# AR Navigation IOD

## Functional Description

This STSS handles the functions associated with the AR Navigation IOD feature. AR (Augmented Reality) Navigation IOD (Information on Demand) provides display of 2D Navigation or AR Navigation video generated by IVI (in-vehicle infotainment system). When video input is not available, AR Navigation IOD displays a text indicating the system status. The Instrument Cluster sends CAN signals to request the video from IVI and request Navigation mode change between 2D Navigation or AR Navigation.

The customer uses the steering wheel up/down buttons to switch between different IODs. The customer uses the steering wheel OK button to request a Navigation mode change.

## Interfaces

Figure 1 AR Navigation IOD Function Context Diagram



### Inputs

* INTERNAL:
* Operational\_Mode
* MC Switch (UP, DOWN, OK)
* NavIOD\_Cfg
* NavIOD\_Timeout\_Cfg
* IPC\_VideoInput\_Status
* Video input from APIM
* MUX signals on the CAN Bus from APIM

1. NavIOD\_Status signal

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Signal Name** | **Size (bits)** | **Detail** | **Units** | **Res.** | **Offset** | **State Encoded** | **Min** | **Max** |
| NavIOD\_Status | 4 |  | SED | 1 | 0 |  | 0  (0x0) | 1  (0xF) |
|  |  | Feature not available |  |  |  | 0 (0x0) |  |  |
|  |  | Feature available but no output |  |  |  | 1 (0x1) |  |  |
|  |  | Output |  |  |  | 2 (0x2) |  |  |
|  |  | Reserved (2D\_Cruise) |  |  |  | 3 (0x3) |  |  |
|  |  | Reserved (2D\_Nav) |  |  |  | 4 (0x4) |  |  |
|  |  | Reserved  (AR\_Nav) |  |  |  | 5 (0x5) |  |  |
|  |  | Reserved |  |  |  | 6 (0x6) |  |  |
|  |  | Reserved |  |  |  | … |  |  |
|  |  | System Error |  |  |  | 15 (0xF) |  |  |

### Outputs

* MUX signals on the CAN Bus

1. NavIOD\_Request Signal

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Signal Name** | **Size (bits)** | **Detail** | **Units** | **Res.** | **Offset** | **State Encoded** | **Min** | **Max** |
| NavIOD\_Request | 3 |  | SED | 1 | 0 |  | 0  (0x0) | 1  (0x7) |
|  |  | No\_Request (Default) |  |  |  | 0 (0x0) |  |  |
|  |  | Video\_Request |  |  |  | 1 (0x1) |  |  |
|  |  | ModeChange\_Request |  |  |  | 2 (0x2) |  |  |
|  |  | Reserved |  |  |  | … |  |  |
|  |  | Reserved |  |  |  | 7 (0x7) |  |  |

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## Function/Performance

### Operational Modes

|  |  |
| --- | --- |
| **Mode** | **Differentiating Vehicle Conditions** |
| Sleep Mode | AR Navigation IOD Disabled |
| Limited Mode | AR Navigation IOD Disabled |
| Normal Mode | AR Navigation IOD Enabled / Disabled |
| Crank Mode | AR Navigation IOD Enabled / Disabled |

### Voltage Levels

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

### Human-Machine Interface

#### Visual

Refer to HMI spec and production assets.

#### Video Resolution

|  |  |
| --- | --- |
|  | CD542 13.2 Cluster Specific |
| LVDS Input Video Resolution | 1920\*720 |
| LVDS Input Video Refresh Rate | 30 Hz |
| Displayed video resolution | 1280\*470 |
|  |  |

#### Audio

None

#### Switch Control Logic

The customer uses the steering wheel up/down buttons to switch between different IODs. The customer uses the steering wheel OK button to request a Navigation mode change.

Enter/Exit the AR Navigation IOD shall follow the overall Cluster IOD strategy of switching between different IODs.

### System Accuracy

Within a 100msec of receiving a message that results in a change of state the cluster will update the display to the proper status.

### Operation: Performance and Functional

#### Navigation IOD Enable/Disable

Cluster shall provide the AR Navigation IOD function if NavIOD\_Cfg.= 0x01 Enabled. For variant which have AR Navigation and 3D Map in cluster, the AR Navigation IOD shall displayed in cluster, could not be set in IVI.

Cluster shall not provide the AR Navigation IOD function if NavIOD\_Cfg.= 0x00 Disabled.

