# Dual Mode Exhaust Control Function –CGEA1.3

## Functional Description

This STSS is for the performance settings on selected S550 end items. The user can select one of the 3 available exhaust modes based on loudness.

Once configured as Enabled at vehicle end-of-line through a DE0X bit, the Dual Mode Exhaust can be set via the 5-way switch on the steering wheel thru the cluster settings menu.

When selecting the modes for Dual Mode exhaust thru the 5-way switch, the cluster will send out a request signal to the PCM which in return will send an acknowledgment message back to the cluster with proper status confirming the mode request.

The Dual mode Exhaust Control function correlates the EngExhMdeQueit\_D\_RqDrv signal, the EngExhMdeQueit\_D2\_Stat signal, the 5 button M/C switches and the Operational\_Mode to change the dual mode exhaust settings.

## Interfaces

### Interface Context Diagram (I/O Block Diagram)

Figure 1 Dual Mode Exhaust Control Function Context Diagram



### Inputs

* INTERNAL:
* Operational\_Mode
* M/C Switch event
* M/C\_Display\_Status
* SVT\_Status\_Screen\_IOD\_MC\_Flag (from Status Screen Information – S550 SVT Only - CGEA1.3 STSS)
* Dual\_Exhaust\_Cfg – DEXX Configuration
* Dual\_Exhaust\_Btn\_Cfg – DEXX Configuration
* MUX message on the CAN Bus

1. EngExhMdeQuiet\_D2\_Stat Signal

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Signal Name** | **Size (bits)** | **Detail** | **Units** | **Res.** | **Offset** | **State Encoded** | **Min** | **Max** |
| EngExhMdeQuiet\_D2\_Stat | 3 |  | SED | 1 | 0 |  | 0 (0x0) | 7 (0x7) |
|  |  | Null |  |  |  | 0x0 |  |  |
|  |  | Stealth |  |  |  | 0x1 |  |  |
|  |  | Normal |  |  |  | 0x2 |  |  |
|  |  | Sport |  |  |  | 0x3 |  |  |
|  |  | Track |  |  |  | 0x4 |  |  |
|  |  | NotUsed |  |  |  | 0x5 |  |  |
|  |  | Notused |  |  |  | 0x6 |  |  |
|  |  | Faulty |  |  |  | 0x7 |  |  |

1. EngExhMdeQuiet\_B\_RqDrv Signal

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Signal Name** | **Size (bits)** | **Detail** | **Units** | **Res.** | **Offset** | **State Encoded** | **Min** | **Max** |
| EngExhMdeQuiet\_B\_RqDrv | 1 |  | SED | 1 | 0 |  | 0 (0x0) | 1 (0x1) |
|  |  | NotPressed |  |  |  | 0x0 |  |  |
|  |  | Pressed |  |  |  | 0x1 |  |  |

### Outputs

* Dual\_Exhaust\_Setup\_MC – flag to determine the menu setting options.
* Exhaust\_Mode\_Status\_Screen\_MC – variable that will be used to display the exhaust mode in the SVT status screen.
* Track\_Use\_Only\_MC\_Status\_Flag - confirmation text flag passed on to the warning arbitrator
* MUX message on the CAN Bus

1. EngExhMdeQuiet\_D2\_Rq Signal

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Signal Name** | **Size**  **(bits)** | **Detail** | **Units** | **Res.** | **Offset** | **State Encoded** | **Min** | **Max** |
| EngExhMdeQuiet\_D2\_Rq | 3 |  | SED | 1 | 0 |  | 0 (0x0) | 7(0x7) |
|  |  | Null |  |  |  | 0x0 |  |  |
|  |  | Stealth |  |  |  | 0x1 |  |  |
|  |  | Normal |  |  |  | 0x2 |  |  |
|  |  | Sport |  |  |  | 0x3 |  |  |
|  |  | Track |  |  |  | 0x4 |  |  |
|  |  | NotUsed |  |  |  | 0x5 |  |  |
|  |  | NotUsed |  |  |  | 0x6 |  |  |
|  |  | NotUsed |  |  |  | 0x7 |  |  |

