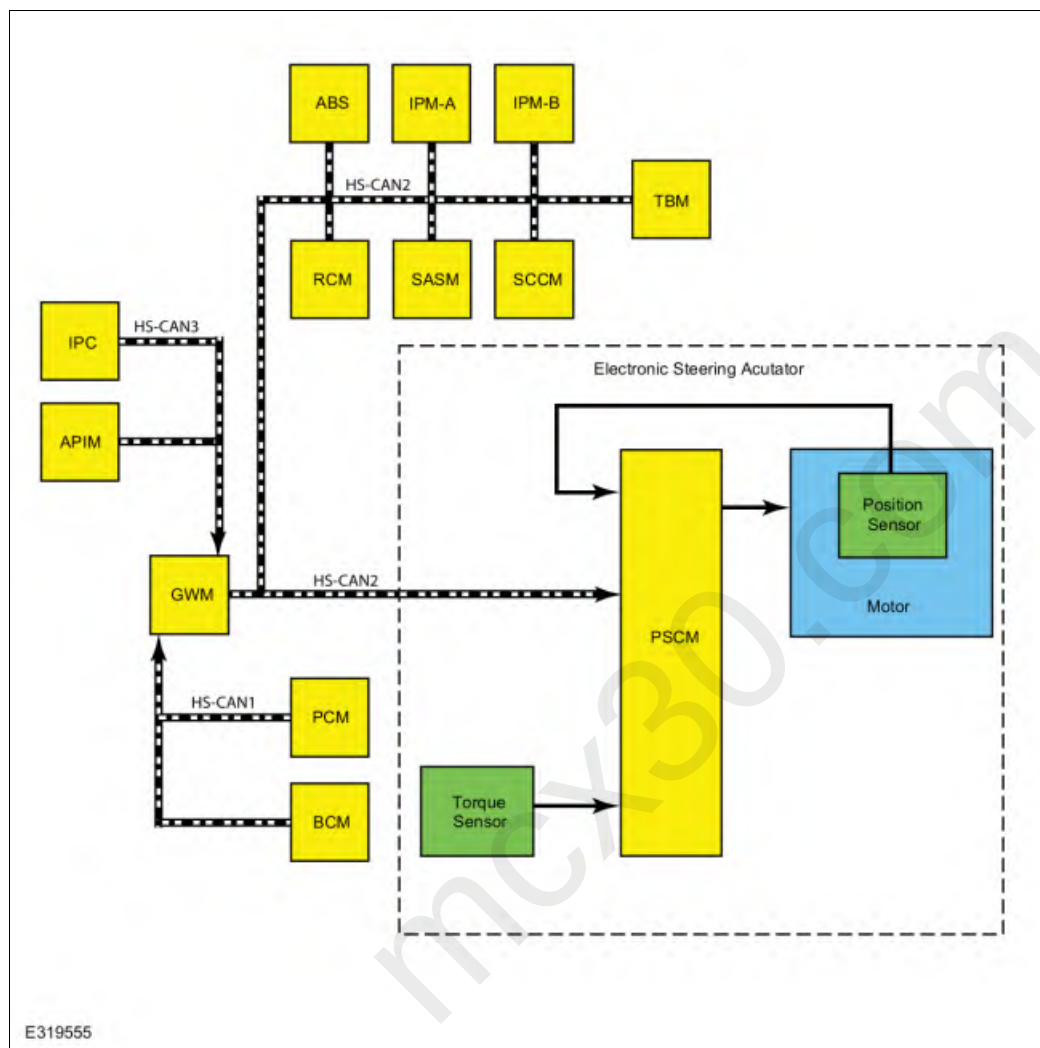


Power Steering - Vehicles With: Electronic Steering Actuator - System Operation and Component Description

System Operation

System Diagram



Item	Description
1	Electronic steering actuator
2	Motor
3	Position sensor
4	Torque sensor
5	PSCM
6	GWM
7	TBM
8	PCM
9	RCM
10	ABS module
11	IPMB
12	IPMA

