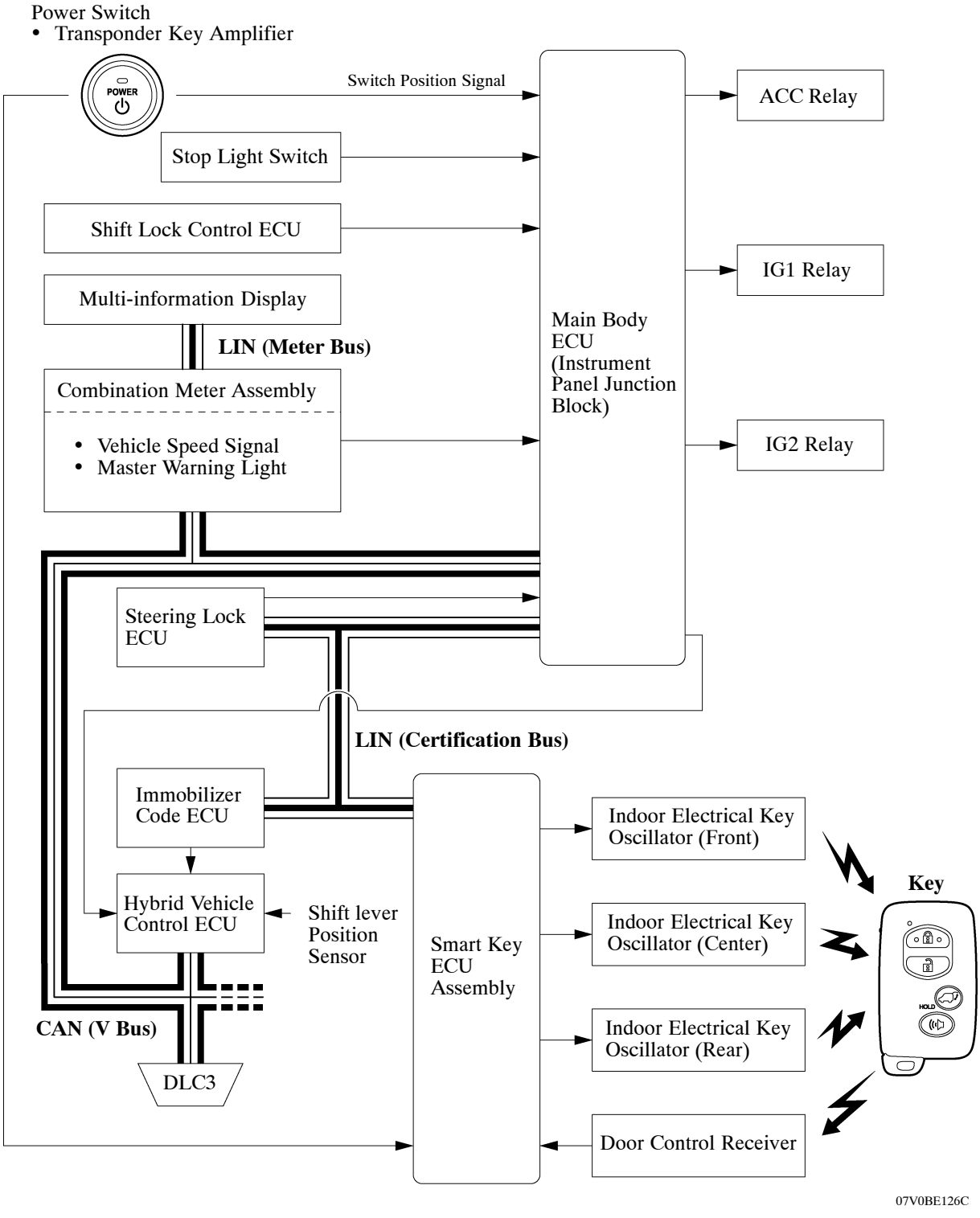
■START FUNCTION

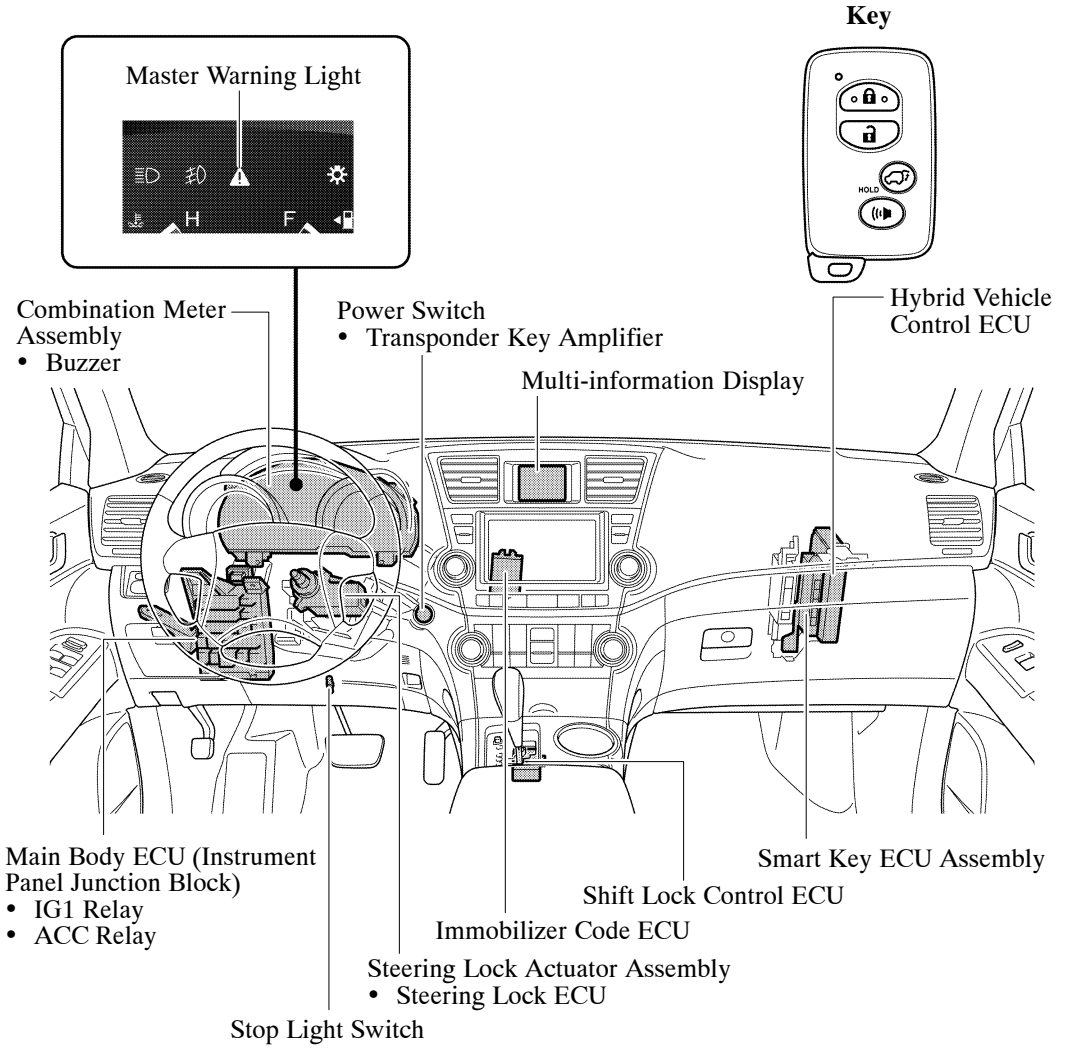
1. System Diagram

The main body ECU (instrument panel junction block) controls the start function. The system diagram below shows the components that relate to this function.

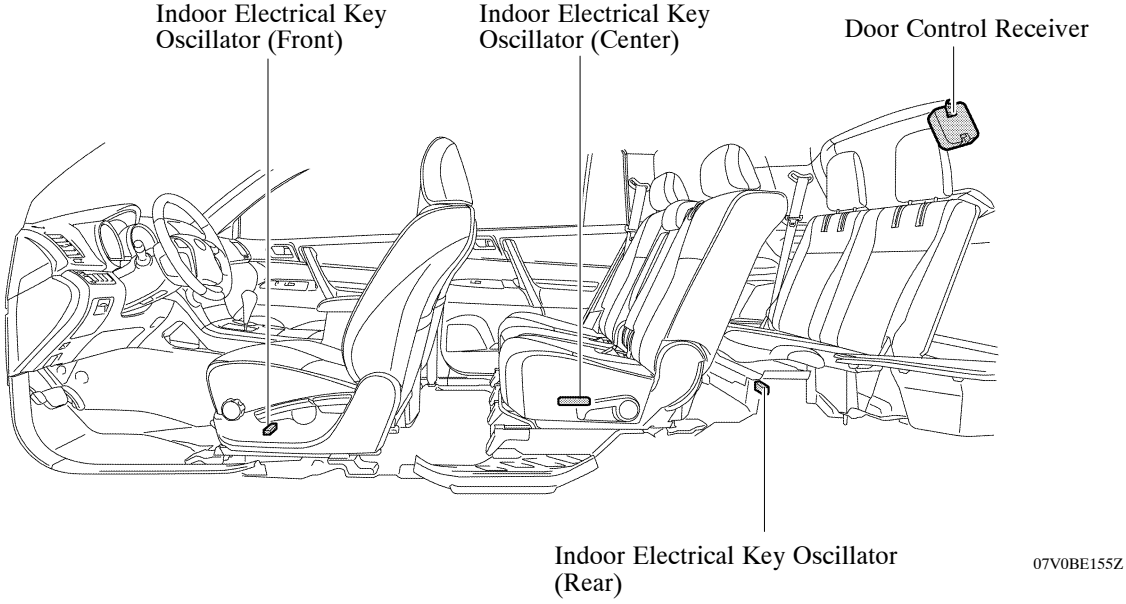


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2. Layout of Main Components



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3. Function of Main Components

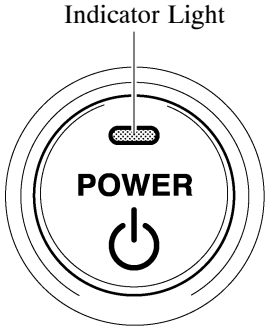
Component	Function
Power Switch • Transponder Key Amplifier	• Transmits the power switch signal to the main body ECU (instrument panel junction block). • Informs the driver of any power source or system abnormality through the illumination state of the indicator light. • Receives the ID code and transmits it to the smart key ECU assembly when the key battery is too weak to respond to the tuner based on the room oscillators.
Key	Receives the signals from the oscillators and returns the ID code to the door control receiver.
Indoor Electrical Key Oscillator • Front, Center, Rear	Receives a request signal from the smart key ECU assembly and forms the actuation area in the vehicle interior.
Door Control Receiver	Receives the ID code from the key and transmits it to smart key ECU assembly.
Main Body ECU (Instrument Panel Junction Block)	• Switches the power source among four modes (OFF, ACC, IG-ON, READY) in accordance with the shift position and the brake pedal (depressing/not depressed). • Controls the smart key system in accordance with the signals received from the switches and each ECU.
