

Lane keep assist hands off	IPMA	Used to display a hands off warning message and sounds a chime through the audio system.
Lane keeping system status display	IPMA	Used to display the lane keeping system status (suppressed, available and active states).

Lane Keeping System Operation

The lane keeping system is turned on and off using the lane keeping system switch located on the LH steering column multifunction switch. The lane keeping system switch is directly connected to the SCCM. The last known on/off setting for the lane keeping system is recalled every time the key is turned on. When a MyKey® is in use, the system defaults the lane keeping alert mode to on and cannot be turned off. When the system is on, it is active only when the vehicle speed is above 64 km/h (40 mph) and at least one lane marking can be detected by the camera. The system can be turned off at any time by pressing the lane keeping system switch. If the lane keeping system switch is pressed when a MyKey® is in use, the IPC message center will display a message informing the driver that the system is on.

The system can be temporarily suppressed at any time by the following:

- Rapid braking or acceleration
- Evasive steering maneuver
- Using the turn signal indicator (only for the side the indicator is on)

Lane Keeping Alert

The lane keeping alert generates vibration through the steering wheel when an unintended lane departure is detected by the IPMA. When commanded by the IPMA, the PSCM rapidly oscillates the power steering left to right, simulating the vehicle driving on a rumble strip. The intensity of the steering wheel vibration can be adjusted using the Driver Assist options in the message center. The system also provides a visual alert in the message center when a lane departure is detected.

Lane Keeping Aid

The lane keeping aid provides steering torque to help the driver keep the vehicle in the lane when a lane departure is detected. The IPMA sends the road curvature and calculated steering angle messages to the PSCM. The PSCM uses these messages to calculate and generate the intervention torque.

Hands-Off Warning

When the lane keeping aid is active, the PSCM continuously monitors the torque sensor in the EPAS system to determine if a hand is on the steering wheel and sends the data to the IPMA. If the IPMA detects that the driver's hands are off the wheel for more than a few seconds, the hands-off warning is generated.

The hands-off warning is generated in 2 levels. The first level is a message center warning only and is triggered after 3 seconds of hands-off driving is detected. The second level warning consists of a message center warning and an audio chime and is generated after 6 seconds of hands-off driving.

NOTE: Due to certain road conditions and the driver's individual grip/touch on the steering wheel, the system may generate a hands-off warning when hand(s) are still on the steering wheel.

IPMA Camera Windshield Defrost Heater

The camera windshield defrost heater keeps the windshield in front of the IPMA clear of frost and ice. The IPMA uses input from the front camera and the ambient air temperature to turn the camera windshield defrost heater on and off. Voltage and ground is supplied to the heater by the IPMA. The heater may be commanded on if the ambient temperature is below 5°C (41°F).

The IPMA camera windshield defrost heating element is integral to the windshield and can not be serviced without replacing the windshield. Before replacing the IPMA camera heated windshield element or the IPMA for an IPMA camera heated windshield element concern, verify the integrity of the wiring, connectors and terminals on the jumper harness.

System Display

When the lane keeping system is turned on, an overhead graphic of a vehicle and lane markings is displayed in the IPC. If the lane keeping aid mode is selected when the system is on, arrow markings pointing toward the lane lines are also displayed. When the system is off, the lane marking graphics are not displayed. Additional graphics appear in the display if the adaptive cruise control is enabled. While the system is on, the color of the lane markings change to indicate the system status.

Gray: Indicates the system is temporarily unable to provide lane keeping aid or alert activation on the indicated side(s). This may be caused by:

- The vehicle speed is under the activation limit

- High sunload on the IPMA camera lens
- Too close to lane markings
- Lane markings are too narrow or wide
- Road has no or poor lane markings in the camera field-of-view
- Following vehicle in front too closely
- IPMA camera blocked
- Windshield dirty or damaged
- Standing water on road
- Environmental conditions (significant sun angles, shadows, snow, heavy rain or fog)
- Turn signal is active
- Vehicle is in a dynamic maneuver
- Tight curves on the road

Green: Indicates the system is available or ready to provide a lane keeping aid or alert activation on the indicated side(s).

Yellow: Indicates the system is providing or has just provided a lane keeping aid activation.

Red: Indicates the system is providing or has just provided a lane keeping alert activation.

Message Center Settings

The system has 2 optional setting menus available through the Driver Assist menu in the message center. The last-known selection for each setting is stored by the IPMA and does not need to be set again after the key is cycled.

