and Vehicle Displays)
    - Post-Crash Alert (override for Exterior Lighting, Interior Lighting and Vehicle Displays)

3.1.1.1 Host Vehicle State required for Feature operation

The feature is expected to have functionality across all Power Modes and Vehicle Modes that would qualify under “normal” operation of vehicle – Vehicle isn’t in an error, error recovery, diagnostic, or any related state which would inhibit normal function of the vehicle.

3.2 Quality Requirements

3.2.1 Reliability Requirements

No additional reliability requirements for the intended implementation.

3.2.2 Performance Requirements

- The lighting elements controlled by this feature while it is active shall be steady burning (no flickering) when illuminated
- By default, if a lighting element is required to “Fade ON”, it shall take 3 seconds to ramp up its illumination level from “OFF” level to the desired “ON” level – “ON” illumination level shall be specified by Vehicle Harmony group.
- By default, if a lighting element is required to “Fade OFF”, it shall take 5 seconds to complete when starting at “ON” illumination level
- If a lighting element is required to “Fade ON” or “Fade OFF”, it shall continuously ramp ON or OFF to its “ON” level - shall not “flicker” as defined by the Interior Harmony Group, identified during vehicle walk-around
- Exterior Lighting elements required to “Fade ON” or “Fade OFF” shall follow ramp in either direction following Stevens’ Power Law curve until the illumination reaches the desired “ON” or “OFF” level respectively
- Interior Lighting elements required to “Fade ON” or “Fade OFF” shall transition in either direction following “Smooth Dimming” until the illumination reaches the desired “ON” or “OFF” level
- Exterior Lighting elements required to “Snap ON” or “Snap OFF” shall step up or down their illumination level to the desired “ON” or “OFF” level following a step function
- Interior Lighting elements required to “Snap ON” or “Snap OFF” shall step up or down their illumination level to the desired “ON” or “OFF” level following a step function
- Interior Lighting elements required to “Pulse” shall ramp up to their “ON” illumination level and then immediately transition between their “ON” and configurable illumination level (10% of “ON” illumination level by default) at a configurable frequency (set to 1Hz by default) – point back BCM FS

3.2.2.1 Performance Latency Requirements

- The feature shall require the system to respond to a user specific interaction within 250ms

3.2.3 Safety Requirements

The following requirements refer to the safety requirements as defined and managed by the ASO office. Each requirement points to a specific “Regulation Records” (RRs) as they’re listed in FSMS, which in turn refer to sections from the applicable Regulation.

Links to RRs are used instead of pointing to the specific language that applies within the larger Regulatory document to protect against continual updates/re-interpretations – link to RR won’t change, but content within RR shall/might eventually change. It is also strongly advised that the listed “RR” Author” be contacted to assure that the content within the RR is being interpreted correctly.

3.2.3.1 NAFTA Requirements to abide by (or not violate)

RR ID/ Revision	Country/ Vehicle area	Regulation Number and Title	RR Author

CAN-004804/1	Canada/ Exterior Lighting	SCHEDULE IV Part II(CMVSS 108 and 108.1)/LIGHTING SYSTEM, RETRO-REFLECTIVE DEVICES and HEADLAMP CONCEALMENT DEVICES	Adams-Campos, Kelley-KADAMSCA (kadamsca)
CAN-004804/3	Canada/ Exterior Lighting	CMVSS 108/LIGHTING SYSTEM, RETRO-REFLECTIVE DEVICES and HEADLAMP CONCEALMENT DEVICES	Adams-Campos, Kelley-KADAMSCA (kadamsca)
CAN-004911/3	Canada/ Interior Lighting	CMVSS 101/SCHEDULE IV PART II 101 (CMVSS 101) Controls and Displays	Laesch,Renu-RLAESCH1 (rlaesch1)
MEX-006134/1	Mexico/ Vehicle Display	MEX SECOFI-25/INSTRUMENT CLUSTER.	Arellano-Belloc,Hector-HARELLAN (harellan)
USA-006741/1	US / Exterior Lighting	USA - STATE - ALL/EXTERIOR LIGHTING - GENERAL	Adams-Campos, Kelley-KADAMSCA (kadamsca)
USA-008716/3	US / Interior Lighting & Vehicle Displays	FMVSS 101/FMVSS 101 Controls and Displays	Laesch,Renu-RLAESCH1 (rlaesch1)
USA-008732/1	US / Interior Lighting & Vehicle Displays	/NHTSA Visual-Manual Guidelines for In-Vehicle Electronic Devices	Leigh,Michael-MLEIGH (mleigh)
USA-009169/2	US / Exterior Lighting	USA - STATE - SEVERAL/HEADLAMPS (LOW-BEAMS)	Adams-Campos, Kelley-KADAMSCA (kadamsca)
USA-011127/2	US / Exterior Lighting, Interior Lighting & Vehicle Display	/2019MY U.S. NHTSA New Car Assessment Program (NCAP)	Buckman, Jennifer-JBARNARD (jbarnard)

3.2.3.2 **ECE Requirements to abide by (or not violate)**

RR ID/ Revision	Country/ Vehicle area	Regulation Number and Title	RR Author
ECE-008757/1	ECE / Vehicle Displays & Interior Lighting	RE3 ANNEX 16./ON-BOARD COMMUNICATION AND INFORMATION SYSTEMS.	Abraham,James-JABRAH11 (jabrah11)
ECE-004951/10	ECE / Vehicle Display	ECE-39/SPEEDOMETER	Sanchez,Greg-GSANCHE1 (gsanche1)
ECE-005073/16	ECE / Interior Lighting & Vehicle Displays	ECE-121.01/Identification of Hand Controls, Tell-Tales and Indicators	Mueller,Joachim-JMUELLE6 (jmuelle6)
ECE-005009/12	ECE / Exterior Lighting	ECE-26.02/Exterior Projections	Mueller,Joachim-JMUELLE6 (jmuelle6)

3.2.3.3 **China Requirements to abide by (or not violate)**

RR ID/Revision	Country	Regulation Number and Title	RR Author
XCT-011075/1	Cross Country Topics / Vehicle Display	CROSS COUNTRY SPEEDOMETER MATRIX/CROSS COUNTRY MATRIX FOR SPEEDOMETER AND ODOMETER	Laesch,Renu-RLAESCH1 (rlaesch1)
CHN-005444/1	China / Exterior Lighting & Interior Lighting	GB 17509-2008/CHINA: DIRECTION INDOCATORS	Zhang,Yue-YZHAN256 (yzhan256)
CHN-008524/1	China / Exterior Lighting	GB 11566-2009/CHINA: EXTERIOR PROJECTIONS	Zhang,Yue-YZHAN256 (yzhan256)
CHN-004436/16	China / Exterior Lighting, Interior Lighting & Vehicle Display	GB 7258/CHINA: CCC VEHICLE APPROVAL	Zhang,Yue-YZHAN256 (yzhan256)
CHN-004329/5	China / Interior Lighting & Vehicle Displays	GB 4094/CHINA: SYMBOLS FOR CONTROLS, INDICATORS, AND TELL-TALES	Zhang,Yue-YZHAN256 (yzhan256)
CHN-004330/5	China / Interior Lighting & Vehicle Display	GB 15082/CHINA: SPEEDOMETERS FOR MOTOR VEHICLE	Zhang,Yue-YZHAN256 (yzhan256)

*__NOTE__ – China market regulatory requirements are close to ECE market requirements with very few exceptions.
*__NOTE__ – Consult ASO team for any markets not specified.

3.2.4 **Security Requirements**

N/A – No unique security requirements are required by this feature.

4 FUNCTIONAL DECOMPOSITION

4.1 List of Functions

Section #	Function Name	Function Description
5.2.1	Welcome Farewell State and Sub-state Determination	Algorithm within the controlling module which shall accept input signals to then determine the specific state and sub-state of Welcome Farewell
5.2.2	LE_WF_ Illumination Requestor	Function that will transmit the expected response (i.e. “Fade On”) to all illumination controlling smart modules, based on the output it receives out of the Welcome Farewell State Determination function.

5.2.3	LE_WF_ Illumination Response	Function that will accept the expected response output from the “LE_WF_ Illumination Requestor” function to then drive the actual illumination for a given light assembly or display to meet the expected final output as per “RQT-002004-021878 DNA WELCOME-FAREWELL STRATEGY REV. XX” for Ford vehicles or “RQT-002004-022094 LINCOLN EMBRACE WELCOME AND FAREWELL BEHAVIOR REV. XX” for Lincoln vehicles
5.2.4	LE_WF_Welcome/ Farewell Display	Function that will accept a combination of outputs from the “Welcome Farewell State Determination” and “LE_WF_ Illumination Requestor” functions to then drive the “Welcome” and “Farewell” animations for a given display to meet the expected final output as per “RQT-002004-021878 DNA WELCOME-FAREWELL STRATEGY REV. XX” for Ford vehicles or “RQT-002004-022094 LINCOLN EMBRACE WELCOME AND FAREWELL BEHAVIOR REV. XX” for Lincoln vehicles

5 Function Requirement

5.1 Power Modes of each Function

Function Name	Power Mode
Welcome Farewell State Determination	(Ignition States: OFF, ACCY, RUN and START) OR (Vehicle Bus: Awake) OR (Local Sleep Inhibition: Active)
LE_WF_ Illumination Requestor	(Ignition States: OFF, ACCY, RUN and START) OR (Vehicle Bus: Awake) OR (Local Sleep Inhibition: Active)
LE_WF_ Illumination Response	(Ignition States: OFF, ACCY, RUN and START) OR (Vehicle Bus: Awake) OR (Local Sleep Inhibition: Active)
LE_WF_Welcome/ Farewell Display	(Ignition States: OFF, ACCY, RUN and START) OR (Vehicle Bus: Awake) OR (Local Sleep Inhibition: Active)

5.2 Welcome/Farewell State and Sub-state determination

Function that the Centralized Welcome/Farewell controlling module will use to determine and transmit the specific Welcome/Farewell State and Welcome/Farewell Sub-state to the receiving modules and systems.

Inputs used for Welcome/Farewell State and Sub-state Determination

The Welcome Farewell State and Sub-state Determination Function requires the following set of inputs:

- Approach Detected/Not-Detected: PK position relative to vehicle, either within or outside “Approach” zone.
- Vehicle Entry Door Ajar Status: Front Driver and Passenger Door, Rear Driver and Passenger Door
- Vehicle Lock vs Unlock Status
- Vehicle Lock vs Unlock Requestor: Key-fob/PK, Door Keypad, or Interior Door Trim switch
- Vehicle Ignition Status: Off, Accessory (if applicable), Run, or Start.

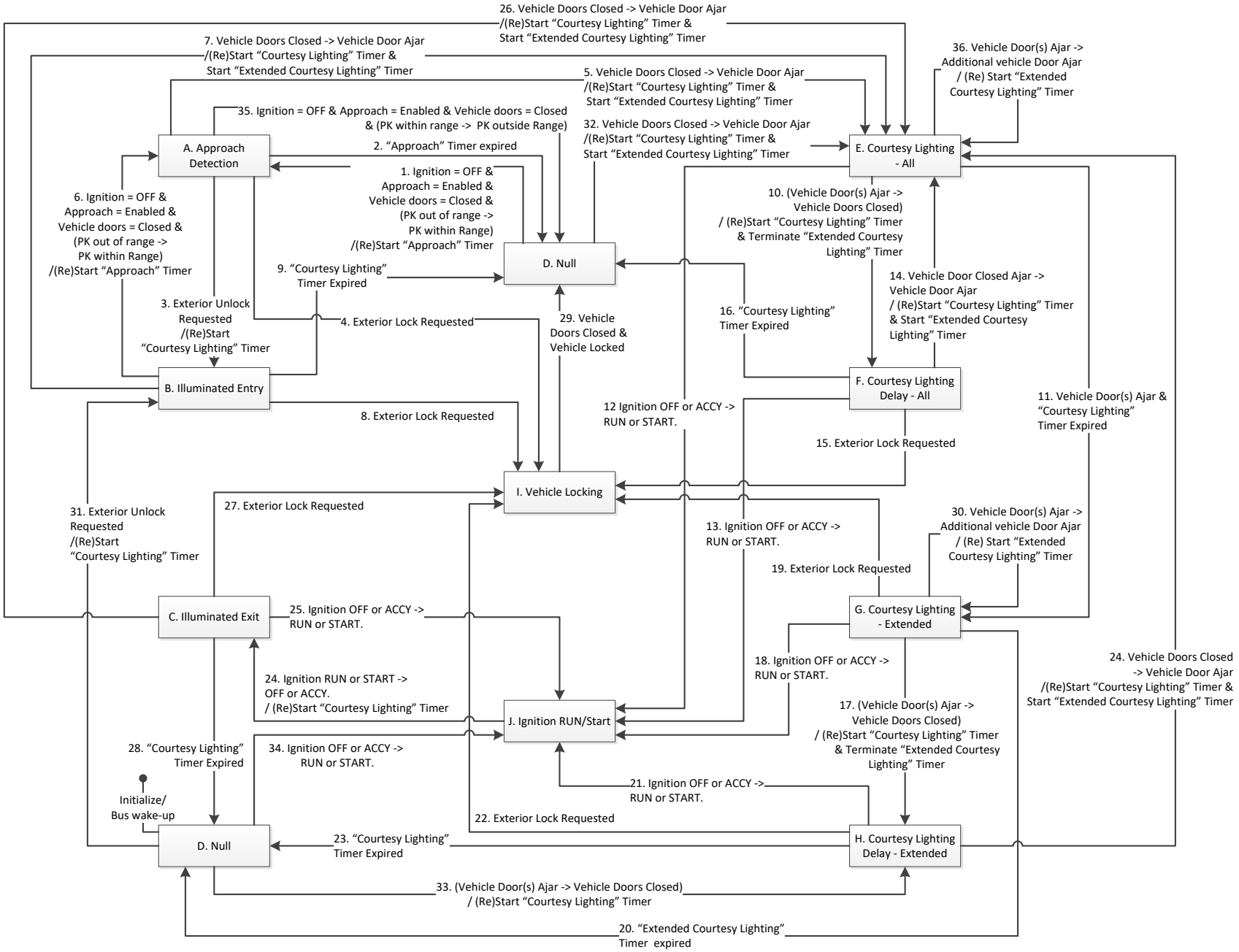
Welcome/Farewell State Determination Definitions

Welcome: State that shall be active as a vehicle user is entering the vehicle until either the ignition is started (transition to “Ignition Run/Start” state), vehicle bus goes to sleep (“Null” sub-state) or the vehicle is locked from the exterior (“Vehicle Locking” sub-state).
Ignition Run/Start: State that shall be active from the time ignition is in Run/Start (includes accessory) until the ignition transitions to OFF (“Illuminated Exit” sub-state)
Farewell: State that shall be active as the vehicle user is leaving the vehicle after transitioning the ignition to OFF (“Illuminated Exit” sub-state) until either the ignition is re-started (transitioning back to “Ignition Run/Start” state), vehicle bus goes to sleep (“Null” sub-state) or the vehicle is locked from the exterior (“Vehicle Locking” sub-state).
Null: Null state from where the Welcome/Farewell State Determination initialize and transition to due to time-outs or when the state determination function is no longer active.

Welcome/Farewell Sub-State Determination Definitions

Approach Detection: Keyfob or Phone-as-a-key (PaaK) Device is within detection zone around vehicle (currently set to 2.5m)
Illuminated Entry: Vehicle unlocked using either a Key-Fob, PaaK. Door Keypad code or any other means from the exterior of the vehicle while the ignition is OFF
Courtesy Lighting - All: A vehicle entry door transitioning to Ajar while the ignition is OFF, applicable to both Exterior and Interior lighting elements
Courtesy Lighting Delay- All: All vehicle entry door equaling closed after an ajar door(s) transitioned to closed, applicable to both Exterior and Interior lighting elements
Courtesy Lighting - Extended: A vehicle entry door transitioning to Ajar while the ignition is OFF, applicable to just Interior lighting elements
Courtesy Lighting Delay- Extended: All: All vehicle entry door equaling closed after an ajar door(s) transitioned to closed, applicable to just Interior lighting elements
Ignition Run/Start: Vehicle Ignition is in Run or Start state
Illuminated Exit: The vehicle transmission has transitioned from non-OFF to OFF
Vehicle Locking: The vehicle was locked using either a Key-Fob, PaaK. Door Keypad code or any other means from the exterior of the vehicle while the ignition is OFF
Null: Null state

Welcome/Farewell Sub-State Determination flow diagram



*__NOTE__ – Even though the diagram above has two separate “Null” states called out, they are referring to the same “Null” state.

