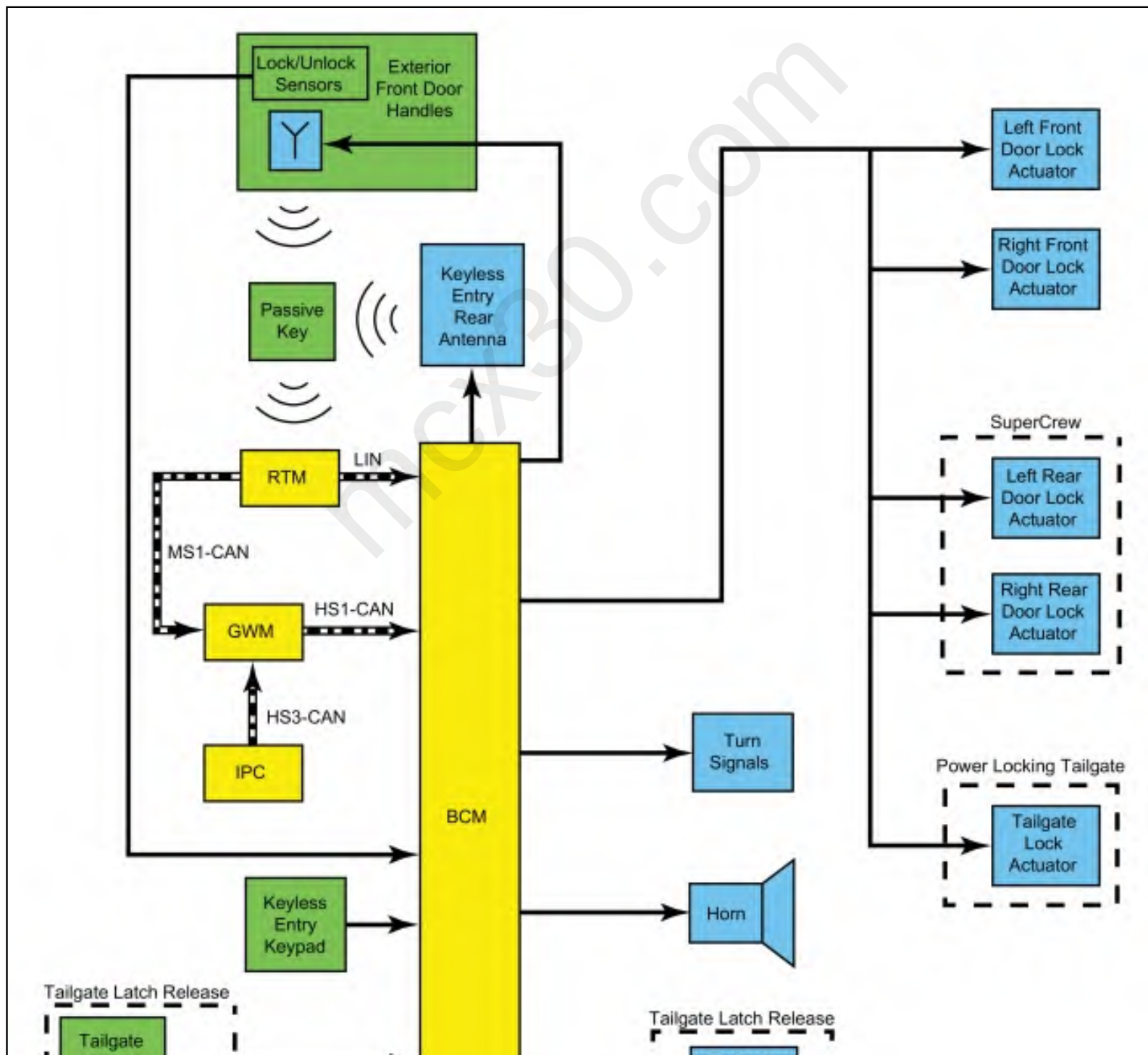
