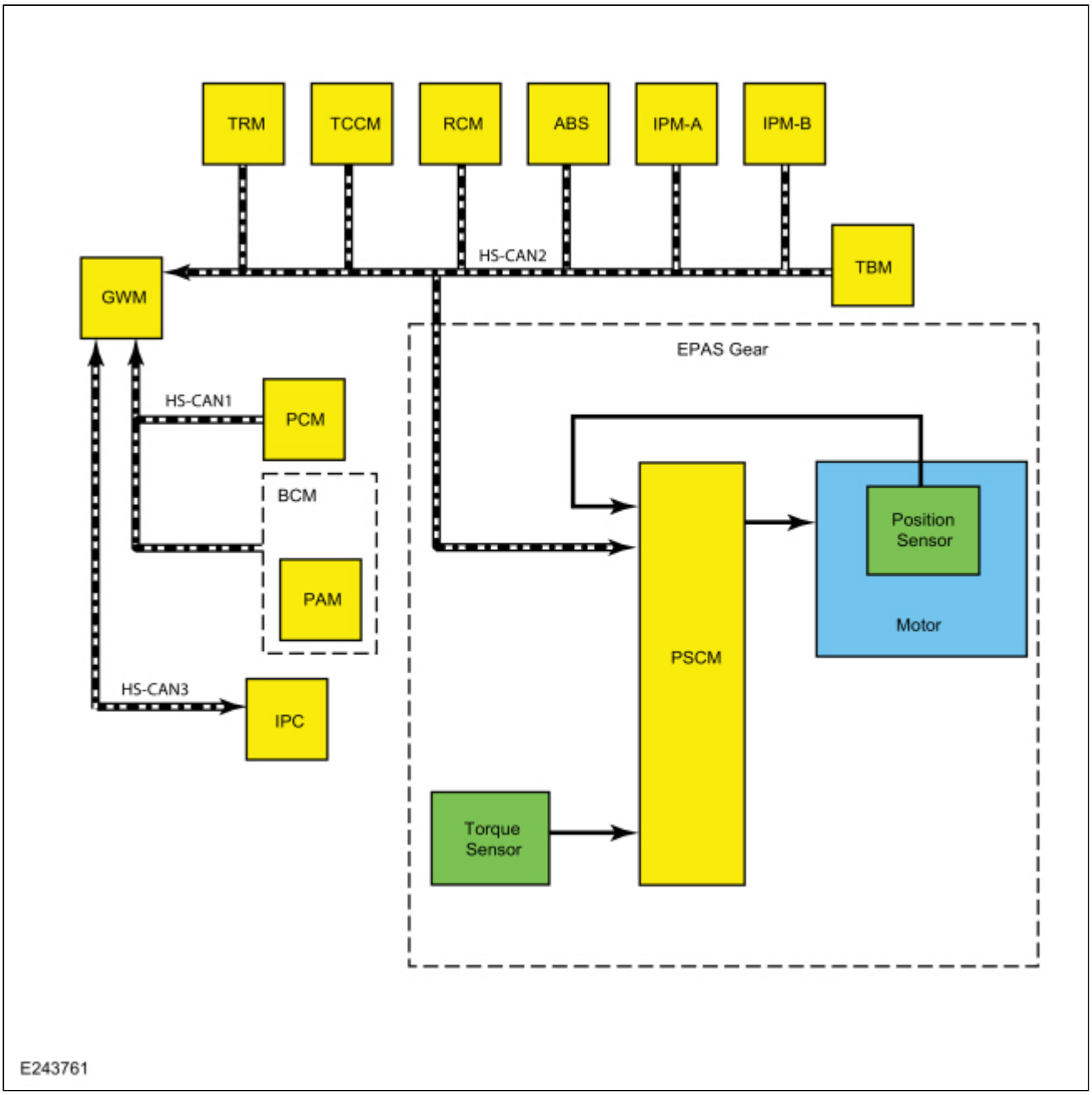
211-02 Power Steering
Description and Operation