## Function/Performance

### Operational Modes

|  |  |
| --- | --- |
| **Mode** | **Differentiating Vehicle Conditions** |
| Sleep Mode | Dual Mode Exhaust Setting Inactive |
| Limited Mode | Dual Mode Exhaust Setting Inactive |
| Normal Mode | Dual Mode Exhaust Setting Active/Inactive |
| Crank Mode | Dual Mode Exhaust Setting Active/Inactive |

### 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

#### Indicator Graphics / Display Format

Please refer to program specific menu structure for actual graphics.

**Example Menu Structure:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Menu level 1** | **Menu level 2** |  | **Menu level 3** |
| Track Apps (if configured as Enabled) | Dual Mode Exhaust (If configured as Enabled) |  | Quiet |
|  | Normal |
|  |  |  | Track |

##### Indicator Color Coordinates

Reference section COLOR & ILLUMINATION REQUIREMENTS (GRAPHICS)

##### Indicator Characteristics

Refer to Message Center X Display\_Y Button Interface Section, where X and Y are appropriate values in this document.

#### Audio

None

#### Switch Control Logic

Consumer access to the SVT vehicle settings shall be as specified in the message center basic functionality display as specified in Message Center X Display\_Y Button Interface Section, where X and Y are appropriate values in this document.

### 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

#### Subsystem Algorithm Flowchart / State Diagram

Figure 2 Dual Mode Exhaust Configuration Flowchart



Figure 3: Dual Mode Exhaust Selection Function based on M/C Switch Event (Menu based Selection)



1. Dual\_Exhaust\_Mode\_Setup\_MC and next state based on M/C Switch Event

|  |  |  |
| --- | --- | --- |
| **Dual\_ Exhaust\_Setup\_MC** | **M/C Switch Selection Event** | **Next Dual\_Exhaust\_Setup\_MC State**  **and**  **EngExhMdeQuiet\_D2\_Rq Signal** |
| Quiet | M/C Switch Event (Select Normal or Track) | 0x2 (If Normal is Selected)  0x4 (if Track is Selected) |
| Normal | M/C Switch Event (Select Quiet or Track) | 0x1 (If Quiet is Selected)  0x4 (if Track is Selected) |
| Track | M/C Switch Event (Select Quiet/Normal or Sport) | 0x1 (If Quiet is Selected)  0x2 (If Normal is Selected) |

Figure 4: Dual Mode Exhaust Selection Function based on ECP Switch Event (Pop-up based selection)



1. Dual\_Exhaust\_Mode\_Setup\_MC and next state based on Dedicated button

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Operational\_**  **Mode** | **Dual\_Exhaust\_**  **Cfg** | **Dual\_Exhaust\_**  **Button\_Cfg** | **EngExhMdeQuiet\_B\_RqDrv Signal** | **EngExhMdeQuiet\_**  **D2\_Stat Signal** | **Dual Exhaust Mode**  **Pop-up Sample Graphics** |
| Normal or Crank | Enabled (0x1) | Enabled (0x1) | Transition to Pressed  (0x1) | Stealth (0x1) | WTBD |
| Normal (0x2) | WTBD  cid:image001.png@01CF5966.7CCDEBC0 |
| Track (0x4) | WTBD  cid:image002.png@01CF5966.7CCDEBC0 |
| X | Null (0x0), UnUsed (0x5, 0x6), Faulty (0x7) or Declared Missing | W3346 |
| All Other Cases | | | | | No Graphic shown |