	D -> A.1: “Approach” timer initialized. Timer set to 25 seconds by default Transition as written applied to “Unlocked” configurable variant of Approach Detection. For “Locked” variant of Approach Detection, vehicle must have been locked using an exterior means. **Welcome/Farewell State:** Don’t care -> Welcome
	A -> D.2: “Approach” timer expired. Timer set to 25 seconds by default **Welcome/Farewell state:** Don’t care -> Null
	A -> B.3: “Courtesy Lighting” timer initialized. Timer set to 25 seconds by default. “Approach” timer terminated. **Welcome/Farewell state:** Don’t care -> Welcome
	A -> I.4: Terminate any active timers **Welcome/Farewell state:** Don’t care -> Welcome
	A -> E.5: “Courtesy Lighting” timer restarted at first door ajar transition. Shall not reset with each additional door ajar thereafter. “Extended Courtesy Lighting” timer initialized at first door ajar transition. Timer set to 10 minutes by default. Shall reset with each additional door ajar thereafter. **Welcome/Farewell state:** Don’t care -> Welcome
	A -> D.35: “Approach” timer terminated on transition to “Null”. PK range and detection speed varies depending on number of antennas on vehicle and antenna scan sequence/rate **Welcome/Farewell state:** Don’t care -> Null
	B -> A.6: “Approach” timer re-initialized. “Courtesy Lighting” timer terminated. Transition as written applied to “Unlocked” configurable variant of Approach Detection. Shall not occur for “Locked” variant of Approach Detection **Welcome/Farewell state:** Don’t care -> Welcome
	B -> E.7: “Courtesy Lighting” timer restarted at first door ajar transition. Shall not reset with each additional door ajar thereafter. “Extended Courtesy Lighting” timer initialized at first door ajar transition. Timer set to 10 minutes by default. Shall reset with each additional door ajar thereafter. **Welcome/Farewell state:** Don’t care -> Welcome
	B -> I.8: Terminate any active timers **Welcome/Farewell state:** Don’t care -> Farewell
	B -> D.9: “Courtesy Lighting” timer expired. Timer set to 25 seconds by default **Welcome/Farewell state:** Don’t care -> Null
	C -> J.25: Any active timers terminated. Vehicle behavior must follow legislative in-drive requirements. **Welcome/Farewell state:** Farewell -> Ignition Run/Start
	C -> E.26 “Courtesy Lighting” timer restarted at first door ajar transition. Shall not reset with each additional door ajar thereafter. “Extended Courtesy Lighting” timer initialized at first door ajar transition. Timer set to 10 minutes by default. Shall reset with each additional door ajar thereafter. **Welcome/Farewell state:** remain in Farewell if interior door handle used to open driver door. Farewell -> Welcome if exterior door handle used to open door
	C -> I.27 Terminate any active timers

	Welcome/Farewell state: remain in Farewell
	C -> D.28 “Courtesy Lighting” timer expired. Timer set to 25 seconds by default **Welcome/Farewell state:** Farewell -> Null
	D -> B.31 Courtesy Lighting” timer initialized. Timer set to 25 seconds by default. “Approach” timer terminated. **Welcome/Farewell state:** Null -> Welcome
	D -> E.32 “Courtesy Lighting” timer started at first door ajar transition. Shall not reset with each additional door ajar thereafter. “Extended Courtesy Lighting” timer initialized at first door ajar transition. Timer set to 10 minutes by default. Shall reset with each additional door ajar thereafter. **Welcome/Farewell state:** Null -> Welcome
	D -> H.33 “Courtesy Lighting” timer started after all ajar vehicle entry doors transition to closed. **Welcome/Farewell state:** Null -> Welcome
	D -> J.34 Vehicle behavior must follow legislative in-drive requirements. **Welcome/Farewell state:** Null -> Ignition Run/Start
	E -> F.10: “Courtesy Lighting” timer restarted after all ajar vehicle entry doors transition to closed. “Extended Courtesy Lighting” timer terminated. **Welcome/Farewell state:** Keep previous state (Welcome or Farewell)
	E -> G.11: “Courtesy Lighting” timer expired. Timer set to 25 seconds by default Transition has no impact on active “Extended Courtesy Lighting” timer (continue counting down) **Welcome/Farewell state:** Keep previous state (Welcome or Farewell)
	E -> J.12: Any active timers terminated. Vehicle behavior must follow legislative in-drive requirements. **Welcome/Farewell state:** Don’t care -> Ignition Run/Start
	E -> E.36: “Extended Courtesy Lighting” timer reset with each additional door ajar transition**.** “Courtesy Lighting” timer restarted at first door ajar transition. Shall not reset with each additional door ajar thereafter. **Welcome/Farewell state:** Keep previous state (Welcome or Farewell)
	F -> J.13: Any active timers terminated. Vehicle behavior must follow legislative in-drive requirements. **Welcome/Farewell state:** Don’t care -> Ignition Run/Start
	F -> E.14 “Courtesy Lighting” timer restarted at first door ajar transition. Shall not reset with each additional door ajar thereafter. “Extended Courtesy Lighting” timer initialized at first door ajar transition. Timer set to 10 minutes by default. Shall reset with each additional door ajar thereafter. **Welcome/Farewell state:** Keep previous state (Welcome or Farewell)
	F -> I.15 Terminate any active timers **Welcome/Farewell state:** Don’t care -> Farewell
	F -> D.16 “Courtesy Lighting” timer expired. Timer set to 25 seconds by default **Welcome/Farewell state:** Don’t care -> Null
	G -> H.17 “Courtesy Lighting” timer restarted after all ajar vehicle entry doors transition to closed. “Extended Courtesy Lighting” timer terminated. **Welcome/Farewell state:** Keep previous state (Welcome or Farewell)

	G -> J.18 Any active timers terminated. Vehicle behavior must follow legislative in-drive requirements. **Welcome/Farewell state:** Don't care -> Ignition Run/Start
	G -> I.19 Terminate any active timers **Welcome/Farewell state:** Don't care -> Farewell
	G -> D.20 "Extended Courtesy Lighting" timer expired. Timer set to 10 minutes by default
	G -> G.30 "Extended Courtesy Lighting" timer reset with each additional door ajar transition
	H -> J.21 Any active timers terminated. Vehicle behavior must follow legislative in-drive requirements. **Welcome/Farewell state:** Don't care -> Ignition Run/Start
	H -> I.22 Terminate any active timers **Welcome/Farewell state:** Don't care -> Farewell
	H -> D.23 "Courtesy Lighting" timer expired. Timer set to 25 seconds by default **Welcome/Farewell state:** Don't care -> Null
	H -> E.24 "Courtesy Lighting" timer restarted at first door ajar transition. Shall not reset with each additional door ajar thereafter. "Extended Courtesy Lighting" timer initialized at first door ajar transition. Timer set to 10 minutes by default. Shall reset with each additional door ajar thereafter. **Welcome/Farewell state:** Keep previous state (Welcome or Farewell)
	I -> D.29 Transition occurs after vehicle lock is confirmed **Welcome/Farewell state:** Don't care -> Null

5.3 LE_WF_ Illumination Requestor

Function that will accept outputs from the "Welcome Farewell State and Sub-state Determination" function, to determine the appropriate illumination response and transmit the appropriate control signal i.e. Ramp up, Ramp Down, Snap On, Snap Off etc.; as per RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX" for Ford vehicles and "RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX" for Lincoln vehicles

5.3.1 Control Signal Definitions & Configurability

RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX" for Ford vehicles and "RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX" for Lincoln vehicles, requires the following four categories of responses in order to satisfy their requirements.

- **"Fade On"**: Request that requires the target lighting element to ramp up their illumination level along as perceived linear curve. The default duration shall be 3 seconds, with a minimum configurable value of 40ms, a maximum configurable value of 5 seconds, and configurable over 40ms steps.

- **"Fade Off"**: Request that requires the target lighting element to ramp down their illumination level along as perceived linear curve. The default duration shall be 5 seconds, with a minimum configurable value of 40ms, a maximum configurable value of 5 seconds, and configurable over 40ms steps.

- **"Snap On"**: Request that requires the target lighting element to step up their illumination level from an OFF level to a non-OFF level. The default duration shall be not exceed than 40ms with no additional configurability.

- **“Snap Off”**: Request that requires the target lighting element to step down their illumination level from a non-OFF level to an OFF level. The default duration shall be not exceed than 40ms with no additional configurability.

5.3.2 Control Signal Value Targets

The Control Signals tied to the target vehicle’s illumination element shall ramp or snap along the aforementioned curves until they reach a target value that’s defined as either “ON/Embrace” or “OFF” under “RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX” for Ford vehicles and “RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX” for Lincoln vehicles.

ARL call-out	Target Control Signal value	Minimum value	Maximum value	Config. Steps
“ON/Embrace”	80% PWM	20% PWM	100% PWM	1%
“OFF”	<= 15% PWM	0% PWM	15% PWM	1%

5.3.3 Control Signal response transitions based on changes in Welcome/Farewell state and sub-state transitions to meet call-outs in RQTs

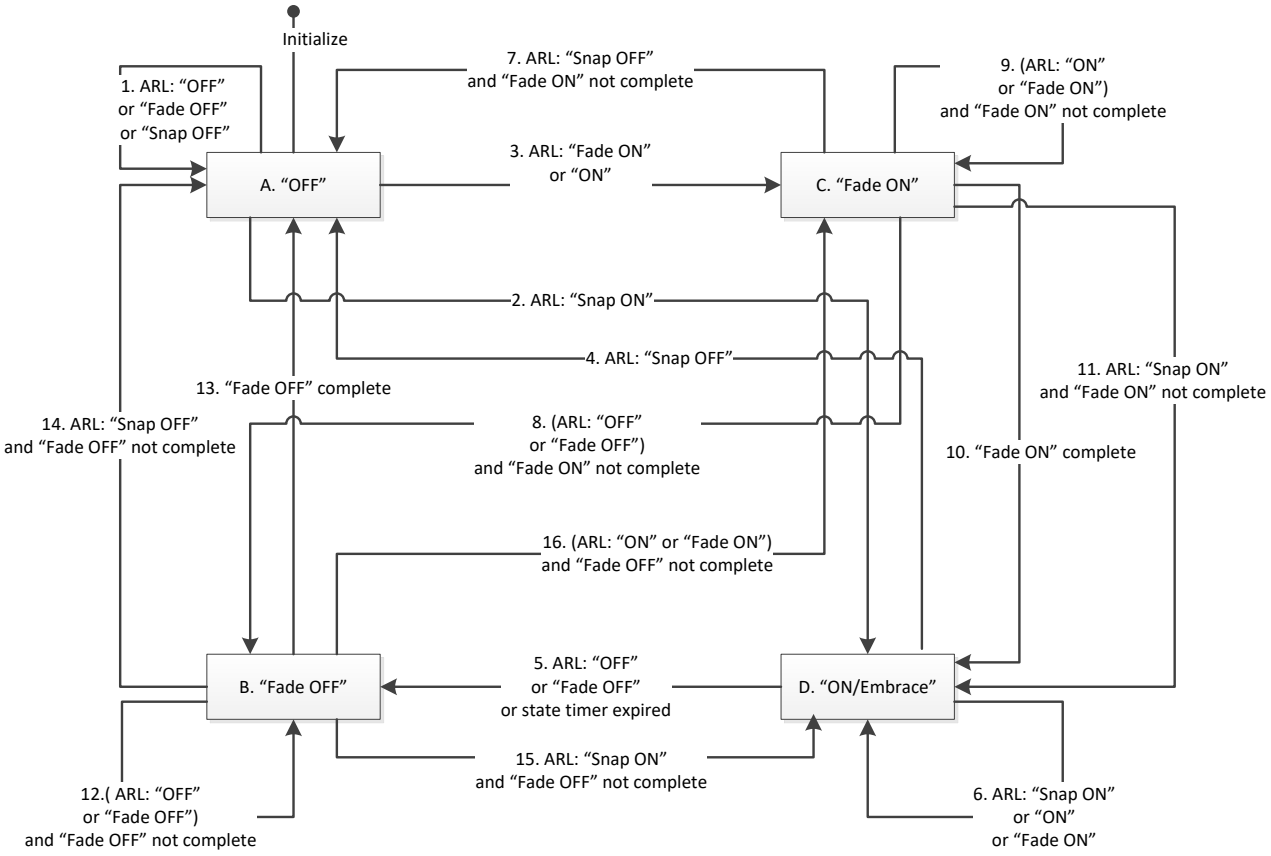


Figure 2: Illumination Control Signal transitions based on ARL requests.

	A -> A.1: No action, remain OFF
	A -> D.2: Illuminate to “ON/Embrace Level”, step function
	A ->C.3: Start “Fade ON” sequence (3 seconds by default)
	C ->A.4: De-illuminate to “OFF” level, step function
	D ->B.5: Start “Fade OFF” sequence (5 seconds by default)

	D ->D.6: Remain at “ON/Embrace” level, reset state time-out timer
	C ->A.7: Interrupt “Fade ON” sequence, de-illuminate to “OFF” level, step function
	C ->B.8: Interrupt “Fade ON” sequence, begin “Fade OFF” sequence. Start “Fade OFF” from same point/level “Fade ON” reached at time of interruption. “Fade OFF” time = % Fade ON complete * Fade OFF total time.
	C ->C.9: Start “Fade ON” sequence after first request. Do not reset “Fade ON” sequence with each new request.
	C ->D.10: “Fade ON” complete. Start state time-out timer.
	C ->D.11: Interrupt “Fade ON” sequence, illuminate to “ON/ Embrace” level, step function
	B ->B.12: Start “Fade OFF” sequence after first request. Do not reset “Fade OFF” sequence with each new request.
	B ->A.13: “Fade OFF” complete. Remain OFF for duration of state.
	B ->A.14: Interrupt “Fade OFF” sequence, de-illuminate to “OFF” level, step function
	B ->D.15: Interrupt “Fade OFF” sequence, illuminate to “ON/ Embrace” level, step function
	B ->C.16: Interrupt “Fade OFF” sequence, begin “Fade ON” sequence. Start “Fade ON” from same point/level “Fade OFF” reached at time of interruption. “Fade ON” time = % Fade OFF complete * Fade ON total time.

NOTE: 1. Additional requirements called out under section 5.3.1.2 Control Signal Definitions and Configurability in satisfying behavior listed under “Control signal response”

5.3.4 **Additional requirements**

- Conflicting requests sent mid illumination ramping (Fade ON -> Fade OFF before Fade ON complete, or Fade OFF -> Fade ON before Fade OFF complete): New Fade request shall be honored starting at illumination level that was reached by previous request while maintaining specified ramp rate (shall complete in lesser time). No time delay required before acting on new Fade request.
- Ignition transitions from OFF to RUN/Start: Front Illumination shall follow legislative requirements on Illumination behavior (can forego “Fade ON” or “Fade OFF” behavior/delays if in conflict legislative requirements)

5.3.5 **Illumination Algorithm inhibits and overrides**

- LE_WF_ Illumination Requestor shall be given the least priority over competing algorithms that control Illumination
- Activating “Perimeter Alarm Mode” or “Panic Alarm” feature as per BCM FS shall inhibit the LE_WF_ Illumination Requestor while feature is active
- Activating “Silent Mode” feature as per BCM FS shall inhibit LE_WF_ Illumination Requestor while feature is active
- Activating “Key-Off-Load Mode” feature as per BCM FS shall inhibit LE_WF_ Illumination Requestor while feature is active
- Activating “Post-Crash Alert” feature as per BCM FS shall inhibit LE_WF_ Illumination Requestor while feature is active.

5.4 LE_WF_ Illumination Response

Function that will accept outputs from the “LE_WF_ Illumination Requestor “ to then have the lighting element(s) in the vehicle respond by illuminating to satisfy the requirements in RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX” for Ford vehicles and “RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX” for Lincoln vehicles

- Vehicle Illumination shall illuminate in response to control signal ramping up
- Vehicle Illumination shall de-illuminate in response to control signal ramping down
- Vehicle Illumination shall consistently illuminate to the same illumination level at a given duty cycle.