Smart Key ECU Assembly	• Certifies the ID code received from the door control receiver and transmits the certification results to the immobilizer code ECU and steering lock ECU. • Transmits the steering lock/unlock request signals. • Transmits the HV immobilizer set/unset request signals.
Stop Light Switch	Outputs the state of the brake pedal to main body ECU (instrument panel junction block).
Immobilizer Code ECU	Receives the steering lock/unlock or HV immobilizer set/unset request signals from the smart key ECU assembly, certifies them, and transmits each signal to the steering lock ECU or hybrid vehicle control ECU.
Steering Lock ECU	Receives the steering unlock/lock request signal from the immobilizer code ECU, and activates the steering lock motor.
Hybrid Vehicle Control ECU	• Receives the THS-II start request signal from the main body ECU (instrument panel junction block). • Receives the HV immobilizer unset request signal from the immobilizer code ECU. • Receives the above signals from the main body ECU (instrument panel junction block) and immobilizer code ECU, and starts the THS-II.
Combination Meter Assembly • Master Warning Light • Buzzer	Illuminates simultaneously with a buzzer in the combination meter assembly to inform the driver of malfunctions in the smart key system.
Multi-information Display	The following warning messages appear to alert the driver. • Shift to P range • Key is not detected • To start, depress the brake pedal, and push the POWER switch • Low Key Battery • Steering Lock is still active • Check Steering Lock System