**Figure 5: Dual Exhaust Mode State Diagram for ExhEngMdeQuiet\_D2\_Rq (for use with Dedicated button)**



1. Dual\_Exhaust\_Status\_Screen\_MC Based on EngExhQuietMde\_D\_Stat

| **Operational\_**  **Mode** | | **SVT\_Status\_Screen\_IOD\_MC\_Flag** | | **EngExhQuietMde\_D2\_Stat Signal** | | **Dual\_Exhaust\_**  **Status\_Screen\_MC** | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Normal or Crank | | Active | | Stealth (0x1) | | Quiet | |
| Normal (0x2) | | Normal | |
| Track (0x4) | | Track | |
| 0x0, 0x5, 0x6 or Faulty (0x7) or Declared Missing | | Fault | |
| All other cases | | | | | | Inactive | |

1. State Matrix for Track Use Only Warning

| **Operational\_Mode** | **Dual\_Exhaust\_**  **Cfg** | **EngExhMdeQuiet\_D2\_Stat Signal** | **Track\_Use\_Only\_MC\_Status\_Flag**  **(**Msg ID: W3575**)** |
| --- | --- | --- | --- |
| Normal or Crank | Enabled (0x1) | Track (0x4) | Active |
| All Other Cases | | | Inactive |

#### Operation Description (supports algorithm flowchart /state diagram)

* The cluster does not control the Dual mode Exhaust. It simply allows the user to request a change in the mode between Quiet and Sport. The PCM is the controlling module, and the cluster shall confirm the mode based on the status received over the EngExhMdeQuiet\_D2\_Stat signal.
* When equipped, the user shall also have the ability to change the Dual mode Exhaust via the dedicated toggle switch on the ECP or thru the cluster message center Track Apps menu using the 5-way switch on the steering wheel.
* The cluster has different HMI depending on whether the dual exhaust mode change is triggered thru the ECP switch or the 5-way switch.
* When changing the Dual mode Exhaust via the dedicated switch, the use of the 5-way switch shall have no effect on the Dual mode exhaust change. Similarly, when changing the Dual mode Exhaust via the 5-way switch, the pressing of the dedicated Dual Exhaust switch on the ECP shall have no effect on the exhaust mode change.
* The Dual Exhaust shall default to the “Normal” mode at every key cycle.
* The Dual mode Exhaust is also tied in with the Drive Mode feature. Depending on the drive mode selected, the dual exhaust mode may change as well. The user can, however, override that mode by changing that mode as defined in this STSS.
* When the Dual mode Exhaust is changed thru the Drive mode feature or the ECP switch, the cluster does not need to switch to the Dual Exhaust settings menu display. However, the modes shall change in the background so that if the customer decides to use the 5 button M/C switches to change the setting later on, the correct mode is displayed as selected.
* In case of a fault (EngExhMdeQuiet\_D2\_Stat = 0x5, 0x6, 0x7 or declared missing), the cluster shall activate W3346 and at the same time request Normal EngExhMdeQuiet\_D2\_Rq = Normal (0x2) mode in the background. Dual\_Exhaust\_Setup\_MC and Exhaust\_Mode\_Status\_Screen\_MC (for SVT) shall also be set to NORMAL mode.
* The Dual mode Exhaust settings shall be displayed only when the feature is configured as enabled.