- Specific “ON”, “ON/Embrace”, “Snap ON” illumination level for each individual lighting element shall be specified by Vehicle Harmony Group.
- Vehicle Illumination shall meet the requirements specified in section 3.2.2 “Performance Requirements” unless otherwise specified by SME or Vehicle Harmony Group
- Vehicle Illumination shall meet (or not violate) all applicable requirements in section 3.2 “Quality”.
- When the control signal reaches 0% duty cycle the desired Vehicle Illumination element’s intensity level shall equal 0 (go to “OFF”)
- During control signal “Fade ON” sequence, the Vehicle Illumination element shall Fade ON smoothly – no observable flickering.
- During control signal “Fade OFF” sequence, the Vehicle Illumination element shall Fade OFF smoothly – no observable flickering.
- During control signal “Snap ON” sequence, the Vehicle Illumination element shall Snap ON without flickering.
- During control signal “Snap OFF” sequence, the Vehicle Illumination element shall Snap OFF without flickering.
- Vehicle Illumination response to ramping control signals shall not be inhibited if any of the individual Vehicle Illumination lighting elements are malfunctioning/burnout.
- If the Control Signal, Power, or Ground to a specific Vehicle Illumination element is corrupted/disconnects, that specific lighting element shall default to “OFF” (de-illuminated)

5.5 LE_WF_Welcome/ Farewell Display

Vehicles equipped with customer facing displays or display devices i.e. heads-up-displays, shall be required to display combination of “Welcome” or “Farewell” screens based on the outputs from the Welcome/Farewell State and Sub-state determination function. These displays or display devices include but aren’t limited to:

- Center-stack Welcome/Farewell Display (Sync Screen)
- Cluster Welcome/Farewell Display (TFT/Digital portion)
- Heads-up displays (aHUD)

Inputs		Output
Welcome/Farewell State	**Welcome/Farewell Sub-state**	**Welcome/Farewell Animation Request**
Don’t Care[1]	Approach Detection	Wake-up display
Don’t Care[1]	Illumination Entry	Wake-up display (stay awake)
Welcome	Courtesy Lighting – All	Welcome Animation[3]
Welcome	Courtesy Lighting Delay – All	Welcome Animation[3]
Welcome	Courtesy Lighting – Extended	Off (stay awake)
Welcome	Courtesy Lighting Delay – Extended	Off (stay awake)
Welcome	Null	Off (Sleep)
Ignition Run/Start	Don’t Care	Vehicle Start Animation[3] then transition to in-drive display
Don’t Care[2]	Illuminated Exit	Farewell animation[3] or ON
Farewell	Courtesy Lighting – All	Farewell animation[3]
Farewell	Courtesy Lighting Delay – All	Off (Sleep)
Farewell	Courtesy Lighting – Extended	Off (Sleep)
Farewell	Courtesy Lighting Delay – Extended	Off (Sleep)
Farewell	Null	Off (Sleep)
Null	Null	Off (Sleep)

Note 1: State is only possible when “Welcome/Farewell State” = Welcome.
Note 2: State is only possible when “Welcome/Farewell State” = Farewell
Note 3: Specific animation owned by HMI and Studio group.

6 FEATURE VARIANT DESIGN ARCHITECTURE

6.1 Electrical Architecture – FNV3

Please note that the feature does not require specific modules (except the BCM) to be present on a vehicle, and is instead tailored to the content of the vehicle. The following section is a generic starting point to show how functions are allocated based off vehicle content and desired functionality.

6.1.1 Electrical Topology

Applicable for Lincoln and Ford vehicles on the FNV2 architecture

6.1.2 Common Requirements

6.1.2.1 Participating ECUs

Generic list of participating ECUs provided in table below. Functionality along with Publisher and Subscriber requirements will change based on vehicle content.

ECU	Network	CAN		LIN	
		Publisher	Subscriber	Publisher	Subscriber
BCM	FD-1	X		X	
HCM	HS-2	X	X		
LDM					X
ALM					X
OHC					X
Mini-ICP					X
SCCM	HS-2		X		
APIM_CIM	HS-3	X	X		
APIM_CDC	HS-3	X	X		
RACM	HS-3		X		
DDM	FD-3		X		
PDM	FD-3		X		
ECG	G/W	X	X		

6.1.2.2 **Signal Requirements**

The following section lists all of the signals required to complete the desired behaviors required by the Feature. It links the logical data-flows used within this document to the actual CAN OR LIN signals which shall actually be used by the modules.

6.1.2.2.1 CAN Signal Requirements

Signal Database Detail	**Value**
Signal Name	VehWlcmFrwl_D_Stat
Functional Voltage Range (Min,Max)	6-16v
Performance Voltage Range (Min,Max)	9-16v
Source Network	FD1 CAN
Signal refresh rate	500 ms
Publishing Interval (ms)	<= 40ms
Publisher Latency Requirements	If microprocessor is awake: <= 51ms
	If microprocessor is asleep: <=121ms
Publishing Network Sleep Inhibitor	If signal is not equal to Null, then allow for network sleep but not for local sleep
Updates Signal while asleep	Updates on change
Network Wake Up	Wake up network on signal change to non-Null value
Max latency before signal is valid on Network wakeup	<= 50ms
Max latency before signal is valid on reset	<= 120ms
CAN Node Type	FD1
Signal Domain	Refer to data dictionary
Signal Transmit Strategy	Event Periodic
Signal Send Type	OnChange
Signal Transmit Cycle Time	500 ms
End-to-End Latency Requirements	<=250 ms
Publishing ECU	BCM

Signal Database Detail	**Value**
Signal Name	VehWlcmFrwlMde_D_Stat
Functional Voltage Range (Min,Max)	6-16v
Performance Voltage Range (Min,Max)	9-16v
Source Network	FD1 CAN
Signal refresh rate	500 ms
Publishing Interval (ms)	<= 40ms
Publisher Latency Requirements	If microprocessor is awake: <= 51ms
	If microprocessor is asleep: <=121ms
Publishing Network Sleep Inhibitor	If signal is not equal to Null, then allow for network sleep but not for local sleep
Updates Signal while asleep	Updates on change
Network Wake Up	Wake up network on signal change to non-Null value
Max latency before signal is valid on Network wakeup	<= 50ms
Max latency before signal is valid on reset	<= 120ms
CAN Node Type	FD1
Signal Domain	Refer to data dictionary
Signal Transmit Strategy	Event Periodic
Signal Send Type	OnChange

Signal Transmit Cycle Time	500 ms
End-to-End Latency Requirements	<=250 ms
Publishing ECU	BCM

Signal Database Detail	**Value**
Signal Name	Dimming_Lvl
Functional Voltage Range (Min,Max)	6-16v
Performance Voltage Range (Min,Max)	9-16v
Source Network	FD1 CAN
Signal refresh rate	500 ms
Publishing Interval (ms)	<= 40ms
Publisher Latency Requirements	If microprocessor is awake: <= 51ms
	If microprocessor is asleep: <=121ms
Publishing Network Sleep Inhibitor	If signal is not equal to OFF, then allow for network sleep but not for local sleep
Updates Signal while asleep	Updates on change
Network Wake Up	Wake up network on signal change to non-OFF value
Max latency before signal is valid on Network wakeup	<= 50ms
Max latency before signal is valid on reset	<= 120ms
CAN Node Type	FD1
Signal Domain	Refer to data dictionary
Signal Transmit Strategy	Event Periodic
Signal Send Type	OnChange
Signal Transmit Cycle Time	500 ms
End-to-End Latency Requirements	<=250 ms
Publishing ECU	BCM

Signal Database Detail	**Value**
Signal Name	Litval
Functional Voltage Range (Min,Max)	6-16v
Performance Voltage Range (Min,Max)	9-16v
Source Network	FD1 CAN
Signal refresh rate	500 ms
Publishing Interval (ms)	<= 40ms
Publisher Latency Requirements	If microprocessor is awake: <= 51ms
	If microprocessor is asleep: <=121ms
Publishing Network Sleep Inhibitor	If signal is not equal to OFF, then allow for network sleep but not for local sleep
Updates Signal while asleep	Updates on change
Network Wake Up	Wake up network on signal change to non-OFF value
Max latency before signal is valid on Network wakeup	<= 50ms
Max latency before signal is valid on reset	<= 120ms
CAN Node Type	FD1
Signal Domain	Refer to data dictionary
Signal Transmit Strategy	Event Periodic
Signal Send Type	OnChange
Signal Transmit Cycle Time	500 ms
End-to-End Latency Requirements	<=250 ms
Publishing ECU	BCM

Signal Database Detail	Value
Signal Name	HMI_HMIMode_St
Functional Voltage Range (Min,Max)	6-16v
Performance Voltage Range (Min,Max)	9-16v
Source Network	HS3 CAN
Signal refresh rate	500 ms
Publishing Interval (ms)	<= 40ms
Publisher Latency Requirements	If microprocessor is awake: <= 51ms
	If microprocessor is asleep: <=121ms
Publishing Network Sleep Inhibitor	If signal is not equal to OFF, then allow for network sleep but not for local sleep
Updates Signal while asleep	Updates on change
Network Wake Up	Wake up network on signal change to non-OFF value
Max latency before signal is valid on Network wakeup	<= 50ms
Max latency before signal is valid on reset	<= 120ms
CAN Node Type	HS3
Signal Domain	Refer to data dictionary
Signal Transmit Strategy	Event Periodic
Signal Send Type	OnChange
Signal Transmit Cycle Time	500 ms
End-to-End Latency Requirements	<=250 ms
Publishing ECU	APIM

Signal Database Detail	Value
Signal Name	Ignition_Status
Functional Voltage Range (Min,Max)	6-16v
Performance Voltage Range (Min,Max)	9-16v
Source Network	FD1 CAN
Signal refresh rate	500ms
Publishing Interval (ms)	<= 40ms
Publisher Latency Requirements	If microprocessor is awake: <= 51ms
	If microprocessor is asleep: <=121ms
Publishing Network Sleep Inhibitor	If signal is not equal to OFF, then allow for network sleep but not for local sleep
Updates Signal while asleep	Updates on change
Network Wake Up	Wake up network on signal change to non-OFF value
Max latency before signal is valid on Network wakeup	<= 50ms
Max latency before signal is valid on reset	<= 120ms
CAN Node Type	FD1
Signal Domain	Refer to data dictionary
Signal Transmit Strategy	Event Periodic
Signal Send Type	OnChange
Signal Transmit Cycle Time	500 ms
End-to-End Latency Requirements	<=250 ms
Publishing ECU	BCM

Signal Database Detail	Value
Signal Name	ExtLghtAnmtn_D_Rq
Functional Voltage Range (Min,Max)	6-16v
Performance Voltage Range (Min,Max)	9-16v

Source Network	HS3 CAN
Signal refresh rate	500ms
Publishing Interval (ms)	<= 40ms
Publisher Latency Requirements	If microprocessor is awake: <= 51ms
	If microprocessor is asleep: <=121ms
Publishing Network Sleep Inhibitor	If signal is not equal to OFF, then allow for network sleep but not for local sleep
Updates Signal while asleep	Updates on change
Network Wake Up	Wake up network on signal change to non-OFF value
Max latency before signal is valid on Network wakeup	<= 50ms
Max latency before signal is valid on reset	<= 120ms
CAN Node Type	HS3
Signal Domain	Refer to data dictionary
Signal Transmit Strategy	Event Periodic
Signal Send Type	OnChange
Signal Transmit Cycle Time	500 ms
End-to-End Latency Requirements	<=250 ms
Publishing ECU	APIM_CIM

Signal Database Detail	**Value**
Signal Name	TailLghtAnmtn_D_Stat
Functional Voltage Range (Min,Max)	6-16v
Performance Voltage Range (Min,Max)	9-16v
Source Network	HS3 CAN
Signal refresh rate	500ms
Publishing Interval (ms)	<= 40ms
Publisher Latency Requirements	If microprocessor is awake: <= 51ms
	If microprocessor is asleep: <=121ms
Publishing Network Sleep Inhibitor	If signal is not equal to OFF, then allow for network sleep but not for local sleep
Updates Signal while asleep	Updates on change
Network Wake Up	Wake up network on signal change to non-OFF value
Max latency before signal is valid on Network wakeup	<= 50ms
Max latency before signal is valid on reset	<= 120ms
CAN Node Type	HS3
Signal Domain	Refer to data dictionary
Signal Transmit Strategy	Event Periodic
Signal Send Type	OnChange
Signal Transmit Cycle Time	500 ms
End-to-End Latency Requirements	<=250 ms
Publishing ECU	HCM

6.1.2.2.2 Local Sleep Inhibition while Illumination is active

The illumination master ECU (BCM) might initiate a network sleep in low power modes (Ignition_Status < (Run and Start) to minimize battery drainage. At the same time it might be necessary to keep the illumination active (> OFF) in some cases. All components receiving illumination signals shall maintain the last valid illumination signal value > OFF if a valid network sleep is initiated and the last received illumination signal is != OFF. The dimming master (BCM) shall wake-up and distribute the illumination signals = OFF if the condition, which requires illumination, does not exist anymore. Otherwise, illumination is required to stay ON indefinitely.

6.1.2.2.3 CAN Error Handling for Interior Illumination Specific Signals

If a Signal gateway message or Frame gateway message containing either Dimming_Lvl, or HMI_HMIMode_St signal has an update bit which shows “not updated” (signal went “missing”) for less than a period of time as per “Diagnostic Fault Coverage and DTC Numbers Design Consideration” (typically 5 seconds). Then the subscriber shall continue using last known value of those signals.

If a Signal gateway message or Frame gateway message containing Dimming_Lvl, or HMI_HMIMode_St signal has an update bit which shows “not updated” (signal went missing) for greater than a period of time as per “Diagnostic Fault Coverage and DTC Numbers Design Consideration” (typically 5 seconds). Then the subscriber shall follow the following logic:

CAN Input Signals		Output for Dimming Algorithm
Dimming_lvl	**Ignition_Status**	**Dimming_lvl**
Off / missing / unused / invalid	Not-OFF	Night_12
Night_1 ... Night_12, Day_1 … Day_6	Not-OFF	Night_1 ... Night_12, Day_1 … Day_6
Off/ unused / invalid / missing (on reset)	OFF	OFF
Night_1 ... Night_12, Day_1 … Day_6	OFF	Night_1 ... Night_12, Day_1 … Day_6
Night_1 ... Night_12, Day_1 … Day_6 -> Missing	OFF	Keep last valid Dimming_lvl value > Missing (until “OFF” is received)

CAN Input Signals			Internal Illumination Handling
Ignition_Status	**HMI_HMIMode_St**	**Dimming_Lvl**	**Dimming_Lvl**
Run, Start	Don’t care	0x0 to 0x12	0x0 to 0x12
Not (Run, Start)	Don’t care	0x1 to 0x12	0x1 to 0x12
Not (Run, Start)	On	0x0 (OFF) / missing / invalid	Last received value in range (0x1 to 0x12) [1)]
Not (Run, Start)	OFF	missing / invalid	Last received value in range (0x0 to 0x12) [2)]
Not (Run, Start)	Off	0x0 (OFF)	OFF

1) 0xC if last received value in range 0x1 to $0x12_{Dimming\_Lvl}$ cannot be retrieved, only on battery re-connect or ECU reset.
2) 0xC if last received value in range 0x1 to $0x12_{Dimming\_Lvl}$ cannot be retrieved (only on battery re-connect or ECU reset.

6.1.2.2.4 CAN Error Handling for remaining (non-Interior Illumination) Signals

- If a Signal gateway or Frame gateway message containing the transmitted signal has an update bit which shows “not updated” for less than as period of time as per “Diagnostic Fault Coverage and DTC Numbers Design Consideration” (typically 5 seconds). Then the subscriber shall continue using last known value of the signal
- If a Signal gateway or Frame gateway message containing the transmitted signal has an update bit which shows “not updated” for greater than as period of time as per “Diagnostic Fault Coverage and DTC Numbers Design Consideration” (typically 5 seconds). Then the subscriber shall use the signal’s default value as listed in the data dictionary

6.1.2.2.5 CAN Error Handling for Signal Gateway Messages

- If a Signal gateway message containing the transmitted signal has an update bit which shows “not updated” for less than as period of time as per “Diagnostic Fault Coverage and DTC Numbers Design Consideration” (typically 5 seconds). Then the subscriber shall continue using last known value of the signal
- If a Signal gateway message containing the transmitted signal has an update bit which shows “not updated” for greater than as period of time as per “Diagnostic Fault Coverage and DTC Numbers Design Consideration” (typically 5 seconds). Then the subscriber shall use the signal’s default value as listed in the data dictionary

6.1.2.2.6 LIN Signal Requirements

It should be noted that the following section does not cover the level of details included under the previous “CAN Signal Requirements”, since that level of details is owned and controlled by the LIN module owner, and contained within the LDFs.