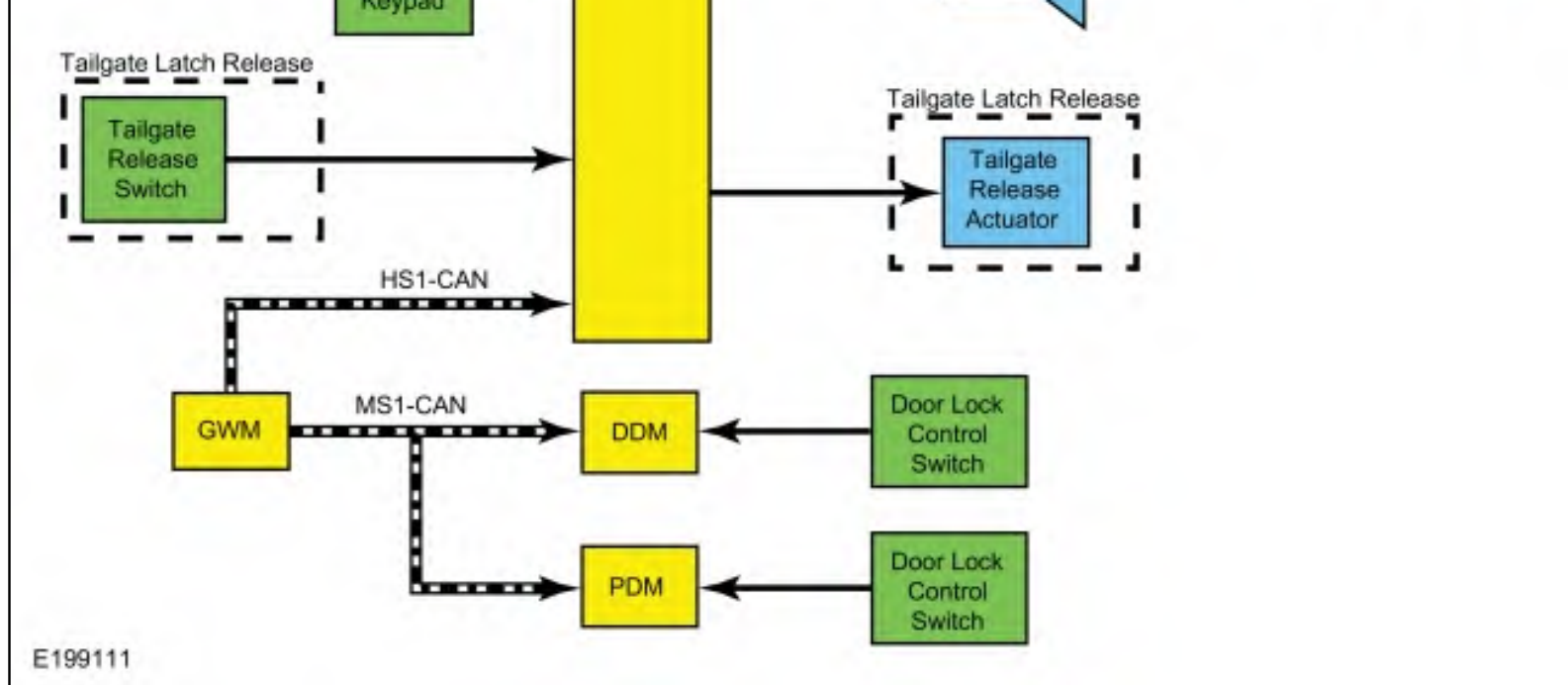


