211-05 Steering Wheel and Column Electrical Components
Description and Operation

2019 Ranger
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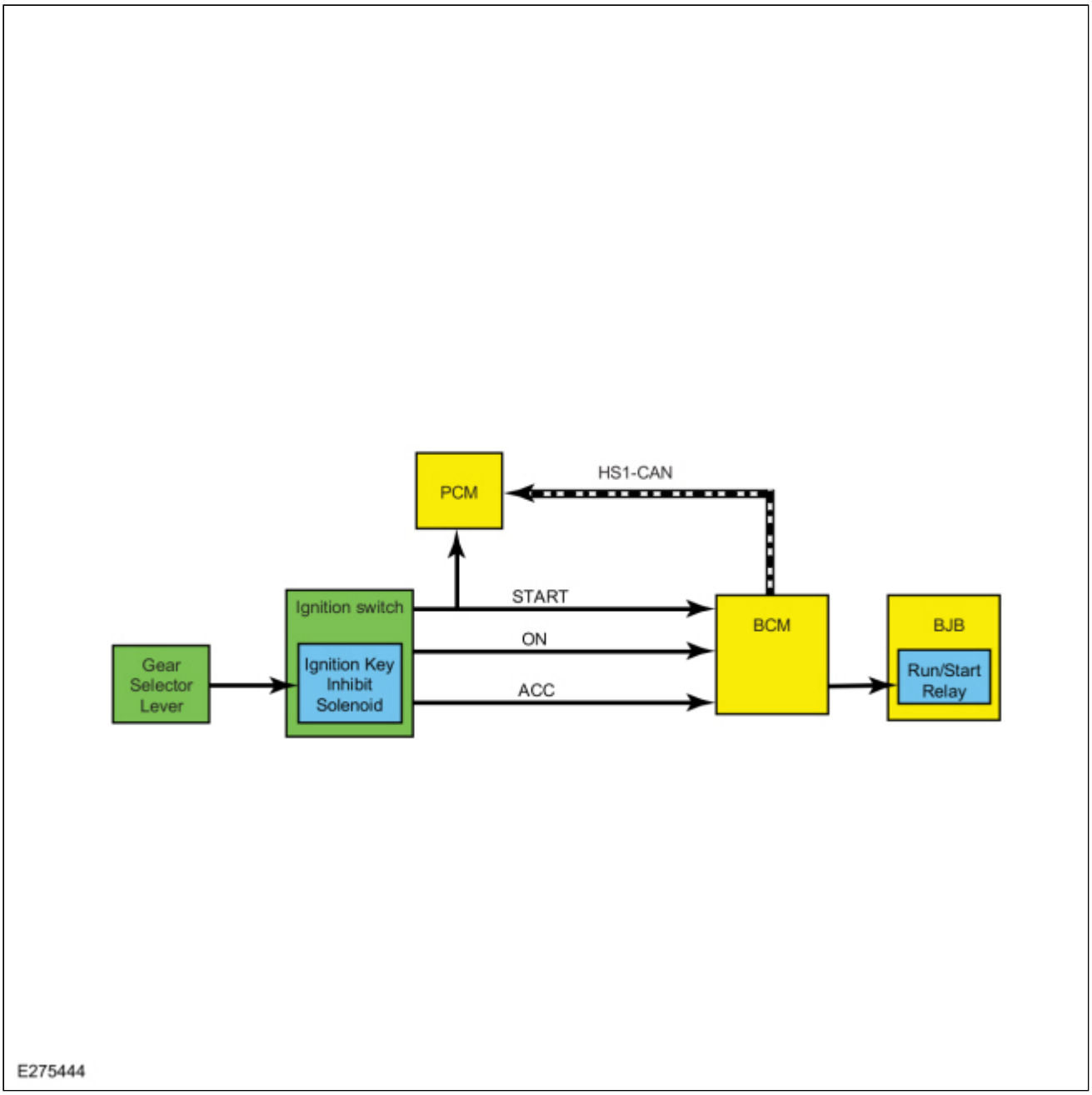
Steering Wheel and Column Electrical Components - System Operation and Component Description

System Operation

System Diagram - Conventional Ignition Switch



Network Message Chart - Conventional Ignition Switch

PCM Module Network Input Messages

Broadcast Message	Originating Module	Message Purpose

Broadcast Message	Originating Module	Message Purpose
Ignition status	BCM	This message informs the PCM of the current ignition status; off, on, start, unknown or invalid.

