# Boost/Vacuum Gauge – CGEA1.3

## Functional Description

The Boost/Vacuum gauge display provides a numerical display and a virtual graphical gauge to inform the driver of the pressure or vacuum in the intercooler.

The Boost/Vacuum Gauge display correlates the Operational Mode and the EngMnfld\_P\_Actl signal from the PCM to display the pressure or vacuum and generate virtual gauge pointer movement.

The Boost/Vacuum is determined by the PCM. The PCM is responsible for any filtering of the data and the Instrument Cluster only needs to display the information it receives. The Instrument cluster, however, is responsible for any scaling or unit changes that might be required. The Boost portion of the gauge display is in PSI and the Vacuum portion in inches of Hg. The CAN message will report all pressures in units of kPa. A zero value in the CAN input will correspond to atmospheric pressure and read zero for boost and vacuum pressure. A negative value in the message will correspond to vacuum and the cluster will convert the vacuum to inches of Hg. A positive value in the message will correspond to boost pressure. This gauge does not require any red indications because it does not provide warning for any fault condition.

The Boost/Vacuum Gauge shall provide an analog gauge with a rotating pointer to register increase in the boost pressure by rotating clockwise, and increase in vacuum by rotating counter clockwise.

## Interfaces

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

Figure 1.0 Boost/Vacuum Gauge Context Diagram



### Inputs

* INTERNAL:
  + Operational\_Mode: Refer to section Operational Modes
  + Boost\_Vac\_Cfg
  + DIAG\_SESSION\_TIMER
  + Diagnostic DID 600D (Turbo Boost Gauge Pointer Position)
* MUX signal on the CAN Bus

1. EngMnfld\_P\_Actl Signal

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Signal Name** | **Size**  **(bits)** | **Detail** | **Units** | **Res.** | **Offset** | **State Encoded** | **Min** | **Max** |
| EngMnfld\_P\_Actl | 13 |  | kPa | 0.1 | -206.80 |  | 0 (0x0) | 8191 (0x1FFF) |
|  |  |  |  |  |  |  |  |  |

### Outputs

* Boost Vacuum Gauge Indication

## Function/Performance

### Operational Modes

|  |  |
| --- | --- |
| **Mode** | **Differentiating Vehicle Conditions** |
| Sleep Mode | Boost Vacuum Gauge Indication at “Rest Position” |
| Limiting Mode | Boost Vacuum Gauge Indication at “Rest Position” |
| Normal Mode | Boost Vacuum Gauge Indication at “Boost\_Vacuum\_Gauge\_Indication” |
| Crank Mode | Boost Vacuum Gauge Indication at “Boost\_Vacuum\_Gauge\_Indication” |

### Voltage Levels

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

### Human-Machine Interface

#### Visual

#### Indicator Graphics / Display Format

##### Indicator Color Coordinates

Refer to section COLOR & ILLUMINATION REQUIREMENTS (GRAPHICS) in the Master Document Section in this SPSS.

##### Indicator Characteristics

| **Description of Gauge** | **Scale Range** | **Scale Span** | **Operating Span** |
| --- | --- | --- | --- |
| North American | 30 – 0 inHg (vacuum)  0 – 30 PSI (boost) | 0 – 144 angular degrees | 0 - 144 angular degrees |

#### Audio

None

#### Switch Control Logic

Not applicable.

### System Accuracy

Shall indicate the data contained in EngMnfld\_P\_Actl Signal.

### Operation: Performance and Functional

#### Subsystem Algorithm Flowchart / State Diagram

Figure 1.1 Boost Vacuum Gauge Control Algorithm



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

1. State Matrix for Boost Vacuum Gauge

|  |  |  |  |
| --- | --- | --- | --- |
| **Operational\_Mode** | **DIAG\_SESSION**  **\_TIMER** | **DIAG\_DID\_**  **600D**  **(Turbo Boost Gauge Pointer Position)** | **Boost\_Vacuum\_Gauge\_Indication** |
| Normal or Crank | Not Active | X | As per Figure 1.1 - Boost Vacuum Gauge Control Algortihm |
| Normal | Active | Not Received | As per Figure 1.1 - Boost Vacuum Gauge Control Algortihm | |
| Active | Received with Appropriated Data | Pointer Location per Diagnostic DID | |
| All Other Cases | | | As per Figure 1.1 - Boost Vacuum Gauge Control Algortihm |

* Gauge pointer shall move to Rest Position at max rate when EngMnfld\_P\_Actl signal is declared missing as per section 1.4
* Pointer overshoot and return to Boost or vacuum indicated by EngMnfld\_P\_Actl Signal shall not exceed one angular degree.
* Pointer movement shall appear smooth and continuous.
* Pointer shall not waver at constant position with constant command.
* No pointer stick shall be observed at any time.
* The cluster shall update the virtual gauge pointer position at least every 50 msec since the Boost Vacuum gauge has a high degree of pointer movement.
* The cluster shall linear interpolate between input values to calculate the target position to ensure smooth pointer movement between targets.