4. Construction and Operation

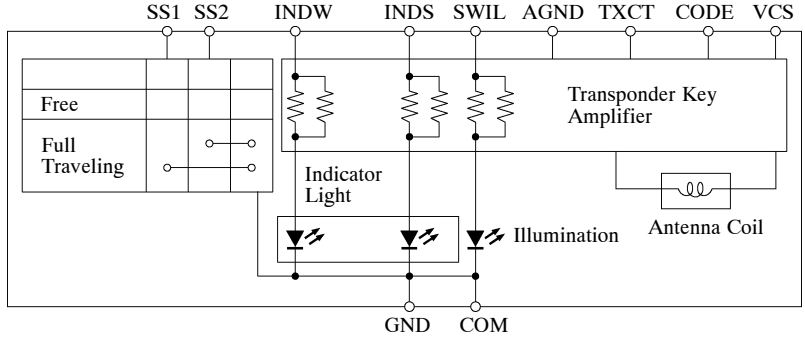
Power Switch

The power switch consists of a momentary type switch, indicator light (amber and green color LEDs), illumination, antenna coil, and transponder key amplifier.

- The driver can determine the present power source and check whether the THS-II can start or not in accordance with the illumination state of the indicator light.
- If the main body ECU (instrument panel junction block) detects an abnormality with the smart key system, the ECU makes the amber indicator light flash. If the THS-II is stopped in this state, it might not be possible to restart it.



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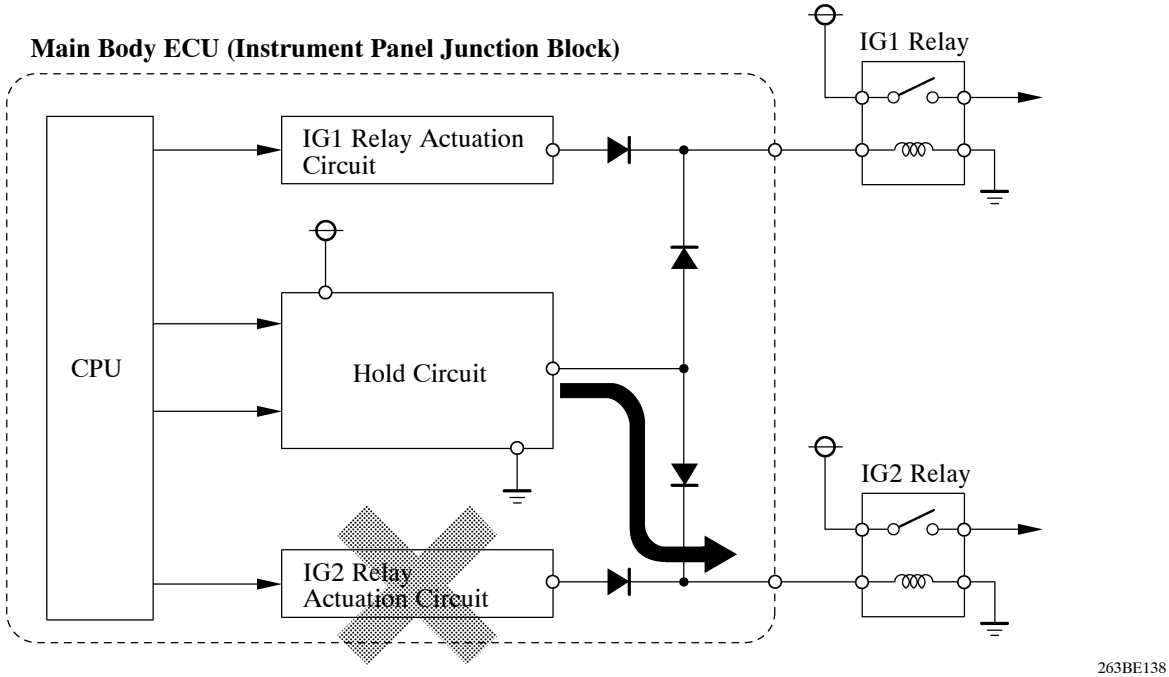
▶ Indicator Light Condition ◀

Power Source Condition	Indicator Light Condition	
	Brake pedal not depressed	Brake pedal depressed with shift lever in "P"
OFF	OFF	ON (Green)
ACC, IG-ON	ON (Amber)	ON (Green)
READY	OFF	OFF
Steering lock not unlocked	Flashes (Green) for 30 seconds	Flashes (Green) for 30 seconds
Smart Key System Malfunction	Flashes (Amber) for 15 seconds	Flashes (Amber) for 15 seconds

Main Body ECU (Instrument Panel Junction Block)

The main body ECU (instrument panel junction block) consists of the IG1 and IG2 relay actuation circuits, CPU, and hold circuit.

- The hold circuit is installed to prevent the power supply to the relays from being cut off when an abnormality occurs in the IG1 and/or IG2 relay actuation circuits while driving.



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Service Tip

The main body ECU (instrument panel junction block) constantly stores the present power source state in its memory. Therefore, if the power to the main body ECU (instrument panel junction block) is interrupted due to the removal of the auxiliary battery, the main body ECU (instrument panel junction block) restores the power source after the auxiliary battery is reconnected.