#### Function Safety Classification (EMC)

Class B

#### Memory Storage

1. Function Parameters

| **Parameter Name** | **Description** | **Value at**  **Battery Connect** | **Value at**  **Module Wake-up** |
| --- | --- | --- | --- |
| Dual\_Exhaust\_Setup\_MC | Dual exhaust mode setting Output state | Normal (0x0) | Normal (0x0) |
| Exhaust\_Mode\_Status\_  Screen\_MC | Output that will be used to display status in the SVT status screen. | Inactive (0x0) | Inactive (0x0) |
| Dual\_Exhaust\_MC\_Flag | Internal flag used to control the state of the dual mode exhaust pop-up. This variable can reset the warning prior to the TA\_Timer expiring. | Inactive (0x0) | Inactive (0x0) |
| SVT\_Status\_Screen\_IOD\_MC\_Flag | Internal input from “Status Screen Information Display – CGEA1.3” STSS | | |
| Track\_Use\_Only\_MC\_Status\_Flag | Confirmation status flag passed on to the warning arbitrator | Inactive | Inactive |
| EngExhMdeQuiet\_D2\_Stat | Input signal from the PCM | Normal (0x2) | Do Not Init |
| EngExhMdeQuiet\_B\_RqDrv | Input signal from FCIM indicating whether Exhaust mode switch has been pressed. | NotPressed (0x0) | NotPressed (0x0) |
| EngExhMdeQuiet\_D2\_Rq | Output request transmit signal from the IPC | Normal (0x2) | Normal (0x2) |
| M/C Switch Event | Event that is indicated as per the switch interface for the Message Center. See \* | See \* | See\* |
| M/C\_Display\_Status | State Indicator to identify which text is currently being displayed on Message Center display. See \* | See \* | See\* |
| Dual\_Exhaust\_Cfg | State indicator for feature presence controlled via CAN at EOL at VO plant. Set to disabled at Cluster Supplier Manufacturing Plant | Use Stored Value | Use Stored Value |
| Dual\_Exhaust\_Buttn\_Cfg | State indicator for feature presence controlled via CAN at EOL at VO plant. Set to disabled at Cluster Supplier Manufacturing Plant | Use Stored Value | Use Stored Value |
| Operational\_Mode | 4 state indicator for cluster operational mode | Limited | Limited, Normal or Crank |

\* Refer to Message Center X Display\_Y Button Interface Section, where X and Y are appropriate values in this document.

#### Reconfigurable Telltale

Not applicable

#### Prove Out

Not applicable

#### Message Center Msg

Refer to program specific menu structure for appropriate display graphics.

## 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 Dual\_Exhaust\_Cfg = Disabled (0x0), the cluster shall never log a missing message DTC for this feature.

## Diagnostics

### Self Test

None

### Engineering Test Mode

Reference section “Dealer / Engineering Test Mode (ETM)”

### Part II Performance

**Supported Diagnostic Trouble Codes (DTCs)**

DTCs shall be logged as per the diagnostics section of this SPSS.\*

|  |  |
| --- | --- |
| **DTC** | **Description** |
| C10000 | Loss of Communication with PCM |
| C25600 | Lost Communication With Front Controls Interface Module "A" |

\* If the missing signal has a related update bit, \_UB, signal, then the “Invalid Data” DTC is to be logged.

Otherwise, the “Lost Communication” DTC is logged.

**DID DE05**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Block**  **Num** | **Block Description** | **Size**  **(bits)** | **Type** | **Byte(s)** | **Bits** | **Description** | **"0"** | **"1"** | **Default** | **Comments/**  **Information** |
| PACKETED BLOCKS | |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| $05 | Option Content (B&A) | 1 | 1 | \* | \* | Dual Exhausts | Disabled | Enabled | Disabled | Disabled means the feature is not present in the vehicle, and the settings menu is not displayed in the cluster. |
|  |  | 1 |  |  |  | Dual Exhaust Button | Disabled | Enabled | Disabled | Disabled means the vehicle is not equipped with the exhaust button. The exhaust menu may be displayed via the menu in the cluster. |
| \*Byte and bit location to be identified in Part II Specification for this cluster | | | | | | | | | | |
|  | | | | | | | | | | |

