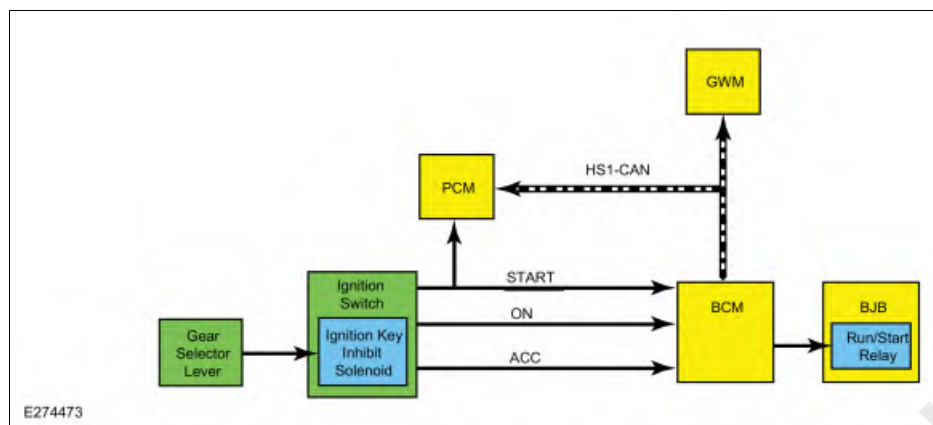


Steering Wheel and Column Electrical Components - System Operation and Component Description

System Operation

System Diagram - Conventional Ignition Switch



Item	Description
1	Ignition Switch
2	START
3	ACC
4	ON
5	HS1-CAN
6	BJB
7	Gear Selector Lever
8	Ignition Key Inhibit Solenoid
9	PCM
11	BCM
12	GWM
13	Run/Start Relay

Network Message Chart - Conventional Ignition Switch

GWM Module Network Input Messages

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

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, 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.

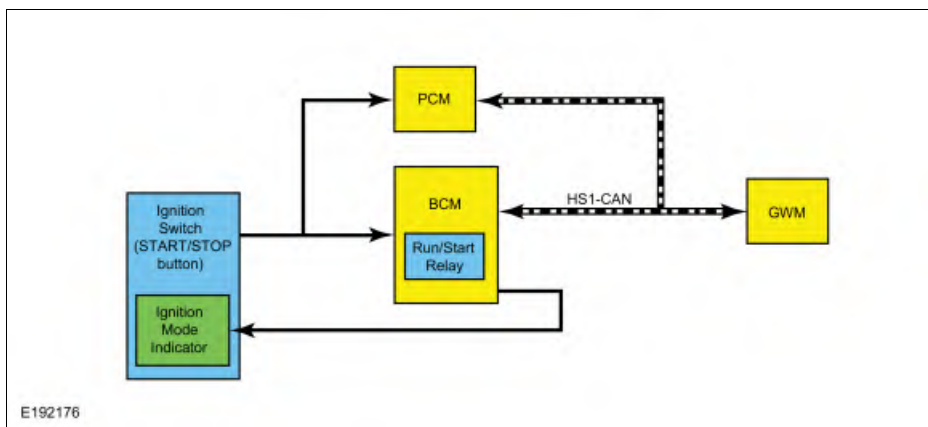
The key removal inhibit solenoid (part of the ignition switch) receives battery voltage at all times from the BCM fuse 18 (5A). The ground control circuit for the key removal inhibit solenoid is routed to a park detect switch within the brake shift interlock actuator.

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 brake shift interlock actuator is open, preventing the solenoid from actuating. When the selector lever is moved out of PARK, the switch closes and completes the circuit 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



Item	Description
1	HS1-CAN
2	Ignition Switch (START/STOP button)
3	GWM
4	PCM
5	Ignition Mode Indicator
6	BCM
7	Run/Start Relay

Network Message Chart - Push Button Ignition Switch

GWM Module Network Input Messages

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

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: 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).

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

Ignition Entry Condition	Desired Ignition Mode	Action To Take
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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: 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).