13	BCM
14	SASM
15	APIM
16	IPC
17	SCCM

Network Message Chart

PSCM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Accelerator pedal position	PCM	This message is first sent to the GWM and then to the PSCM. Provides the PSCM with the current accelerator pedal position and notifies the PSCM if the data is valid or invalid. Used for PTBA operation.
Ambient air temperature	IPC	This message is first sent to the GWM and then to the PSCM. Informs the PSCM of the current ambient air temperature. The PSCM uses this information for various calculations, system and fault condition monitoring.
ABS active	ABS module	Used to confirm the operational state of the ABS.
Battery voltage	BCM	This message is first sent to the GWM and then to the PSCM. Provides the PSCM with the current battery voltage. The PSCM uses this information for system and fault monitoring purposes.
Brake pedal applied	PCM	This message is first sent to the GWM and then to the PSCM. Informs the PSCM the driver has pressed the brake pedal and notifies the PSCM if the data is valid or invalid.
Driven wheel torque	PCM	This message is first sent to the GWM and then to the PSCM. Informs the PSCM of the current torque output available at the drive wheels.
Ignition status	BCM	This message is first sent to the GWM and then to the PSCM. Used to confirm the ignition status of the vehicle; off, accessory, run, start, invalid or unknown.
Lane keeping alert request	IPMA	Provides the PSCM with the relevant lane departure warning information such as direction, intervention request (low, medium or high) as well as surface curvature and angle. Used for the lane departure warning system operation.
Lane departure warning request	IPMA	Used to command the electronic steering actuator if intervention is required for the lane departure warning system.
Odometer master value	IPC	This message is first sent to the GWM and then to the PSCM. Informs the PSCM of the current odometer value in kilometers.
Powertrain status	PCM	This message is first sent to the GWM and then to the PSCM. Used to confirm the status of the engine and drivetrain operating mode; off - torque not available, on - torque not available, start in progress - torque not available or on - torque available.
Reverse gear status	PCM	This message is first sent to the GWM and then to the PSCM. Informs the PSCM of the current reverse gear status; inactive not confirmed, inactive confirmed, active not confirmed, active confirmed or fault. Used for PTBA operation.
Stability control active	ABS module	Used to confirm the operational state of the stability control system.
Steering wheel angle	ABS module	Used to verify the validity of the calculated steering angle.
Steering wheel relative angle sensor	SASM	Informs the PSCM of the current steering wheel relative angle sensor position in degrees or if the information is faulty.
Trailer backup assist disable request	IPC	This message is first sent to the GWM and then to the PSCM. Used to disable the PSCM for PTBA operation for the trailer chosen by the driver.
Trailer backup assist enabled request	IPC	Used to enable the PSCM for PTBA operation for the trailer chosen by the driver.

Broadcast Message	Originating Module	Message Purpose
Trailer backup assist switch request	TRM	Used to provide the current PTBA control knob position and button status; pressed, not pressed.
Trailer brake connection	TBM	Informs the PSCM a trailer has been connected to the vehicle.
Trailer data	IPMB	This message is first sent to the GWM and then to the PSCM. Provides the PSCM with the necessary information for PTBA operation.
Trailer data	IPC	This message is first sent to the GWM and then to the PSCM. Used to provide the trailer data for the current active trailer. Includes the trailer identification and all the trailer measurements stored in the IPC.
Trailer hitch yaw rate	RCM	Provides the PSCM with a calculated, trailer hitch yaw rate based on the trailer identification and the trailer measurements stored in the IPC. Used for PTBA operation.
Trailer lamp connection	TRM	This message is first sent to the GWM and then to the PSCM. Informs the PSCM a trailer has been connected to the vehicle.
Trailer reverse enabled	IPMB	This message is first sent to the GWM and then to the PSCM. Informs the PSCM the PTBA system is set up, available or currently active.
Trailer speed limiting status	PCM	Used to provide the target sticker tracking data to the PSCM. Includes trailer angle data and the status of the IPMB ability to track the sticker.
Trailer target sticker data	IPMB	Used as an input to the PTBA controller in the PSCM.
Transmission gear lever position	PCM	This message is first sent to the GWM and then to the PSCM. Informs the PSCM of the current driver selected transmission gear. Used for PTBA operation.
Turn signal switch	SCCM	Provides the PSCM with the current turn signal switch status; off, left, right or unused. Used by the PSCM for lane departure warning.
Vehicle configuration information	BCM	This message is first sent to the GWM and then to the PSCM. Used to compare the PSCM configuration against the vehicles specific configuration (central car configuration).
Vehicle lateral acceleration	ABS module	Used by the PSCM for steering assist calculations.
Vehicle lateral acceleration	RCM	Used by the PSCM for steering assist calculations.
Vehicle longitudinal acceleration	ABS module	Used by the PSCM for steering assist calculations.
Vehicle longitudinal acceleration	RCM	Used by the PSCM for steering assist calculations.
Vehicle roll rate	ABS module	Used by the PSCM for steering assist calculations.
Vehicle roll rate	RCM	Used by the PSCM for steering assist calculations.
Vehicle yaw rate	ABS module	Used by the PSCM for steering assist calculations.
Vehicle yaw rate	RCM	Used by the PSCM for steering assist calculations.
Wheel data	ABS module	Provides the PSCM with the current, relevant wheel data; rotation count, rotation speed and rotation direction. Used for PTBA operation.

EPAS System

The PSCM controls the functions of the electronic steering actuator and communicates with other modules over the HS-CAN2 and through the GWM.

To activate, the electronic steering actuator requires battery voltage at the hot at all times PSCM input, battery voltage at the PSCM ignition-run

input, the PSCM must communicate with other modules over the HS-CAN2 and the PSCM must receive the powertrain status message from the PCM.

The main input for calculating the level of steering assist is the steering torque sensor signal (internal to the PSCM). Vehicle speed is also taken into consideration in order to achieve the vehicle speed dependent steering assist characteristic.

