1 HUD_Speedometer Gauge Digital – CGEA1.3+

1.1 Functional Description

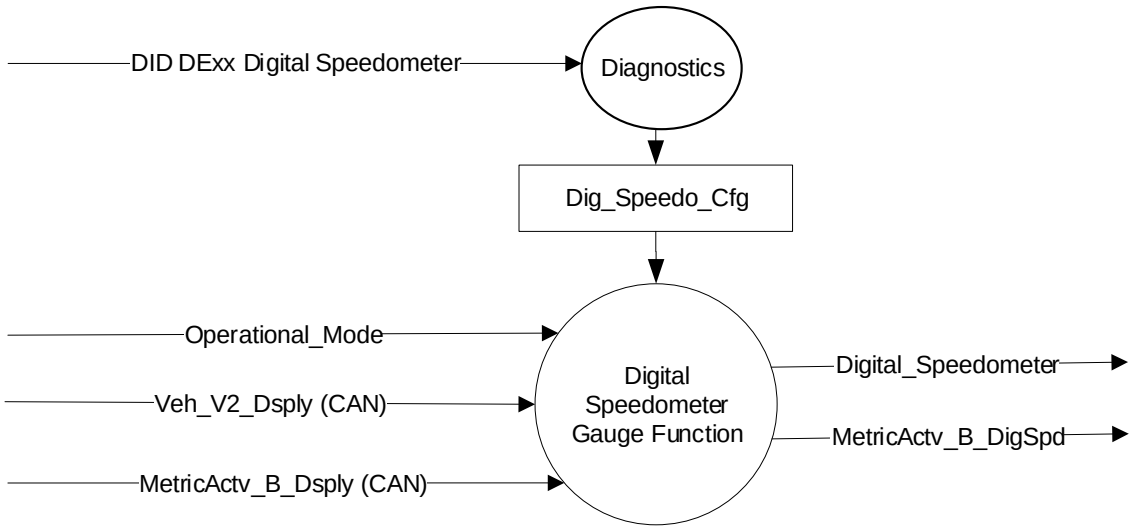
The purpose of the Digital Speedometer Gauge feature is to inform the driver of the vehicle's speed.

The digital speedometer gauge display in the HUD is a client function of the cluster where both analog and digital values are calculated. Cluster as the server is responsible for the integrity, accuracy and filtering of the vehicle speed signals
while HUD as a client is responsible for display only.

1.2 Interfaces

1.2.1 Interface Context Diagram (I/O Block Diagram)

Digital Speedometer Gauge Context Diagram



1.2.2 Inputs

1.2.2.1 IR-REQ-302098/A-Internal

1. Operational_Mode

1.2.2.2 MUX Signals

1.2.2.2.1 SIG-REQ-302092/A-Veh_V2_Dsply

Signal Name	ID	Size (bits)	Pos. (bits)	Detail	Units	Res.	Offset	State Encoded	Min	Max	Sender
Veh_V2_Dsply	0x225	9	0		Unitless	1	0		0 (0x00)	511(0x1FF)	IPC

1.2.2.2.2 SIG-REQ-302093/A- MetricActv_B_Dsply

Signal Name	ID	Size (bits)	Pos. (bits)	Detail	Units	Res.	Offset	State Encoded	Min	Max	Sender
MetricActv_B_Dsply	0x225	1	0		SED	1	0		0(0x0)	1 (0x1)	IPC
				Inactive				0x0			
				Active				0x1			

1.2.3 IR-REQ-302099/A-Outputs

1. Digital_Speedometer – Numeric display of the vehicle's indicated speed.
2. MetricActv_B_DigSpd – Metric active for Digital Speedometer unit.

1.3 Function/Performance

1.3.1 F-REQ-302100/A-Operational Modes

Mode	Differentiating Vehicle Conditions
Sleep Mode	Digital Speedometer Gauge OFF
Limited Mode	Digital Speedometer Gauge OFF
Normal Mode	Digital Speedometer Gauge On
Crank Mode	Digital Speedometer Gauge On

1.3.2 Voltage Levels

Refer to the HUD Features Table located in the Operational Modes and Voltage Range Strategies Section of this SPSS.

1.3.3 Human-Machine Interface

1.3.3.1 Visual

1.3.3.1.1 Indicator Graphics / Display Format

Refer to Graphics Section in the Master Document Section in this SPSS. Example shown below.

1.3.3.1.1.1 HMI-REQ-302135/A-HMI Support

1. HMI shall support 3 digits integer display.

1.3.3.1.2 Indicator Color Coordinates

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

1.3.3.1.3 Indicator Characteristics

None

1.3.3.2 Audio

None.