## 

## Reference Specification

IS-0001 WARNINGS/INDICATORS/DISPLAYS PROVEOUT

IS-0052 OPERATING VOLTAGES - FUNCTIONAL/PERFORMANCE

IS-0069 FUNCTIONAL IMPORTANCE CLASS

IS-0324 WINDSHIELD & OTHER REFLECTIONS

IS-0327 WARNING INDICATOR EVALUATION

IS-0379 NORTH AMERICAN WARNINGS AND INDICATORS STRATEGY

IL-0019 GENERAL ILLUMINATION DIMMING

IL-0021 CRAFTSMANSHIP - DISPLAYS

IL-0022 GENERAL ILLUMINTATION COLOR

IL-0023 CLARITY/LEGIBILITY/READABILITY

IL-0025 INTERIOR ILLUMINATION INTENSITY

IL-0027 VISUAL CONTRAST

IL-0048 ILLUMINATION ACCEPTABILITY

03-0661  PLACEMENT: CONTROL AND DISPLAY LOCATIONS

03-0670  INTERIOR VISIBILITY

03-0672  INTERIOR VISIBILITY: REFLECTIONS IN DISPLAYS

03-0673  INTERIOR VISIBILITY: VISUAL OBSCURATIONS

03-0674  INTERIOR VISIBILITY: ILLUMINATION CONTROLS / DISPLAYS

03-0675  INTERIOR VISIBILITY: VEILING GLARE

03-0677  INTERIOR VISIBILITY: SUNLIGHT WASHOUT

03-0681  IDENTIFICATION: CHARACTER AND SYMBOL SIZE

03-0685  IDENTIFICATION: SYMBOLS,  ABBREV FOR CONTROL

## Revision History

**SPSS Module Revision History**

|  |  |  |  |
| --- | --- | --- | --- |
| **Revision Level** | **Name** | **Change Description** | **Date** |
| 1.0 | V. Patel | Initial Release for 2015 S550 SVT. Feature was approved in DI Change control on 10/10.2013. Feature owner: Mike Makled, Mike Leese (SVT group) | 11/27/2013 |
| 1.1 | V. Patel | The purpose of this version is to provide clarifications to supplier Q&A. There is no change in feature functionality. All updates are marked in Red.   * Section 1.3.5.1:   + Figure 3: Added activation of warning for EngExhMdeQuiet\_D\_Stat = 0x0, 0x3 and declared missing.   + Figure 4: Added Exhaust\_Mode\_Status\_Screen\_MC = Dual\_Exhaust\_Setup\_MC to make sure the status screen is updated for dedicated button press event as well.   + Figure 5: Fixed signal name in the title of the figure.   + Table 1.5: Updated table with latest graphics. Also consolidated the rows that activate the same graphic.   + Table 1.4: Added a column to show “EngExhMdeQuiet\_B\_RqDrv” transitioning to Pressed (0x1) as an input condition to activate the Dual mode exhaust graphics. * Section 1.3.5.2: Added statement to clarify that Exhaust mode is reverted to “Normal” in the background if the EngExhMdeQuiet\_D\_Stat signal = 0x0, 0x3 or declared missing. At the same time, W3346 is triggered as well. | 6/24/2014 |
| 2.0 | V. Patel | This version incorporates all the updates for the 2019 EVO program. 3 exhaust modes are offered instead of two. So, different CAN signals are used to process the new modes.  Feature owner: Jon Holt (S550 EVO team)  This version should be treated as a new STSS for the 2019 EVO cluster.   * Section 1.2.1, figure 1, 1.2.2, 1.2.3: Replaced the old CAN signals with the new CAN signals. EngExhMdeQuiet\_D2\_Stat and EngExhMdeQuiet\_D2\_Rq. Added new output warning flag, Track\_Use\_Only\_MC\_Status\_Flag * Section 1.3.3.2: Updated to show menu with 3 exhaust options. * Section 1.3.5.1:   + Figure 3, 4: Updated to replace old CAN signals with new ones.   + Table 1.3, 1.4: Updated the matrix to show 3 modes and next possible states for each.   + Table 1.5: Updated to reflect 3 modes in the status screen display.   + Table 1.6: Developed state matrix to activate Track Use Only warning. * Section 1.3.5.2: Replaced old signals with new ones wherever referenced. * Section 1.3.5.4: Replaced old signals with new ones wherever referenced. Added Track\_Use\_Only\_MC\_Status\_Flag default states. | 6/29/2017 |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |