# Trailer Brake Mode Control Function – CGEA1.3/1.2/1.1

## Functional Description

When the vehicle is equipped with a Trailer Brake Module (or Trailer Brake Controller, TBC) the Trailer Brake Mode control function allows the driver to toggle the status of the Trailer Brake Mode from Electric only to Electric Over Hydraulic (EOH). The Instrument Cluster uses the Trailer Brake Mode Actual signal for the Message Center function and the Trailer Brake Mode Request signal to toggle the Trailer Brake Mode in the TBM module. The driver can also select the TBC Effort (Low/Medium/High) vi the Setting Menu in the cluster. The Instrument Cluster uses the TrlBrkInitOut\_D\_Stat signal for the Message Center function and the TrlBrkInitOut\_D\_Rq signal to change the Trailer Brake Effort in the TBM module.

## Interfaces

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

**Trailer Brake Mode Function Context Diagram**



### Inputs

#### IR-REQ-306719/A-INTERNAL:

* Reset Switch Event
* Trailer\_Brake\_Cfg
* Operational\_Mode
* M/C\_Display\_Status

#### MUX message on the CAN Bus from TBM

##### SIG-REQ-306715/A-TrlrBrkMde\_D\_Actl Signal

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Signal Name** | **Size (bits)** | **Detail** | **Units** | **Res.** | **Offset** | **State Encoded** | **Min** | **Max** |
| TrlrBrkMde\_D\_Actl | 1 |  | SED | 1 | 0 |  | 0  (0x0) | 1 (0x1) |
|  |  | Electric |  |  |  | (0x0) |  |  |
|  |  | Electric\_Over\_Hydraulic |  |  |  | (0x1) |  |  |

##### SIG-REQ-306716/A-TrlBrkInitOut\_D\_Stat Signal

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Signal Name** | **Size (bits)** | **Detail** | **Units** | **Res.** | **Offset** | **State Encoded** | **Min** | **Max** |
| TrlBrkInitOut\_D\_Stat | 2 |  | SED | 1 | 0 |  | 0  (0x0) | 3 (0x3) |
|  |  | Null |  |  |  | (0x0) |  |  |
|  |  | Light |  |  |  | (0x1) |  |  |
|  |  | Medium |  |  |  | (0x2) |  |  |
|  |  | Heavy |  |  |  | (0x3) |  |  |

### Outputs

#### IR-REQ-306720/A-Internal:

Trailer\_Brake\_Mode\_MC

#### MUX message on the CAN Bus

##### SIG-REQ-306717/A-TrlrBrkMde\_D\_Rq Signal

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Signal Name** | **Size (bits)** | **Detail** | **Units** | **Res.** | **Offset** | **State Encoded** | **Min** | **Max** |
| TrlrBrkMde\_D\_Rq | 1 |  | SED | 1 | 0 |  | 0 (0x0) | 1 (0x1) |
|  |  | Electric |  |  |  | (0x0) |  |  |
|  |  | ElectricOverHydraulic |  |  |  | (0x1) |  |  |

##### SIG-REQ-306718/A-TrlBrkInitOut\_D\_Stat Signal

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Signal Name** | **Size (bits)** | **Detail** | **Units** | **Res.** | **Offset** | **State Encoded** | **Min** | **Max** |
| TrlBrkInitOut\_D\_Rq | 2 |  | SED | 1 | 0 |  | 0  (0x0) | 3 (0x3) |
|  |  | Null |  |  |  | (0x0) |  |  |
|  |  | Light |  |  |  | (0x1) |  |  |
|  |  | Medium |  |  |  | (0x2) |  |  |
|  |  | Heavy |  |  |  | (0x3) |  |  |

## Function/Performance

### F-REQ-306721/A-Operational Modes

|  |  |
| --- | --- |
| **Mode** | **Differentiating Vehicle Conditions** |
| Sleep Mode | Trailer Brake Mode Control Function Text Message Disabled |
| Limiting Mode | Trailer Brake Mode Control Function Text Message Disabled |
| Normal Mode | Trailer Brake Mode Control Function Text Message Enabled / Disabled |
| Crank Mode | Trailer Brake Mode Control Function Text Message 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

##### Indicator Graphics / Display Format

For High End Display (SHMI), refer to “<*Program*> Cluster Menu Structure.xls”.

**Example Graphics:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Menu level 1** | **Menu level 2** |  | **Menu level 3** | **Conditions Required to Display** |
| Trailer Brake | Mode |  | Electric | Level 1 - Trailer\_Brake\_Cfg = 0x1 |
|  | EOH |  |
| Effort |  | Light |  |
|  | Medium |  |
|  | Heavy |  |

Refer to Message Center Function description reference "B Display 2x14 Text Message List.xls" file or "E Display 2x14 Text Message List.xls" file -- Message ID SU278 and SU920

##### 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 Trailer Brake Mode Configuration 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.

### PFM-REQ-306737/A-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

##### F-REQ-306730/A-Trailer Brake Mode Flowcharts



##### F-REQ-306731/B-Flow Chart



**Note:** In the Trailer Brake Mode Function Flowchart, the definition of "RESET Switch Event" is defined in Message Center X Display\_Y Button Interface Section, where X and Y are appropriate values in this document.

##### F-REQ-306724/A-Trailer\_Brake\_Mode\_MC State Assignment

|  |  |
| --- | --- |
| **TrlrBrkMde\_D\_Actl**  **HS\_CAN Signal** | **Trailer\_Brake\_Mode\_ MC** |
| Electric (0x0) | Electric (0x0) |
| Electric\_Over\_Hydraulic (0x1) | EOH (0x1) |
| Missing per Section 1.4.1 | Error (0x2) |

##### F-REQ-306725/A-Trailer\_Brake\_InitOut\_ MC State Assignment

|  |  |
| --- | --- |
| **TrlBrkInitOut\_D\_Stat**  **HS\_CAN Signal** | **Trailer\_Brake\_InitOut\_ MC** |
| Light (0x1) | Light (0x1) |
| Medium (0x2) | Medium (0x2) |
| Heavy (0x3) | Heavy (0x3) |
| Null (0x0) | Error (0x0) |
| Missing per Section 1.4.1 | Error (0x0) |

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

##### F-REQ-306726/A-Message Center Display per Current State for TBCM Mode

|  |  |  |
| --- | --- | --- |
| **Trailer\_Brake\_Mode\_MC** | **Message ID: SU278**  **Reset Switch Event** | **Next TrlrBrkMde\_D\_Rq State** |
| EOH (0x1) | TBC MODE  ELECTRIC <EOH> | Electric (0x0) |
| Electric (0x0) | TBC MODE  <ELECTRIC> EOH | ElectricOverHydraulic (0x1) |
| Error (0x2) | TBC MODE  ELECTRIC EOH | ElectricOverHydraulic (0x1) |

##### F-REQ-306727/A-High End Display and TBC Mode Request Messages based upon Trailer\_Brake\_Mode\_MC

|  |  |  |  |
| --- | --- | --- | --- |
| **Trailer\_Brake\_Mode\_MC** | **Display Menu** | **5-Button**  **Switch SelectionEvent** | **TrlBrkMde\_D\_Rq**  **Signal** |
| Electric (0x0) |  | Up/Down + OK (Select EOH) | 0x1 (ElectricOverHydraulic) |
| EOH (0x1) |  | Up/Down + OK (Select Electric) | 0x0 (Electric) |
| Error (0x2) |  | Up/Down + OK (Select Electric or EOH) | 0x0 (if Electric is Selected)  0x1 (if EOH is Selected) |

Note: Trailer\_Brake\_Cfg must be set to Enabled (0x1) to display this menu

##### F-REQ-306728/A-Message Center Display per Current State for TBCM Effort

|  |  |  |
| --- | --- | --- |
| **Trailer\_Brake\_InitOut\_ MC** | **Message ID: SU920**  **Reset Switch Event** | **Next TrlrBrkInitOut\_D\_Rq State** |
| Light (0x1) | TBC EFFORT  <LOW> MED HIGH | Medium (0x2) |
| Medium (0x2) | TBC EFFORT  LOW <MED> HIGH | Heavy (0x3) |
| Heavy (0x3) | TBC EFFORT  LOW MED <HIGH> | Light (0x1) |
| Error (0x0) | TBC EFFORT  LOW MED HIGH | Light (0x1) |

##### F-REQ-306729/A-High End Display and TBC Mode Request Messages based upon Trailer\_Brake\_InitOut\_MC

|  |  |  |  |
| --- | --- | --- | --- |
| **Trailer\_Brake\_InitOut\_MC** | **Display Menu** | **5-Button**  **Switch SelectionEvent** | **TrlBrkInitOut\_D\_Rq**  **Signal** |
| Light (0x1) |  | Up/Down + OK (Select Medium or Heavy) | 0x2 (if Medium is Selected)  0x3 (if Heavy is Selected) |
| Medium (0x2) |  | Up/Down + OK (Select Light or Heavy) | 0x1 (if Low is Selected)  0x3 (if Heavy is Selected) |
| Heavy (0x3) |  | Up/Down + OK (Select Light or Medium) | 0x1 (if Low is Selected)  0x2 (if Medium is Selected) |
| Error (0x0) |  | Up/Down + OK (Select Light or Medium or Heavy) | 0x1 (if Low is Selected)  0x2 (if Medium is Selected)  0x3 (if Heavy is Selected) |

Note: Trailer\_Brake\_Cfg must be set to Enabled (0x1) to display this menu

###### F-REQ-306722/A-Vehicle Configuration

* This feature will be set via diagnostic at Vehicle Operations using DID DExx. Trailer\_Brake\_Cfg is set equal to the last value received in the diagnostic routine.

###### F-REQ-306723/A-Trailer Brake Mode

* The customer will have the ability to change the value of Trailer Brake Mode and Trailer Brake Effort when the Instrument Cluster Message Center (IC) is enabled (Operational Mode is Normal)

#### FS-REQ-306738/A-Function Safety Classification (EMC)

Class B

#### NVM-REQ-306733/A-Memory Storage

| **Parameter Name** | **Description** | **Value at**  **Battery Connect** | **Value at**  **Module Wake-up** |
| --- | --- | --- | --- |
| Trailer\_Brake\_Mode\_MC | Output for TBC Mode displayed in the M/C | Error (0x2) | Do Not Init |
| Trailer\_Brake\_InitOut\_MC | Output for TBC Effort displayed in the M/C | Error (0x0) | Do Not Init |
| TrlrBrkMde\_D\_Rq Signal | Output command acknowledging signal sent from the IPC to TBM for TBC Mode | Electric (0x0) | Do Not Init |
| TrlrBrkMde\_D\_Actl Signal | Input signal sent from the TBM to the IPC for TBC Mode | Electric (0x0) | Do Not Init |
| TrlBrkInitOut\_D\_Rq Signal | Output command signal sent from the IPC to TBM for initial trailer braking magnitude | Null (0x0) | Null (0x0) |
| TrlBrkInitOut\_D\_Stat Signal | Input signal sent from the TBM to the IPC for initial trailer braking magnitude | Null (0x0) | Do Not Init |
| M/C\_Display\_Status | See \* below | See \* below | See \* below |
| Reset Switch Event | Event that is indicated as per the switch interface for Message Center display. See \* | See \* below | See \* below |
| Operational\_Mode | 4 state indicator for cluster operational mode | Limited | Limited, Normal or Crank |
| Trailer\_Brake\_Cfg | Configures cluster to allow Trailer Brake Warning Messages to be displayed, and to allow SETUP menu (set to disable at cluster end of line). See Warning – Trailer Brake Controller STSS for definition. | Use Stored Value | Use Stored Value |

\* 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

For S-HMI clusters, refer to text as defined in the Text Message List section of this SPSS.

Refer to Message Center Function description reference "B 2x14 Text Message List.xls" or "E Display 2x14 Text Message List.xls" file-- Message ID SU278 and SU920.

## Error Handling

### Missing Message Strategy

#### Reference

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.