The intention of this section is to list the required LIN signals to ensure that they are not discarded due to any future LDF updates.

Signal Database Detail	**Value**
Signal Name	Dimming_lvl
Source Network	LIN
Signal refresh rate	<=40ms
Signal Domain	Refer to Data Dictionary
Signal Transmit Strategy	<=40ms Event Periodic
Signal Send Type	OnChange
Signal Transmit Cycle Time	<=40ms Event Periodic
Publishing ECU	BCM

Signal Database Detail	**Value**
Signal Name	Litval
Source Network	LIN
Signal refresh rate	<=40ms
Signal Domain	Refer to Data Dictionary
Signal Transmit Strategy	<=40ms Event Periodic
Signal Send Type	OnChange
Signal Transmit Cycle Time	<=40ms Event Periodic
Publishing ECU	BCM

Signal Database Detail	**Value**
Signal Name	Wfsuperstate
Source Network	LIN
Signal refresh rate	<=40ms
Signal Domain	Refer to Data Dictionary
Signal Transmit Strategy	<=40ms Event Periodic
Signal Send Type	OnChange
Signal Transmit Cycle Time	<=40ms Event Periodic
Publishing ECU	BCM

Signal Database Detail	**Value**
Signal Name	Wfsubstate
Source Network	LIN
Signal refresh rate	<=40ms
Signal Domain	Refer to Data Dictionary
Signal Transmit Strategy	<=40ms Event Periodic
Signal Send Type	OnChange
Signal Transmit Cycle Time	<=40ms Event Periodic
Publishing ECU	BCM

Signal Database Detail	Value
Signal Name	WelcomeFarewell_State
Source Network	LIN
Signal refresh rate	<=40ms
Signal Domain	Refer to Data Dictionary
Signal Transmit Strategy	<=40ms Event Periodic
Signal Send Type	OnChange
Signal Transmit Cycle Time	<=40ms Event Periodic
Publishing ECU	BCM

Signal Database Detail	Value
Signal Name	WelcomeFarewell_Substate
Source Network	LIN
Signal refresh rate	<=40ms
Signal Domain	Refer to Data Dictionary
Signal Transmit Strategy	<=40ms Event Periodic
Signal Send Type	OnChange
Signal Transmit Cycle Time	<=40ms Event Periodic
Publishing ECU	BCM

Signal Database Detail	Value
Signal Name	Customer_Color
Source Network	LIN
Signal refresh rate	<=40ms
Signal Domain	Refer to Data Dictionary
Signal Transmit Strategy	<=40ms Event Periodic
Signal Send Type	OnChange
Signal Transmit Cycle Time	<=40ms Event Periodic
Publishing ECU	BCM

Signal Database Detail	Value
Signal Name	Customer_Intensity
Source Network	LIN
Signal refresh rate	<=40ms
Signal Domain	Refer to Data Dictionary
Signal Transmit Strategy	<=40ms Event Periodic
Signal Send Type	OnChange
Signal Transmit Cycle Time	<=40ms Event Periodic
Publishing ECU	BCM

Signal Database Detail	Value
Signal Name	Ignition_Status
Source Network	LIN
Signal refresh rate	<=40ms
Signal Domain	Refer to Data Dictionary

Signal Transmit Strategy	<=40ms Event Periodic
Signal Send Type	OnChange
Signal Transmit Cycle Time	<=40ms Event Periodic
Publishing ECU	BCM

6.1.3 FNV3 Vehicle ECU specific requirements

All illumination-controlling modules are expected to meet or not violate all the applicable requirements listed within section 3.2

6.1.3.1 **Body Control Module (BCM) Requirements**

The BCM shall meet the requirements listed within section 3.2 “Welcome/Farewell State and Sub-state determination” section/function and transmit the appropriate State and Sub-state over CAN and LIN

Logical Data-flows & Vehicle Harmony RQT call-outs		CAN Signals		LIN Signals				CAN/LIN Signals
Welcome/ Farewell State	**Welcome/ Farewell Substate**	**VehWlcmFrwl_D_Stat**	**VehWlcmFrwlMde_D_Stat**	**Wfsuperstate**	**WFsubstate**	**WelcomeFarewell _State**	**WelcomeFarewell _SubState**	**Dimming_lvl**
Welcome	Approach Detection	WELCOME	APPROACH	WELCOME	Approach	WELCOME	APPROACH	Off
Welcome	Illuminated Entry	WELCOME	ILLUMINATEDENTRY	WELCOME	IllumEntry	WELCOME	ENTRY	Off
Welcome	Courtesy Lighting - All	WELCOME	COURTESYLIGHTINGALL	WELCOME	DoorAjar CourtesyLight	WELCOME	DOOR	Non-OFF
Welcome	Courtesy Lighting Delay - All	WELCOME	COURTESYLIGHTINGDELAYALL	WELCOME	Courtesy LightDelay	WELCOME	DELAY	Non-OFF
Welcome	Courtesy Lighting - Extended	WELCOME	COURTESYLIGHTINGEXTENDED	Don’t Care	NULL	Don’t Care	NULL	Off
Welcome	Courtesy Lighting Delay - Extended	WELCOME	COURTESYLIGHTINGDELAYEXT	Don’t Care	NULL	Don’t Care	NULL	Off
Welcome	NULL	WELCOME	NULL	WELCOME	NULL	WELCOME	NULL	Off
Ignition Run/Start	Don’t care	RUNSTART	Don’t care	RUNSTART	Don’t care	RUN_START	Don’t’ Care	Non-OFF
Farewell	Illuminated Exit	FAREWELL	ILLUMINATEDEXIT	FAREWELL	IllumExit	FAREWELL	EXIT	Non-OFF
Farewell	Courtesy Lighting - All	FAREWELL	COURTESYLIGHTINGALL	FAREWELL	DoorAjar CourtesyLight	FAREWELL	DOOR	Non-OFF
Farewell	Courtesy Lighting Delay - All	FAREWELL	COURTESYLIGHTINGDELAYALL	FAREWELL	Courtesy LightDelay	FAREWELL	DELAY	Non-OFF
Farewell	Courtesy Lighting - Extended	FAREWELL	COURTESYLIGHTINGEXTENDED	Don’t Care	NULL	Don’t Care	NULL	Off
Farewell	Courtesy Lighting Delay - Extended	FAREWELL	COURTESYLIGHTINGDELAYEXT	Don’t Care	NULL	Don’t Care	NULL	Off
Farewell	NULL	FAREWELL	NULL	FAREWELL	NULL	FAREWELL	NULL	Off
NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	Off

6.1.3.1.1 BCM Hardwired Exterior Illumination:

The BCM shall utilize the following functions to support illumination control of Exterior Illumination, as per RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX" for Ford vehicles and "RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX" for Lincoln vehicles, directly hardwired to it (combination of Front, Rear, and Supplementary):

- "Welcome/Farewell State and Sub-state determination", section 5.2.
- "LE_WF_Illumination Requestor", section 5.3, with the following default values:
  - Fade On = 700ms
  - Fade Off = 1700ms
- "LE_WF_Illumination Response", section 5.4.

6.1.3.1.2 BCM Hardwired Interior Courtesy Lamp Illumination:

The BCM shall utilize the following functions to support illumination control of Interior Courtesy Lamps, as per RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX" for Ford vehicles and "RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX" for Lincoln vehicles, directly hardwired to it (combination of Dome Lamps and Cargo Lamps):

- "Welcome/Farewell State and Sub-state determination", section 5.2.
- "LE_WF_Illumination Requestor", section 5.3, with the following default values:
  - Fade On = 700ms
  - Fade Off = 1700ms
- "LE_WF_Illumination Response", section 5.4.

6.1.3.1.3 BCM Hardwired Switch Backlighting Illumination:

The BCM shall utilize the following functions to support illumination control of Interior Switch Backlighting, as per RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX" for Ford vehicles and "RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX" for Lincoln vehicles, directly hardwired to it:

- "Welcome/Farewell State and Sub-state determination", section 5.2.
- "LE_WF_Illumination Requestor", section 5.3, with the following default values:
  - Fade On = 700ms
  - Fade Off = 1700ms
- "LE_WF_Illumination Response", section 5.4.

6.1.3.1.4 BCM Hardwired Illumination Summary

Logical Data-flows & Vehicle Harmony RQT call-outs		**Exterior Illumination "LE_WF_Illumination _Requestor" summary[1]**	**Interior Courtesy Lamp "LE_WF_Illumination_ Requestor" summary[1]**	**Switch Backlighting "LE_WF_Illumination _Requestor" summary[1]**
Welcome/ Farewell State	**Welcome/ Farewell Substate**			
Welcome	Approach Detection	"Fade On"	"Fade On"	"Fade Off" or "Off"
Welcome	Illuminated Entry	"Fade On" or "On/Embrace"	"Fade On" or "On/Embrace"	"Fade Off" or "Off"
Welcome	Courtesy Lighting - All	"Fade On" or "On/Embrace"	"Fade On" or "On/Embrace"	"Fade On" or "On/Embrace"
Welcome	Courtesy Lighting Delay - All	"Fade On" or "On/Embrace"	"Fade On" or "On/Embrace"	"Fade On" or "On/Embrace"
Welcome	Courtesy Lighting - Extended	"Fade Off" or "Off"	"Fade On" or "On/Embrace"	"Fade Off" or "Off"
Welcome	Courtesy Lighting Delay - Extended	"Fade Off" or "Off"	"Fade Off" or "Off"	"Fade Off" or "Off"
Welcome	NULL	"Fade Off" or "Off"	"Fade Off" or "Off"	"Fade Off" or "Off"

Ignition Run/Start	Don't care	In-drive setting/Legislative mode	In-drive setting/Legislative mode	In-drive setting/Legislative mode
Farewell	Illuminated Exit	"On/Embrace"	"On/Embrace"	"On/Embrace"
Farewell	Courtesy Lighting - All	"Fade On" or "On/Embrace"	"Fade On" or "On/Embrace"	"Fade On" or "On/Embrace"
Farewell	Courtesy Lighting Delay - All	"Fade On" or "On/Embrace"	"Fade On" or "On/Embrace"	"Fade On" or "On/Embrace"
Farewell	Courtesy Lighting - Extended	"Fade Off" or "Off"	"Fade On" or "On/Embrace"	"Fade Off" or "Off"
Farewell	Courtesy Lighting Delay - Extended	"Fade Off" or "Off"	"Fade Off" or "Off"	"Fade Off" or "Off"
Farewell	NULL	"Fade Off" or "Off"	"Fade Off" or "Off"	"Fade Off" or "Off"
NULL	NULL	"Fade Off" or "Off"	"Fade Off" or "Off"	"Fade Off" or "Off"

Note 1: Summary is a generic response, exact response per each Illumination element listed in RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX" for Ford vehicles and "RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX" for Lincoln vehicles

6.1.3.2 **LED Driver Module (LDM) requirements**

The LDM shall utilize the following functions and signals to support illumination control of Front Exterior Illumination, as per RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX" for Ford vehicles and "RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX" for Lincoln vehicles, directly hardwired to it:

- Subscribe to "WFState" and "WFSubstate" published by BCM via LIN as part of "Welcome/Farewell State and Sub-state determination" function in section 5.2.
- "LE_WF_Illumination Requestor", section 5.3, with the following default values:
  - Fade On = 3 seconds
  - Fade Off = 5 seconds
- "LE_WF_Illumination Response", section 5.4.

LIN Signals		**Front Exterior Illumination "LE_WF_Illumination_Requestor" summary[1]**
Wfstate	**WFsubstate**	
WELCOME	Approach	"Fade On"
WELCOME	IllumEntry	"Fade On" or "On/Embrace"
WELCOME	DoorAjarCourtesyLight	"Fade On" or "On/Embrace"
WELCOME	CourtesyLightDelay	"Fade On" or "On/Embrace"
WELCOME	NULL	"Fade Off" or "Off"
RUNSTART	Don't care	In-drive setting/Legislative mode
FAREWELL	IllumExit	"On/Embrace"
FAREWELL	DoorAjarCourtesyLight	"Fade On" or "On/Embrace"
FAREWELL	CourtesyLightDelay	"Fade On" or "On/Embrace"
FAREWELL	NULL	"Fade Off" or "Off"
NULL	NULL	"Fade Off" or "Off"

Note 1: Summary is a generic response, exact response per each Front Exterior Illumination element listed in RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX" for Ford vehicles and "RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX" for Lincoln vehicles

6.1.3.3 **Rear Fade-Control-Module (R-FCM) requirements**

The R-FCM shall utilize the following functions and signals to support illumination control of Rear Exterior Illumination, as per RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX" for Ford vehicles and "RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX" for Lincoln vehicles, directly hardwired to it:

- Subscribe to "WFState" and "WFSubstate" published by BCM via LIN as part of "Welcome/Farewell State and Sub-state determination" function in section 5.2.

- "LE_WF_Illumination Requestor", section 5.3, with the following default values:
  - Fade On = 3 seconds
  - Fade Off = 5 seconds
- "LE_WF_Illumination Response", section 5.4.

LIN Signals		Rear Exterior Illumination "LE_WF_Illumination_Requestor" summary[1]
Wfsuperstate	**WFsubstate**	
WELCOME	Approach	"Fade On"
WELCOME	IllumEntry	"Fade On" or "On/Embrace"
WELCOME	DoorAjarCourtesyLight	"Fade On" or "On/Embrace"
WELCOME	CourtesyLightDelay	"Fade On" or "On/Embrace"
WELCOME	NULL	"Fade Off" or "Off"
RUNSTART	Don't care	In-drive setting/Legislative mode
FAREWELL	IllumExit	"On/Embrace"
FAREWELL	DoorAjarCourtesyLight	"Fade On" or "On/Embrace"
FAREWELL	CourtesyLightDelay	"Fade On" or "On/Embrace"
FAREWELL	NULL	"Fade Off" or "Off"
NULL	NULL	"Fade Off" or "Off"

Note 1: Summary is a generic response, exact response per each Rear Exterior Illumination element listed in RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX" for Ford vehicles and "RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX" for Lincoln vehicles

6.1.3.4 **Overhead Console (OHC) requirements**

The OHC shall utilize the following functions and signals to support illumination control of Interior Courtesy Lamp Illumination, as per RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX" for Ford vehicles and "RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX" for Lincoln vehicles, directly hardwired to it:

- Subscribe to "WelcomeFarewell_State" and "WelcomeFarewell_Substate" published by BCM via LIN as part of "Welcome/Farewell State and Sub-state determination" function in section 5.2.
  - Additionally subscribe to Door Ajar Signals (listed below)
- "LE_WF_Illumination Requestor", section 5.3, with the following default values:
  - Fade On = 3 seconds
  - Fade Off = 5 seconds
- "LE_WF_Illumination Response", section 5.4.