2019 Ranger
Procedure revision date: 06/8/2018

Power Steering - System Operation and Component Description

System Operation

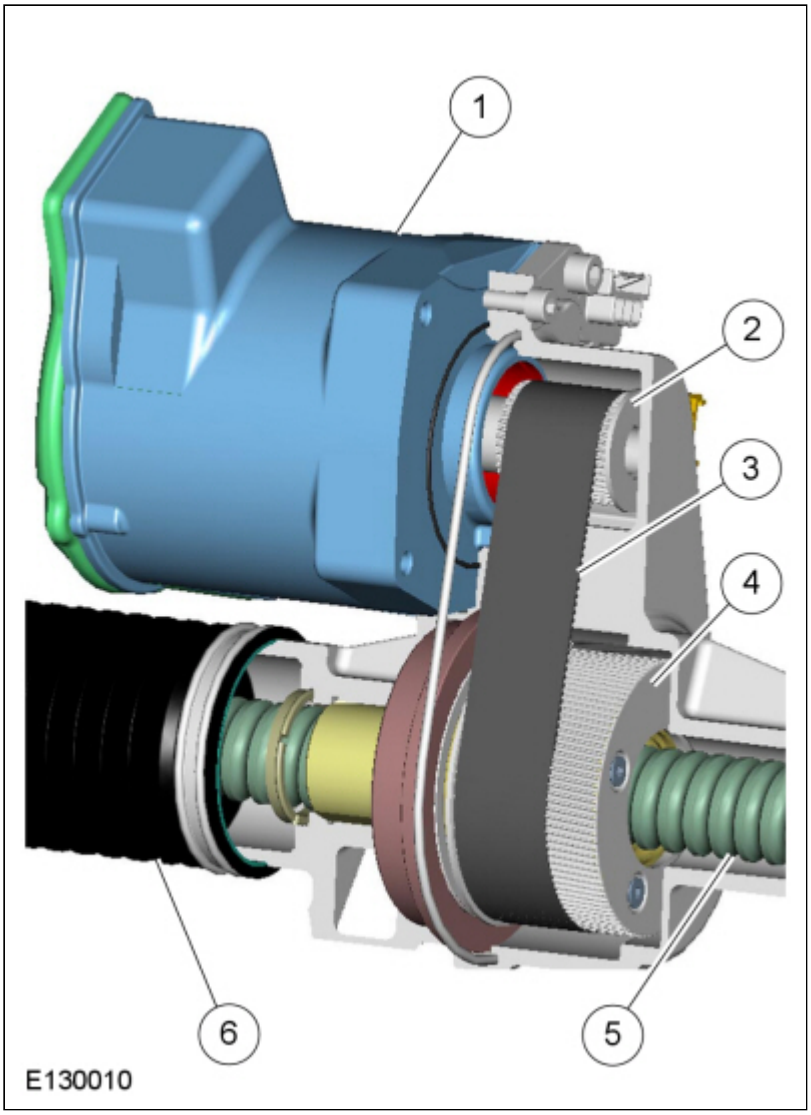
Electronic Power Assist Steering (EPAS) System Operation



The EPAS gear is an assembly consisting of a PSCM, an electric motor and a steering torque sensor, all of which are serviced as an assembly.

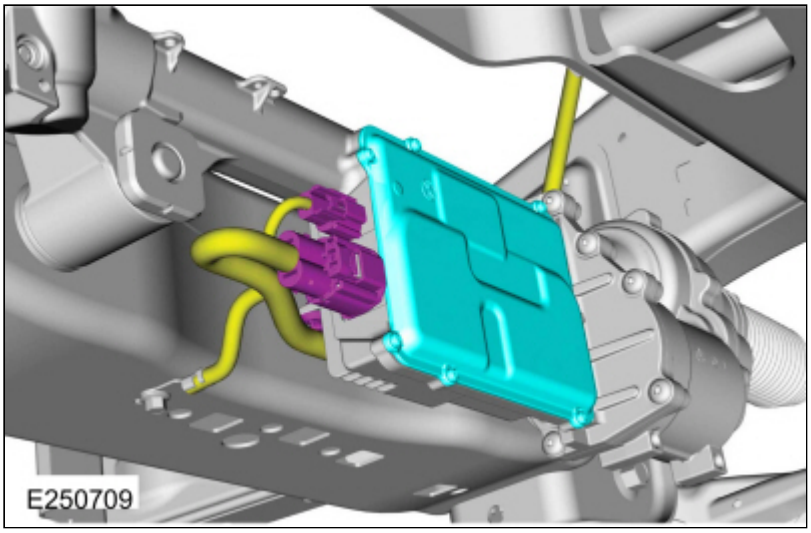
NOTE: *The inner and outer tie rods and the steering gear bellows boots are available separately for service.*

The steering torque sensor is mounted near the input shaft of the EPAS gear and is used by the PSCM to determine how much force is being used to turn the steering wheel.



Item	Description
1	EPAS motor
2	Drive pinion, toothed belt drive
3	Toothed belt
4	Output pinion, toothed belt drive
5	Steering rack
6	Steering gear rubber boot

The EPAS gear uses a reversible motor to apply the steering assist. The motor is connected to the rack of the steering gear by a toothed belt and pulley/bearing assembly. The motor is used by the PSCM to move the rack inside the steering gear housing.