For this reason, if the auxiliary battery is removed when the power switch is in a state other than OFF, the power will be restored to the vehicle at the same time the power is restored to the main body ECU (instrument panel junction block) (by reconnecting the auxiliary battery).

Therefore, before removing the auxiliary battery, be sure to turn the power switch OFF.

5. Start Function Operation

General

The start function has different power source patterns depending on the brake pedal state and shift lever position.

Pattern (See page)	Brake Pedal	Shift Lever	Power Source Pattern
A (BE-141)	Depressed	P Position	When the power switch is pushed once. • OFF → READY (THS-II is started)
B (BE-143)	Not Depressed	P Position	Each time the power switch is pushed. • OFF → ACC → IG-ON → OFF
C (BE-146)		Except P Position	Each time the power switch is pushed. • OFF → ACC → IG-ON → ACC
D (BE-146)	—	P Position	When the power switch is pushed in the IG-ON condition. • IG-ON or READY → OFF
E (BE-146)	—	Except P Position	When the power switch is pushed in the IG-ON condition. • IG-ON or READY → ACC

▶ Transition of Power Source ◀

Shift Position		P			Except P	
Pattern		B or D	A or D	-	C or E	-
Power Switch		Push	Push	-	Push	Push
Brake		-	Depressed	-	-	Depressed
Hour		-	-	After 1 hour	-	-
Power Source	OFF					
	ACC					
	IG					
	READY					

⇦ : Transition

⇦ : Only when the key certification is OK.

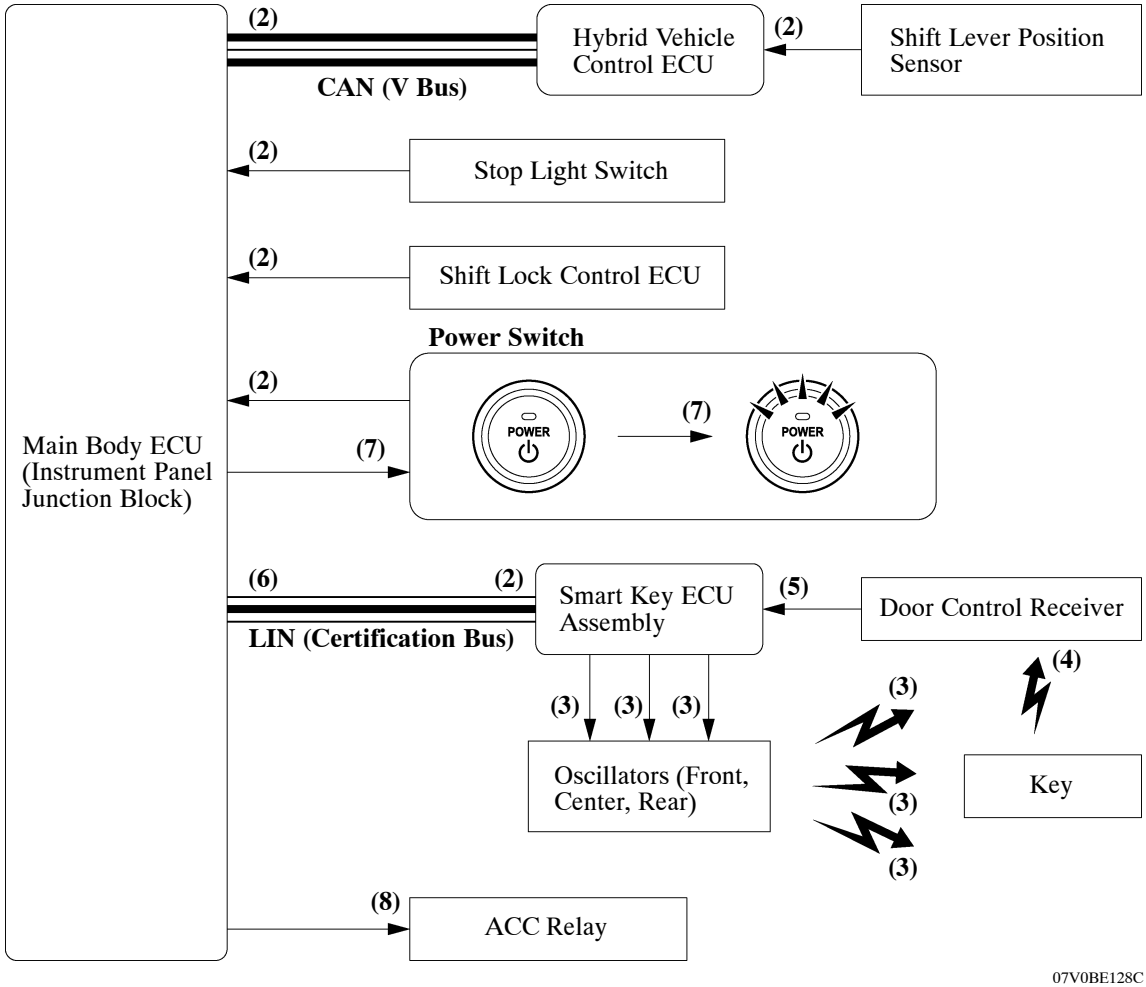
⬅ : Only when the vehicle is stopped.

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NOTE:
- Normally, the operation of the power switch is disabled while the vehicle is being driven. However, in an emergency, by pressing the power switch for approximately 3 seconds or more, the driver can stop the THS-II while the vehicle is in motion.
- If no signals are transmitted to the main body ECU (instrument panel junction block) due to malfunctions in the stop light switch or shift lever position sensor, the hybrid control system may not start when the power switch is pressed with the brake pedal depressed. In such cases, performing the following procedure may be enable the THS-II to start: 1) press the power switch to turn the power source from OFF to ACC, and 2) press the power switch again and hold it for 15 seconds or more.
- The above 2 operations must be applied only in emergency situations. Under normal conditions, the THS-II must not be stopped by pressing the power switch during driving or started without depressing the brake pedal when the shift lever is in any position other than P.

Pattern A: OFF → READY (THS-II is started)

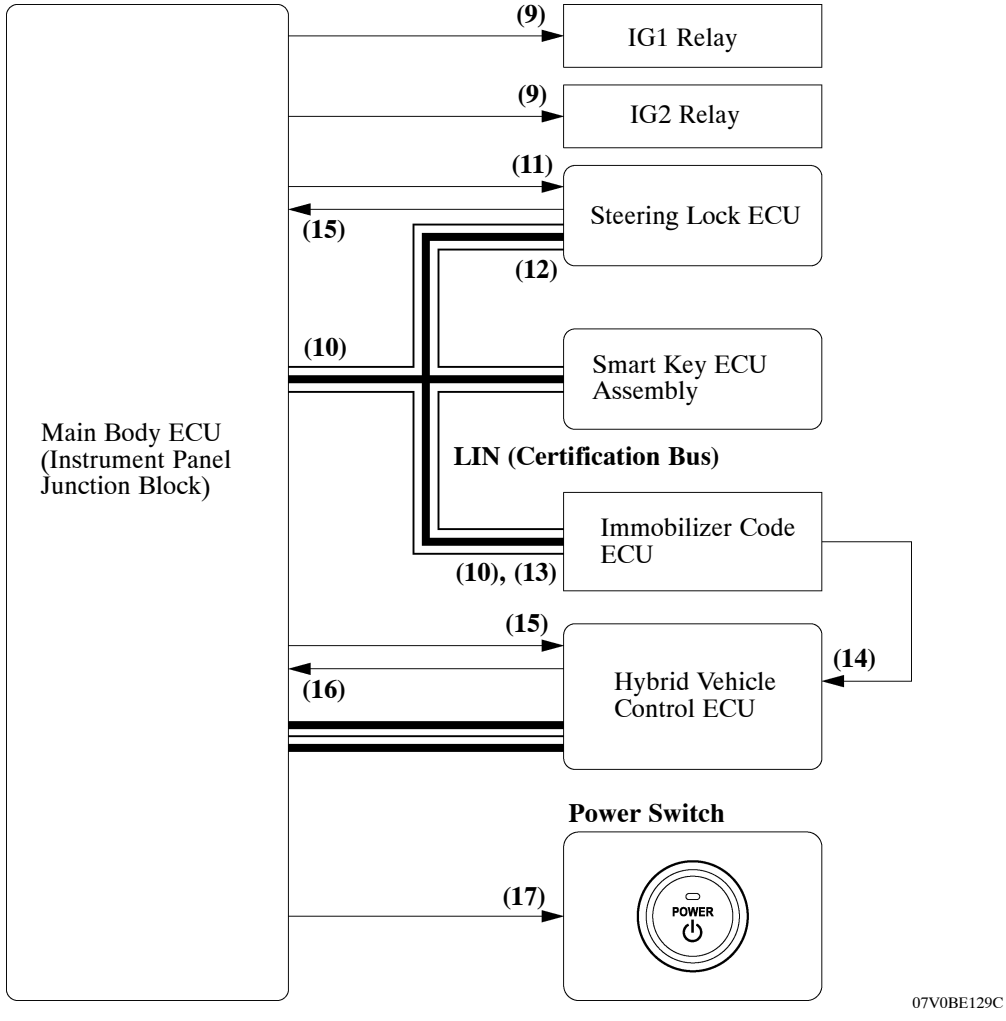
Step	System Operation
(1)	The driver holds the key and enters the vehicle.
(2)	When the driver presses the power switch once with the following conditions satisfied, the main body ECU (instrument panel junction block) recognizes the power switch signal and transmits the key certification request to the smart key ECU assembly. • Shift position is “P”. • Brake pedal is depressed. • Power switch is “OFF”.
(3)	The smart key ECU assembly receives the certification request and transmits a request signal to the oscillators (front, center, rear). These oscillators then transmit the request signal.
(4)	When the key receives the request signal, it transmits its ID code to the door control receiver. The signal includes the response code.
(5)	The door control receiver receives this code and transmits it to the smart key ECU assembly.
(6)	The smart key ECU assembly judges and certifies the ID code, and transmits a key certification OK signal to the main body ECU (instrument panel junction block).
(7)	The brake pedal is depressed, so the main body ECU (instrument panel junction block) turns ON the green indicator light of the power switch.
(8)	After receiving the key certification OK signal, the main body ECU (instrument panel junction block) turns ON the ACC relay.



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(Continued)

Step	System Operation
(9)	After turning ON the ACC relay, the main body ECU (instrument panel junction block) turns ON the IG1 and IG2 relays.
(10)	The smart key ECU assembly checks that the power source mode has switched from OFF to IG-ON, and transmits a steering unlock request signal to the main body ECU (instrument panel junction block) and immobilizer code ECU.
(11)	The main body ECU (instrument panel junction block) receives this signal and supplies power to the steering lock ECU.
(12)	The steering lock ECU receives the steering unlock request signal via the immobilizer code ECU, and releases the steering lock.
(13)	After checking the steering unlock condition, the smart key ECU assembly transmits an HV immobilizer unset request signal to the immobilizer code ECU.
(14)	The immobilizer code ECU certifies the unset request signal of the smart key ECU assembly, transmits the HV immobilizer unset request signal to the hybrid vehicle control ECU, and unsets the HV immobilizer.
(15)	After checking that the steering is in the unlocked condition, the main body ECU (instrument panel junction block) transmits a THS-II start request signal to the hybrid vehicle control ECU.
(16)	The hybrid vehicle control ECU judges that the THS-II has started and sends a READY signal to the main body ECU (instrument panel junction block).
(17)	The main body ECU (instrument panel junction block) receives this signal, checks that THS-II start is completed, and turns OFF the indicator light of the power switch.