Handles, Locks, Latches and Entry Systems - System Operation and Component Description

System Operation

System Diagram





Network Message Chart

BCM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Vehicle speed	PCM	The BCM uses the vehicle speed data for the autolock and auto-unlock features.
Door lock switch status	DDM/ PDM	Provides the BCM with lock/unlock requests based on the input from the door lock control switch.

IPC Module Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Message center feature configuration	IPC	Provides the BCM configuration settings selected by the driver of the vehicle, such as autolock and auto-unlock settings.

Power Door Locks

The BCM controls the door locks using a series of integrated relays (driver door unlock/passenger doors unlock/all doors lock). When the relays are not energized, ground is provided on both circuits to the lock motors. When an unlock relay energizes, voltage is provided to one side of the lock motor to unlock the door(s). When the lock relay energizes, the polarity is reversed and the motors lock the doors.

The DDM and PDM send voltage signals to the door lock control switches. When a door lock control switch is pressed, the voltage signal is routed to ground, indicating a request to lock/unlock the doors. When the DDM or PDM detects a lock or unlock request, a message is sent over the CAN to the BCM to lock or unlock the doors.

In the event of a power door lock failure, the doors can be individually locked through the manual door lock.

Based on input from the door lock control switches, the keyless entry keypad (if equipped), the passive entry system (if equipped) and the RKE transmitter, the BCM unlocks the driver door, unlocks all the doors or locks all the doors.

Switch Inhibit Feature

The switch inhibit feature prevents unauthorized access to the vehicle from the door lock control switches. The BCM disables the function of both door lock control switches 20 seconds after the vehicle is electronically locked. If any of these switches are activated while they are inhibited, a chime sounds and a message is displayed in the message center to indicate the switches are inhibited. The BCM enables the function of these switches when the vehicle is electronically unlocked.

This feature can be configured on/off through the message center.

Power Door Locking Feedback

The exterior lamps and horn provide visual and audible feedback when unlocking and locking the doors under certain circumstances. Refer to the following table:

Action	Status of Door(s)	Status of Hood	Visual/Audible Feedback
Press the lock button on the door lock control switch	Open	Closed	A short flash of the turn signals after all the doors are closed.
Press 7/8 and 9/0 on the keyless entry keypad	Closed	Closed	A short flash of the turn signals.
Press the unlock button on a RKE transmitter	Closed	Closed	A long flash of the turn signals.
Press the lock button on a RKE transmitter	Closed	Closed	A short flash of the turn signals.
Press the lock button on a RKE transmitter	Open	Closed	A short flash of the turn signals after all the doors are closed.
Press the lock button on a RKE transmitter	Closed	Open	A short flash of the turn signals after the hood is closed.

Press the lock button on a RKE transmitter twice within 3 seconds	Closed	Closed	The horn chirps twice and the turn signals flash twice.
Press the lock button on a RKE transmitter twice within 3 seconds	Open	Closed	The horn immediately chirps twice and the turn signals flash twice after all the doors are closed.
Press the lock button on a RKE transmitter twice within 3 seconds	Closed	Open	The horn immediately chirps twice and the turn signals flash twice after the hood is closed.

There is also feedback provided by the vehicle to the key for the remote start feature. For additional information regarding the remote start feedback, refer to the Owner's Literature.

Power Locking Tailgate

The power locking tailgate feature operates in conjunction with the front passenger power door lock.

When the front passenger door is electronically locked or unlocked, the tailgate is also locked or unlocked.

Tailgate Latch Release

The tailgate latch can be released using:

- the tailgate release switch.
- a programmed RKE transmitter.
- a programmed passive key.

The BCM sends a voltage signal to the tailgate release switch. When a tailgate release switch is pressed, the voltage signal is routed to ground, indicating a request to release the tailgate latch.

When using a programmed RKE transmitter, press the tailgate release button twice within 3 seconds to release the tailgate latch. If the vehicle speed is 5 km/h (3.1 mph) or less, the BCM provides voltage to the tailgate latch actuator.

The tailgate latch can also be released using a programmed passive key. Refer to Tailgate Passive Entry in this section for information on the passive entry feature.

Keyless Entry Keypad

The BCM sends voltage signals on 3 separate circuits to the keyless entry keypad. When an individual keypad button is pressed, an individual or combination of the input circuits is routed to ground. Based on these inputs, the BCM determines which button was pressed. When a valid code is received, the BCM locks/unlocks the doors.

When a keypad button is pressed, the buttons illuminate. The keypad illumination turns off after 5 seconds have elapsed since the last button press. The keypad also illuminates any time the illuminated entry feature is active.

The keyless entry keypad can be used to:

- unlock the driver door.
- unlock all the doors (and the tailgate).
- lock all the doors (and the tailgate).
- program/erase up to 5 user codes.

Locking the Doors with the Keyless Entry Keypad

It is not necessary to enter the factory set or personal code prior to locking all doors. To lock all doors, press the 7/8 and 9/0 buttons at the same time for approximately 0.5 second. The locking function is disabled when the driver door is open.

Unlocking the Doors with the Keyless Entry Keypad

NOTE: *Vehicles equipped with passive entry come from the factory set with the 2-stage unlock feature disabled (all doors unlock when the factory keycode is entered).*

To unlock the driver door, enter either the factory set code or a personal code (each digit must be pressed within 5 seconds of the prior digit). The illuminated entry feature activates unless disabled.

If the 2-stage unlock is enabled, enter the factory set code or a personal code (driver door unlocks) and then touch the 3/4 button within 5 seconds to unlock all doors. This feature can be changed to a 1-stage unlock using the message center settings.

Anti-Scan Feature

To provide added security, the keypad is disabled for 1 minute after 36 button presses without a valid entry code being entered. The keypad flashes during this 1 minute mode with all functionality disabled except for 7/8 and 9/0 still being allowed to lock the vehicle.

Anti-scan turns off after 1 minute of keypad inactivity, the unlock button is pressed on a valid programmed RKE transmitter, a passive entry feature is used, or the ignition is turned on.

Factory Keycode Retrieval

The factory keycode for the keyless entry keypad can be retrieved from a label on the BCM, a wallet card in the Owner's Literature, using a diagnostic scan tool, or by using 2 programmed keys.

To retrieve the factory keycode using 2 programmed keys, carry out the following steps within 10 seconds:

- Place the first programmed key into the ignition lock cylinder or backup starting location and turn the ignition on.
- Turn the ignition off and remove the first programmed key.
- Place the second programmed key into the ignition lock cylinder or backup location and turn the ignition on.

NOTE: Any warning messages that may be present are displayed in the message center prior to the keycode being displayed.

The factory keycode displays momentarily in the message center.

RKE

The RKE feature is controlled by the BCM. When a button is pressed, the Transmitter Identification Code (TIC) and RKE command is received by the RTM. The RTM interprets the information and sends a message to the BCM over a LIN circuit, and when the network is awake over the CAN. If the BCM detects a valid programmed key, it carries out the command by controlling the door locks, releasing the tailgate latch or activating the horn or turn signals as required.

The RKE system can be used to:

- unlock the driver door.
- unlock all doors (and the tailgate).
- lock all doors (and the tailgate).
- release the tailgate latch (tailgate release button must be pressed twice within 3 seconds) (if equipped).
- arm/disarm the perimeter alarm.
- activate/deactivate the panic alarm.
- remotely start the vehicle.
- configure the staged lock programming (2-stage unlock or global unlock).

The RKE transmitters for an IKT have a normal operating range of 20m (66 ft) in an open air, no obstruction environment.

The RKE transmitters for a passive key have a normal operating range of 50m (165 ft) in an open air, no obstruction environment.

The RKE transmitters and the BCM also utilize a rolling code to prevent the code from being captured by a code grabber. The system advances the counter in the RKE transmitter and the BCM every time a RKE transmitter button is pressed.

The message center displays Key Battery Low Replace Soon when the battery in the key needs to be replaced.

RKE Transmitter Unlock

The RKE feature provides a staged process for unlocking the doors. Upon receipt of the first request for unlocking the doors, the RKE feature unlocks only the driver door. If another unlock request is received within 3 seconds of the first, all the doors and the tailgate are unlocked. This feature can be disabled so that all the doors unlock on the first press of the unlock button (global unlock) using the message center settings.

Vehicles not equipped with push-button start come from the factory set with the 2-stage unlock feature enabled (2 unlock presses to unlock all doors).

Vehicles equipped with push button start come from the factory set with the 2-stage unlock feature disabled (single press unlocks all doors).

RKE Transmitter Lock

The RKE feature requests all of the doors and tailgate lock when the lock button is pressed.

RKE Transmitter Tailgate Latch Release

The RKE transmitter provides a tailgate release function. The tailgate release button must be pressed twice within 3 seconds for the tailgate latch to release.