#### Enter/Exit AR Navigation IOD

The cluster shall able to use MC Switch (UP, DOWN) input to change between different IODs and to enter (activate) or exit (deactivate) the AR Navigation IOD.

#### Suppress Nav Repeater

If AR Navigation IOD is activated, the Cluster shall suppress Navigation Repeater function, until AR Navigation IOD is deactivated.

#### NavIOD Display Modes

If AR Navigation IOD is activated, the Cluster shall enter one of below display modes:

|  |  |
| --- | --- |
| Display Mode | Description |
| NavIOD Display Mode 1 | In this mode, the cluster shall show a text message |
| NavIOD Display Mode 2 | In this mode, the cluster shall show the video, with defined resolution and size in HMI specification |

#### NavIOD Display Modes - Flowchart / State Diagram

If AR Navigation IOD is activated, the cluster shall follow below State Diagram to decide which NavIOD Display Mode to enter, and to transfer between the 2 NavIOD Display Modes.



#### NavIOD Display Mode 1 – Text Display

In NavIOD Display Mode 1, the cluster shall display a text following below table:

|  |  |  |  |
| --- | --- | --- | --- |
| Nav\_IOD Text Name | Condition | Priority | Description |
| Loading\_Map | Default | 1 |  |
| System\_Error | NavIOD\_Status == Error  OR  IPC\_VideoInput\_Status == Error | 2 |  |
| System\_Not\_Available | Time while in NavIOD Display Mode 1 > NavIOD\_Timeout\_Cfg | 3 |  |
|  |  |  |  |

If more than one condition is met, the cluster shall follow the priority numbers to decide which text to display. Smaller number has higher priority.

After enter into AR Navigation IOD, Cluster display the “Map Loading” text for 2s, then display the normal Navigation information

#### NavIOD Display Mode 1 – Video Request

In NavIOD Display Mode 1, the cluster shall send CAN signal NavIOD\_Request = 0x1 Video\_Request

#### NavIOD Display Mode 2 – ModeChange Request

In NavIOD Display Mode 2, the cluster shall send CAN signal NavIOD\_Request following below table

When the OK button is used by Warning message…

|  |  |  |  |
| --- | --- | --- | --- |
| NavIOD\_Request | Condition | Priority | Description |
| 0x1 Video\_Request | MC Switch OK == Not Pressed |  |  |
| 0x2 ModeChange | MC Switch OK == Pressed |  |  |
|  |  |  |  |

#### NavIOD\_Request Decision Table

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| AR Navigation IOD | NavIOD Display Mode | MC Switch OK |  | NavIOD\_Request |
| Disabled | <Don’t Care> | <Don’t Care> |  | 0x0 No\_Request |
| Deactivated | <Don’t Care> | <Don’t Care> |  | 0x0 No\_Request |
| Activated | Mode 1 | <Don’t Care> |  | 0x1 Video\_Request |
| Activated | Mode 2 | Not Pressed |  | 0x1 Video\_Request |
| Activated | Mode 2 | Pressed |  | 0x2 ModeChange |

#### Prove Out

Not applicable

#### Message Center Msg

None. Refer to program specific menu structure for display text.

## Trigger AR Naviagtion IOD

Use case1: PreCondition: Cluster AR Navigation IOD is activated,

PostCondition: Cluster shall send NavIOD\_Request = 0x1

IVI receives NavIOD\_Request = 0x1, if IVI map is activated, IVI shall send NavIOD\_Status = 0x02，IVI send out the Video

Use case2: PreCondition: Cluster AR Navigation IOD is de-activated,

PostCondition: Cluster shall send NavIOD\_Request = 0x0

### AR Navigation IOD is de-activated

If Cluster AR Navigation IOD is de-activated, Customer operation below action, IVI shall send NavIOD\_Status = 6 (0x6) for 200ms:

* Press the sync to cluster menu
* Start the AR Navigation (according to UE)
* 4 fingers swipe

Cluster receives NavIOD\_Status = 6 (0x6), activate the Cluster Navigation IOD,

If the Cluster AR Navigation IOD already displayed and receives NavIOD\_Status = 6 (0x6), Cluster no need further action.

Cluster exit AR Navigation IOD not controlled by IVI

### AR Navigation IOD is activated

If Cluster AR Navigation IOD is activated, Customer operation below action:

* Press the sync to cluster menu
* 4 fingers swipe

There will be a toast “(AR) Navigation already displayed in Cluster” in IVI, toast reference HMI UE

## 3D Map IVI logic

IPC\_Map\_Mode\_Cfg = 0x0, Cluster 3D Map setting disable

IPC\_Map\_Mode\_Cfg = 0x1, Cluster 3D Map setting enable

Default is 3D map is open



Customer could choose the Cluster displayed map style in IVI, either Cluster 3D Map or not

3D Map menu open: using 3 Map scale according to the Vehicle speed, the speed could configurable, the Map Scale is limited in 1:10, 1:20, 1:50 to display the 3D effect.

3D Map menu closed: Cluster content follow IVI display, if IVI zoom in and zoom out, Content in cluster also follow same way

## Error Handling

### Missing Message Strategy

The signals will be declared missing as per the Diagnostics section of this SPSS.

DTCs states and history will be determined as per the Diagnostics section of this SPSS.

If CAN signal NavIOD\_Status is not received < 5s, use last value received.

If CAN signal NavIOD\_Status is not received >= 5s, use 0x0 value.

If NavIOD\_Cfg == Disabled, the cluster shall never log a missing message for this feature.

### Internal signal - IPC\_VideoInput\_Status

The cluster shall monitor errors related to LVDS input function, and output IPC\_VideoInput\_Status internal signal.

|  |  |  |
| --- | --- | --- |
| IPC\_VideoInput\_Status | Condition |  |
| 0x0 Video\_Not\_Received | LVDS input is OK but no video input |  |
| 0x1 Video\_Received | Receiving video stream on LVDS input |  |
| 0x2 System\_Error | If any of below conditions are met:  LVDS input – invalid data  LVDS input - open circuit  LVDS input - short to ground  LVDS input - short to battery  LVDS input – internal failure |  |
|  |  |  |

## Diagnostics

### Self Test

If NavIOD\_Cfg = Enabled, the Cluster shall detect below DTC during self-test

|  |  |  |
| --- | --- | --- |
|  | LVDS input - short to battery |  |
|  | LVDS input - short to ground |  |
|  | LVDS input - open circuit |  |
|  | LVDS input – internal failure |  |

### Engineering Test Mode

None.

### Part II Performance

**Supported Diagnostic Trouble Codes (DTCs)**

|  |  |  |
| --- | --- | --- |
| **DTC** | **Description** | **When Logged** |
| Cxxxx | Lost communication with APIM | CAN signal NavIOD\_Status signal missing for at least 5 consecutive seconds. Or follow diagnostic spec defined time condition for missing signals.  If NavIOD\_Cfg == Disabled, NavIOD\_Status signal missing should be ignored. |
|  | LVDS input - short to battery |  |
|  | LVDS input - short to ground |  |
|  | LVDS input - open circuit |  |
|  | LVDS input – invalid data | Invalid video steam received from LVDS |
|  | LVDS input – internal failure | De-serializer or SOC malfunction |

If NavIOD\_Cfg == Disabled, the cluster shall not log DTC for this feature.

**DID DExx:**

| **Block Description** | **Bits** | **State: Description** | **Default** | **Comments/**  **Information** |
| --- | --- | --- | --- | --- |
| PACKETED BLOCKS |  |  |  |  |
|  |  |  |  |  |
| Option Content (B&A) | 3 | NavIOD\_Cfg  0x0 = Disabled  0x1 = Enabled  0x2 ~ 0x7 = reserved | 0 | Disabled mean the feature is not available |
| Option Content (B&A) | 8 | NavIOD\_Timeout\_Cfg  Resolution = 1 second(s)  Min = 0 second(s)  Max = 255 second(s) | 30 seconds | 0 seconds should also be treated as default value (30 seconds) |
| Option Content (B&A) | 2 | IPC\_Map\_Mode\_Cfg  0x0 = Cluster 3D Map setting disable  0x1 = Cluster 3D Map setting enable  0x2 ~ 0x3 = reserved | 1 |  |

## Reference Specification

None.

## Revision History

**SPSS Module Revision History**

|  |  |  |  |
| --- | --- | --- | --- |
| **Revision Level** | **Name** | **Change Description** | **Date** |
| 0.1 |  | Initial release. |  |
| 0.6 |  | Add AR Navigation could open the AR Navigation IOD  Timeout time update as 5s as previous aligned  Add the “Map loading” hold in the cluster screen for 2s  Add finger swipe and button click to sync map to Cluster  Add the 3D button description |  |
|  |  |  |  |
|  |  |  |  |
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|  |  |  |  |