The electronic steering actuator unit uses a reversible motor to apply the steering assist by rotating the steering shaft. The electronic steering actuator unit is connected directly to the steering shaft, located between the steering gear and the steering column.

The PSCM continually monitors and adjusts steering efforts based on the steering torque sensor signal, motor position and HS-CAN2 inputs to enhance the feel of the steering system. As vehicle speed increases, the amount of assist decreases to improve and enhance road feel at the steering wheel. As vehicle speed decreases, the amount of assist increases to ease vehicle maneuvering. Compensation is made to reduce the effect of pull or drift experienced when driving on roads with a high degree of camber. Compensation is also made for the impact of wheel imbalance on steering feel, up to a predetermined threshold.

The steering torque sensor senses the torque at the steering wheel. It is integrated into the PSCM and works by measuring the relative rotation between an input and output shaft which are connected by a torsion bar. The steering torque sensor sends out 2 PWM signals which allows a channel to channel cross-check and an accurate correction of the neutral point.

The PSCM is self-monitoring and is capable of setting and storing Diagnostic Trouble Codes (DTCs). Depending on the DTC set, the PSCM may enter a failure mode. In addition, the PSCM may send a request to the IPC to display a message in the message center, alerting the driver of a potential electronic steering actuator concern. The warning message is sent over the HS-CAN2 to the GWM which relays the message to the IPC over the HS-CAN3.

Failure Modes

When certain Diagnostic Trouble Codes (DTCs) are present in the PSCM, the electronic steering actuator system enters a failure mode of operation.

Hydraulic-Only Steering Mode - The electronic steering actuator enters a hydraulic-only steering mode (no electrical steering assistance is provided) when a concern considered to be a critical safety concern is detected, or to protect the internal components of the electronic steering actuator when a non-critical safety concern is detected by the PSCM, concerns such as low battery voltage, high battery voltage, or over-temperature are considered non-critical safety concerns. The hydraulic-only steering mode gives the steering operation a heavier than normal feel.

Pull Drift Compensation (PDC)

Electronic steering actuator equipped vehicles have a Pull Drift Compensation (PDC) feature to assist drivers in compensating for variation in road and driving conditions. The feature adjusts power assist offset by reducing the steering wheel effort (input torque) required to keep the vehicle traveling straight. The Pull Drift Compensation (PDC) feature is automatically enabled at vehicle speeds above 40 km/h (25 mph) with sensors indicating the vehicle is traveling straight. Pull Drift Compensation (PDC) is designed to compensate for variations in road crown, the system detects input torque to the wheel by the driver to slowly ramp in a steering assist offset to neutralize, in most situations and within limits, steering efforts for the duration of time those driving conditions exist. Full compensation requires up to 45 seconds. Changing lanes on a multilane road and the expected change in road crown would trigger a change in torque input and a compensation adjustment, and is a normal operation of the Pull Drift Compensation (PDC) feature. The feature updates automatically and continuously, however, since it is based on input torque, the feature only works with hands on the steering wheel while driving in a straight line. The system does not compensate when turning or during slight curves on highways. The system does not compensate if driver input torque, steering wheel angle or vehicle yaw rate is too large. For the system to compensate, the driver must have both hands on the steering wheel.

Lane Departure Warning (LDW)

Lane Departure Warning (LDW) utilizes the camera located in the IPMA to detect and track the road lane markings. The feature detects unintentional drifting toward the outside of the lane and alerts the driver through steering wheel vibrations and a visual alert in the IPC message center.

Refer to: Lane Keeping System - Overview (419-07 Lane Keeping System, Description and Operation).

Pro Trailer Back Up Assist

The PTBA system is controlled by the PSCM and, when activated, aids the driver in steering the vehicle with a trailer attached while driving in REVERSE. The PTBA system is comprised of several systems and modules working together to aid in vehicle and trailer control. The presence of certain Diagnostic Trouble Codes (DTCs) in any of those modules or systems may keep the active park assist system from being enabled or may disable the system if currently being used.

Refer to: Parking Aid - Overview (413-13C Parking Aid - Vehicles With: Trailer Back Up Assist (TBA), Description and Operation).

Component Description

Electronic Steering Actuator

The electronic steering actuator unit is an assembly consisting of a PSCM, a motor, and a steering torque sensor, all of which are serviced as an

assembly. The lower intermediate shaft, heat shield, and bracket are available separately for service.

- The steering torque sensor is mounted near the input shaft of the electronic steering actuator and is used by the PSCM to determine how much force is being used to turn the steering wheel.
- The electronic steering actuator is connected to the hydraulic steering gear by the lower intermediate shaft.
- The electronic steering actuator gear has a heat shield on the inboard side of the assembly.
- The electronic steering actuator is connected to the vehicle frame by a bracket.

PSCM

The PSCM is the ECU for the electronic steering actuator system. The module monitors all sensor inputs and HS-CAN2 messages relating to the electronic steering actuator system and directly controls the output of the motor.

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