#### SR-REQ-306734/A-Trailer\_Brake\_Cfg

If Trailer\_Brake\_Cfg = Disabled, 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

#### DTC-REQ-306735/A-Supported Diagnostic Trouble Codes (DTCs)

|  |  |
| --- | --- |
| **DTC** | **Description** |
| C13700 | Lost Communication With Trailer Brake Control Module |

#### DCR-REQ-306736/A-DID DExx

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Bits** | **State: Description** | **"0"** | **"1"** | **Default** | **Comments/Information** |
| 1 | Trailer Brake Gain Warning | Disabled | Enabled | Disabled | If disabled, the TBM is not equipped. The TBC warnings and Setup menu are enabled together. |

## Reference Specification

None

## Revision History

**SPSS Module Revision History**

| **Revision Level** | **Name** | **Change Description** | **Date** |
| --- | --- | --- | --- |
| 1.0 | SWatkins | Initial Release | 8/05/08 |
| 1.1 | SWatkins | Update typo in 1.3.5.1 (Trailer Brake Mode Control Function). The second decision box had 2 "yes" paths. | 11/20/08 |
| 1.2 | SWatkins | Per request from Bang Cao and Peter Huang, change default to Electric.   1. Section 1.3.5.4 - Changed battery connect default of TrlrBrkMde\_D\_Rq   Notes:  Note that the cluster does not have quite the normal handshake with the TBM module. This was not intentional, but the system works as intended. This is because the TBM does not follow the usual “ignore the cluster for 2s after key in RUN so that the cluster can sync up with the correct setting” handshake. Effectively, the cluster is the “owner” of the TBM setting instead of the TBM module. Thus, the cluster has a battery connect default of Electric, which will force the setting to Electric. When the setting is changed, the cluster will store in battery backed memory. Which will then force the TBM back to the last setting each key cycle. | 5/26/2010 |
| CGEA1.3 1.0 | V. Patel | Updated for CGEA 1.3 based on CGEA STSS v1.2  Section 1.2.2 – Removed table referencing the HS-CAN message that contains the input signal.  Section 1.2.3 – Removed table referencing the HS-CAN message that contains the output signal.  Section 1.2 – Deleted “Position” column from the input and output signal tables.  Section 1.4 – Rewritten. Deleted references of specific missing message flags and timer.  Section 1.5.3 – Deleted DTC logging criteria from the table. | 5/26/2010 |
| CGEA 1.3/1.2/1.1 version 2.0 | T. Cwik | Feature owner John Crossman and Peter Huang and Bang Cao.  This change is to add a second Message Center Settings Menu for TBC Effort and to add the S-HMI Display interfaces.  Section 1.1 – Added text about second setting.  Section 1.2.1 – Figure 1 – Added TrlBrkInitOut\_D\_Stat and TrlBrkInitOut\_D\_Rq  Section 1.2.2 – Added Table 1.1 and renumbered subsequent tables.  Section 1.2.3 – Added Table 1.3 and renumbered subsequent tables.  Section 1.3.3.2 – Added S-HMI graphics text and example. Added SU920 to “B” or “E” display text.  Section 1.3.5.1 –  – Updated Figure 2 Trailer Brake Mode Control Function Flowchart to include the “Trailer Brake Effort” screen.  – Added Table 1.5 and renumbered subsequent tables.  Section 1.3.5.2 –  – Added Tables 1.7, 1.8 and 1.9  – Added “and Trailer Brake Effort” to 2nd tic point  Section 1.3.5.4 – Added Trailer\_Brake\_InitOut\_MC, TrlBrkInitOut\_D\_Stat and TrlBrkInitOut\_D\_Rq  Section 1.3.5.7 – Added S-HMI text. Added SU920 to “B” or “E” display text. | 12/12/2012 |
| CGEA 1.3/1.2/1.1 version 2.1 | S. Watkins  M. Hakim | This revision is to handle open issues, as well as spec cleanup. Details are as follows:  Updated Configuration DID DE00 to DExx throughout the document.  Section 1.2.2: Corrected configuration typo Trailer\_Brake\_Cfg instead of TBC\_Cfg  Corrected CAN input signal TrlrBrkMde\_D\_Actl & CAN output signal TrlrBrkMde\_D\_Rq detail values throughout the document.  Removed SU Message IDs throughout the document.  Section 1.3.5.4, Memory Storage table: Updated TrlrBrkMde\_D\_Actl Signal initialization at Battery Connect.  Updated document footer. | 9/24/2013 |
| 2.2 | P.Denduku | Initial VSEM RM Release; Deleted Strike through text from Section 1.2.2 | 8/13/2018 |