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

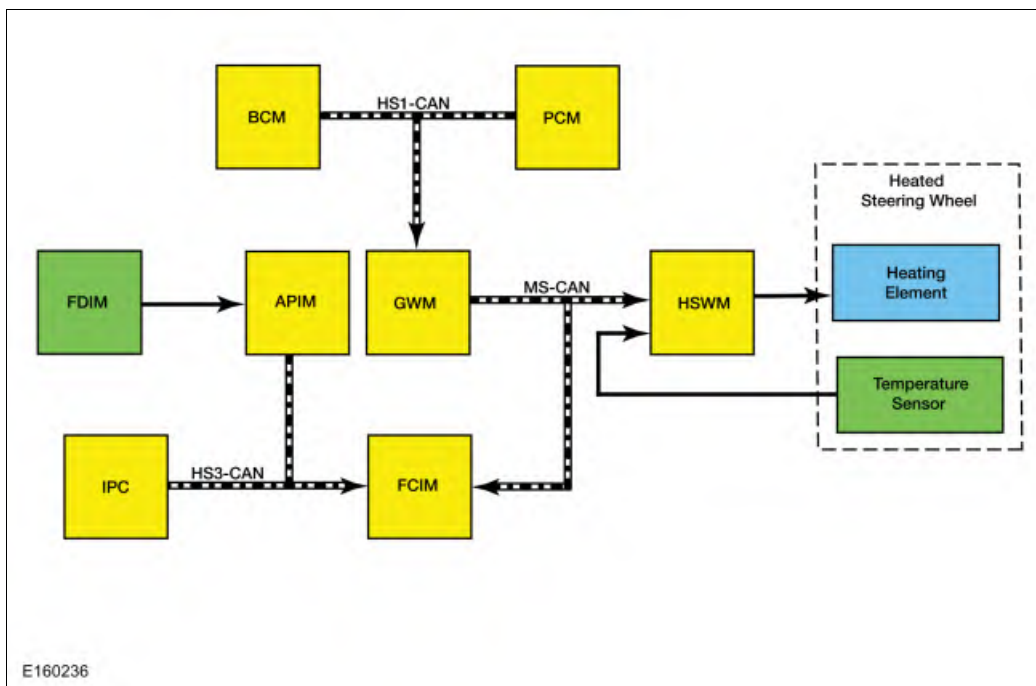
If the brake pedal is applied when the START/STOP button is pressed, the vehicle temporarily goes into the START mode so long as a valid programmed key is detected within the vehicle.

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 - Heated Steering Wheel (vehicles not equipped with adaptive steering)



Network Message Chart - Heated Steering Wheel

HSWM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Engine power status	PCM	This message indicates to the HSWM whether the engine is running.
Ignition status	BCM	Indicates which ignition mode is active.
Transport mode	BCM	Message is used to reduce the drain on the battery during long periods when the vehicle is not used, such as shipping from the factory to the dealership.
Steering wheel heat request	FCIM	Message is used to activate the heated steering wheel function when the touchscreen button is pressed on the FDIM, or when the conditions are met to activate the heated steering wheel (and heated seats) during a remote start.

FCIM Module Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Heated steering wheel button status	APIM	This message informs the FCIM that the heated steering wheel touchscreen button was pressed on the FDIM.
Ambient exterior temperature data	IPC	This message is used by the FCIM when determining if outside conditions are cold enough to request the heated steering wheel be activated during remote start operation.

Heated Steering Wheel

When the HSWM receives a request to heat the steering wheel, the HSWM applies voltage and ground to the steering wheel heating elements (integral to the steering wheel) to heat the steering wheel to a temperature of approximately 28-34°C (82-94°F). The heated steering wheel temperature is maintained by the HSWM using a temperature sensor in the steering wheel.

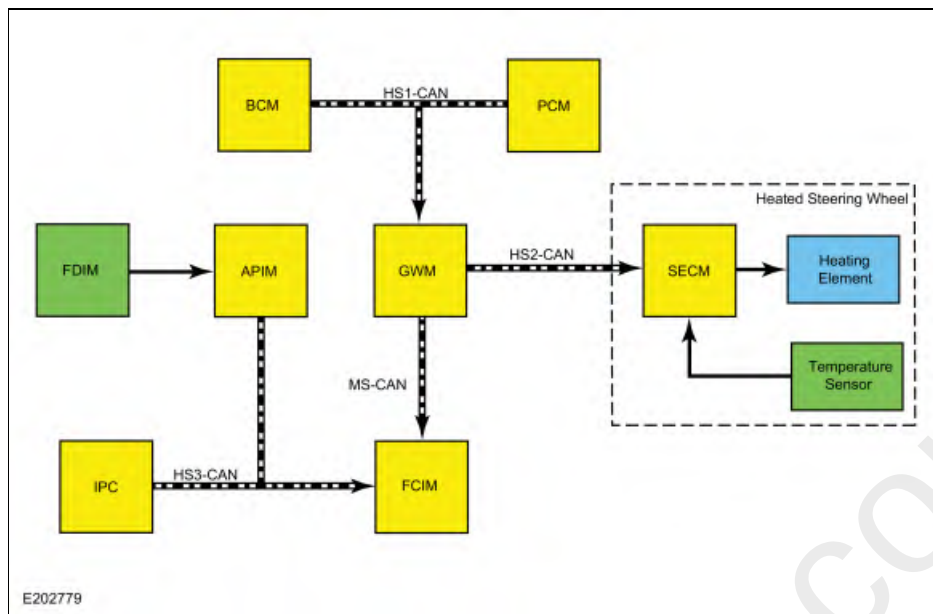
The HSWM is designed to remain on, heating the steering wheel and maintaining the temperature until switched off on the FDIM or the ignition is turned off.

