Research & Vehicle Technology
"Infotainment Systems Product Development"

Feature – Exterior Lights Soft Switch

APIM Phoenix Domain Controller Infotainment Subsystem Part Specific Specification (SPSS)

Version 1.0

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Revision History

Date	Version	Notes	
October 22, 2021	1.0	Initial Release	

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1 Architectural Design

1.1 Overview

The intent of Soft Switch is to describe software based switch operation that controls various vehicle lights, such as low beam lights, parking, fog or spot lights. Each one of these is considered a separate feature, but signals to request the lights and the signal that indicates the type of light currently active is shared among the features, hence all the features are described in this SPSS. Common requirements between them are found in General requirements. Unique requirements that are applicable only to particular features are located in the respective functions.

1.2 REQ-456638/A-Soft Switch Client

Client provides a way for user input to interface with the feature. In this feature is also provides soft switch state too.

1.3 REQ-456639/A-Soft Switch Server

Soft switch server takes controls the feature state. It takes as input client requests and decides to changes the lights states.

1.4 Logical Signal Mapping

The CAN signals mentioned throughout this document shall refer to the CAN signal's logical name. The logical names shall be mapped to their actual CAN signal names. Please use the table below to perform the mapping. The InfoCAN database file is the master file for the actual CAN signal names. Note: some CAN signals referenced throughout this document may use the logical name while some may use the actual CAN signal name.

Logical Name	CAN Signal Name
IgnSt	Ignition_Status
LLightSt	HeadLghtSwtch_D_Stat
LFogFrontSt	FogLightFrontON_B_Stat
LFogRearSt	FogLightRearON_B_Stat
LLightsRq	HeadLghtCtl_D_RqMnu
LFogFrontRq	FogLghtFrontButtn_B_Rq
LFogRearRq	FogLghtRearButtn_B_Rq
	DrStatDrv_B_Actl
	DrStatPsngr_B_Actl
	Veh_Lock_Status

1.5 REQ-456640/A-Soft Switch Client Tx

1.5.1 REQ-456658/A-LLightsRq

LLightsRq: This signal is transmitted from client to request Low Beam light status change.

Signal Parameter	Parameter Description
0x0	Null State
0x1	Off
0x2	ParkLamp
0x3	AutoLamp
0x4	HeadLamp
0x5	NotUsed_1
0x6	NotUsed_2
0x7	Faulty

1.5.2 REQ-459617/A-LFogFrontRq

LFogFrontRq: This signal is an indicator of Soft Switch button press state for the front fog lights transmitted from client to server.

Signal Parameter	Parameter Description
0x0	Not Pressed
0x1	Pressed

1.5.3 REQ-459618/A-LFogRearRq

LFogRearRq: This signal is an indicator of Soft Switch button press state for the rear fog lights transmitted from client to server.

Signal Parameter	Parameter Description
0x0	Not Pressed
0x1	Pressed

1.6 REQ-456641/A-Soft Switch Client Rx

1.6.1 REQ-456657/A-IgnSt

IgnSt: This signal is sent to client to indicate ignition state.

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

1.6.2 REQ-456659/A-LLightSt

LLightSt: This signal is received by the client. It provides the state of the lights.

Signal Parameter	Parameter Description
0x0	Off
0x1	Parklamp
0x2	Headlamp
0x3	Autolamp

1.6.3 REQ-459597/A-LFogFrontSt

LFogFrontSt: This signal provides the status of Front fog lights to the client.

Signal Parameter	Parameter Description
0x0	Off
0x1	On

1.6.4 REQ-459598/A-LFogRearSt

LFogRearSt: This signal provides the status of Rear fog lights to the client.

Signal Parameter	Parameter Description
0x0	Off
0x1	On

1.6.5 REQ-460697/A-DrStatDrv_B_Actl

DrStatDrv_B_Actl :This signal is received by client. It provides the driver door open/closed status.

Signal Parameter	Label	Description
0x0	Closed	Driver Door is Closed
0x1	Ajar	Driver Door is Open

1.6.6 REQ-460698/A-DrStatPsngr_B_Actl

DrStatPsngr_B_Actl: This signal is received by client. It provides front passenger door signal status.

Signal Parameter	Label	Description
0x0	Closed	Passenger Door is Closed
0x1	Ajar	Passenger Door is Open

1.6.7 REQ-460699/A-Veh_Lock_Status

Veh_Lock_Status : This signal is received by client. It provides the status of vehicle locks.

Signal Parameter	Label	Description
0x0	LOCK_DBL	Double Lock all doors (disable the interior and exterior door handles)
0x1	LOCK_ALL	Lock all doors (disable the exterior door handles only)
0x2	UNLOCK_ALL	Unlock all doors
0x3	UNLOCK_DRV	Unlock the driver’s door

2 General Requirements

2.1 REQ-456698/A-Soft Switch Availability in Client

Soft Switch could have a diagnostics value that indicates if the feature is available or not. If the feature/function is not available, the function and its requirements are not to be executed by the client.

2.2 REQ-456718/A-Light State Request

The client shall transmit the light type being requested by the user. The Client shall continuously transit that request until the user makes another request or vehicle is turned off.

