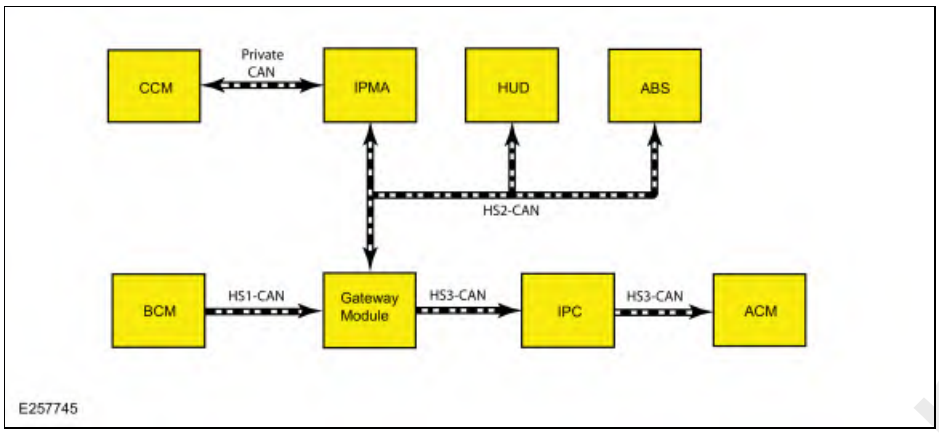
Collision Warning and Collision Avoidance System - System Operation and Component Description

System Operation

ACC With Pre-Collision Assist With HUD



Item	Description
1	ACM
2	HUD
3	CCM
4	IPC
5	BCM
6	GWM
7	ABS Module
8	IPMA

Network Message Chart

Network Input Messages - ACM

Broadcast Message	Originating Module	Message Purpose
IPC chime	IPC	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
HUD active	HUD module	Used for HUD module active status.
HUD fault	HUD module	Used for HUD module fault status.

Network Input Messages - HUD

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

Network Input Messages - IPC

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

Pre-Collision Assist System Operation

The pre-collision assist system is offered as a camera-only option without ACC. An additional safety feature on vehicles equipped with ACC uses both the CCM and the IPMA. 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:

- 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 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.

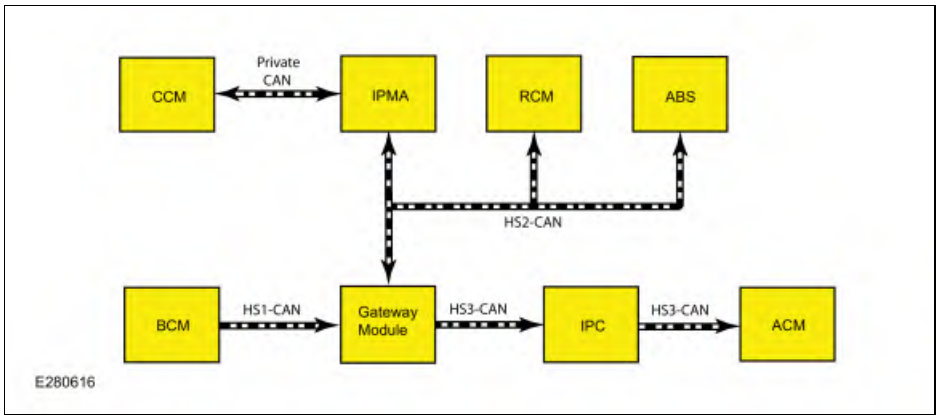
Snow plows, or similar equipment, installed on the front of the vehicle can confuse the radar mounted in the front bumper, causing erratic behavior. The forward collision warning system should be disabled while the equipment is installed.

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

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

ACC With Pre-Collision Assist Without HUD



Item	Description
1	ACM
2	RCM
3	CCM
4	IPC
5	BCM
6	GWM
7	ABS Module
8	IPMA

Network Message Chart

Network Input Messages - ACM

Broadcast Message	Originating Module	Message Purpose
IPC chime	IPC	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 - IPC

Broadcast Message	Originating Module	Message Purpose
Collision avoidance and driver support camera status	IPMA	Data used to command the pre-collision assist system fault status in the message center.
Collision avoidance and driver support chime status	CCM	Data used to command a warning chime that a collision event is possible.
Collision avoidance and driver support radar blocked warning	CCM	Data used to command a radar blocked message in the message center.
Forward collision chime request	CCM	Data used to command warning chime during possible collision event. When this message is received, the IPC sends the audio mute message to the ACM.
Forward collision warning message request	CCM	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	IPMA	Data used to communicate the function status of the camera in the IPMA.

Network Input Messages - ABS Module

Broadcast Message	Originating Module	Message Purpose
Collision mitigation by braking deceleration request	CCM	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	CCM	Data used to enable the ABS 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 offered as a camera-only option without ACC. An additional safety feature on vehicles equipped with ACC uses both the CCM (radar) and the IPMA. 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

Vehicles equipped with ACC uses object detection information from the radar sensor integrated in the CCM and the forward-looking camera in the IPMA located on the windshield, below 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.

Vehicles equipped without ACC uses object detection information from the forward-looking camera in the IPMA only.

When the vehicle approaches the object, the IPMA sends a message through the GWM to the IPC module to turn on the red pre-collision warning indicator in the message center and to sound an audible alert. The IPMA also sends a message to the ABS module to pre-charge the brakes in order to prepare them for rapid braking. 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.

The pre-collision alert system uses image recognition software that differentiates 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 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 detected by the system.

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

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.

All CCM Diagnostic Trouble Codes (DTCs) are sent to the IPMA on a dedicated private CAN. The IPMA acts as a gateway for the CCM.

HUD

The HUD contains the 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 strong 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.
