# 4 x 4 High Telltale for MSOS and non-MSOS Vehicles – CGEA1.3

## Functional Description

The purpose of the 4 x 4 High telltale is to inform the driver that the vehicle is operating in four wheel drive high mode.

The 4x4 High telltale correlates the AwdHiLamp\_D\_RqDsply signal, the module configuration, and the Operational Mode to illuminate or extinguish the 4x4 High telltale (non\_MSOS equipped vehicles). Alternatively, for MSOS equipped vehicles, the 4x4 High telltale correlates the 4x4 HIGH hardwired input, the 4x4 LOW hardwired input, the bulb\_proveout\_timer, and the Operational\_Mode to illuminate or extinguish the 4x4 High telltale .

The 4x4 High telltale shall provide an iconic representation that will illuminate or extinguish to inform the driver whether they are in 4x4 mode or some other mode.

For non-MSOS equipped vehicles TCCM module sends out AwdRnge\_D\_Actl signal. MSOS vehicles are not equipped with a TCCM module so IPC sends out AwdRnge\_D\_ActlIPC in lieu of AwdRnge\_D\_Actl signal. Modules which receive AwdRnge\_D\_Actl signal on non-MSOS vehicles will use IPC transmitted signal AwdRnge\_D\_ActlIPC on MSOS equipped vehicles. .

Note the AwdRnge\_D\_Actl signal transmitted by TCCM is not used by IPC.

This STSS is only used for programs with both non-MSOS and MSOS 4 wheel drive systems. At the time of this release P558 is the only CGEA1.3 program known to have the MSOS feature.

## Interfaces

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

4x4 High Indication



### Inputs

#### IR-REQ-344096/A-INTERNAL:

2WD\_4x4\_AWD\_Cfg

4x4\_CAN\_HW\_Cfg

DIAG\_SESSION\_TIMER

Operational\_Mode

Bulb\_Proveout\_Timer

DIAG\_DID\_61CE,3,6 Four Wheel Drive (4WD) High Telltale)

ETM\_Bulb\_Check\_State

Self\_Test\_Entry\_Bulb\_Check\_Timer

#### MUX message on the HS CAN Bus from HS\_4x4CM

##### SIG-REQ-344087/A-Signal AwdHiLamp\_D\_RqDsply

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Size  (bits) | Detail | Units | Res. | Offset | State Encoded | Min. | Max. |
| AwdHiLamp\_D\_RqDsply | 2 |  | SED | 1 | 0 |  | 0(0x0) | 3(0x3) |
|  |  | Off |  |  |  | 0x0 |  |  |
|  |  | On |  |  |  | 0x1 |  |  |
|  |  | Flash |  |  |  | 0x2 |  |  |
|  |  | Not\_Used |  |  |  | 0x3 |  |  |

### Outputs

#### IR-REQ-344098/A-INTERNAL:

* 4x4\_High\_Telltale, which is used to control the state of the LED.
* AwdRnge\_D\_ActlIPC signal, when 4x4\_CAN\_HW configured as HW:

#### MUX message on the HS CAN Bus

##### SIG-REQ-344088/A-Signal AwdRnge\_D\_ActlIPC

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **ID** | **Size**  **(bits)** | **Detail** | **Units** | **Res.** | **Offset** | **State Encoded** | **Min.** | **Max.** |
| AwdRnge\_D\_ActlIPC | 3 |  | SED | 1 | 0 |  | 0(0x0) | 7(0x7) |
|  |  | Low\_Range\_Locked |  |  |  | 0x0 |  |  |
|  |  | Low\_Range\_Auto |  |  |  | 0x1 |  |  |
|  |  | Low\_Range\_2wd |  |  |  | 0x2 |  |  |
|  |  | Neutral |  |  |  | 0x3 |  |  |
|  |  | High\_Range\_Locked |  |  |  | 0x4 |  |  |
|  |  | High\_Range\_Auto |  |  |  | 0x5 |  |  |
|  |  | High\_Range\_2wd |  |  |  | 0x6 |  |  |
|  |  | Unknown |  |  |  | 0x7 |  |  |

## Function/Performance

### F-REQ-344105/A-Operational Modes

|  |  |
| --- | --- |
| **Mode** | **Differentiating Vehicle Conditions** |
| Sleep Mode | 4x4 High Telltale OFF |
| Limited Mode | 4x4 High Telltale OFF |
| Normal Mode | 4x4 High Telltale ON/OFF |
| Crank Mode | 4x4 High Telltale ON/OFF |

### 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

#### HMI-REQ-344097/A-Indicator Graphics / Display Format



For actual symbol definition refer to the Ford Approved Symbols List Abbreviations section which is controlled/accessed by RQT-001301-003514 (Legacy 03-0685) ARL. **4H** may be substituted for **4x4 HIGH** symbol at the request of the program/styling and is also defined in the Ford Approved Symbols List Abbreviations section.