The **Mode** setting allows the driver to select which of the system features will be enabled and turned on when the button is pressed. The 3 options in this menu are:

- Lane Keeping Alert only - provides a steering wheel vibration when an unintended lane departure is detected.
- Lane Keeping Aid only - provides steering input toward the center of the lane when an unintended lane departure is detected.
- Lane Keeping Alert and Lane Keeping Aid - provides both a warning and steering input towards the center of the lane.

The **Intensity** setting allows the driver to select the intensity of the steering wheel vibration used in lane keeping alert mode. This setting does not impact the lane keeping aid mode. The 3 options in this menu are:

- Low
- Normal
- High

NOTE: The steering wheel performs a test vibration after the intensity setting is changed through the Driver Assist menu in the message center.

Camera Alignment

Camera alignment is required for the lane keeping alert and lane keeping aid to function correctly. The procedure is initiated using the diagnostic scan tool and requires about 10 minutes of driving above 64 km/h (40 mph) on a flat, straight road with highly visible lane markings to complete.

NOTE: The alignment completion is indicated on the diagnostic scan tool. If the alignment is unsuccessful, check the IPMA for proper installation.

NOTE: The FRONT CAMERA MALFUNCTION - SERVICE REQUIRED message in the IPC disappears when the system is aligned.

The IPMA camera alignment procedure should be performed when any of the following occur:

- Windshield replacement
- Change in tire size
- Suspension repair or alignment
- Front air bag deployment

Component Description

IPMA

The IPMA is located on the windshield, below the interior rear view mirror. The IPMA communicates on the HS-CAN2 and on vehicles equipped with the adaptive cruise control and collision warning system, the IPMA shares information with the CCM on a dedicated CAN circuits to assist the driver in avoiding collision. The IPMA contains a forward-looking camera that is used to detect the position of the vehicle within the lane.

The IPMA requires PMI and camera alignment when replaced.

Camera Windshield Defrost Heater

The camera windshield defrost heater is a resistive-type heater grid that is adhered to the inside of the windshield directly in front of the IPMA camera.

The camera windshield defrost heater uses a jumper harness between the component and the vehicle harness. Before replacing the camera windshield defrost heater or IPMA for a camera windshield defrost heater concern, verify the integrity of the wiring, connectors and terminals on the jumper harness.

Lane Keeping System Switch

The lane keeping system switch is momentary contact switch located on the LH steering column multifunction switch. The lane keeping system inputs directly to the SCCM, which provides a switch state message to the IPMA.

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Diagnosis and Testing

Lane Keeping System

DTC Chart(s)

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

IPMA DTC Chart

DTC	Description	Action <i>New: hover over Pinpoint Test links to show title</i>
B120C:11	Heater for Windshield Mounted Sensor: Circuit Short To Ground	GO to Pinpoint Test C
B120C:13	Heater for Windshield Mounted Sensor: Circuit Open	GO to Pinpoint Test C
B13A6:14	Lane Departure Warning (LDW) Switch Input: Circuit Short To Ground or Open	GO to Pinpoint Test A
C0072:00	Brake Temperature Too High: No Sub Type Information	This DTC sets when the CCM receives a brake over temperature message from the brake system. This condition disables the adaptive cruise control and displays ADAPTIVE CRUISE NOT AVAILABLE message in the IPC. ALLOW the brake system to cool for 30 minutes. CLEAR the Diagnostic Trouble Codes (DTCs) and REPEAT the self-test.
C1001:08	Vision System Camera: Bus Signal/Message Failure	GO to Pinpoint Test Q
C1001:54	Vision System Camera: Missing Calibration	This continuous memory DTC sets when a new IPMA has been installed without performing the camera alignment. PERFORM the camera alignment using a diagnostic scan tool.
C1001:78	Vision System Camera: Alignment or Adjustment Incorrect	This continuous memory DTC sets when a new IPMA has been installed without performing the camera alignment. PERFORM the camera alignment using a diagnostic scan tool.
C1001:97	Vision System Camera: Component or System Operation Obstructed or Blocked	CLEAN and INSPECT the windshield in front of the camera, remove any aftermarket stickers that may be blocking the view of the camera. REPAIR or REPLACE the windshield as necessary if damage is found.
C1001:98	Vision System Camera: Component or System Over Temperature	The IPMA is over-temperature. This may occur during extended use in extremely high weather temperatures. The lane keeping system operation resumes after the IPMA cools.
C1A67:08	Forward Looking Sensor: Bus Signal/Message Failure	GO to Pinpoint Test Q
U0100:00	Lost Communication With ECM/PCM "A": No Sub Type Information	GO to Pinpoint Test E
U0101:00	Lost Communication with TCM: No Sub Type Information	GO to Pinpoint Test E