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

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

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 that can be experienced when driving on roads with a high degree of camber.

The PSCM is self-monitoring and is capable of setting and storing DTCs. Depending on the DTC set, the PSCM may enter 1 of 2 failure modes of operation:

- **Reduced steering assist mode** - Protect the internal components of the EPAS when a concern such as low/high battery voltage or over-temperature concerns that are not considered to be a critical safety concern. This reduced steering assist mode gives the steering a heavier than normal feel
- **Manual steering mode** - Entered when a critical safety concern is detected. In this mode, the vehicle has mechanical steering operation only (no electrical steering assistance) which gives steering operation a heavy feel

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 EPAS concern.

The EPAS system also supports the active park assist and the lane keeping system operation.

Selectable Steering

The selectable steering feature allows the driver to select 1 of 3 steering modes. These steering modes alter the feel and response of the EPAS system. Each steering mode can be selected using the selectable steering button on the steering wheel.

NOTE: *After a selection is made, a soft feedback bump may be felt in the steering wheel.*

Pressing the switch sends a message to the IPC and the PSCM. The IPC displays the current mode in the message center and the PSCM modifies EPAS operation according to the selected steering mode:

- **Normal**: Default system setting (system defaults to standard mode if the battery is disconnected)
- **Sport**: Slightly higher effort required for steering with more road feel through the steering wheel
- **Comfort**: Slightly less effort required for steering with less road feel through the steering wheel

If the vehicle is equipped with the terrain management system, the steering feel changes when a new terrain mode is selected. This automatic selection can be overridden by using the selectable steering button.

Pull Drift Compensation (PDC)

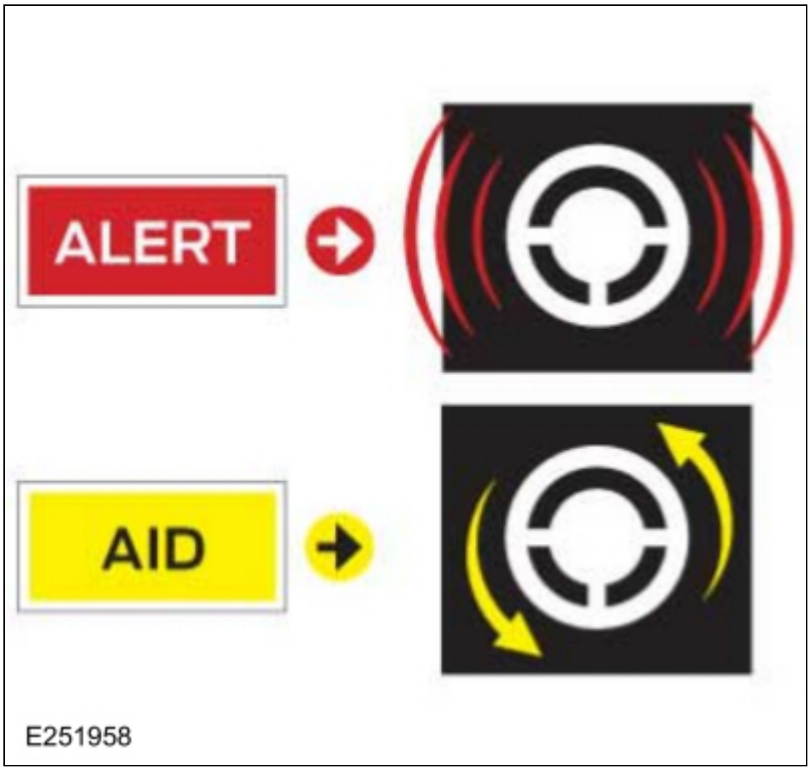
The Pull Drift Compensation (PDC) feature to assist drivers in compensating for variation in road and driving conditions. The feature adjusts power assist offset by reducing the steering wheel effort (input torque) required to keep the vehicle traveling straight.

The PDC feature is automatically enabled at vehicle speeds above 40 km/h with sensors indicating the vehicle is traveling straight. 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 can take up to 45 seconds. Changing lanes on a multilane road and the expected change in road crown would trigger a change in steering torque input.

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 excessive.

Lane Keeping System (LKS)



NOTE: *If equipped, the Lane Keeping System (LKS) can interfere with accurate EPAS diagnostics. Disable the LKS before test driving the vehicle to diagnose EPAS concerns.*

The Lane Keeping System (LKS) utilizes the camera located in the IPMA to detect and track the road lane markings. The LKS has 2 functions, lane keeping alert and lane keeping aid.

The lane keeping alert 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.

The lane keeping aid assists the driver by automatically providing steering torque to help the driver keep the vehicle in the lane.