##### HMI-REQ-344089/A-Indicator Color Coordinates

Amber - Reference SDS IH-0001/IS-0379

##### HMI-REQ-344090/A-Indicator Characteristics

LED - 4x4 High Telltale

#### Audio

None.

### PFM-REQ-344104/A-System Accuracy

The 4x4\_High\_Telltale shall change the state of the Telltale within 100msec of a state change as indicated in the state matrix reference 1.3.5.1 Subsystem Algorithm Flowchart / State Diagram.

### Operation: Performance and Functional

#### Subsystem Algorithm Flowchart / State Diagram

##### F-REQ-344091/A-4x4 High Fixed / Dedicated RTT Diagnostic Flowchart





##### F-REQ-344092/A-State Matrix for 4x4\_High\_Telltale

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Operational\_ mode** | **2WD\_ 4x4\_ AWD\_ cfg** | **4x4\_CAN\_ HW\_Cfg** | **ETM Bulb\_ Check\_State** | **DIAG\_ SESSION\_ TIMER** | **Self\_Test\_ Entry\_Bulb\_ Check\_Timer** | **DIAG\_DID\_61CE,3,6 Four Wheel Drive (4WD) High Telltale** | **DIAG\_DID\_61A5,4,6**  **(all warning lamps)** | **Bulb\_ Proveout\_ Timer** | **4x4 HIGH\_50msec**  **debounced switch state** | **4x4 LOW\_50msec**  **debounced switch state** | **AwdHiLamp\_ D\_RqDsply** | **4x4\_High\_**  **Telltale** |
| Normal or  Crank | 4x4 | X | X | Not Active | X | X | X | Active | X | X | X | ON |
| ON (0x1) | Not Active | X | X | X | X | X | X | X | ON |
| CAN | X | Not Active | X | X | X | X | X | X | ON (0x1) | ON |
| Normal | X | Active | Not Active | Not Received | Not Received | X | X | X | ON (0x1) | ON |
| HW | OFF (0x0) | Not Active | X | X | X | Expired | Active (GND) | Active (GND) | X | OFF |
| X | Not Active | X | X | X | X | Active (GND) | Inactive (OPEN) | X | ON |
| OFF (0x0) | Not Active | X | X | X | Expired | Inactive (OPEN) | Active (GND) | X | OFF |
| OFF (0x0) | Not Active | X | X | X | Expired | Inactive (OPEN) | Inactive (OPEN) | X | OFF |
| OFF (0x0) | Active | Not Active | Not Received | Not Received | Expired | Active (GND) | Active (GND) | X | OFF |
| X | Active | Not Active | Not Received | Not Received | X | Active (GND) | Inactive (OPEN) | X | ON |
| OFF (0x0) | Active | Not Active | Not Received | Not Received | Expired | Inactive (OPEN) | Active (GND) | X | OFF |
| OFF (0x0) | Active | Not Active | Not Received | Not Received | Expired | Inactive (OPEN) | Inactive (OPEN) | X | OFF |
| X | X | Active | Not Active | Not Received | Not Received | Active | X | X | X | ON |
| ON (0x1) | Active | Not Active | Not Received | Not Received | X | X | X | X | ON |
| X | Active | X | ON (0x1) | X | X | X | X | X | ON |
| X | Active | X | X | ON (0x1) | X | X | X | X | ON |
| X | Active | Active | X | X | X | X | X | X | ON |
| All Other Cases | | | | | | | | | | | | OFF |

X=Don’t Care

Not Received = The state when a DIAG\_SESSION\_TIMER is active and the DID has not been received

##### F-REQ-344093/A-State Matrix for AwdRnge\_D\_ActlIPC signal and DIAG\_DID\_1E7B when configured for HW

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Operational\_ Mode** | **2WD\_4X4\_ AWD\_Config** | **4x4\_ CAN\_HW\_**  **Config** | **Bulb\_ Proveout\_ Timer** | **4x4 HIGH\_1000msec**  **debounced switch state** | **4x4 LOW\_1000msec**  **debounced switch state** | **AwdRnge\_D\_ActlIPC**  **Signal** | **DIAG\_DID\_1E7B** |
| Normal  or Crank | 4x4 (0x1) | HW (0x0) | Active | X | X | 0x7 (Unknown) | 0xFF (Invalid) |
| Inactive | Active (GND) | Active (GND) | 0x0 (Low Range Locked) | 0x4 (Four Wheel Drive - Low) |
| Active (GND) | Inactive (OPEN) | 0x4 (High Range Locked) | 0x2 (Four Wheel Drive – High) |
| Inactive (OPEN) | Active (GND) | 0x7 (Unknown) | 0xFF (Invalid) |
| Inactive (OPEN) | Inactive (OPEN) | 0x6 (High\_Range\_2wd) | 0x0 (Two Wheel Drive) |
| 2WD (0x0) | X | Inactive | X | X | 0x6 (High\_Range\_2wd) | 0x0 (Two Wheel Drive) |
| All Other Cases | | | | | | 0x7 (Unknown) | 0xFF (Invalid) |

X=Don’t Care

Not Received = The state when a DIAG\_SESSION\_TIMER is active and the DID has not been received

No State Change = The state does not change; keep the existing state.