LIN Signals			Interior Courtesy Lamp Illumination "LE_WF_Illumination_Requestor" summary[1]
Welcome Farewell_State	**Welcome Farewell_Substate**	**Door_Ajar_Status**	
WELCOME	Approach	Don't Care	"Fade On"
WELCOME	IllumEntry	Don't Care	"Fade On" or "On/Embrace"
WELCOME	Door	Don't Care	"Fade On" or "On/Embrace"
WELCOME	Delay	Don't Care	"Fade On" or "On/Embrace"
WELCOME	NULL	DF_Door_Ajar_Status | PF_Door_Ajar_Status | DR_Door_Ajar_Status | PR_Door_Ajar_Status = Open	"Fade On" or "On/Embrace"
WELCOME	NULL	DF_Door_Ajar_Status & PF_Door_Ajar_Status & DR_Door_Ajar_Status & PR_Door_Ajar_Status = Closed	"Fade Off" or "Off"
RUNSTART	Don't care	Don't Care	In-drive setting/Legislative mode
FAREWELL	IllumExit	Don't Care	"On/Embrace"

FAREWELL	Door	Don't Care	"Fade On" or "On/Embrace"
FAREWELL	Delay	Don't Care	"Fade On" or "On/Embrace"
FAREWELL	NULL	DF_Door_Ajar_Status | PF_Door_Ajar_Status | DR_Door_Ajar_Status | PR_Door_Ajar_Status = Open	"Fade On" or "On/Embrace"
FAREWELL	NULL	DF_Door_Ajar_Status & PF_Door_Ajar_Status & DR_Door_Ajar_Status & PR_Door_Ajar_Status = Closed	"Fade Off" or "Off"
NULL	NULL	DF_Door_Ajar_Status | PF_Door_Ajar_Status | DR_Door_Ajar_Status | PR_Door_Ajar_Status = Open	"Fade On" or "On/Embrace"
NULL	NULL	DF_Door_Ajar_Status & PF_Door_Ajar_Status & DR_Door_Ajar_Status & PR_Door_Ajar_Status = Closed	"Fade Off" or "Off"

Note 1: Summary is a generic response, exact response per each Interior Courtesy Lamp Illumination element listed in RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX" for Ford vehicles and "RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX" for Lincoln vehicles

6.1.3.5 **Ambient Light Module (ALM) & Mini-ICP requirements**

The ALM and Mini-ICP shall utilize the following functions and signals to support illumination control of Interior Ambient Lighting and Mini-ICP Illumination, as per RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX" for Ford vehicles and "RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX" for Lincoln vehicles, directly hardwired to it:

- Subscribe to "WelcomeFarewell_State" and "WelcomeFarewell_Substate" published by BCM via LIN as part of "Welcome/Farewell State and Sub-state determination" function in section 5.2.
  - Additionally subscribe to "Customer_Color" and "Customer_Intensity"
- "LE_WF_Illumination Requestor", section 5.3, with the following default values:
  - Fade On = 700ms
  - Fade Off = 1700ms
- "LE_WF_Illumination Response", section 5.4.

LIN Signals		**Interior Ambient Lighting Illumination "LE_WF_Illumination_Requestor" summary[1]**
Welcome Farewell_State	**Welcome Farewell_Substate**	
WELCOME	Approach	"Fade On" [2]
WELCOME	Entry	"Fade On" or "On/Embrace" [2]
WELCOME	Door	"Fade On" or "On/Embrace" [2]
WELCOME	Delay	"Fade On" or "On/Embrace" [2]
WELCOME	NULL	"Fade Off" or "Off"
RUNSTART	Don't care	In-drive setting/Legislative mode
FAREWELL	Exit	"On/Embrace" [2]
FAREWELL	Door	"Fade On" or "On/Embrace" [2]
FAREWELL	Delay	"Fade On" or "On/Embrace" [2]
FAREWELL	NULL	"Fade Off" or "Off"
NULL	NULL	"Fade Off" or "Off"

Note 1: Summary is a generic response, exact response per each Interior Ambient Lighting Illumination element listed in RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX" for Ford vehicles and "RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX" for Lincoln vehicles

Note 2: Shall monitor Customer_Color and Customer_Intensity to determine Color and Intensity of ambient lighting while illuminated

6.1.3.6 **Headlamp Switch (HDLPSW-LIN) requirements**

The HDLPSW-LIN shall utilize the following functions and signals to support illumination control of Switch-Backlighting Illumination, as per RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX" for Ford vehicles and "RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX" for Lincoln vehicles, directly hardwired to it:

- Subscribe to "Dimming_lvl" published by BCM via LIN.
  - Additionally subscribe to "Litval" to meet "Smooth Dimming" requirements
- "LE_WF_Illumination Requestor", section 5.3, with the following default values:
  - Fade On = 40ms
  - Fade Off = 40ms
- "LE_WF_Illumination Response", section 5.4.

LIN Signals		**Switch-Backlighting Illumination "LE_WF_Illumination_Requestor" summary[1]**	**Illumination Intensity[2]**
Dimming_lvl	**Ignition_Status**		
Off/ unused / invalid / missing (on reset)	Not-OFF	"Fade On" or "On/Embrace"	Night_12
Night_1 ... Night_12, Day_1 … Day_6	Not-OFF	"Fade On" or "On/Embrace"	Night_1 ... Night_12, Day_1 … Day_6
Night_1 ... Night_12, Day_1 … Day_6 -> Missing	Not-OFF	"Fade On" or "On/Embrace"	Keep last valid Dimming_lvl value > Missing (until "OFF" is received)
Off/ unused / invalid / missing (on reset)	OFF	"Fade Off" or "Off"	Off
Night_1 ... Night_12, Day_1 … Day_6	OFF	"Fade On" or "On/Embrace" to intensity	Night_1 ... Night_12, Day_1 … Day_6[2]
Night_1 ... Night_12, Day_1 … Day_6 -> Missing	OFF	"Fade On" or "On/Embrace" to intensity	Keep last valid Dimming_lvl value > Missing (until "OFF" is received)

Note 1: Summary is a generic response, exact response listed in RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX" for Ford vehicles and "RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX" for Lincoln vehicles
Note 2: Shall also monitor and adjust illumination intensity based off of changes in Litval, in order to meet "Cockpit Illumination"/"Smooth Dimming" requirements listed in latest version of ES-H1BT-1A278-AA-VXX

6.1.3.7 **Steering Column Control Module (SCCM) requirements**

The SCCM shall utilize the following functions and signals to support illumination control of Switch-Backlighting Illumination, as per RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX" for Ford vehicles and "RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX" for Lincoln vehicles, directly hardwired to it:

- Subscribe to "Dimming_lvl" published by BCM via CAN.
  - Additionally subscribe to "Litval" to meet "Smooth Dimming" requirements
- "LE_WF_Illumination Requestor", section 5.3, with the following default values:
  - Fade On = 40ms
  - Fade Off = 40ms
- "LE_WF_Illumination Response", section 5.4.

CAN Signals		**Switch-Backlighting Illumination "LE_WF_Illumination_Requestor" summary[1]**	**Illumination Intensity[2]**
Dimming_lvl	**Ignition_Status**		
Off/ unused / invalid / missing (on reset)	Not-OFF	"Fade On" or "On/Embrace"	Night_12

Night_1 ... Night_12, Day_1 … Day_6	Not-OFF	“Fade On” or “On/Embrace”	Night_1 ... Night_12, Day_1 … Day_6
Night_1 ... Night_12, Day_1 … Day_6 -> Missing	Not-OFF	“Fade On” or “On/Embrace”	Keep last valid Dimming_lvl value > Missing (until “OFF” is received)
Off/ unused / invalid / missing (on reset)	OFF	“Fade Off” or “Off”	Off
Night_1 ... Night_12, Day_1 … Day_6	OFF	“Fade On” or “On/Embrace” to intensity	Night_1 ... Night_12, Day_1 … Day_6[2]
Night_1 ... Night_12, Day_1 … Day_6 -> Missing	OFF	“Fade On” or “On/Embrace” to intensity	Keep last valid Dimming_lvl value > Missing (until “OFF” is received)

Note 1: Summary is a generic response, exact response listed in RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX” for Ford vehicles and “RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX” for Lincoln vehicles
Note 2: Shall also monitor and adjust illumination intensity based off of changes in Litval, in order to meet “Cockpit Illumination”/”Smooth Dimming” requirements listed in latest version of ES-H1BT-1A278-AA-VXX

6.1.3.8 **Instrument Panel Cluster (IPC) requirements**

6.1.3.8.1 IPC Welcome/Farewell Graphics

The IPC shall utilize the following functions to support Welcome/Farewell animation transitions, as per RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX” for Ford vehicles and “RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX” for Lincoln vehicles, for displays directly connected to it:

- “Welcome/Farewell State and Sub-state determination”, section 5.2.
- “LE_WF_Welcome/Farewell Display”, section 5.5

CAN Inputs		**LE_WF_Welcome/Farewell Display**	
VehWlcmFrwl_D_Stat	**VehWlcmFrwlMde_D_Stat**	**Welcome/Farewell Animation Request**	**Odometer display**
WELCOME	APPROACH	Wake-up display	Off
WELCOME	ILLUMINATEDENTRY	Wake-up display (stay awake)	Off
WELCOME	COURTESYLIGHTINGALL	Welcome Animation[1]	On[2]
WELCOME	COURTESYLIGHTINGDELAYALL	Welcome Animation[1]	Off
WELCOME	COURTESYLIGHTINGEXTENDED	Off (stay awake)	Off
WELCOME	COURTESYLIGHTINGDELAYEXT	Off (stay awake)	Off
WELCOME	NULL	Off (Sleep)	Off
RUNSTART	Don’t care	Vehicle Start Animation[1] then transition to in-drive display	On[2]
FAREWELL	ILLUMINATEDEXIT	Farewell animation[1]	On[2]
FAREWELL	COURTESYLIGHTINGALL	Off (stay awake)	On[2]
FAREWELL	COURTESYLIGHTINGDELAYALL	Off (Sleep)	Off
FAREWELL	COURTESYLIGHTINGEXTENDED	Off (Sleep)	Off
FAREWELL	COURTESYLIGHTINGDELAYEXT	Off (Sleep)	Off
FAREWELL	NULL	Off (Sleep)	Off
NULL	NULL	Off (Sleep)	Off

Note 1: Specific animation owned by HMI and Studio group.
Note 2: Intensity to illuminate to dimming_lvl, refer to section 6.1.2.2.3 “CAN Error Handling for Interior Illumination Specific Signals” for additional details

6.1.3.8.2 IPC Display Intensity and Backlighting

The IPC shall utilize the following functions to support illumination control of its Display and all other lighting emitting sources within it i.e. backlighting, halo rings, gauges etc. as per RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX" for Ford vehicles and "RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX" for Lincoln vehicles:

- Subscribe to "Dimming_lvl" published by BCM via CAN.
  - Additionally subscribe to "Litval" to meet "Smooth Dimming" requirements
- "LE_WF_Illumination Requestor", section 5.3, with the following default values:
  - Fade On = 40ms
  - Fade Off = 40ms
- "LE_WF_Illumination Response", section 5.4.

CAN Signals		**Display and Backlighting Illumination "LE_WF_Illumination_Requestor" summary[1]**	**Illumination Intensity[2]**
Dimming_lvl	**Ignition_Status**		
Off/ unused / invalid / missing (on reset)	Not-OFF	"Fade On" or "On/Embrace"	Night_12
Night_1 ... Night_12, Day_1 … Day_6	Not-OFF	"Fade On" or "On/Embrace"	Night_1 ... Night_12, Day_1 … Day_6
Night_1 ... Night_12, Day_1 … Day_6 -> Missing	Not-OFF	"Fade On" or "On/Embrace"	Keep last valid Dimming_lvl value > Missing (until "OFF" is received)
Off/ unused / invalid / missing (on reset)	OFF	"Fade Off" or "Off" [3]	Off[3]
Night_1 ... Night_12, Day_1 … Day_6	OFF	"Fade On" or "On/Embrace" to intensity	Night_1 ... Night_12, Day_1 … Day_6[2]
Night_1 ... Night_12, Day_1 … Day_6 -> Missing	OFF	"Fade On" or "On/Embrace" to intensity	Keep last valid Dimming_lvl value > Missing (until "OFF" is received)

Note 1: Summary is a generic response, exact response listed in RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX" for Ford vehicles and "RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX" for Lincoln vehicles
Note 2: Shall also monitor and adjust illumination intensity based off of changes in Litval, in order to meet "Cockpit Illumination"/"Smooth Dimming" requirements listed in latest version of ES-H1BT-1A278-AA-VXX
Note 3: Illuminate to Night_12 intensity if warnings present, for duration of active warning.

6.1.3.9 **Accessory Protocol Interface Module (APIM/SYNC) requirements**

6.1.3.9.1 APIM Welcome/Farewell Graphics

The APIM shall utilize the following functions to support Welcome/Farewell animation transitions, as per RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX" for Ford vehicles and "RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX" for Lincoln vehicles, for displays directly connected to it:

- "Welcome/Farewell State and Sub-state determination", section 5.2.
- "LE_WF_Welcome/Farewell Display", section 5.5

CAN Inputs		**LE_WF_Welcome/Farewell Display**
VehWlcmFrwl_D_Stat	**VehWlcmFrwlMde_D_Stat**	**Welcome/Farewell Animation Request**
WELCOME	APPROACH	Wake-up display
WELCOME	ILLUMINATEDENTRY	Wake-up display (stay awake)
WELCOME	COURTESYLIGHTINGALL	Welcome Animation[1]
WELCOME	COURTESYLIGHTINGDELAYALL	Welcome Animation[1]
WELCOME	COURTESYLIGHTINGEXTENDED	Off (stay awake)
WELCOME	COURTESYLIGHTINGDELAYEXT	Off (stay awake)
WELCOME	NULL	Off (Sleep)
RUNSTART	Don't care	Vehicle Start Animation[3] then transition to in-drive display

FAREWELL	ILLUMINATEDEXIT	ON
FAREWELL	COURTESYLIGHTINGALL	Farewell animation[1]
FAREWELL	COURTESYLIGHTINGDELAYALL	Off (Sleep)
FAREWELL	COURTESYLIGHTINGEXTENDED	Off (Sleep)
FAREWELL	COURTESYLIGHTINGDELAYEXT	Off (Sleep)
FAREWELL	NULL	Off (Sleep)
NULL	NULL	Off (Sleep)

Note 1: Specific animation owned by HMI and Studio group.

6.1.3.9.2 APIM Display Intensity and Backlighting

The APIM shall utilize the following functions to support illumination control of its Display and all other lighting emitting sources within it i.e. switch backlighting etc. as per RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX" for Ford vehicles and "RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX" for Lincoln vehicles:

- Subscribe to "Dimming_lvl" published by BCM via CAN.
  - Additionally subscribe to "Litval" to meet "Smooth Dimming" requirements
- "LE_WF_Illumination Requestor", section 5.3, with the following default values:
  - Fade On = 40ms
  - Fade Off = 40ms
- "LE_WF_Illumination Response", section 5.4.

CAN Signals			**Display and Backlighting Illumination "LE_WF_Illumination_ Requestor" summary[1]**	**Illumination Intensity[2]**
Dimming_lvl	**Ignition _Status**	**HMI_HMIMode_St (Extended Play)**		
Off/ unused / invalid / missing (on reset)	Not-OFF	Don't' Care	"Fade On" or "On/Embrace"	Night_12
Night_1 ... Night_12, Day_1 … Day_6	Not-OFF	Don't' Care	"Fade On" or "On/Embrace"	Night_1 ... Night_12, Day_1 … Day_6
Night_1 ... Night_12, Day_1 … Day_6 -> Missing	Not-OFF	Don't' Care	"Fade On" or "On/Embrace"	Night_1 ... Night_12, Day_1 … Day_6
Night_1 ... Night_12, Day_1 … Day_6	OFF	Don't Care	"Fade On" or "On/Embrace" to intensity	Night_1 ... Night_12, Day_1 … Day_6[2]
Night_1 ... Night_12, Day_1 … Day_6 -> Missing	OFF	Don't Care	"Fade On" or "On/Embrace" to intensity	Last non-OFF value: Night_1 ... Night_12, Day_1 … Day_6[3] (until "OFF" is received)
Off/ unused / invalid / missing (on reset)	OFF	Off	"Fade Off" or "Off"	Off
Off/ unused / invalid / missing (on reset)	OFF	Not-OFF	"Fade On" or "On/Embrace"	Last non-OFF value: Night_1 ... Night_12, Day_1 … Day_6[3]

Note 1: Summary is a generic response, exact response listed in RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX" for Ford vehicles and "RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX" for Lincoln vehicles

Note 2: Shall also monitor and adjust illumination intensity based off of changes in Litval, in order to meet "Cockpit Illumination"/"Smooth Dimming" requirements listed in latest version of ES-H1BT-1A278-AA-VXX

Note 3: Only applicable to Audio Control switch/knob backlighting. Remaining backlighting can go to OFF. If previous Dimming_lvl non-OFF value cannot be determined, illuminate to Night_12 intensity

6.1.3.10 **Front Control Interface Module (FCIM, FCIMB) requirements**

6.1.3.10.1 FCIM/FCIMB Display Intensity and Backlighting

The FCIM/FCIMB shall utilize the following functions to support illumination control of its switch backlighting. as per RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX" for Ford vehicles and "RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX" for Lincoln vehicles:

- Subscribe to "Dimming_lvl" published by BCM and "HMI_HMIMode_St published by APIM via CAN.
  - Additionally subscribe to "Litval" to meet "Smooth Dimming" requirements
- "LE_WF_Illumination Requestor", section 5.3, with the following default values:
  - Fade On = 40ms
  - Fade Off = 40ms
- "LE_WF_Illumination Response", section 5.4.