The controls and indicators for the heated steering wheel system are located on the FDIM (touchscreen) only. The FDIM does not communicate on any network and is connected directly to the APIM.

Remote Start System

The heated steering wheel system (along with the heated front seats) may be configured using the message center to activate when the remote start feature is used, based on outside air temperature. During remote start, the outside air temperature is continually evaluated by the HVAC system. The heated steering wheel system activation changes if the outside air changes from cold to moderate or warm temperatures or back from moderate or warm to cold temperatures.

System Diagram - Heated Steering Wheel (vehicles equipped with adaptive steering)



Item	Description
1	MS-CAN
2	HS3-CAN
3	HS1-CAN
4	HS2-CAN
5	FDIM
6	FCIM
7	APIM
8	IPC
9	SECM
10	Heated Steering Wheel
11	BCM
12	PCM
13	Temperature Sensor
14	Heating Element
15	GWM

Network Message Chart - Heated Steering Wheel

SECM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Engine power status	PCM	This message indicates to the HSWM whether the engine is running.

Broadcast Message	Originating Module	Message Purpose
Ignition status	BCM	Indicates which ignition mode is active.
Steering wheel heat request	FCIM	Message is used to activate the heated steering wheel function when the touchscreen button is pressed on the FDIM, or when the conditions are met to activate the heated steering wheel (and heated seats) during a remote start.

FCIM Module Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Heated steering wheel command status	APIM	This message informs the FCIM that the heated steering wheel touchscreen button was pressed on the FDIM.
Ambient exterior temperature data	IPC	This message is used by the FCIM when determining if outside conditions are cold enough to request the heated steering wheel be activated during remote start operation.

Heated Steering Wheel

When the SECM receives a request to heat the steering wheel and the engine is running, the SECM applies voltage and ground to the steering wheel heating elements (integral to the steering wheel) to heat the steering wheel to a temperature of approximately 28-34°C (82-94°F). The heated steering wheel temperature is maintained by the SECM using a temperature sensor in the steering wheel.

The SECM is designed to remain on, heating the steering wheel and maintaining the temperature until switched off on the FDIM or the ignition is turned off.

The controls and indicators for the heated steering wheel system are located on the FDIM (touchscreen) only. The FDIM does not communicate on any network and is connected directly to the APIM.

Remote Start System

The heated steering wheel system (along with the heated front seats) may be configured using the message center to activate when the remote start feature is used, based on outside air temperature. During remote start, the outside air temperature is continually monitored by the HVAC system. The heated steering wheel system activation changes if the outside air changes from cold to moderate or warm temperatures or back from moderate or warm to cold temperatures.

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.

HSWM

The HSWM controls the steering wheel heating elements. The HSWM uses the steering wheel temperature sensor to maintain the steering wheel temperature. The HSWM is designed to remain on, heating the steering wheel and maintaining temperature until switched off using the FDIM or the ignition is turned off.

The HSWM requires PMI when replaced.

Steering Effort Control Module (SECM) (vehicles equipped with adaptive steering)

The SECM controls the steering wheel heating elements. The SECM uses the steering wheel temperature sensor to maintain the steering wheel temperature. The SECM is designed to remain on, heating the steering wheel and maintaining temperature until switched off using the FDIM or the ignition is turned off.

The SECM cannot be serviced independently. It is only replaced as an assembly with the steering wheel.

The SECM requires PMI when replaced.

For additional information,

Refer to: Power Steering (211-02 Power Steering, Diagnosis and Testing).

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.

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