Note: it is necessary to have both a long (1000 msec) and a short (50 msec) debounce of 4x4 HIGH and 4x4 LOW hardwired inputs. The long debounce is to prevent cycling of the traction control LED during a blocked 4x4 shift event.

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

#### FS-REQ-344107/A-Function Safety Classification (EMC)

Class B

#### Memory Storage

##### NVM-REQ-344094/A-Parameters Table

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter Name** | **Description** | **Value at**  **Battery Connect** | **Value at**  **Module Wake-up** |
| 4x4\_High\_Telltale | Used to control the state of the LED | OFF (0x0) | OFF (0x0) |
| AwdHiLamp\_ D\_RqDsply | CAN signal sent from 4x4CM. | 0 (0x0) | 0 (0x0) |
| DIAG\_DID\_61CE, 3, 6  [(4WD) High Telltale] | Warning Lamp "B" Status byte 3 bit 6  Four Wheel Drive (4WD) High Telltale | Off (0x0) | Off (0x0) |
| DIAG\_DID\_61A5,4,6 (all warning lamps) | Indicator Lamp Control 2, byte 4, bit 6 (all warning lamps) | 0 (0x0) | 0 (0x0) |
| DIAG\_DID\_1E7B (Four Wheel Drive Mode) | Diagnostic DID used to report 4x4 switch state for MSOS-equipped vehicles | Invalid (0xFF) | Invalid (0xFF) |
| ETM\_Bulb\_Check\_State | State indicator for warning bulb in ETM | OFF (0x0) | OFF (0x0) |
| 2WD\_4x4\_AWD\_Cfg | State indicator for feature presence controlled via CAN at EOL at VO plant. | Use Stored Value | Use Stored Value |
| 4x4\_CAN\_HW\_Cfg | State indicator as to whether 4x4 states are received via CAN or HW to IPC. | Use Stored Value | Use Stored Value |
| Operational\_Mode | 4 state indicator for cluster operational mode | Limited | Limited, Normal or Crank |

##### NVM-REQ-344095/A-Timer Table

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter Name** | **Description** | **Value at**  **Battery Connect** | **Value at**  **Module Wake-up** |
| DIAG\_SESSION\_TIMER | Timer used to time-out a diagnostic session | Not Active | Not Active |
| Bulb\_Proveout\_Timer | Internal command directing proveout | Not Active | Not Active |
| Self\_Test\_Entry\_Bulb\_Check\_ Timer | Timer used in diagnostic session to do a self check of telltales | Not Active | Not Active |

#### SR-REQ-344099/A-Prove Out

3.0 +/- 0.1 seconds as per bulb prove out section. Cluster controls prove out. No DTCs shall be logged while in Prove Out.

#### Reconfigurable Telltale

No.

#### Message Center Msg

None

## 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.

#### SR-REQ-344100/A-Config

If the 2WD\_4x4\_AWD configuration is not 4x4 (01), OR if the 4x4\_CAN\_HW configuration is not CAN, the cluster shall never log a missing message DTC due to this feature.

## Diagnostics

### SR-REQ-344106/A-Self Test

Bulb illuminated during self test as per Self\_Entry\_Bulb\_Check\_Timer

### Engineering Test Mode

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

### Part II Performance

#### DCR-REQ-344101/A-DID $DE00

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Block**  **Num** | **Block Description** | **Size (bits)** |  | **Byte(s)** | **Bits** | **State: Description** | **"0"** | **"1"** | **Default** | **Comments/**  **Information** |
| PACKETED BLOCKS | |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| $00 | Option Content (B&A) |  |  | \* | 2 | 2WD/4x4/AWD | encoded | encoded | 4x4 |  |
|  |  |  |  |  |  | 00 - 2WD | encoded | encoded |  |  |
|  |  |  |  |  |  | 01 - 4x4 | encoded | encoded |  |  |
|  |  |  |  |  |  | 10 - AWD | encoded | encoded |  |  |
|  |  |  |  | \* | 1 | 4x4\_CAN\_HW | Hardwired | CAN | CAN | Set to Hardwired for MSOS vehicles only |
| \*Byte and bit location to be identified in Part II Specification for this cluster | | | | | | | | | | |