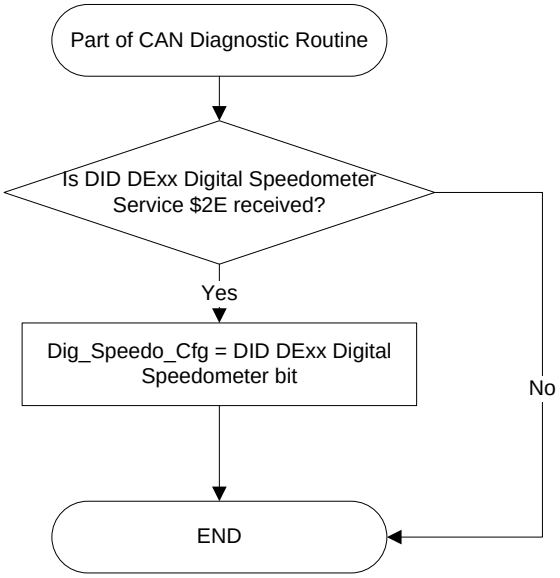
1.3.4 PFM-REQ-302134/A-System Accuracy

1. Shall update digital speedometer display every DIG_SPD_UPDATE_RATE ms

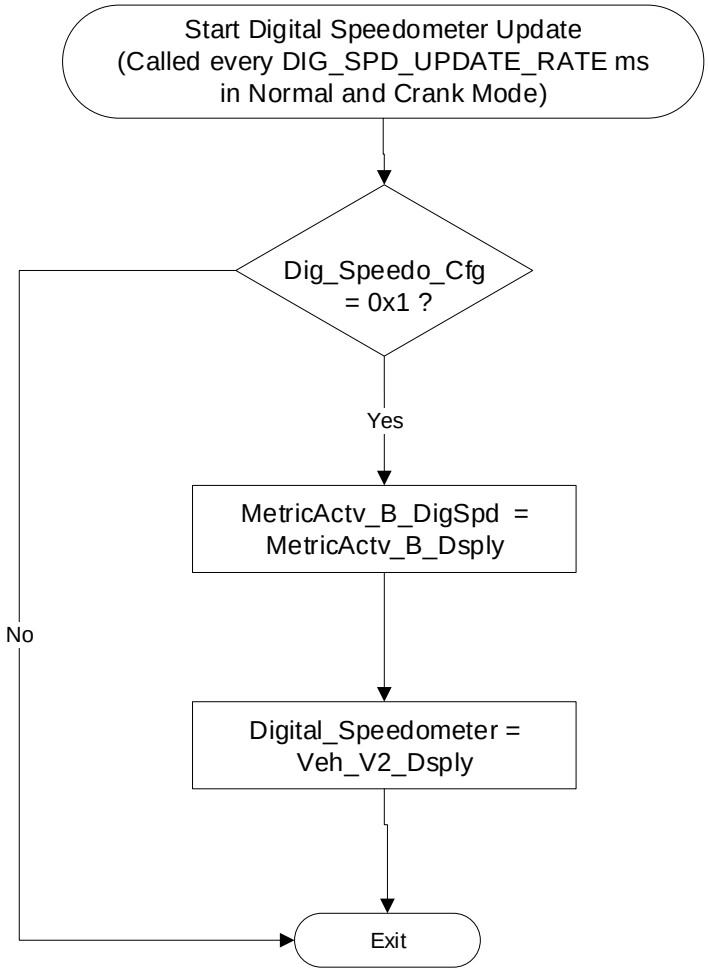
1.3.5 Operation: Performance and Functional

1.3.5.1 Subsystem Algorithm Flowchart / State Diagram

1.3.5.1.1 F-REQ-302105/A-CAN routine



1.3.5.1.2 F-REQ-302106/A- Subsystem Flowchart



1.3.5.2 Operation Description (supports algorithm flowchart /state diagram)

1.3.5.2.1 F-REQ-302094/A-Mirror

1. The Digital Speedometer Gauge in the HUD shall mirror the Digital Speedometer in the cluster.

1.3.5.2.2 F-REQ-302095/A-Display unit

1. The display unit of the Digital Speedometer Gauge in the HUD will follow the display unit of Digital Speedometer Gauge in the cluster.

1.3.5.2.3 F-REQ-302096/A-Display unit of the vehicle

1. Note that the display unit of the Digital Speedometer Gauge in the cluster that is selectable by the driver could be different from the display unit of the vehicle.