#### Function Safety Classification (EMC)

Class B

#### Memory Storage

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter Name** | **Description** | **Value at Battery Connect** | **Value at Module Wake-up** |
| EngMnfld\_P\_Actl Signal | Input vacuum/boost data sent from the PCM | 0 kPa | 0 kPA |
| Boost\_Vacuum\_Gauge\_  Indication | Output to control the gauge Pointer. | 0 (Rest Position) | 0 (Rest Position) |
| Boost\_Vac\_Cfg | State indicator for feature presence controlled via CAN at EOL at VO plant. Set to None at Cluster Supplier Manufacturing Plant | Use Stored Value | Use Stored Value |
| DIAG DID 600D | Turbo Boost Gauge Pointer Position | 0 (0x0) | 0 (0x0) |
| Operational\_Mode | 4 state indicator for cluster operational mode | Limited | Limited or Normal or Crank |

|  |  |  |  |
| --- | --- | --- | --- |
| **Timer Name** | **Description** | **Value at Battery Connect** | **Value at Module Wake-up** |
| DIAG\_SESSION\_TIMER | Timer used to time-out a diagnostic session | 0 | 0 |

#### Prove Out

No

## Error Handling

### Missing Message Strategy

The signal 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 Boost\_Vac\_Cfg is not configured as Boost&Vac (0x3), the cluster shall not log a missing message DTC due to this feature.

## Diagnostics

### Self Test

None

### Engineering Test Mode

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

### Part II Performance

**Supported Diagnostic DIDs (Service $22 and $2F)**

|  |  |  |
| --- | --- | --- |
| **Number** | **DID / CommonID Name** | **DID Type** |
| 600D | Turbo Boost Gauge Pointer Position | Numeric |

**DID DEXX**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Block**  **Num** | **Block**  **Description** | **Size (bits)** | **Type** | **Byte** | **Bit** | **State: Description** | **"0"** | **"1"** | **Default** | **Comments** |
| PACKETED BLOCKS | |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| $XX | Option Content (B&A) | 2 | 1 | \* | \* | Boost Vacuum | Encoded | Encoded | 00 |  |
|  |  |  |  |  |  | 00 | Encoded | Encoded |  | 00 – None |
|  |  |  |  |  |  | 01 | Encoded | Encoded |  | 01 – Reserved (for future use) |
|  |  |  |  |  |  | 10 | Encoded | Encoded |  | 10 – Vacuum Only |
|  |  |  |  |  |  | 11 | Encoded | Encoded |  | 11 – Boost & Vac |
|  | \*Byte and bit location to be identified in Part II Specification for this cluster | | | | | | | | | |

**Supported Diagnostic Trouble Codes (DTCs)**

|  |  |  |
| --- | --- | --- |
| **DTC** | **Description** | **When Logged** |
| C10000 | Lost Communication with PCM | When EngMnfld\_P\_Actl is declared missing.. |

## Reference Specification

* Func. Criticality EC-0048
* Mod. PWR-up / Reset EC-0049
* Low-High Vol. Perform. EC-0058
* Instr. & Gauges (indic. Grad) IS-0015
* Oper. Voltage Func. IS-0053
* Symbol Usage 01-0238 / 01-0239
* Symbol Leg. 01-0240
* Harmony: Graphics / Font / Ill. 17-0040
* Ergo - Access. 17-0052
* Control & Display Loc. 17-0060
* Logical grouping Function and Usage 17-0062
* Assoc. of Controls with Disp. & elem. 17-0063
* Ill. Controls & Disp. 17-0074
* Id. Legibility 17-0081
* Logic of Op. 17-0120
* Interpretation 17-0122

## Revision History

**SPSS Module Revision History**

|  |  |  |  |
| --- | --- | --- | --- |
| **Revision Level** | **Name** | **Change Description** | **Date** |
| 1.0 | V. Patel | Initial release for CGEA1.3, based on Boost Vacuum Virtual Gauge Display – S197 only v1.1 dated 3/29/2011 | 02/15/2013 |
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