Pattern B: OFF → ACC → IG-ON → OFF

1) OFF → ACC

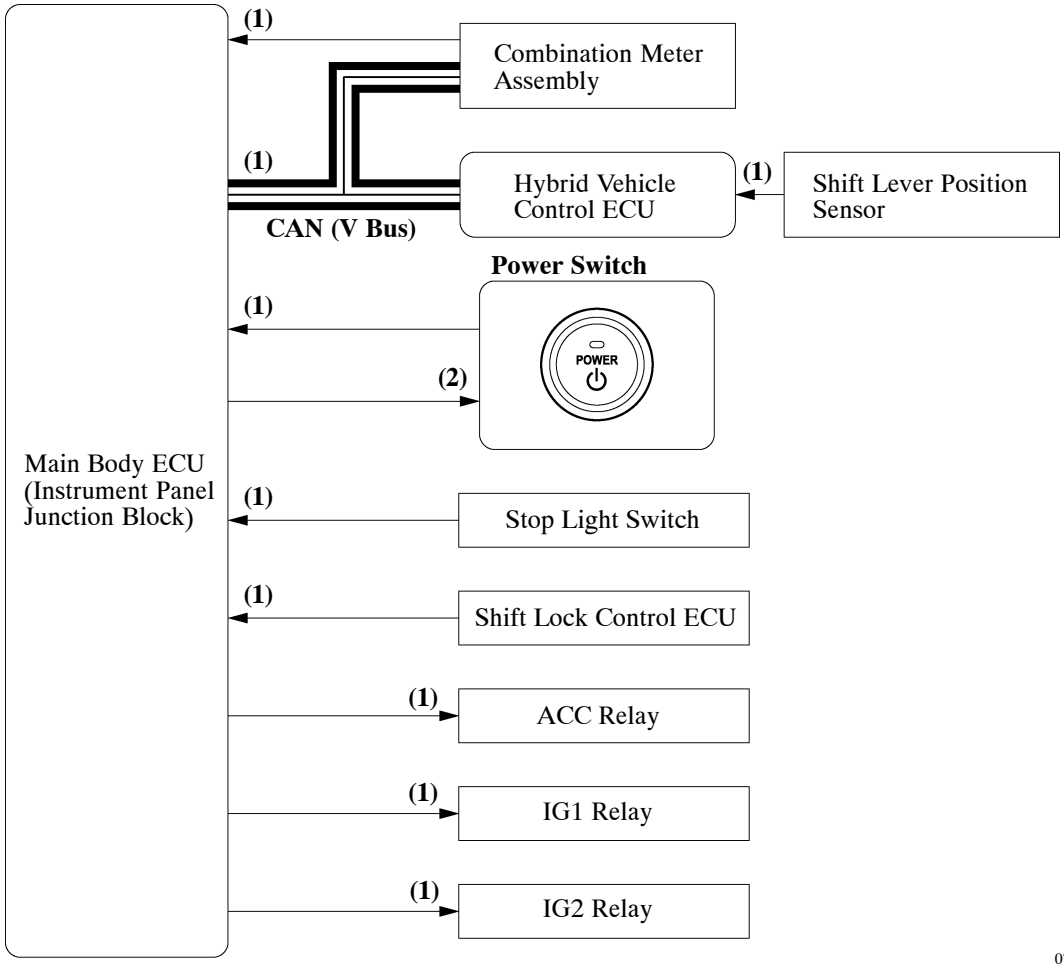
Step	System Operation
(1)	The[driver[has[the[key[in[their[possession[and[enters[the[vehicle.
(2)	When[the[driver[presses[the[power[switch[once[with[the[following[conditions[satisfied,[the[main[body ECU[(instrument[panel[junction[block)[recognizes[the[power[switch[signal[and[transmits[the[key certification[request[to[the[smart[key[ECU[assembly. •[Shift[position[is["P". •[Brake[pedal[is[not[depressed. •[Power[switch[is["OFF".
(3)	Due[to[the[brake[pedal[not[being[depressed,[the[main[body[ECU[(instrument[panel[junction[block)[will turn[ON[the[amber[indicator[light[of[the[power[switch.
(4)	The[rest[of[the[system[operation[is[the[same[as[**(4) to (8) in pattern "A"**.[For[details,[see[page[BE-141.

2) ACC → IG-ON

Step	System Operation
(1)	When[the[power[source[mode[is["ACC"[and[the[driver[pressed[the[power[switch[again,[the[main[body ECU[(instrument[panel[junction[block)[recognizes[the[power[switch[signal[and[turns[ON[the[IG[relays.
(2)	The[rest[of[the[system[operation[is[the[same[as[**(10) to (14) in pattern "A"**.[For[details,[see[page[BE-142.