1.3.5.2.4 F-REQ-302097/A-Rate

1. The Digital Speedometer Gauge shall support a programmable display update rate, denoted as DIG_SPD_UPDATE_RATE.

1.3.5.3 FS-REQ-302101/A-Function Safety Classification (EMC)

B

1.3.5.4 NVM-REQ-302102/C-Memory Storage

Parameter Name	Description	Value at Battery Connect	Value at Module Wake-up
Dig_Speedo_Cfg	State Indicator for presence of Digital Speedometer display. Controlled via CAN at EOL at VO plant. Defaulted to (0x1) Enabled at supplier manufacturing.	Use Stored Value	Use Stored Value
Veh_V2_Dsply	CAN signal from the cluster indicates the Digital Speedometer value.	Default (0)	Do Not Init
MetricActv_B_Dsply	CAN signal from the cluster indicates the display unit displayed for Digital Speedometer in the cluster. Either Metric or English. This parameter only affects digital speedometer units in the cluster.	Do Not Init	Do Not Init
MetricActv_B_DigSpd	Display unit displayed for Digital Speedometer in the HUD. Either Metric (0x1)or English (0x0).	Default (0x0)	Do Not Init
Operational_Mode	4 state indicator for HUD operational mode	Limited	Limited or Normal or Crank
Digital_Speedometer	Numeric display of the vehicle's indicated speed	Default (0)	Do Not Init
DIG_SPD_UPDATE_RATE	Controls refresh rate of digital speedometer displayed value in ms. Selectable 100ms – 1000ms in 50ms increments. Needs to match the one used in the IPC. Default is 400ms.	Use Stored Value	Use Stored Value

1.3.5.5 Prove Out

No

1.3.5.6 Reconfigurable Telltale

No

1.3.5.7 Message Center Msg

No

1.4 Error Handling

None. (Note an error in analog speedometer will cause digital speedometer to be 0)

1.4.1 Missing Message Strategy

1.4.1.1 Missing Reference

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

1.4.1.2 DTC State & History

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

1.4.2 Invalid Message Strategy

None

1.4.3 SIG-REQ-395059/A-Missing Signal Strategy

If **MetricActv_B_Dsply** signal is missing for 5 seconds or more then No change in unit for Digital speed upon user selection of distance unit.

If **Veh_V2_Dsply** signal is missing for 5 seconds or more then HUD shows dashes for Digital speed.

1.5 Diagnostics

1.5.1 Self Test

None

1.5.2 Engineering Test Mode

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

1.5.3 Part II Performance

1.5.3.1 DTC-REQ-302103/A-Supported Diagnostic Trouble Codes (DTCs)

DTC	Description
C15500	Lost communication with IPC

1.5.3.2 DCR-REQ-302104/A-DID DExx

Block Num	Block Description	Size (bits)	Type	Byte(s)	Bits	State: Description	"0"	"1"	Default	Comments/ Information
PACKETED BLOCKS										
$xx	Option Content (B&A)	*	1	*	*	Dig_Speedo_Cfg	Disabled	Enabled	Enabled	Enabled turns on digital speedometer display menu. Should always be Enabled.
*Byte and bit location to be identified in Part II Specification for this HUD										

1.5.3.3 DID-REQ-406111/A-Supported Diagnostic DIDs (Service $22)

Number	DID / CommonID Name	DID Type	Comments
$409D	Digital Speedometer	Unsigned Numeric	This DID will tell the vehicle Digital Speedometer value on the basis of Signals “Veh_V2_Dsply” and MetricActv_B_Dsply” coming from IPC. Whatever digital speed and unit appear on HUD, this DID will generate the same speed with same unit.

1.6 Reference Specification

IPC- Speedometer Gauge Digital - CGEA1.3_v4.1

1.7 Revision History

SPSS Module Revision History

Revision Level	Name	Change Description	Date
1.0	M. Ye	Initial release	4/24/2014
1.1	M. Ye	Updated the following CAN input signal names per NetCom review 1. Veh_Digtal_Speed → Veh_V_Dsply 2. Digital_Speed_Units_IPC → MetricActv_B_Dsply 3. Updated the definition of the signals Updated message ID for above signals	8/15/2014
1.2	A. Salameh	Updated CAN Signal from Veh_V_Dsplay to Veh_V2_Dsplay	1/31/2018

1.3	P. Denduku	Initial VSEM RM Release	03/20/2018
1.4	F. Sethi	Added requirement “SIG-REQ-395059/A-Missing Signal Strategy”; If **MetricActv_B_Dsply** signal is missing for 5 seconds or more then No change in unit for Digital speed upon user selection of distance unit. If **Veh_V2_Dsply** signal is missing for 5 seconds or more then HUD shows dashes for Digital speed. This STSS is applicable for CGEA1.3 and greater architectures.	07/22/2020
1.5	F. Sethi	Add new DID Requirement “REQ-406111/A-Supported Diagnostic DID (Service $22), while adding new DID $409D. Corrected typo mistake “NVM-REQ-302102/B-Memory Storage” by updating “cluster” with “HUD” where “Parameter Name” is “Opperational_Mode”	01/06/2021