CAN Signals			Backlighting Illumination "LE_WF_Illumination_ Requestor" summary[1]	Illumination Intensity[2]
Dimming_lvl	**Ignition _Status**	**HMI_HMIMode_St (Extended Play)**		
Off/ unused / invalid / missing (on reset)	Not-OFF	Don't' Care	"Fade On" or "On/Embrace"	Night_12
Night_1 ... Night_12, Day_1 … Day_6	Not-OFF	Don't' Care	"Fade On" or "On/Embrace"	Night_1 ... Night_12, Day_1 … Day_6
Night_1 ... Night_12, Day_1 … Day_6 -> Missing	Not-OFF	Don't' Care	"Fade On" or "On/Embrace"	Night_1 ... Night_12, Day_1 … Day_6
Night_1 ... Night_12, Day_1 … Day_6	OFF	Don't Care	"Fade On" or "On/Embrace" to intensity	Night_1 ... Night_12, Day_1 … Day_6[2]
Night_1 ... Night_12, Day_1 … Day_6 -> Missing	OFF	Don't Care	"Fade On" or "On/Embrace" to intensity	Last non-OFF value: Night_1 ... Night_12, Day_1 … Day_6[3] (until "OFF" is received)
Off/ unused / invalid / missing (on reset)	OFF	Off	"Fade Off" or "Off"	Off
Off/ unused / invalid / missing (on reset)	OFF	Not-OFF	"Fade On" or "On/Embrace"	Last non-OFF value: Night_1 ... Night_12, Day_1 … Day_6[3]

Note 1: Summary is a generic response, exact response listed in RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX" for Ford vehicles and "RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX" for Lincoln vehicles
Note 2: Shall also monitor and adjust illumination intensity based off of changes in Litval, in order to meet "Cockpit Illumination"/"Smooth Dimming" requirements listed in latest version of ES-H1BT-1A278-AA-VXX
Note 3: Only applicable to Audio Control switch/knob backlighting. Remaining backlighting can go to OFF. If previous Dimming_lvl non-OFF value cannot be determined, illuminate to Night_12 intensity

6.1.3.11 **Rear Audio Control Module (RACM) requirements**

6.1.3.11.1 RACM Welcome/Farewell Graphics

The RACM shall utilize the following functions to support Welcome/Farewell animation transitions, as per RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX" for Ford vehicles and "RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX" for Lincoln vehicles, for displays directly connected to it:

- "Welcome/Farewell State and Sub-state determination", section 5.2.
- "LE_WF_Welcome/Farewell Display", section 5.5

CAN Inputs		LE_WF_Welcome/Farewell Display
VehWlcmFrwl_D_Stat	**VehWlcmFrwlMde_D_Stat**	**Welcome/Farewell Animation Request**
WELCOME	APPROACH	OFF(but Wake-up display)
WELCOME	ILLUMINATEDENTRY	**OFF** - But Wake-up Display (Or Stay Awake, If Already Awake)
WELCOME	COURTESYLIGHTINGALL	**ON** - Start Welcome Animation
WELCOME	COURTESYLIGHTINGDELAYALL	**ON** - (And Continue Welcome Animation1 Until End, If Applicable)

WELCOME	COURTESYLIGHTINGEXTENDED	Off (stay awake)
WELCOME	COURTESYLIGHTINGDELAYEXT	Off (stay awake)
WELCOME	NULL	Off (Sleep)
RUNSTART	Don't care	**ON** - Usable Interface ASAP
FAREWELL	ILLUMINATEDEXIT	**ON** - Usable Interface ASAP (Only ON if Display not Manually Turned OFF)
FAREWELL	COURTESYLIGHTINGALL	**ON** - Start Farewell Screen/Animation and Continue Until End
FAREWELL	COURTESYLIGHTINGDELAYALL	Off (Sleep)
FAREWELL	COURTESYLIGHTINGEXTENDED	Off (Sleep)
FAREWELL	COURTESYLIGHTINGDELAYEXT	Off (Sleep)
FAREWELL	NULL	Off (Sleep)
NULL	NULL	Off (Sleep)

Note 1: Specific animation owned by HMI and Studio group.

6.1.3.11.2 RACM Display Intensity and Backlighting

The RACM shall utilize the following functions to support illumination control of its Display and all other lighting emitting sources within it i.e. switch backlighting etc. as per RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX" for Ford vehicles and "RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX" for Lincoln vehicles:

- Subscribe to "Dimming_lvl" published by BCM and "HMI_HMIMode_St published by APIM via CAN.
  - Additionally subscribe to "Litval" to meet "Smooth Dimming" requirements
- "LE_WF_Illumination Requestor", section 5.3, with the following default values:
  - Fade On = 40ms
  - Fade Off = 40ms
- "LE_WF_Illumination Response", section 5.4.

CAN Signals			**Display and Backlighting Illumination "LE_WF_Illumination_ Requestor" summary[1]**	**Illumination Intensity[2]**
Dimming_lvl	**Ignition _Status**	**HMI_HMIMode_St (Extended Play)**		
Off/ unused / invalid / missing (on reset)	Not-OFF	Don't' Care	"Fade On" or "On/Embrace"	Night_12
Night_1 ... Night_12, Day_1 … Day_6	Not-OFF	Don't' Care	"Fade On" or "On/Embrace"	Night_1 ... Night_12, Day_1 … Day_6
Night_1 ... Night_12, Day_1 … Day_6 -> Missing	Not-OFF	Don't' Care	"Fade On" or "On/Embrace"	Night_1 ... Night_12, Day_1 … Day_6
Night_1 ... Night_12, Day_1 … Day_6	OFF	Don't Care	"Fade On" or "On/Embrace" to intensity	Night_1 ... Night_12, Day_1 … Day_6[2]
Night_1 ... Night_12, Day_1 … Day_6 -> Missing	OFF	Don't Care	"Fade On" or "On/Embrace" to intensity	Last non-OFF value: Night_1 ... Night_12, Day_1 … Day_6[3] (until "OFF" is received)
Off/ unused / invalid / missing (on reset)	OFF	Off	"Fade Off" or "Off"	Off
Off/ unused / invalid / missing (on reset)	OFF	Not-OFF	"Fade On" or "On/Embrace"	Last non-OFF value: Night_1 ... Night_12, Day_1 … Day_6[3]

Note 1: Summary is a generic response, exact response listed in RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX" for Ford vehicles and "RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX" for Lincoln vehicles
Note 2: Shall also monitor and adjust illumination intensity based off of changes in Litval, in order to meet "Cockpit Illumination"/"Smooth Dimming" requirements listed in latest version of ES-H1BT-1A278-AA-VXX
Note 3: Only applicable to Audio Control switch/knob backlighting. Remaining backlighting can go to OFF. If previous Dimming_lvl non-OFF value cannot be determined, illuminate to Night_12 intensity

6.1.3.12 **Austere Heads-Up Display (aHUD) requirements**

6.1.3.12.1 aHUD Welcome/Farewell Graphics

The aHUD shall utilize the following functions to support Welcome/Farewell animation transitions, as per RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX" for Ford vehicles and "RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX" for Lincoln vehicles, for displays directly connected to it:

- "Welcome/Farewell State and Sub-state determination", section 5.2.
- "LE_WF_Welcome/Farewell Display", section 5.5

CAN Inputs		**LE_WF_Welcome/Farewell Display**
VehWlcmFrwl_D_Stat	**VehWlcmFrwlMde_D_Stat**	**Welcome/Farewell Animation Request**
WELCOME	APPROACH	Wake-up display
WELCOME	ILLUMINATEDENTRY	Wake-up display (stay awake)
WELCOME	COURTESYLIGHTINGALL	Off (stay awake)
WELCOME	COURTESYLIGHTINGDELAYALL	Off (stay awake)
WELCOME	COURTESYLIGHTINGEXTENDED	Off (stay awake)
WELCOME	COURTESYLIGHTINGDELAYEXT	Off (stay awake)
WELCOME	NULL	Off (Sleep)
RUNSTART	Don't care	Vehicle Start Animation[3] then transition to in-drive display
FAREWELL	ILLUMINATEDEXIT	Farewell animation[1]
FAREWELL	COURTESYLIGHTINGALL	Off (stay awake)
FAREWELL	COURTESYLIGHTINGDELAYALL	Off (Sleep)
FAREWELL	COURTESYLIGHTINGEXTENDED	Off (Sleep)
FAREWELL	COURTESYLIGHTINGDELAYEXT	Off (Sleep)
FAREWELL	NULL	Off (Sleep)
NULL	NULL	Off (Sleep)

Note 1: Specific animation owned by HMI and Studio group.

6.1.3.12.2 aHUD Display Intensity and Backlighting

The aHUD shall utilize the following functions to support illumination control of its Display and all other lighting emitting sources as per RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX" for Ford vehicles and "RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX" for Lincoln vehicles:

- Subscribe to "Dimming_lvl" published by BCM via CAN.
  - Additionally subscribe to "Litval" to meet "Smooth Dimming" requirements
- "LE_WF_Illumination Requestor", section 5.3, with the following default values:
  - Fade On = 40ms
  - Fade Off = 40ms
- "LE_WF_Illumination Response", section 5.4.

CAN Signals		**Display and Backlighting Illumination "LE_WF_Illumination_Requestor" summary[1]**	**Illumination Intensity[2]**
Dimming_lvl	**Ignition_Status**		
Off/ unused / invalid / missing (on reset)	Not-OFF	"Fade On" or "On/Embrace"	Night_12
Night_1 ... Night_12, Day_1 … Day_6 -> Missing	Not-OFF	"Fade On" or "On/Embrace"	Keep last valid Dimming_lvl value > Missing (until "OFF" is received)
Night_1 ... Night_12, Day_1 … Day_6	Not-OFF	"Fade On" or "On/Embrace"	Night_1 ... Night_12, Day_1 … Day_6
Off/ unused / invalid / missing (on reset)	OFF	"Fade Off" or "Off" [3]	Off[3]

Night_1 ... Night_12, Day_1 … Day_6	OFF	“Fade On” or “On/Embrace”	Night_1 ... Night_12, Day_1 … Day_6[2]
Night_1 ... Night_12, Day_1 … Day_6 -> Missing	OFF	“Fade On” or “On/Embrace”	Keep last valid Dimming_lvl value > Missing (until “OFF” is received)

Note 1: Summary is a generic response, exact response listed in RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX” for Ford vehicles and “RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX” for Lincoln vehicles
Note 2: Shall also monitor and adjust illumination intensity based off of changes in Litval, in order to meet “Cockpit Illumination”/”Smooth Dimming” requirements listed in latest version of ES-H1BT-1A278-AA-VXX
Note 3: Illuminate to Night_12 intensity if warnings present, for duration of active warning.

6.1.3.13 **Door Control Modules (DDM/PDM) requirements**

6.1.3.13.1 DDM/PDM Hardwired Exterior Illumination:

The DDM/PDM shall utilize the following functions to support illumination control of Exterior Illumination, as per RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX” for Ford vehicles and “RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX” for Lincoln vehicles, directly hardwired to it (combination of Puddle Lamps, Welcome Mats, Door Keypad Illumination):

- “Welcome/Farewell State and Sub-state determination”, section 5.2.
- “LE_WF_Illumination Requestor”, section 5.3, with the following default values:
  - Fade On = 700ms
  - Fade Off = 1700ms
- “LE_WF_Illumination Response”, section 5.4.

6.1.3.13.2 DDM/PDM Auto-fold Mirrors Control:

The DDM/PDM shall utilize the following functions to support folding control of Mirrors, as per RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX” for Ford vehicles and “RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX” for Lincoln vehicles:

- “Welcome/Farewell State and Sub-state determination”, section 5.2.

6.1.3.13.3 DDM/PDM Hardwired Exterior Illumination/Mirrors Summary:

CAN Signals		**Exterior Illumination “LE_WF_ Illumination_ Requestor” summary[1]**	**Autofold Mirrors**
VehWlcmFrwl_ D_Stat	**VehWlcmFrwlMde_D_Stat**		
WELCOME	APPROACH	“Fade On” or “Animation”	Fold (remain folded)
WELCOME	ILLUMINATEDENTRY	“Fade On” or “Animation”	Fold (remain folded)
WELCOME	COURTESYLIGHTINGALL	“Fade Off” or “Off”	Fold (remain folded)
WELCOME	COURTESYLIGHTINGDELAYALL	“Off”	Unfold (remain unfolded)
WELCOME	COURTESYLIGHTINGEXTENDED	“Off”	Fold (remain folded)
WELCOME	COURTESYLIGHTINGDELAYEXT	“Off”	Unfold (remain unfolded)
WELCOME	NULL	“Off”	Unfold (remain unfolded)
RUNSTART	Don’t care	“Off”	Unfold (remain unfolded)
FAREWELL	ILLUMINATEDEXIT	“Off”	Unfold (remain unfolded)
FAREWELL	COURTESYLIGHTINGALL	“Off”	Unfold (remain unfolded)
FAREWELL	COURTESYLIGHTINGDELAYALL	“Off”	Unfold (remain unfolded)
FAREWELL	COURTESYLIGHTINGEXTENDED	“Off”	Unfold (remain unfolded)

FAREWELL	COURTESYLIGHTINGDELAYEXT	"Off"	Unfold (remain unfolded)
FAREWELL	NULL	"Off"	Unfold (remain unfolded)
NULL	NULL	"Off"	Fold (remain folded)

Note 1: Summary is a generic response, exact response per each Illumination element listed in RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX" for Ford vehicles and "RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX" for Lincoln vehicles

6.1.3.13.4 DDM/PDM Hardwired Interior Switch Backlighting Illumination:

The DDM/PDM shall utilize the following functions to support illumination control of its Interior Trim Switch Backlighting as per RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX" for Ford vehicles and "RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX" for Lincoln vehicles:

- Subscribe to "Dimming_lvl" published by BCM via CAN.
  - Additionally subscribe to "Litval" to meet "Smooth Dimming" requirements
- "LE_WF_Illumination Requestor", section 5.3, with the following default values:
  - Fade On = 40ms
  - Fade Off = 40ms
- "LE_WF_Illumination Response", section 5.4.

CAN Signals		**Interior Switch Backlighting Illumination "LE_WF_Illumination_Requestor" summary[1]**	**Illumination Intensity[2]**
Dimming_lvl	**Ignition_Status**		
Off/ unused / invalid / missing (on reset)	Not-OFF	"Fade On" or "On/Embrace"	Night_12
Night_1 ... Night_12, Day_1 … Day_6 -> Missing	Not-OFF	"Fade On" or "On/Embrace"	Keep last valid Dimming_lvl value > Missing (until "OFF" is received)
Night_1 ... Night_12, Day_1 … Day_6	Not-OFF	"Fade On" or "On/Embrace"	Night_1 ... Night_12, Day_1 … Day_6
Off/ unused / invalid / missing (on reset)	OFF	"Fade Off" or "Off"	Off
Night_1 ... Night_12, Day_1 … Day_6	OFF	"Fade On" or "On/Embrace"	Night_1 ... Night_12, Day_1 … Day_6[2]
Night_1 ... Night_12, Day_1 … Day_6 -> Missing	OFF	"Fade On" or "On/Embrace"	Keep last valid Dimming_lvl value > Missing (until "OFF" is received)

Note 1: Summary is a generic response, exact response listed in RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX" for Ford vehicles and "RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX" for Lincoln vehicles
Note 2: Shall also monitor and adjust illumination intensity based off of changes in Litval, in order to meet "Cockpit Illumination"/"Smooth Dimming" requirements listed in latest version of ES-H1BT-1A278-AA-VXX

6.1.3.14 **Rear-HVAC (R-HVAC) requirements**

6.1.3.14.1 R-HVAC Hardwired Interior Switch Backlighting Illumination:

The R-HVAC shall utilize the following functions to support illumination control of its Switch Backlighting as per RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX" for Ford vehicles and "RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX" for Lincoln vehicles:

- Subscribe to "Dimming_lvl" published by BCM via CAN.
  - Additionally subscribe to "Litval" to meet "Smooth Dimming" requirements
- "LE_WF_Illumination Requestor", section 5.3, with the following default values:
  - Fade On = 40ms
  - Fade Off = 40ms
- "LE_WF_Illumination Response", section 5.4.

