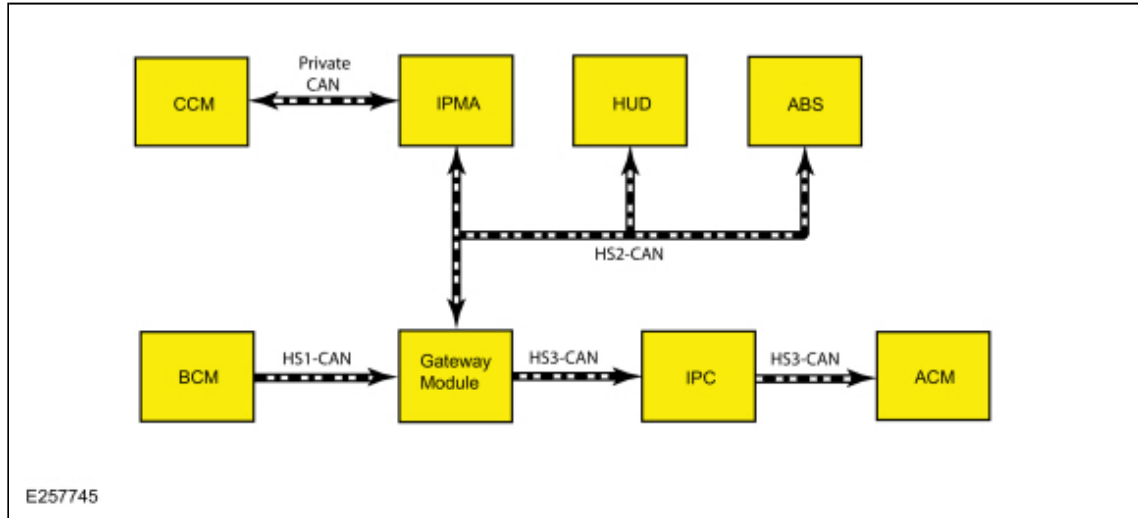


Collision Warning and Collision Avoidance System - System Operation and Component Description

System Operation

ACC With Pre-Collision Assist



Network Message Chart

Network Input Messages - ACM

Broadcast Message	Originating Module	Message Purpose
<u>IPC</u> chime	<u>IPC</u>	Data used to command a warning chime during possible collision event and audio mute so that the warning chime can be heard.

Network Input Messages - CCM

Broadcast Message	Originating Module	Message Purpose
<u>HUD</u> active	<u>HUD</u> module	Used for <u>HUD</u> module active status.
<u>HUD</u> fault	<u>HUD</u> module	Used for <u>HUD</u> module fault status.

Network Input Messages - HUD Module

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Broadcast Message	Originating Module	Message Purpose
HUD flash command	<u>CCM</u>	Flashes the <u>HUD</u> module <u>LED</u> array when commanded.
Ignition status	<u>BCM</u>	Used for ignition switch position input.

Network Input Messages - IPC

Broadcast Message	Originating Module	Message Purpose
Forward collision chime request	<u>CCM</u>	Data used to command warning chime during possible collision event. When this message is received, the <u>IPC</u> sends the audio mute message to the <u>ACM</u> .
Forward collision warning message request	<u>CCM</u>	Data used to command warning chime and messages during possible collision event.

Network Input Messages - IPMA

Broadcast Message	Originating Module	Message Purpose
Collision avoidance and driver support radar status	<u>CCM</u>	Data used to communicate the function status of the radar in the <u>CCM</u> .

Network Input Messages - ABS Module

Broadcast Message	Originating Module	Message Purpose
Collision mitigation by braking deceleration request	<u>CCM</u>	Data used to enable the brakes to slow vehicle speed when the pre-collision assist system determines that a collision is imminent.
Collision mitigation by braking brake pre-charge	<u>CCM</u>	Data used to enable the <u>ABS</u> module to pre-charge the brakes to prepare them for rapid braking by the driver.

Pre-Collision Assist System Operation

The pre-collision assist system is an additional safety feature on vehicles equipped with ACC. The system is active whether the ACC system is on or off. If the system detects a vehicle, pedestrian or other object in the vehicle path of travel, the system provides three levels of functionality:

- Visual and audible alert
- Brake support
- Active braking

The system uses object detection information from the radar sensor integrated in the CCM and the forward-looking camera in the IPMA mounted in the interior rear view mirror. The CCM and the IPMA scan a designated area in front of the vehicle. Network messages are sent between the CCM and the IPMA on dedicated CAN circuits, which determine whether an object, vehicle or pedestrian is in the path of travel, the approximate distance to the object and how fast the vehicle is approaching it.