3 Functional Requirements

3.1 Low Beam

3.1.1 REQ-456699/A-Faulty Request

Among the parameters that client request form Soft Switch server is Faulty.
This value is used from client to indicate various internal faults to the server. The list of DTC for which the client should transmit LLightsRq (Faulty) is the table below:

DTC 0x908E01 – Display General Electrical Failure
DTC 0x908E4A – Display Incorrect Component Failure
DTC 0x908E02 – Display General Signal Failure
DTC 0xC16200 – Lost Communication With Navigation Display Module No Sub Type Information
DTC 0x908E87 – Display Missing Message
DTC 0xF00041 – Control Module General Checksum Failure

3.1.2 REQ-457939/A-ASIL Compliance

The operation is required to satisfy ASIL B compliance rating. Refer to Appendix for related documentation.

3.1.3 Display Related Requirements

This feature execution needs some unique requirements and operation from Client HMI. While HMI spec could be a better place to document these requirements, due to the urgency of releasing the spec for this feature, those requirements are documented in SPSS. Subsequent releases, we could remove some of those requirements from SPSS to HMI spec.

3.1.3.1 REQ-460657/A-Lighting Control Icon

When the Client display is ON, the Master Lighting Control icon on Client display shall be visible in any driving condition.

3.1.3.2 REQ-460658/A-Lighting Control Availability On Client HMI Display

The client display shall stay ON to provide access to the Master Lighting Control, it is allowed to go OFF in the following conditions:

Ignition OFF (IgnSt = OFF)
AND
{
Sequence of conditions indicating the ”user left the vehicle”
OR
After a period of time from Ignition OFF (typ. 10min)
}

3.1.3.3 REQ-460678/A-Truth Table - Client HMI Behavior Related

Input conditions			Output	
Igntion_state	Time elapsed since Key-off	*User left the vehicle detection sequence*	Center stack OFF	Description
ACC or RUN or START	Don't Care	Don't Care	INHIBIT	Center Stack display stays ON @key-on
OFF	No	Not_detected	INHIBIT	Center Stack display stays ON @key-off during a period of time
OFF	Yes	Don't Care	ALLOWED	Center Stack display allowed to go OFF after a period of time @key-off

OFF	Don't Care	Detected	ALLOWED	Center Stack display allowed to go OFF if a series of actions lead to "user left the vehicle" behavior. (like door open/close and vehicle lock command)
Unknown, invalid or missing message	Don't Care	Don't Care	ALLOWED	Center Stack display allowed to go OFF if not able to detect the ignition status at all

IF Ignition == OFF
THEN
IF (detects DrStatDrv_B_Actl transition from Ajar to Closed) OR
(detects DrStatPsngr_B_Actl transition from Ajar to Closed)
THEN
IF detects Veh_Lock_Status transition from unlock (UNLOCK_ALL or UNLOCK_DRV) to lock (LOCK_DBL or LOCK_ALL)
THEN
User_left_the_vehicle_detection_sequence = Detected
ELSE
User_left_the_vehicle_detection_sequence = Not_detected
ELSE
User_left_the_vehicle_detection_sequence = Not_detected
ELSE
User_left_the_vehicle_detection_sequence = Not_detected
If any of the CAN signals involved are missing or invalid, the User_left_the_vehicle_detection_sequence = Not_detected

3.1.3.4 REQ-460677/A-Lighting Soft Switch Operation

Below table provides some relations between ignition status, light switch and display state.

PDC Input			PDC Output signal	
Igntion_state	Touch Screen State	User Action	HeadLghtCtl_D_RqMnu	Description
Transition ACC/OFF to RUN/START or Power-on	N/A	N/A	Null	No valid touch and no trustable previous value
RUN or START	ON	None	*Hold on previous value*	No valid touch
RUN or START	ON	Touch	Off	Valid touch
RUN or START	ON	Touch	ParkLamp	Valid touch
RUN or START	ON	Touch	HeadLamp	Valid touch
RUN or START	ON	Touch	AutoLamp	Valid touch
Transition RUN/START to ACC/OFF	ON	N/A	*Hold on previous value*	No valid touch
OFF or ACC	ON	None	*Hold on previous value*	No valid touch

OFF or ACC	ON	Touch	Off	Valid touch
OFF or ACC	ON	Touch	ParkLamp	Valid touch
OFF or ACC	ON	Touch	HeadLamp	Valid touch
OFF or ACC	ON	Touch	AutoLamp	Valid touch
OFF or ACC or RUN or START	OFF	N/A	*Hold on previous value*	No screen available
Unknown, invalid or missing message	Don't Care	Don't Care	Faulty	Not able to detect ignition transition

3.2 Parking Lights

3.2.1 REQ-457937/A-Power Mode Operation

The Parking/ Position Feature shall be available for all ignition status including when IGNITION == OFF/ACC

3.2.2 REQ-457938/A-Parking Lights Request

The client shall transmit the signal LLightsRq with the parameter 0x1 (Parklmap) once user presses the soft button. This parameter shall be continuously transmitted until vehicle turns Off or user makes another selection in Soft Button.

3.3 Fog Lights

3.3.1 REQ-460637/A-Feature Change Request

The client shall transmit user requests only when user presses the button. The transmitted request is button state, which is indicated as Pressed.

3.3.2 REQ-460638/A-Button Press Timing

Client shall transmit the button press state as Pressed for a 100ms consecutive time length.

3.3.3 REQ-460639/A-Missing Signals

If Fog Lights State signals go missing or aren’t received by the client for a period of 5 sec, the client shall display the state of the fog lights as Off.

4 Appendix: Reference Documents

For ASIL B compliance refer to FFSD04. SRS specification.