CAN Signals		Interior Switch Backlighting Illumination "LE_WF_Illumination_Requestor" summary[1]	Illumination Intensity[2]
Dimming_lvl	**Ignition_Status**		
Off/ unused / invalid / missing (on reset)	Not-OFF	"Fade On" or "On/Embrace"	Night_12
Night_1 ... Night_12, Day_1 … Day_6 -> Missing	Not-OFF	"Fade On" or "On/Embrace"	Keep last valid Dimming_lvl value > Missing (until "OFF" is received)
Night_1 ... Night_12, Day_1 … Day_6	Not-OFF	"Fade On" or "On/Embrace"	Night_1 ... Night_12, Day_1 … Day_6
Off/ unused / invalid / missing (on reset)	OFF	"Fade Off" or "Off"	Off
Night_1 ... Night_12, Day_1 … Day_6	OFF	"Fade On" or "On/Embrace"	Night_1 ... Night_12, Day_1 … Day_6[2]
Night_1 ... Night_12, Day_1 … Day_6 -> Missing	OFF	"Fade On" or "On/Embrace"	Keep last valid Dimming_lvl value > Missing (until "OFF" is received)

Note 1: Summary is a generic response, exact response listed in RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX" for Ford vehicles and "RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX" for Lincoln vehicles

Note 2: Shall also monitor and adjust illumination intensity based off of changes in Litval, in order to meet "Cockpit Illumination"/"Smooth Dimming" requirements listed in latest version of ES-H1BT-1A278-AA-VXX

6.1.3.15 **All Terrain Control Module (ATCM/SDM) requirements**

6.1.3.15.1 ATCM/SDM Hardwired Interior Switch Backlighting Illumination:

The ATCM/SDM shall utilize the following functions to support illumination control of its Switch Backlighting as per RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX" for Ford vehicles and "RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX" for Lincoln vehicles:

- Subscribe to "Dimming_lvl" published by BCM via CAN.
    - Additionally subscribe to "Litval" to meet "Smooth Dimming" requirements
- "LE_WF_Illumination Requestor", section 5.3, with the following default values:
    - Fade On = 40ms
    - Fade Off = 40ms
- "LE_WF_Illumination Response", section 5.4.

CAN Signals		Interior Switch Backlighting Illumination "LE_WF_Illumination_Requestor" summary[1]	Illumination Intensity[2]
Dimming_lvl	**Ignition_Status**		
Off/ unused / invalid / missing (on reset)	Not-OFF	"Fade On" or "On/Embrace"	Night_12
Night_1 ... Night_12, Day_1 … Day_6 -> Missing	Not-OFF	"Fade On" or "On/Embrace"	Keep last valid Dimming_lvl value > Missing (until "OFF" is received)
Night_1 ... Night_12, Day_1 … Day_6	Not-OFF	"Fade On" or "On/Embrace"	Night_1 ... Night_12, Day_1 … Day_6
Off/ unused / invalid / missing (on reset)	OFF	"Fade Off" or "Off"	Off
Night_1 ... Night_12, Day_1 … Day_6	OFF	"Fade On" or "On/Embrace"	Night_1 ... Night_12, Day_1 … Day_6[2]
Night_1 ... Night_12, Day_1 … Day_6 -> Missing	OFF	"Fade On" or "On/Embrace"	Keep last valid Dimming_lvl value > Missing (until "OFF" is received)

Note 1: Summary is a generic response, exact response listed in RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX" for Ford vehicles and "RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX" for Lincoln vehicles
Note 2: Shall also monitor and adjust illumination intensity based off of changes in Litval, in order to meet "Cockpit Illumination"/"Smooth Dimming" requirements listed in latest version of ES-H1BT-1A278-AA-VXX

6.1.3.16 **Headlamp Control Module requirements**

6.1.3.16.1 Exterior Lighting Illumination:

The rear lighting modules shall utilize the following functions and signals to support illumination control of Rear Exterior Illumination, as per RQT-002004-021878 DNA Welcome-Farewell Strategy Rev. XX" for Ford vehicles and "RQT-002004-022094 Lincoln Embrace Welcome and Farewell Behavior Rev. XX" for Lincoln vehicles, directly hardwired to it:

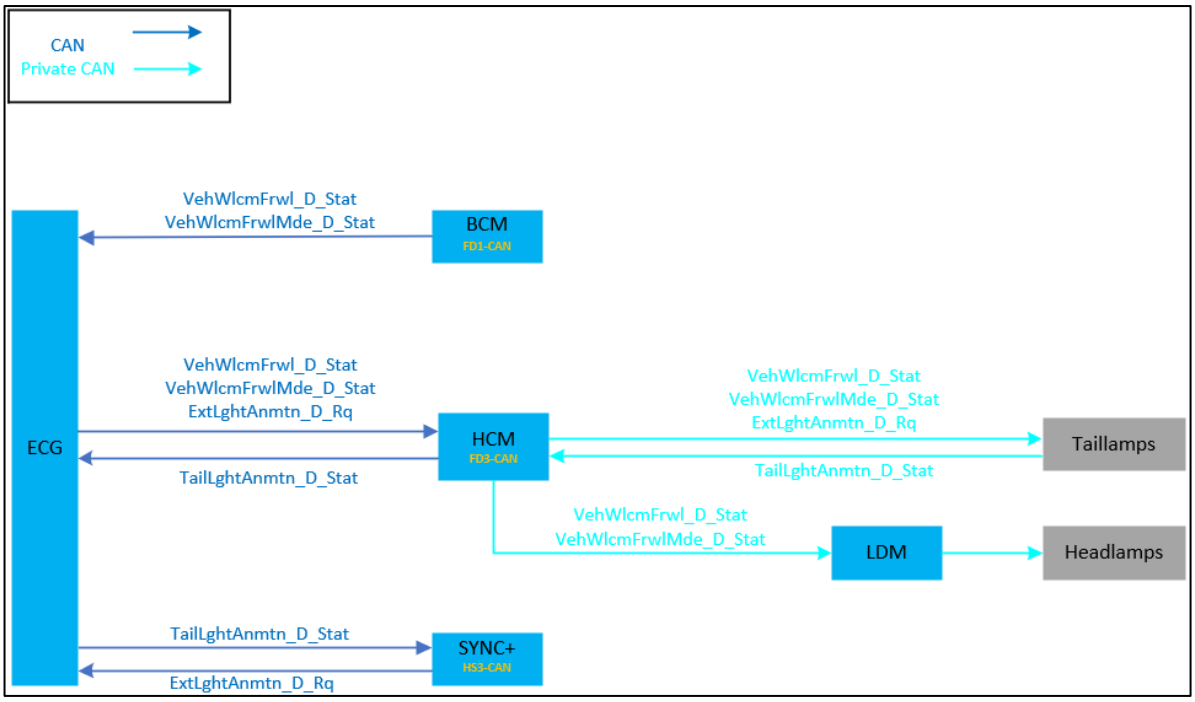
- Subscribe to "VehWlcmFrwl_D_Stat" and "VehWlcmFrwlMde_D_Stat" sent by HCM via private CAN as part of "Welcome/Farewell State and Sub-state determination" function in section 5.2.
- "LE_WF_Illumination Requestor", section 5.3, with the following default values:
  - Fade On = 3 seconds
  - Fade Off = 5 seconds
- "LE_WF_Illumination Response", section 5.4.

6.1.3.16.2 Exterior Lighting Illumination Summary:

Private CAN Signals		**Exterior Lighting Illumination "LE_WF_Illumination_Requestor" summary[1]**
VehWlcmFrwl_D_Stat	**VehWlcmFrwlMde_D_Stat**	
WELCOME	APPROACH	"Fade On" or "Animation"
WELCOME	ILLUMINATEDENTRY	"Fade On" or "Animation"
WELCOME	COURTESYLIGHTINGALL	"On/Embrace"
WELCOME	COURTESYLIGHTINGEXTEND	"Off"
WELCOME	COURSTEYLIGHTINGDELAYALL	"On/Embrace"
WELCOME	COURSTEYLIGHTINGDELAYEXTEND	"On/Embrace"
WELCOME	NULL	"Fade Off" or "Off"
RUNSTART	Don't care	In-drive setting/Legislative mode
FAREWELL	ILLUMINATEDEXIT	"On/Embrace"
FAREWELL	COURTESYLIGHTINGALL	On/Embrace"
FAREWELL	COURTESYLIGHTINGEXTEND	"Off"
FAREWELL	COURSTEYLIGHTINGDELAYALL	"On/Embrace"
FAREWELL	COURSTEYLIGHTINGDELAYEXTEND	"On/Embrace"
FAREWELL	NULL	"Fade Off" or "Off"
NULL	NULL	"Fade Off" or "Animation"

6.1.3.16.3 Boundary Diagram

Headlamp control module receives public CAN signals of "VehWlcmFrwl_D_Stat" and "VehWlcmFrwlMde_D_Stat" that send by BCM, and transmits these two signals via private CAN to headlamps and taillamps to indicate vehicle welcome farewell status.



Other than welcome farewell status signals, HCM also transmits the signal of “ExtLghtAnmtn_D_Rq” to taillamps that send by APIM_CIM(SYNC+) which indicates which exterior lighting animation type is selected by customer through center screen.
Also, Taillamps would also send the private CAN signal of “TailLghtAnmtn_D_Stat” which tells HCM the real animation type that taillamps play. HCM would transmit the signal via public CAN to APIM_CIM(SYNC+) and check if it matches with the selected animation.

6.1.3.16.4 Rear Lighting Animation Setting:

6.1.3.16.4.1 Rear Lighting Animation Client and Sever

The rear lighting animation client interfaces with the user via HMI and is responsible for sending the rear lighting animation setting request to the rear lighting animation server.
The rear lighting animation server is responsible for the rear lighting animation function and interfaces with the rear lighting animation client.

6.1.3.16.4.2 Use Case

Actors	Vehicle front seat occupant(s)
Pre-conditions	Ignition is ON Center stack display is ON and stay at “Rear Lighting Animation” menu
Scenario Description	User selects an animation among three selections via rear lighting animation HMI
Post-conditions	The selected rear lighting animation is the new one and is saved in APIM The selected animation signal transfers from APIM_CIM to HCM via public CAN, then transfers via private CAN to taillamp modules Rear lighting animation settings in HMI shows the animation is selected
Notes	The corresponding animation effect could be showed in HMI when user select it. The specific HMI design is owned by studio or HMI team.

6.1.3.16.4.3 Interface Requirements

Message Type: Request

Note: Request signal from rear lighting animation client to rear lighting animation server to select which animation should be selected and showed for rear lighting.

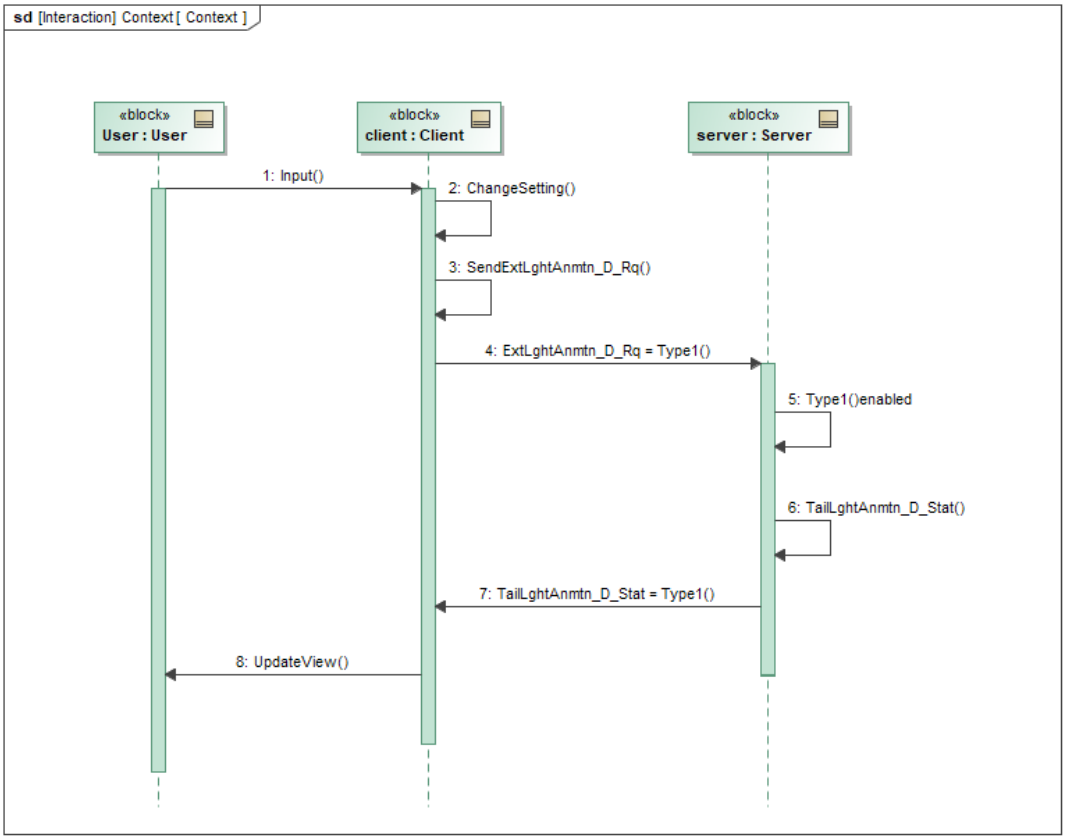
Logical Signal Name	Literals	Value	Description
ExtLghtAnmtn_D_Rq	Null	0x0	Default value.
	Type1	0x1	The first type of exterior lighting animation.
	Type2	0x2	The second type of exterior lighting animation.
	Type3	0x3	The third type of exterior lighting animation.
	Type4	0x4	The fourth type of exterior lighting animation.
	Type5	0x5	The fifth type of exterior lighting animation.
	Type6	0x6	The sixth type of exterior lighting animation.

Logical Signal Name	Literals	Value	Description
TailLghtAnmtn_D_Stat	Null	0x0	Default value.
	Type1	0x1	The first type of taillight animation is played.
	Type2	0x2	The second type of taillight animation is played.
	Type3	0x3	The third type of taillight animation is played.
	Type4	0x4	The fourth type of taillight animation is played.
	Type5	0x5	The fifth type of taillight animation is played.
	Type6	0x6	The sixth type of taillight animation is played.

APIM_CIM would send “ExtLghtAnmtn_D_Rq” for synchronization with taillamp when ignition is on every time. Apart from that, when customer click center screen for choosing a type of rear lighting animation, “ExtLghtAnmtn_D_Rq” will be sent also.

6.1.3.16.4.4 Sequence Diagram

Pre-Condition:
Ignition Status is on
Center stack display is ON and stay at “Rear Lighting Animation” menu



7 DATA DICTIONARY

7.1 Dictionary

Name: **Customer_Color**
Description: Color X, where X is a value in the range of 0 → 15 and corresponds to the customer's selected color
Type: Discrete
Category: LIN
Initial Value: 0
Storage Class: Non-Volatile – Customer Set
Structure of Data: Scalar
Units: N/A
Resolution: 1
Min Value: 0
Max Value: 15

Name: **Customer_Intensity**
Description: A value in the range of 0 → 0xF and corresponds to the customer's selected intensity.
Type: Discrete
Category: LIN
Initial Value: 1
Storage Class: Non-Volatile – Customer Set
Structure of Data: Scalar
Units: N/A
Resolution: 1
Min Value: 0
Max Value: 15

Name: **Dimming_Lvl**
Description: Intensity level of dimmable backlighting.
Type: Discrete
Category: CAN and LIN
Initial Value: NIGHT_12
Storage Class: Volatile
Structure of Data: Scalar

Domain	Domain Element Description
DAY_1	daytime step 1, minimum daytime mode brightness
DAY_2	daytime step 2
DAY_3	daytime step 3
DAY_4	daytime step 4
DAY_5	daytime step 5
DAY_6	daytime step 6, maximum daytime mode brightness
INVALID	means that the BCM is not configured for Day-time Dimmable Backlighting
NIGHT_1	nighttime step 1, minimum nighttime mode brightness
NIGHT_10	nighttime step 10
NIGHT_11	nighttime step 11
NIGHT_12	nighttime step 12, maximum nighttime mode brightness
NIGHT_2	nighttime step 2
NIGHT_3	nighttime step 3
NIGHT_4	nighttime step 4
NIGHT_5	nighttime step 5
NIGHT_6	nighttime step 6
NIGHT_7	nighttime step 7
NIGHT_8	nighttime step 8
NIGHT_9	nighttime step 9
OFF	backlighting is off
UNKNOWN	is not used. BCM never sets this to UNKNOWN.