#### DID-REQ-344102/A-DIDs

|  |  |  |
| --- | --- | --- |
| **Number** | **DID Name** | **PID Type** |
| 61CE,3,6 | Warning Lamp "B" Status byte 3 bit 6  Four Wheel Drive (4WD) High Telltale | Bit Mapped |
| 61A5,4,6 | Indicator Lamp Control 2, byte 4, bit 6 (all warning lamps) | Bit Mapped |
| 1E7B | Four Wheel Drive Mode | State Encoded |

#### DTC-REQ-344103/A-Supported Diagnostic Trouble Codes (DTCs)

|  |  |  |
| --- | --- | --- |
| **DTC** | **Description** | **When Logged** |
| C10200 | Lost Communication with Transfer Case Control Module | Message missing for more than 5 seconds and 4x4\_CAN\_HW\_Cfg = CAN |

## Reference Specification

FO-0007 FOUR WHEEL DRIVE MODE DISPLAY

FO-0008 FOUR WHEEL DRIVE FAULT INDICATOR

IS-0001 WARNINGS/INDICATORS/DISPLAYS PROVEOUT

IS-0046 INSTRUMENTATION MATERIAL RESISTANCE TO CLEANING

IS-0052 OPERATING VOLTAGES - FUNCTIONAL/PERFORMANCE

IS-0069 FUNCTIONAL IMPORTANCE CLASS

IS-0324 WINDSHIELD & OTHER REFLECTIONS

IS-0327 WARNING INDICATOR EVALUATION

IS-0329 FLICKERING OF LAMPS

IS-0379 NORTH AMERICAN WARNINGS AND INDICATORS STRATEGY

IL-0017 TELLTALE AND INTERIOR ILLUMINATION COLOR

IL-0021 CRAFTSMANSHIP - DISPLAYS

IL-0023 CLARITY/LEGIBILITY/READABILITY

IL-0025 INTERIOR ILLUMINATION INTENSITY

IL -0027 VISUAL CONTRAST

IL -0043 OPERATIONAL ENVIRONMENT FUNCTIONALITY

IL -0045 COLOR

IL -0047 TELLTALE; INDICATOR AND DISPLAY LIGHT INTENSITY

IL -0048 ILLUMINATION ACCEPTABILITY

03-0661  PLACEMENT: CONTROL AND DISPLAY LOCATIONS

03-0662  PLACEMENT: LOGICAL GROUPING FUNCTION AND USAGE

03-0664  PLACEMENT: DOWN VISION TO COMPONENTS WITH HIGH VISUAL DEMAND

03-0665  PLACEMENT: EXPECTED LOCATIONS OF CONTROLS AND DISPLAYS VDS

03-0670  INTERIOR VISIBILITY

03-0671  INTERIOR VISIBILITY: REFLECTIONS FROM COMPONENTS & SURFACES

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

03-0682  IDENTIFICATION: LEGIBILITY

03-0685  IDENTIFICATION: SYMBOLS,  ABBREV FOR CONTROL

03-0721  LOGIC OF OPERATION: OPERATIONAL STEREOTYPES

03-0722  LOGIC OF OPERATION: INTERPRETATION

03-0723  LOGIC OF OPERATION: USE OF SYSTEMS WITH VISUAL DISPLAYS

## Revision History

**SPSS Module Revision History**

|  |  |  |  |
| --- | --- | --- | --- |
| **Revision Level** | **Name** | **Change Description** | **Date** |
| 1.0 | J. Blatchford | Initial Release. At the time of this release 2017 P558 is the only CGEA1.3 program known to implement MSOS 4x4. | 3/9/14 |
| 1.1 | J. Blatchford | This update was championed through the DI Change Control/Forum process by Fraser, John (J.) [jfraser4@ford.com](mailto:jfraser4@ford.com) and was approved to implement STSS in 9/7/2017 DI Change Control. J. Blatchford identified an issue in the approved design change so subsequent meetings were required with PTO group to come to consensus on proper logic. John has also confirmed with the appropriate parties this update will have no unintended consequences.  This update corrects a condition where for 2WD vehicles the PTO will not function. As a temporary field fix dealers are re-flashing the IPC to make the vehicle think it is a 4x4 when it is actually 2WD. Since there is no TCCM on 2WD vehicles it appears to work. This update is permanent corrective action for this issue.  Updated Table 1.3 so IPC sends 0x6 (High\_Range\_2wd) signal value for 2WD vehicles. Changes highlighted in green.   * Figure 2:Removed bottom flow chart and added note that Tables 1.2 and 1.3 are always executed. * Updated Table 1.3 so IPC sends 0x6 (High\_Range\_2wd) signal value for 2WD vehicles. | 10/12/2017 |
| 1.2 | V. Patel | Initial release for VSEM requirements migration | 2/27/2019 |
|  |  |  |  |
|  |  |  |  |