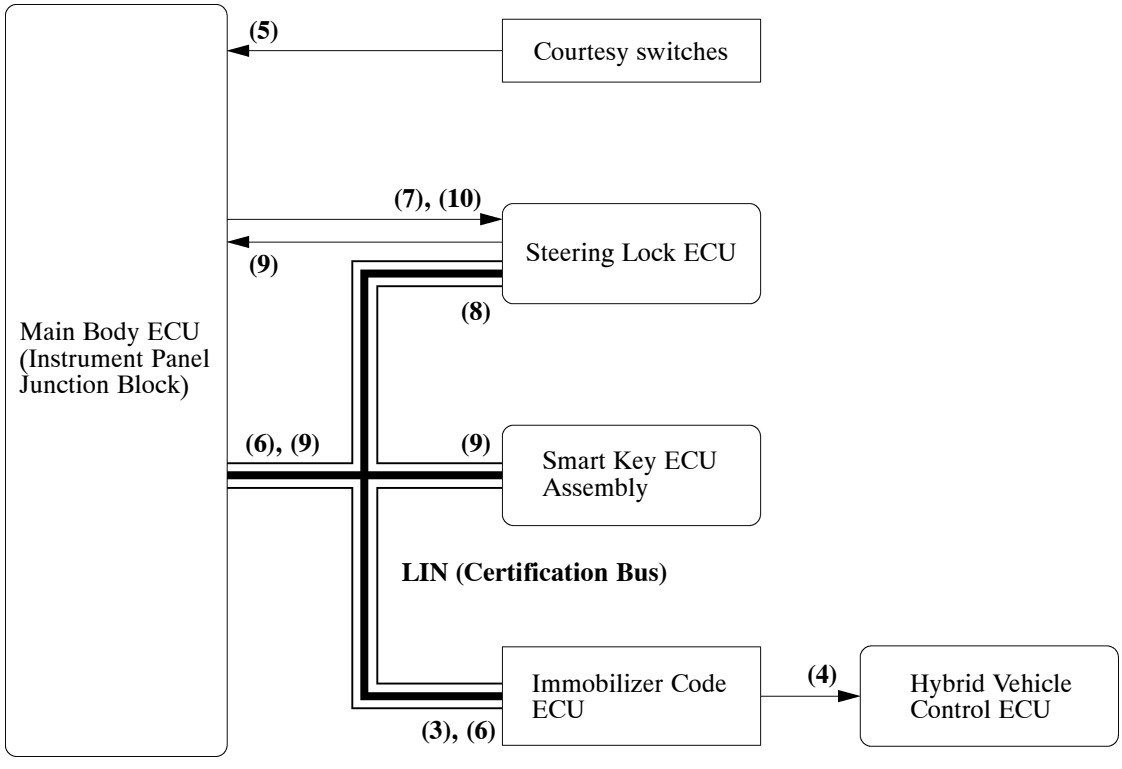
3) IG-ON → OFF

Step	System Operation
(1)	When the power switch is pressed once with the following conditions satisfied, the main body ECU (instrument panel junction block) recognizes the power switch signal and turns OFF the ACC and IG relays. • Shift position is “P”. • Brake pedal is not depressed. • Vehicle speed is 0 mph (0 km/h). • Power source mode is “IG-ON”.
(2)	When the power source mode is switched from IG-ON to OFF, the main body ECU (instrument panel junction block) will turn OFF the indicator light of the power switch.



(Continued)

Step	System Operation
(3)	The smart key ECU assembly transmits an HV immobilizer set request signal to the immobilizer code ECU after confirming that the power is off, the smart key ECU assembly transmits an HV immobilizer set request signal to the immobilizer code ECU.
(4)	The immobilizer code ECU certifies the set request signal of the smart key ECU assembly, transmits the HV immobilizer set request signal to the hybrid vehicle control ECU, and sets the HV immobilizer.
(5)	If any door is opened, the main body ECU (instrument panel junction block) receives a signal from the courtesy switch.
(6)	The smart key ECU assembly checks that any door is opened, and transmits a steering lock request signal to the main body ECU (instrument panel junction block) and immobilizer code ECU.
(7)	The main body ECU (instrument panel junction block) receives this signal and supplies power to the steering lock ECU.
(8)	The steering lock ECU receives the steering lock request signal via the immobilizer code ECU, and locks the steering lock.
(9)	The steering lock ECU transmits a steering lock signal to the smart key ECU assembly and main body ECU (instrument panel junction block) after confirming that the steering is locked.
(10)	The main body ECU (instrument panel junction block) receives this signal, checks that the steering lock is locked, and stops the power supply to the steering lock ECU.

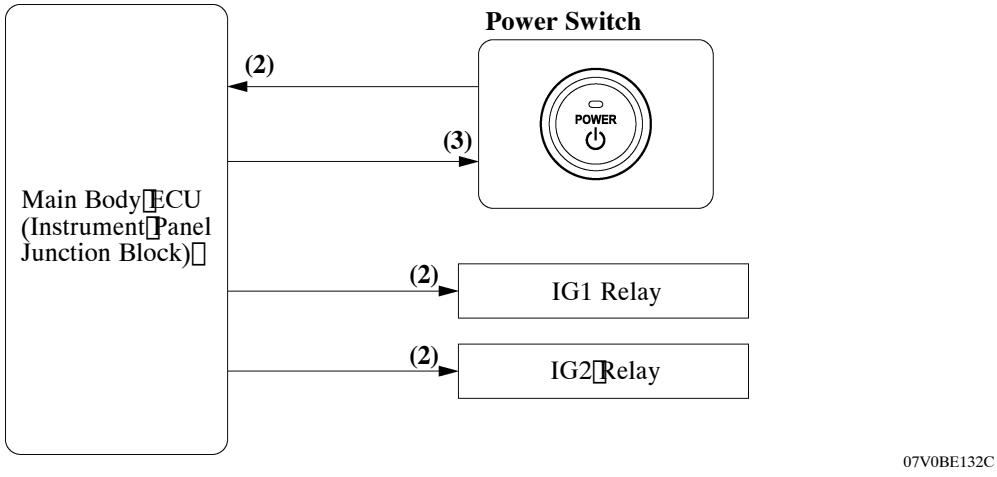


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Pattern C: OFF → ACC → IG-ON → ACC

Step	System Operation
(1)	The system operations for pattern C (OFF → ACC → IG-ON) is the same as that in **pattern "B"**. For details, see page BE-143.
(2)	When the power switch is pressed once with the following conditions satisfied, the main body ECU (instrument panel junction block) recognizes the power switch signal and turns OFF the IG relays. • Shift position is in any position except "P". • Brake pedal is not depressed. • Vehicle speed is 0 mph (0 km/h). • Power source mode is "IG-ON"
(3)	Even after the power source mode switches from IG-ON to ACC, the indicator light of the power switch will remain illuminated in amber.