Name: **Litval**
Description: An indication of ambient light level for use by modules implementing non-standard dimmable backlighting.
Type: Discrete
Category: CAN & LIN
Initial Value: NIGHT
Storage Class: Volatile
Structure of Data: Scalar

Domain	Domain Element Description
DAY	ambient light is at day level
NIGHT	ambient light is at night level
TWILIGHT_1	ambient light is at twilight 1 level
TWILIGHT_2	ambient light is at twilight 2 level
TWILIGHT_3	ambient light is at twilight 3 level
TWILIGHT_4	ambient light is at twilight 4 level

Name: **HMI_HMIMode_St**
Description: Multimedia system state
Type: Discrete
Category: CAN
Initial Value: OFF
Storage Class: Volatile
Structure of Data: Scalar

Domain	Domain Element Description
Invalid	Invalid state (error)
OffMode	Sync screen is OFF

On	Sync screen is ON

Name: **Ignition_Status**
Description: The processed value for current Ignition state.
Type: Discrete
Category: CAN
Initial Value: OFF
Storage Class: Volatile
Structure of Data: Scalar

Domain	Domain Element Description
ACC	ignition is in the ACC position
OFF	ignition is in the OFF position
RUN	ignition is in the RUN position
START	ignition is in the START position

Name: **Wfsuperstate**
Description: Indicates the different phases of Courtesy illumination. i.e Welcome/Farewell/Iginition Run. Used by Exterior Lighting specific modules connected to BCM via LIN
Type: Discrete
Category: LIN
Initial Value: NULL
Storage Class: Volatile
Structure of Data: Scalar

Domain	Domain Element Description
OFF	Vehicle is not in any part of Welcome/Farewell
WELCOME	Vehicle is in Welcome State
RUNSTART	Vehicle is in Ignition Run/Start State
FAREWELL	Vehicle is in Farewell State

Name: **Wfsubstate**
Description: Tell the status of BCM current welcome farewell Substate(i.e. Entry, Door, Delay, Exit, Approach) on LIN. Used by Exterior Lighting specific modules connected to BCM via LIN
Type: Discrete
Category: LIN
Initial Value: NULL
Storage Class: Volatile
Structure of Data: Scalar

Domain	Domain Element Description
NULL	Vehicle is either locked or timed out of states
IllumEntry	Vehicle was unlocked from outside of vehicle
IllEXIT	Vehicle ignition has transitioned to OFF
DoorAjarCourtesyLight	Vehicle door(s) transitioned to Ajar
CourtesyLightDelay	Vehicle door(s) transitioned from Ajar to all Closed
APPROACH	Vehicle Approach was detected

Name: **WelcomeFarewell_State**
Description: Indicates the different phases of Courtesy illumination. i.e Welcome/Farewell/Iginition Run. Used by Interior Lighting specific modules connected to BCM via LIN
Type: Discrete
Category: LIN
Initial Value: NULL
Storage Class: Volatile
Structure of Data: Scalar

Domain	Domain Element Description
NULL	Vehicle is not in any part of Welcome/Farewell
WELCOME	Vehicle is in Welcome State
RUN_START	Vehicle is in Ignition Run/Start State
FAREWELL	Vehicle is in Farewell State

Name: **WelcomeFarewell_Substate**

Description: Tell the status of BCM current welcome farewell Substate(i.e. Entry, Door, Delay, Exit, Approach) on LIN. Used by Interior Lighting specific modules connected to BCM via LIN
Type: Discrete
Category: LIN
Initial Value: NULL
Storage Class: Volatile
Structure of Data: Scalar

Domain	Domain Element Description
NULL	Vehicle is either locked or timed out of states
APPROACH	Vehicle Approach was detected
DELAY	Vehicle door(s) transitioned from Ajar to all Closed
DOOR	Vehicle door(s) transitioned to Ajar
ENTRY	Vehicle was unlocked from outside of vehicle
EXIT	Vehicle ignition has transitioned to OFF

Name: **VehWlcmFrwl_D_Stat**
Description: Indicates the different phases of Welcome/Farewell. i.e Welcome/Farewell/Iginition Run.
Type: Discrete
Category: CAN
Initial Value: NULL
Storage Class: Volatile
Structure of Data: Scalar

Domain	Domain Element Description
NULL	Vehicle is not in any part of Welcome/Farewell
WELCOME	Vehicle is in Welcome State
FAREWELL	Vehicle is in Farewell State
RUNSTART	Vehicle is in Ignition Run/Start State

Name: **VehWlcmFrwlMde_D_Stat**
Description: Tell the status of BCM current welcome farewell Substate on CAN.
Type: Discrete
Category: CAN
Initial Value: NULL
Storage Class: Volatile
Structure of Data: Scalar

Domain	Domain Element Description
NULL	Vehicle is either locked or timed out of states
APPROACH	Vehicle Approach was detected
ILLUMINATEDENTRY	Vehicle was unlocked from outside of vehicle
COURTESYLIGHTINGALL	Vehicle door(s) transitioned to Ajar – Interior and Exterior
COURTESYLIGHTINGDELAYALL	Vehicle door(s) transitioned from Ajar to all Closed – Interior and Exterior
COURTESYLIGHTINGEXTENDED	Vehicle door(s) transitioned to Ajar – Interior only
COURTESYLIGHTINGDELAYEXT	Vehicle door(s) transitioned from Ajar to all Closed – Interior only
ILLUMINATEDEXIT	Vehicle ignition has transitioned to OFF

Name: **ExtLghtAnmtn_D_Rq**
Description: Request the customer selected animation type.
Type: Discrete
Category: CAN
Initial Value: Null
Storage Class: Volatile
Structure of Data: Scalar

Domain	Domain Element Description
Null	Default value.
Type1	The first type of exterior lighting animation.
Type2	The second type of exterior lighting animation.
Type3	The third type of exterior lighting animation.

Type4	The fourth type of exterior lighting animation.
Type5	The fifth type of exterior lighting animation.
Type6	The sixth type of exterior lighting animation.

Name: **TailLghtAnmtn_D_Stat**
Description: Response from the taillight that indicates the type of animation played.
Type: Discrete
Category: CAN
Initial Value: Null
Storage Class: Volatile
Structure of Data: Scalar

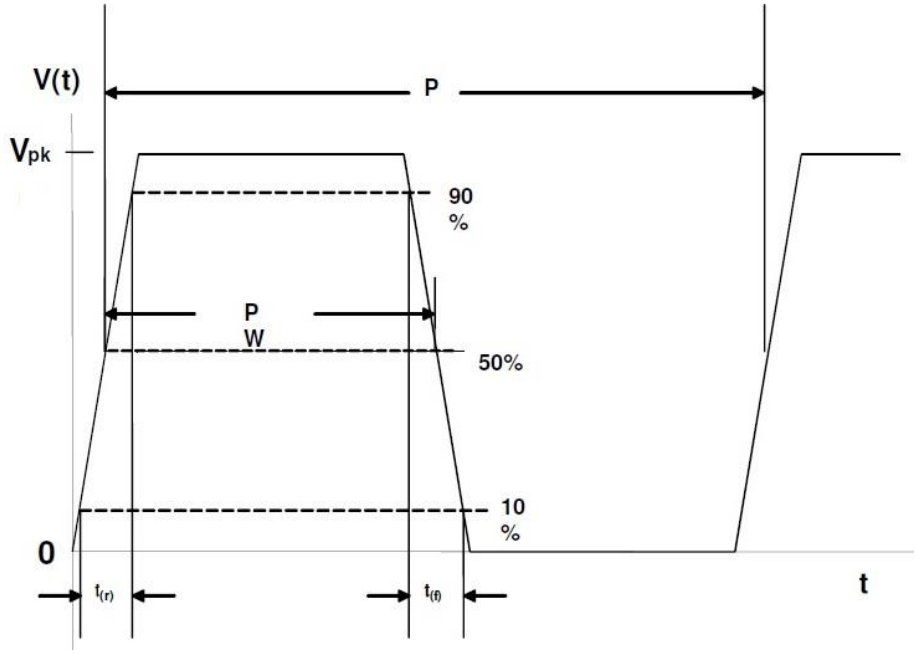
Domain	Domain Element Description
Null	Default value.
Type1	The first type of taillight animation is played.
Type2	The second type of taillight animation is played.
Type3	The third type of taillight animation is played.
Type4	The fourth type of taillight animation is played.
Type5	The fifth type of taillight animation is played.
Type6	The sixth type of taillight animation is played.

8 REVISION HISTORY

Revision Level	Name	Change Description	Date
V2.0	FEHSAN2	Initial Release	9/20/2018
V2.2.2	YWU150	Headlamp Control Module Requirements	4/27/2021

9 APPENDIX

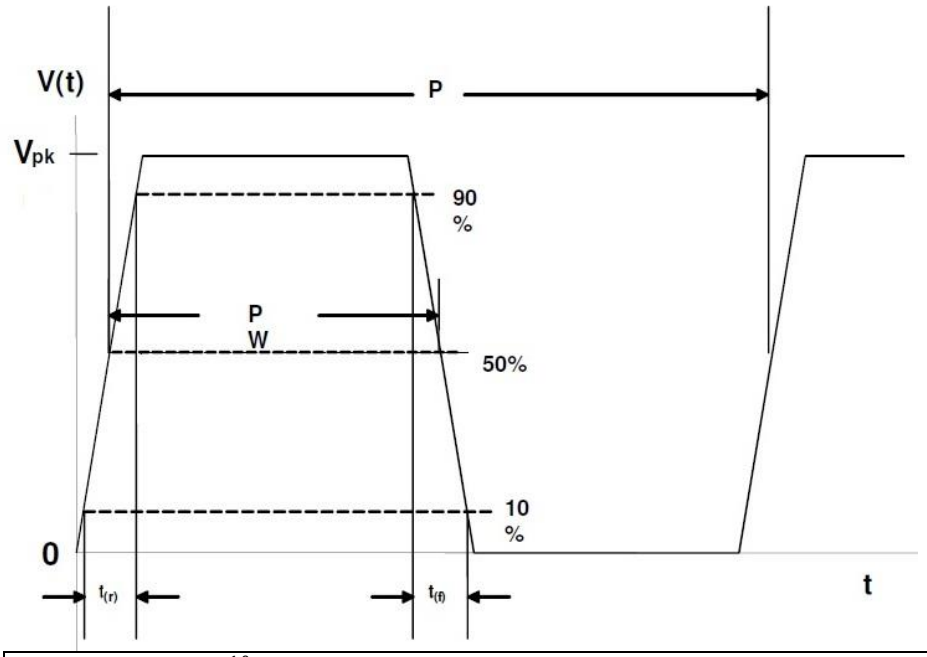
9.1 APPENDIX 1: Exterior Lighting PWM Signal Specification



Operating Conditions: [1,2]		System Voltage: 9.5 < Vsys < 16.0 volts Ambient Temperature: -40oC < Tamb < 85oC				
No	**Characteristic**	**Comment**	**Min**	**Typ**	**Max**	**Unit**
1	PWM output frequency 1/P for Incandescent Bulbs	Configurable in the ECU	100	110		Hz
2	PWM output frequency 1/P for LED Bulbs	Configurable in the ECU	100	220		Hz
3	Frequency jitter	Measured via 1 second sliding window			0.1	Δ %
4	PWM rise t(r) / fall time t(f)		8		50	µs
5	PWM output duty cycle Pw/P[7]		0		100	%
6	PWM output duty cycle jitter	Measured via 1 second sliding window			0.1	Δ %
7	PWM output duty cycle tolerance total				0.2	Δ %
8	PWM resolution	8 bit or better			1/255	
9	PWM response time message [4]				21	ms
10	PWM response time voltage [5]				18	ms
11	Shortage to GND detection	Duty cycle while error detection active	10		100	%
12	Shortage to Ubat or open line detection	Duty cycle while error detection active	0		90	%
13	PWM output voltage (Vpk)	Short circuit & reverse battery protected	Vsys-1.5			V
14	Ground Offset	See ELCOMP requirement RQT-191001-009976 & 009989				V

Note 1: Specified values are valid for complete range of system voltage and ambient temperature.
Note 2: Output values are measured at the ECU with the PWM output and related to ECU GND.
Note 4: Time when message is complete at bus to PWM response is measured at ECU PWM output.
Note 5: Time when voltage jump is applied to PWM response is measured at ECU PWM output.
Note 6: Any received PWM duty cycle shall be mapped to the closed available (taking into account resolution) duty cycle in the receiving ECU.

9.2 APPENDIX 2: Interior Lighting PWM Signal Specification



Operating Conditions: [1,2]		System Voltage: 9.5 < Vsys < 16.0 volts Ambient Temperature: -40oC < Tamb < 85oC				
No	**Characteristic**	**Comment**	**Min**	**Typ**	**Max**	**Unit**
1	PWM output frequency 1/P for Incandescent Bulbs	Configurable in the ECU	100	110		Hz
2	PWM output frequency 1/P for LED Bulbs	Configurable in the ECU	100	220		Hz
3	Frequency jitter	Measured via 1 second sliding window			0.1	Δ %
4	PWM rise t(r) / fall time t(f)		8		50	µs
5	PWM output duty cycle Pw/P[7]		0		100	%
6	PWM output duty cycle jitter	Measured via 1 second sliding window			0.1	Δ %
7	PWM output duty cycle tolerance total				0.2	Δ %
8	PWM resolution	8 bit or better			1/255	
9	PWM response time message [4]				21	ms
10	PWM response time voltage [5]				18	ms
11	Shortage to GND detection	Duty cycle while error detection active	10		100	%
12	Shortage to Ubat or open line detection	Duty cycle while error detection active	0		90	%
13	PWM output voltage (Vpk)	Short circuit & reverse battery protected	Vsys-1.5			V
14	Ground Offset	See ELCOMP requirement RQT-191001-009976 & 009989				V

Note 1: Specified values are valid for complete range of system voltage and ambient temperature.
Note 2: Output values are measured at the ECU with the PWM output and related to ECU GND.
Note 4: Time when message is complete at bus to PWM response is measured at ECU PWM output.
Note 5: Time when voltage jump is applied to PWM response is measured at ECU PWM output.
Note 6: Any received PWM duty cycle shall be mapped to the closed available (taking into account resolution) duty cycle in the receiving ECU.

9.3 APPENDIX 3: CAN LIN Signals Mapping Table

	CAN: **VehWlcmFrwl_D_Stat**		LIN: Interior Lighting **WelcomeFarewell_State**		LIN: Exterior Lighting **Wfsuperstate**
0	NULL	0	NULL	0	OFF
1	WELCOME	3	WELCOME	1	WELCOME
2	FAREWELL	1	FAREWELL	3	FAREWELL
3	RUNSTART	2	RUN_START	2	RUNSTART

	CAN:		LIN: Interior Lighting		LIN: Exterior Lighting

	VehWlcmFrwlMde_D_Stat		WelcomeFarewell_Substate		Wfsubstate
0	NULL	0	NULL	0	NULL
1	APPROACH	1	APPROACH	5	APPROACH
2	ILLUMINATEDENTRY	4	ENTRY	1	IllumEntry
3	COURTESYLIGHTINGALL	3	DOOR	3	DoorAjarCourtesyLight
4	COURTESYLIGHTINGDELAYALL	2	DELAY	4	CourtesyLightDelay
5	COURTESYLIGHTINGEXTENDED	0	NULL	0	NULL
6	COURTESYLIGHTINGDELAYEXT	2	DELAY	4	CourtesyLightDelay
7	ILLUMINATEDEXIT	5	EXIT	2	IllumExit