When the vehicle approaches the object, the IPMA sends a message to the HUD module on the HS-CAN2 (LED display HUD) to flash the red warning Light Emitting Diodes (LEDs) or sends a message through the GWM to the HS-CAN3 (driver information display HUD) to show a solid red bar display. The IPMA sends an alert message on the HS-CAN2 to the GWM and then to the IPC on the HS-CAN3 to sound an audible alert and show a warning message in the message center display. The IPMA also sends a message to the ABS module on the HS-CAN2 to pre-charge the brakes in order to prepare them for rapid braking by the driver. If the system determines that a collision is imminent, an active braking message is sent from the IPMA to the ABS module. The system reduces the gap between the brake pads and discs, applying the brakes to slow vehicle speed without driver intervention. This assists stopping the vehicle to help the driver avoid a collision or reduce damage caused by the impact.

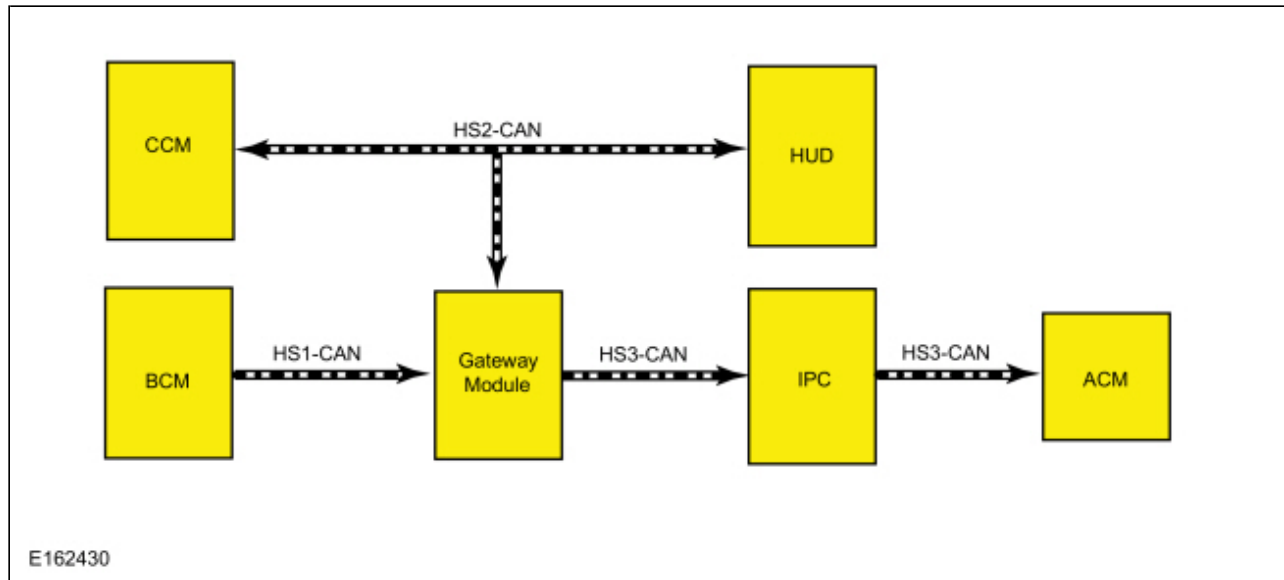
The pre-collision alert system uses image recognition software that can differentiate between shapes, which allows the system to determine if the approaching object is a vehicle or a pedestrian. If the camera does not recognize the shape as the rear end of a vehicle or a pedestrian, the system does not provide full function. The system may not work properly at night, in direct or low sunlight, when camera vision is reduced due to weather conditions or due to a blocked CCM radar sensor. If the IPMA camera module is obstructed, the pre-collision system does not respond properly to pedestrians or stationary vehicles and reduces the ability to recognize moving vehicles. Unconventional vehicle types, pedestrians in groups or with complex backgrounds or partly obscured pedestrians may not be properly detected by the system.

The pre-collision assist system is active at speeds above 5 km/h (3 mph) and pedestrian detection is active at speeds up to 80 km/h (50 mph).