Ignition Switch System

The BCM controls the ignition modes, including OFF, ACC, ON and START. This allows some systems to be activated without starting the vehicle.

The BCM provides voltage at all times to the ignition switch. Depending on the ignition switch position, voltage may be routed to one or two of the ignition switch input circuits back to the BCM.

OFF

The BCM supplies voltage to the ignition switch at all times. When the ignition switch is in the OFF position, the switch is open, preventing any voltage signals from reaching the BCM. When the BCM does not detect voltage from any of the ignition mode-designated circuits, the BCM interprets this as the ignition off mode.

The BCM communicates the ignition mode to the other modules by sending an ignition status message over the CAN and does not energize any relays to prevent voltage from being distributed to the various electrical systems.

ACC

When the ignition switch is in the ACC position, the switch routes voltage through the ACC-designated circuit to the BCM. The BCM interprets this as the ignition accessory mode.

The BCM communicates the ignition mode to the other modules by sending an ignition status message over the CAN and energizes the accessory designated relays and provides power to some electrical system.

ON

When the ignition switch is in the ON position, the switch routes voltage through the ACC-designated and ON-designated circuits to the BCM. The BCM interprets this as the ignition on mode.

The BCM communicates the ignition mode to the other modules by sending an ignition status message over the CAN and activates the internal run/start relay, providing ignition power to the various vehicle systems and modules.

START

When the ignition switch is placed in the START position, the switch routes voltage through the ON-designated and START-designated circuits to the BCM.

The BCM interprets this as the ignition start mode and communicates the ignition mode to the other modules by sending an ignition status message over the CAN. Additionally, the ignition switch routes voltage to the PCM indicating a request to start the vehicle.

The START-designated circuit is only used for vehicle starting.

Ignition Key Inhibit

The ignition key cylinder inhibit feature prevents the ignition lock cylinder from being rotated to the OFF/LOCK position when the vehicle is not in PARK.