Panic Alarm (if equipped)

The panic alarm feature provides audible and visual alarms which are evident from the exterior of the vehicle. When the panic alarm button is initially pressed, the panic alarm feature requests the turn signals flash and the horn sounds for up to 3 minutes or until deactivation. The flashing of the outputs occurs simultaneously.

The panic alarm can only be activated when the ignition is off. This feature is disabled at all other times. Deactivation of an active panic alarm is accomplished when:

- a second press of the RKE transmitter panic button is detected.
- the ignition status changes from off.
- a period of 2 minutes and 45 seconds have elapsed since the initial activation.

Remote Start

The factory-installed remote start allows the vehicle to be remotely started from outside the vehicle. There is a 2-way communication between the passive key and the vehicle to provide the remote start status of the vehicle. The passive key contains a green and a red LED to indicate the remote start status.

LED	Status
Blinking green	Waiting for status update from vehicle
Blinking red	Remote start/stop failed
Solid green	Remote start or extension successful
Solid red	Remote stop successful (engine off)

To remotely start the vehicle, press the lock button once and then the remote start button twice within 3 seconds of each other. The vehicle should remotely start and the LED on the passive key should be lit solid green.

The vehicle does not remote start if any of the following conditions are present:

- The feature is disabled using the message center settings.
- The hood is not closed.
- The vehicle is not in PARK.
- A powertrain system DTC is present, illuminating the service engine soon indicator.
- The ignition is on.
- The alarm system is triggered.
- The vehicle battery voltage is low.

For additional information regarding the remote start system, refer to the Owner's Literature.

Autolock

The autolock feature locks all of the doors after all of the following have occurred:

- All the doors are closed.
- The ignition is on.
- The vehicle is shifted into any gear to put the vehicle in motion.
- The vehicle attains a speed greater than 20 km/h (12.4 mph).

The auto lock feature activates again during the same ignition cycle when all of the following have occurred:

- The vehicle speed is reduced to less than 15 km/h (9.3 mph).
- A door is opened and then closed.
- The vehicle attains a speed greater than 20 km/h (12.4 mph).

The autolock feature can be enabled/disabled through the message center.

Auto-Unlock

NOTE: *The doors do not auto-unlock if the vehicle has been electronically locked before the driver door is unlocked.*

The auto-unlock feature unlocks all of the doors when all of the following conditions have been met:

- All the doors are closed and locked.
- The ignition was on.
- The vehicle was shifted out of park and a speed greater than 20 km/h (12.4 mph) was achieved.
- The vehicle has come to a stop.
- The ignition transitions to accessory or off and, within 10 minutes, the driver door is opened.

The auto-unlock feature can be enabled/disabled through the message center.

Smart Unlock (without push button start)

The smart unlock feature prevents the doors from electronically locking with the key in the ignition lock cylinder. When the BCM receives a lock command from a door lock control switch and the key is detected in the ignition lock cylinder with one of the front doors open, the BCM commands the doors to unlock.

To override the smart unlock feature and intentionally lock the doors with the key in the ignition lock cylinder, close all doors and lock the vehicle by pressing the lock button on another valid programmed IKT, or with another key using the driver door lock cylinder.

Smart Unlock (with push button start)

The smart unlock feature prevents the vehicle from electronically locking when a passive key is left inside the vehicle. When the doors are electronically locked while a door is ajar and then closed, the interior of the vehicle is scanned for a passive key. If a valid programmed passive key is detected inside the vehicle, the BCM unlocks the doors and chirps the horn twice.

To override the smart unlock feature, lock the doors using the keyless entry keypad, the door lock cylinder or another valid programmed passive key.

Passive Entry

The passive entry feature unlocks or locks the doors or releases the tailgate latch without having to use a mechanical key blade or the RKE transmitter feature.

When the BCM detects a lock or unlock sensor is touched on an exterior door handle, or the tailgate release button is pressed, it activates the low frequency antenna in the corresponding exterior door handle or inside the tailgate. The low frequency antenna sends out a signal to activate the passive key. The passive key then responds by sending a high frequency signal back to the RTM. The RTM interprets the high frequency signal from the passive key and sends the information to the BCM. If the BCM detects a valid programmed passive key, the BCM either unlocks the driver door, unlocks or locks all doors, or releases the tailgate latch.

Door Passive Entry

With a valid programmed passive key within 1 m (3.28 ft) outside a door, touch the lock or unlock sensor on the exterior door handle. The doors lock or unlock depending upon which sensor was touched on the handle. The unlock button is located on the inside of the handle and the lock button is located on the outside top face of the handle.

The driver front door passive entry feature either unlocks the driver door (if 2-staged unlock is enabled) or all four doors (if 2-staged unlock is disabled). The passive entry feature always locks all the doors when the lock button is touched.

The passenger door passive entry feature always locks or unlocks all the doors.

Tailgate Passive Entry

With a valid programmed passive key within 1 m (3.28 ft) outside the tailgate, press the tailgate release button on

the underside of the tailgate handle to release the tailgate latch.

Component Description

Door Lock Control Switches

The door lock control switches are double pole, single throw switches. The DDM and PDM provide the voltage signal to the corresponding door lock control switch for the lock and unlock requests. When a switch is pressed to lock or unlock, the corresponding input circuit is routed to ground, indicating a request to lock or unlock the doors.

Door Lock Actuators

The door lock actuators are mounted to the door latches. The door lock actuators operate in 2 directions, depending on the polarity of the voltage.

Tailgate Release Switch

The tailgate release switch is a momentary contact switch. When the tailgate release switch is pressed, a voltage signal from the BCM is routed to ground indicating a request to release the tailgate latch.

Tailgate Lock Actuator

The tailgate lock actuator locks and unlocks the tailgate. It operates in 2 directions, depending on the polarity of the voltage.

Tailgate Latch Release Actuator

The tailgate latch release actuator releases the tailgate latches when actuated.

Keyless Entry Keypad

When a button is pressed on the keypad, it provides a ground signal to the corresponding voltage reference circuit (s) to the BCM.

DDM or PDM

The DDM and the PDM monitor the door lock control switches and control the operation of the power windows and the power mirrors. They communicate with each other and the BCM over the CAN.

The DDM and PDM require PMI when replaced.

IKT

The IKT incorporates both the PATS functions and the RKE transmitter functions in a single device

During key programming procedures, the PATS and RKE transmitter Identification (ID) of an IKT are both programmed. A maximum of 6 keys can be programmed.

Passive Key

The passive key incorporates both the PATS and RKE transmitter functions in a single device.

During key programming procedures, the PATS and RKE transmitter Identification (ID) of a passive key are both programmed. A maximum of 4 passive keys can be programmed.

The passive key also contains a removable key blade that unlocks the driver door in the event of an electrical failure (such as a drained battery). The passive key requires 2 batteries. They should always be replaced as a set. For battery replacement instructions, refer to the Owner's Literature.

To start the vehicle in the event of a passive key battery failure, place the passive key in the backup starting location.

Refer to: [Passive Anti-Theft System \(PATS\) - System Operation and Component Description](#) (419-01C Passive Anti-Theft System (PATS) - Vehicles With: Keyless Vehicle System, Description and Operation).

Exterior Door Handles

The exterior front door handles contain a keyless entry antenna and capacitive touch sensor(s). The antennas and lock/unlock sensors are wired to the BCM. When activated, the antenna transmits a low frequency signal to activate a passive key.

The rear door handles are not equipped with antennas or lock/unlock sensors.

Keyless Entry Rear Antenna

The keyless entry rear antenna is wired to the BCM. When activated, it transmits a low frequency signal to activate a passive key.

RTM

The RTM communicates all RKE and passive key information to the BCM over a LIN-based circuit whether or not the CAN is active. The RTM is a receiving antenna that receives the high frequency signals from Integrated Keyhead Transmitters (IKTs) and passive keys.

The RTM requires PMI when replaced.

BCM

The BCM is the primary module in control of the power door lock system. It is responsible for locking/unlocking the doors. The BCM receives inputs for the door lock control switches, passive keys and RKE commands over the CAN.

The BCM requires PMI when replaced and at least 2 keys programmed to it.

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