The pre-collision assist system has three levels of sensitivity detection (HIGH, NORMAL and LOW) that can be changed through the message center display in the IPC. The alert sensitivity can be adjusted and active braking can be turned OFF in the IPC. The active braking function reverts back to ON at the next ignition cycle.

When a system fault is detected with the pre-collision warning system, the message PRE-COLLISION ASSIST NOT AVAILABLE SENSOR BLOCKED or PRE-COLLISION ASSIST NOT AVAILABLE is displayed in the IPC message center.

Forward Collision Warning System With ACC Pre-Collision Assist



Network Message Chart

Network Input Messages - ACM

Broadcast Message	Originating Module	Message Purpose
<u>IPC</u> chime	<u>IPC</u>	Data used to command a warning chime during possible collision event and audio mute so that the warning chime can be heard.

Network Input Messages - CCM

Broadcast Message	Originating Module	Message Purpose
<u>HUD</u> active	<u>HUD</u> module	Used for <u>HUD</u> module active status.
<u>HUD</u> fault	<u>HUD</u> module	Used for <u>HUD</u> module fault status.

Network Input Messages - HUD

Broadcast Message	Originating Module	Message Purpose
<u>HUD</u> flash command	<u>CCM</u>	Flashes the <u>HUD</u> module <u>LED</u> array when commanded.
Ignition status	<u>BCM</u>	Used for ignition switch position input.

Network Input Messages - IPC

Broadcast Message	Originating Module	Message Purpose
Forward collision chime request	<u>CCM</u>	Data used to command warning chime during possible collision event. When this message is received, the <u>IPC</u> sends the audio mute message to the <u>ACM</u> .
Forward collision warning message request	<u>CCM</u>	Data used to command warning chime and messages during possible collision event.

System Operation

Forward Collision Warning System

The forward collision warning system works in conjunction with the adaptive cruise control system. During a possible collision event, the CCM commands:

- the HUD to flash red warning Light Emitting Diodes (LEDs).
- the IPC to activate a chime and commands.
- the ACM to mute audio volume.

The forward collision warning system is activated when the vehicle is moving forward at a speed greater than 8 kmh (5 mph). The CCM determines the distance and relative speed of the vehicle that is in the path of travel, utilizing a radar sensor (integral to the CCM) to detect other vehicles that are moving in the same direction. If the CCM determines that a collision is possible, the CCM commands the HUD module Light Emitting Diodes (LEDs) to flash and the IPC to chime.

The forward collision warning system and audible warning chime can be enabled and disabled through the message center display in the IPC. The system remembers the last setting.

Snow plows or similar equipment, installed on the front of the vehicle can confuse the radar mounted in the front bumper, causing erratic behavior. The forward collision warning system should be disabled while the equipment is installed.

There are three levels of sensitivity detection (HIGH, NORMAL and LOW) that are changed in the message center display.

If a MyKey® restricted key is in use, the MyKey® turns on the collision warning and does not allow the MyKey® user to disable the audio or visual collision warning system. However, the MyKey® user is able to adjust the warning sensitivity.

When a system fault is detected with the forward collision warning system, the message COLLISION WARNING NOT AVAILABLE, COLLISION WARNING NOT AVAILABLE SENSOR BLOCKED SEE MANUAL or COLLISION WARNING MALFUNCTION is displayed in the IPC message center.

Component Description

CCM

The CCM contains a radar sensor unit that determines the distance and relative speed of the vehicle that is in the path of travel.

HUD - LED Display

The HUD contains red Light Emitting Diodes (LEDs) that warn the driver of a possible collision event when commanded by the CCM.

There are certain situations when the warning Light Emitting Diodes (LEDs) cannot be seen, such as bright sunlight or when wearing sunglasses. The HUD module has a temperature sensor circuit that is integral to the module that senses the temperature of the Light Emitting Diodes (LEDs) internal to the module. When a high passenger compartment temperature such as strong sunlight is sensed by the temperature sensor, the warning Light Emitting Diodes (LEDs) can be temporarily disengaged. If this occurs, only the audible warning chime is used.

Warnings may not appear if there is little distance to the vehicle ahead or abrupt steering wheel and pedal movements are made.

IPMA With Pre-Collision Assist

The IPMA is integral to the interior rear view mirror. The IPMA contains a forward-looking camera with a designated line of sight in front of the moving vehicle. The camera can detect and differentiate between an approaching object, vehicle or pedestrian in the path of travel. This information is shared with the CCM on dedicated CAN circuits.

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