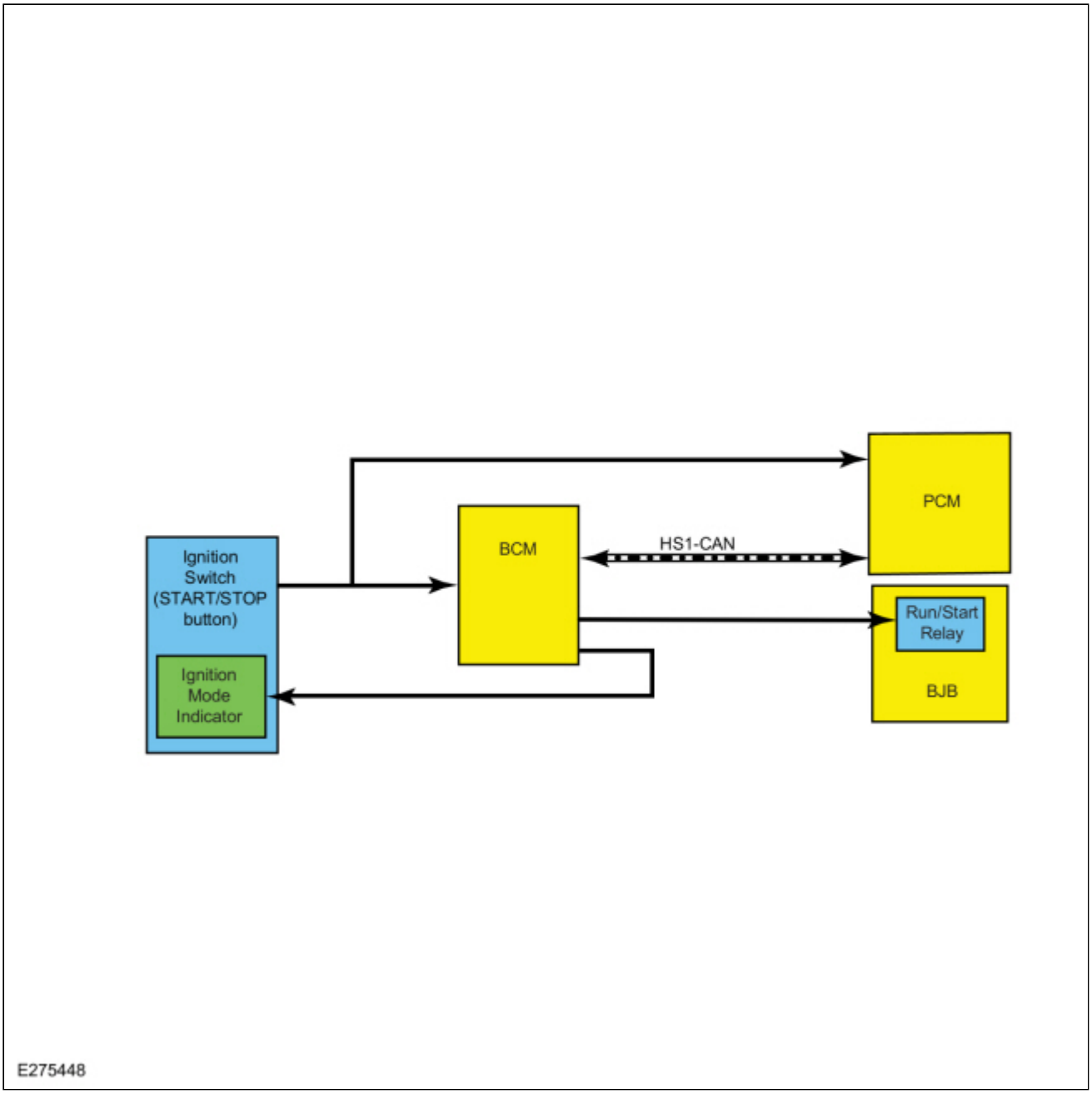
The key removal inhibit solenoid (part of the ignition switch) receives battery voltage at all times from the BCM fuse 18(5A). The ground control circuit for the key removal inhibit solenoid is routed to a park detect switch within the selector lever assembly.

The park detect switch routes the signal directly to ground to activate the ignition key inhibit solenoid.

When the selector lever is in PARK, the park detect switch inside the selector lever assembly is open, preventing the solenoid from actuating. When the selector lever is moved out of PARK, the switch closes and completes the circuit to the to ground.

When the selector lever is in PARK, the key removal inhibit solenoid deactivates and allows the ignition lock cylinder to be turned to the OFF/LOCK position to remove the key.

System Diagram - Push Button Ignition Switch



Network Message Chart - Push Button Ignition Switch

PCM Module Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Ignition status	BCM	This message informs the PCM of the current ignition status; off, run, start, unknown or invalid.

Push Button Ignition Switch

The push button ignition switch is used to control the ignition mode.

There are 2 circuits the BCM monitors from the ignition switch to change the ignition mode. One circuit is monitored for voltage and the other for a ground signal. When the START/STOP button is pressed, one circuit routes battery voltage to the BCM while a voltage signal from the BCM on the second circuit is routed to ground, indicating a request to change the ignition mode. Changing the ignition mode out of OFF works in conjunction with the PATS. The BCM must recognize a valid programmed key before it changes the ignition mode out of OFF.
Refer to: Perimeter Anti-Theft Alarm - System Operation and Component Description (419-01A Perimeter Anti-Theft Alarm, Description and Operation).

Refer to the following table for information about achieving the various ignition modes.

Ignition Entry Condition	Desired Ignition Mode	Action To Take
Off	ON (engine off)	Press the START/STOP button without applying the brake pedal.
Off or on	START	Apply the brake pedal and then press the START/STOP button.
On (engine off)	OFF	Press the START/STOP button.
On (engine running)	OFF	Press and hold the START/STOP button.

Ignition Mode LED Indicator

The ignition mode LED indicates the ignition mode of the vehicle. The BCM controls the voltage to the ignition mode LED indicator. Refer to the following table.

Ignition Mode	Ignition Mode LED Indicator
Off	Off
On (engine off)	Flashing
On (engine running)	On

OFF

The BCM controls the relays providing voltage to the vehicle electrical systems. When the ignition is in the ON mode, a single press and release of the START/STOP button changes the ignition to the OFF mode. No programmed key is required to change the ignition to the OFF mode when the vehicle is running.

If the vehicle is in motion, a momentary press of the START/STOP button does not shut the vehicle off. If the vehicle is moving at a speed greater than 15 km/h (9 mph), the START/STOP button must be pressed and held for longer than one second (or pressed 3 times within 2 seconds) to turn the ignition off.

When the BCM changes the ignition mode to OFF, it communicates the ignition mode to the other modules by sending an ignition status message over the CAN.

ON

The BCM must recognize a programmed key before it changes the ignition mode out of OFF. When the START/STOP button is pressed when the ignition is off, the BCM checks the vehicle for a valid programmed key as part of the PATS function. If no valid programmed key is detected, the ignition remains off.
Refer to: Perimeter Anti-Theft Alarm - System Operation and Component Description (419-01A Perimeter Anti-Theft Alarm, Description and Operation).

When the ignition is in the ON mode, the BCM activates the run/start relay to provide voltage to the vehicle electrical systems and communicates the ignition mode to the other modules by sending an ignition status message over the CAN.

When the vehicle enters ON mode, multiple indicators in the IPC prove out and the IPC displays the gear selection and the vehicle mileage.

START

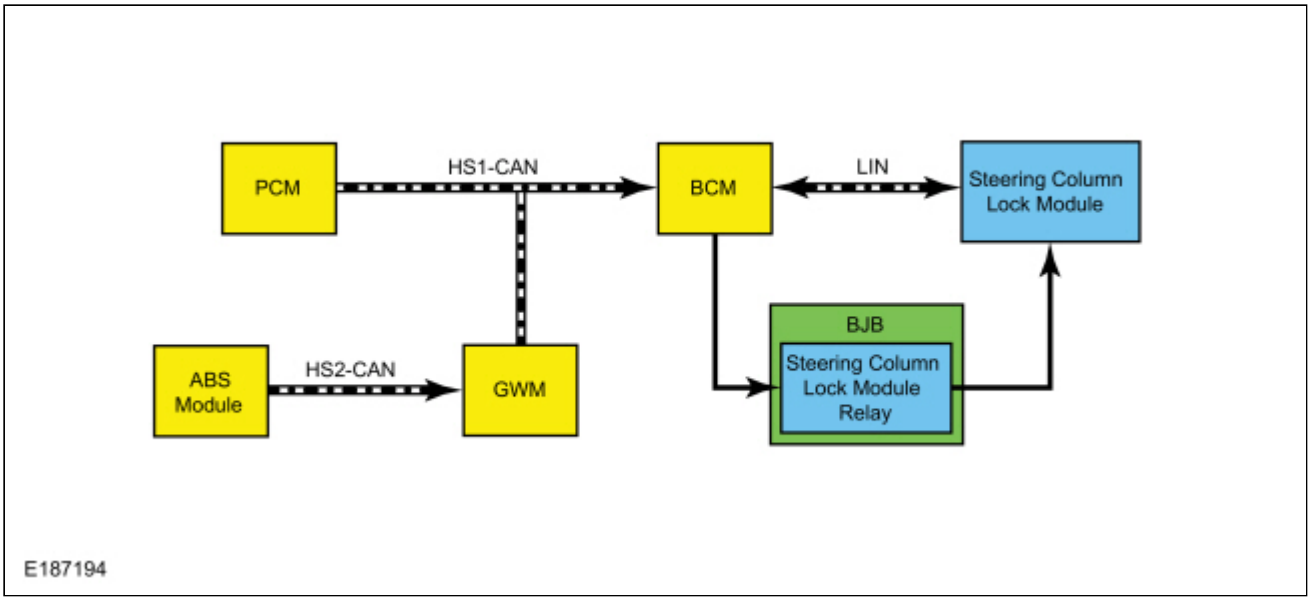
If the brake pedal is applied when the START/STOP button is pressed, the vehicle temporarily goes into the START mode if a valid programmed key is detected within the vehicle.