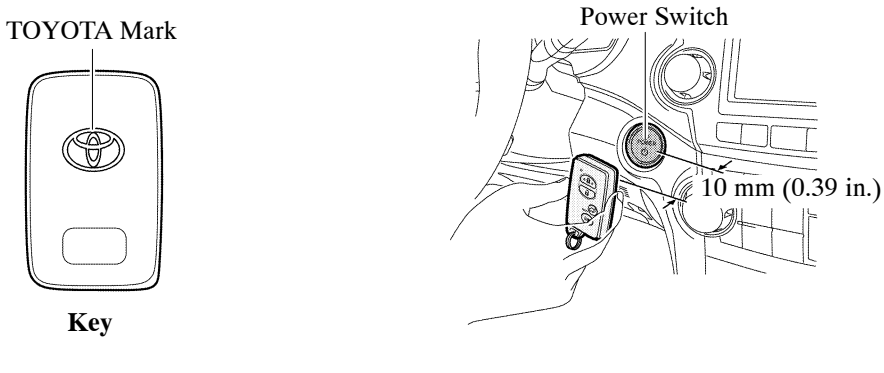
Pattern D: IG-ON → OFF

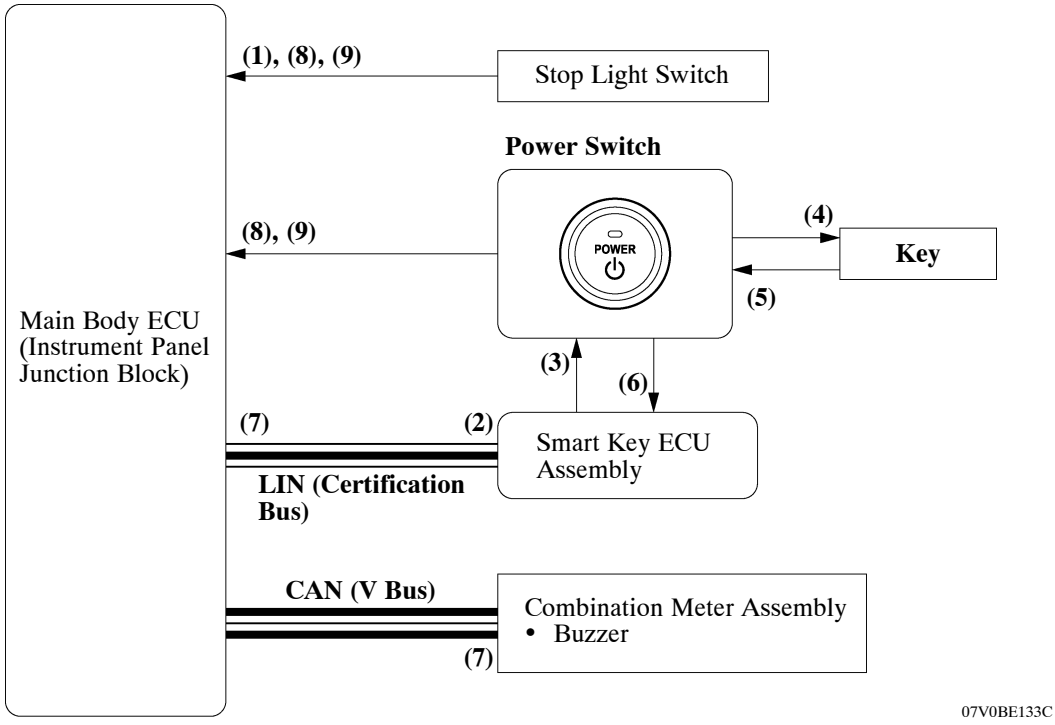
This system operation is the same as IG-ON → OFF in **pattern "B"**. For details, see page BE-144.

Pattern E: IG-ON → ACC

This system operation is the same as **pattern "C"**. However, when the power source mode is switched from READY to OFF, the main body ECU (instrument panel junction block) turns OFF the power switch indicator light.

When key battery is low

Step	System Operation
(1)	To operate the smart key system when the key battery is low, hold the key against the power switch as shown below while depressing the brake pedal. 
(2)	The main body ECU (instrument panel junction block) receives a stop light switch signal and transmits a key certification request signal to the smart key ECU assembly.
(3)	The smart key ECU assembly does not receive an ID code response from the door control receiver, so it actuates the transponder key amplifier built into the power switch.
(4)	The transponder key amplifier outputs an HV immobilizer radio wave to the key.
(5)	The key receives the radio wave, and returns a radio wave response to the transponder key amplifier.
(6)	The transponder key amplifier combines the key ID codes with the radio wave response, and transmits it to the smart key ECU assembly.
(7)	The smart key ECU assembly judges and verifies the ID code, and transmits a key certification OK signal to the main body ECU (instrument panel junction block). The buzzer in the combination meter assembly sounds at the same time.
(8)	After the buzzer sounds, if the power switch is pressed within 5 seconds while the brake pedal is depressed, the power source mode switches to READY, the same as with normal smart key operation.
(9)	After the buzzer sounds, if the power switch is pressed within 5 seconds while the brake pedal is not depressed, the power source mode will be switched to ACC or IG-ON, the same as with normal smart key operation.


Main Body ECU
(Instrument Panel
Junction Block)
(1), (8), (9)
Stop Light Switch
Power Switch
POWER
(8), (9)
(4)
Key
(5)
(3)
(6)
(7)
(2)
Smart Key ECU
Assembly
LIN (Certification
Bus)
CAN (V Bus)
Combination Meter Assembly
• Buzzer
(7)
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6. Diagnosis

The main body ECU (instrument panel junction block) and smart key ECU assembly can detect malfunctions in the smart key system when the power source is in the IG-ON mode.
When the ECUs detect a malfunction, the amber indicator light of the power switch flashes to warn the driver. At the same time, the ECUs store 5-digit DTCs (Diagnostic Trouble Codes) in their memories.

- The indicator light warning continues for 15 seconds even after the power switch is turned OFF.
- The 5-digit DTCs can be read after connecting Techstream to DLC3.
- The smart key system may not operate successfully if a malfunction occurs.