In addition to activating the run/start relay, the BCM communicates the ignition mode to the other modules by sending an ignition status message over the CAN.

After the ignition has completed the vehicle start sequence, the ignition mode returns to ON and the ignition mode indicator in the ignition switch illuminates steadily.

The engine can be started from any ignition mode.

System Diagram - Steering Column Lock



Network Message Chart - Steering Column Lock

Steering Column Lock Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Engine rpm data	PCM	Provides the BCM with the engine speed to indicate if the engine is running or OFF
Ignition status	BCM	Provides the BCM with the vehicle speed to indicate if the vehicle is moving or stationary.

Steering Column Lock

The steering column lock is used to deter vehicle theft by electronically locking the steering column. This prevents the steering wheel from being rotated to turn the front wheels.

The steering column unlocks when:

- the passive entry feature is used to open the driver door.
- the driver door is opened after unlocking the vehicle with a RKE transmitter.
- the START/STOP button is pressed and a valid programmed passive key is detected.
- the remote start feature is activated.

The steering column locks after:

- the ignition is turned off and 45 seconds have elapsed since the delayed accessory feature has turned off.
- 45 seconds have elapsed since the remote feature turned off the vehicle.

The BCM controls the voltage provided to the steering column lock module using a relay (located in the BJB) and communicates with it over a LIN. The BCM monitors inputs from various systems to determine when to send a command to lock or unlock the steering column. The steering column lock module locks and unlocks the steering column as directed by commands received from the BCM.

If the BCM detects a fault from the steering column lock module or the LIN, the BCM prevents the vehicle from starting. The BCM does not provide power to the steering column lock module when the vehicle is moving or the engine is running.

Steering Column Lock Messages

The message center displays a message when the BCM detects a fault from the steering column lock module. The "Steering Malfunction" message displays when a fault with the electronic steering column lock system is present and must be diagnosed.

The "Turn the wheel while starting" message displays when the steering column lock module is unable to unlock the steering column because of a high amount of torque against the lock (such as when the wheels are against a curb when the vehicle is shut off). The torque against the steering column lock must be relieved for the steering column to unlock.

Component Description

Conventional Ignition Switch

The ignition switch is a multiple position rotary switch that is controlled by a lock cylinder and a key. The ignition switch is monitored by the BCM, which controls the voltage to the various electrical systems depending on input from the ignition switch.

The key removal inhibit solenoid (internal to the ignition switch) is an electronically controlled solenoid that prevents the ignition lock cylinder from being turned to the OFF/LOCK position unless the selector lever is in the PARK position. This also prevents the key from being removed from the ignition lock cylinder.

Push Button Ignition Switch

The push button ignition switch is a momentary dual contact switch that provides direct input to the BCM and PCM. Both sets of contacts are normally open. When the START/STOP button is pressed, one set of contacts provides a ground signal to the BCM and the other set of contacts supplies voltage to the BCM and the PCM.

The ignition mode LED indicator is located near the top of the START/STOP button and is controlled by the BCM.

BCM

The BCM controls the run/start relays and sets the vehicle ignition mode based on inputs from the ignition switch. It communicates the ignition mode to other modules over the CAN. If a fault is detected with the ignition switch system, Diagnostic Trouble Codes (DTCs) are set in the BCM.

The BCM requires at least 2 keys to be programmed and PMI when replaced. Additionally, the parameter reset procedure must be carried out.

Steering Column Lock Module

The steering column lock module locks and unlocks the steering column based on commands received from the BCM. The steering column lock module monitors the position of the steering column lock and, if a fault is detected, reports the failure to the BCM.

When the steering column lock module is replaced, the BCM must configured/trained to the new steering column lock module for the steering column lock module to operate correctly.

The BCM sets a DTC if a fault is detected with the steering column lock module. Additionally, if the BCM is not configured to the steering column lock module, the steering column module keeps the column, a programming and/or configuration DTC sets and the vehicle does not start. To configure the BCM to the steering column lock module, Refer to: Perimeter Anti-Theft Alarm - System Operation and Component Description (419-01A Perimeter Anti-Theft Alarm, Description and Operation).