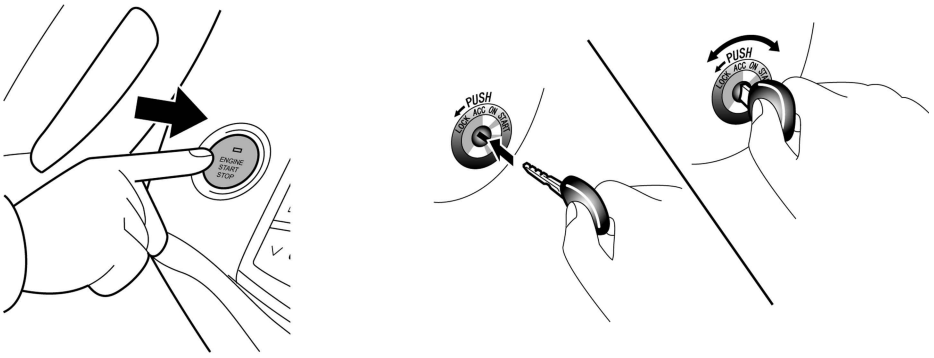
■START FUNCTION

1. General

- While the ignition key must be inserted into the ignition key cylinder and turned from OFF to the START position in order to start the engine on models without the smart entry and start system, models on which the smart entry and start system is installed start the engine when the push-type engine switch is pressed while the brake pedal is depressed and a key is carried by the driver.
- This function has different power source control patterns to suit the state of the brake pedal and shift lever position. For details, see page BE-144.
- Along with the adoption of the start function, an engine cranking hold function is used. For details, see page EG-56.

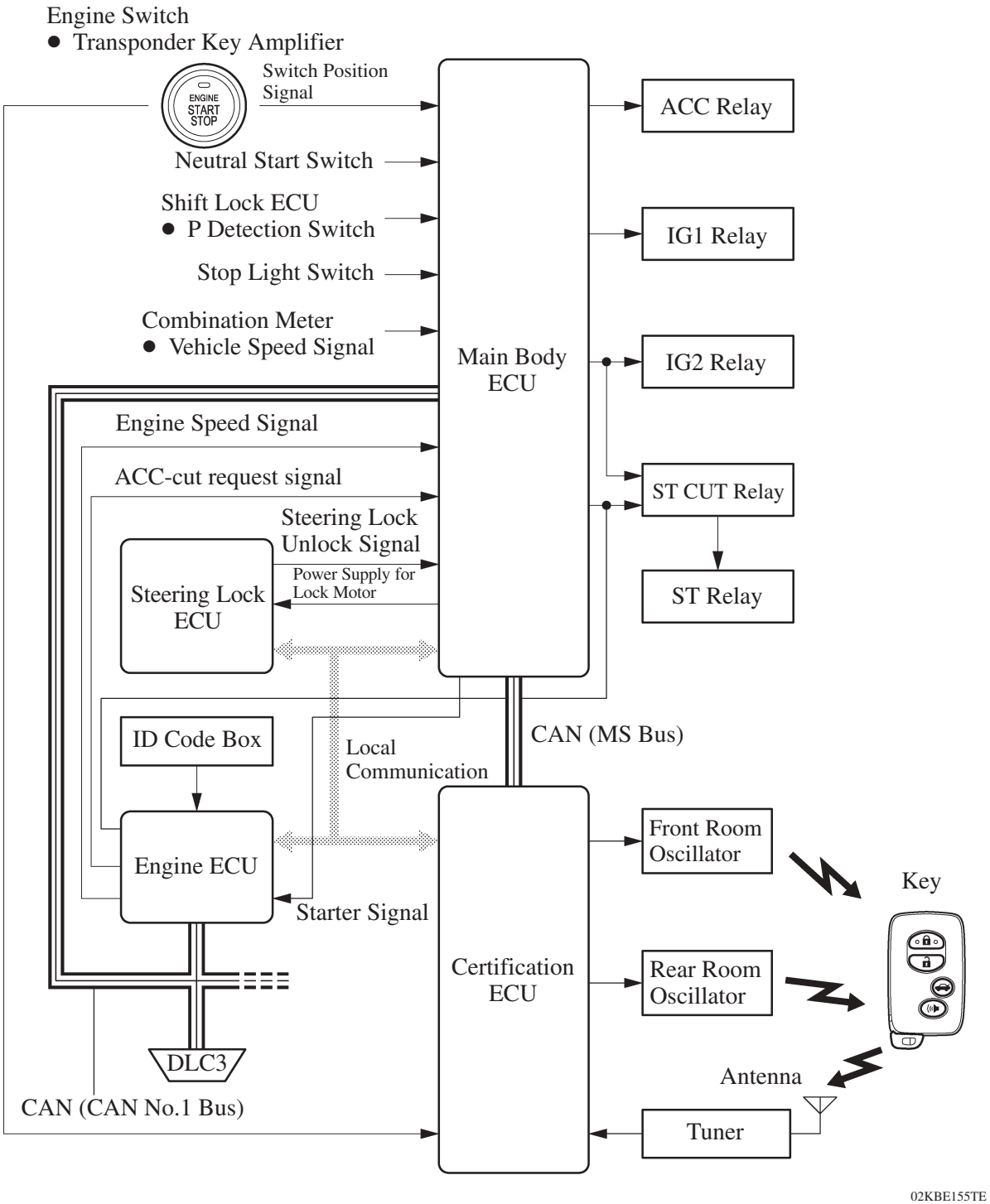


With Smart Entry and Start System **Without Smart Entry and Start System**

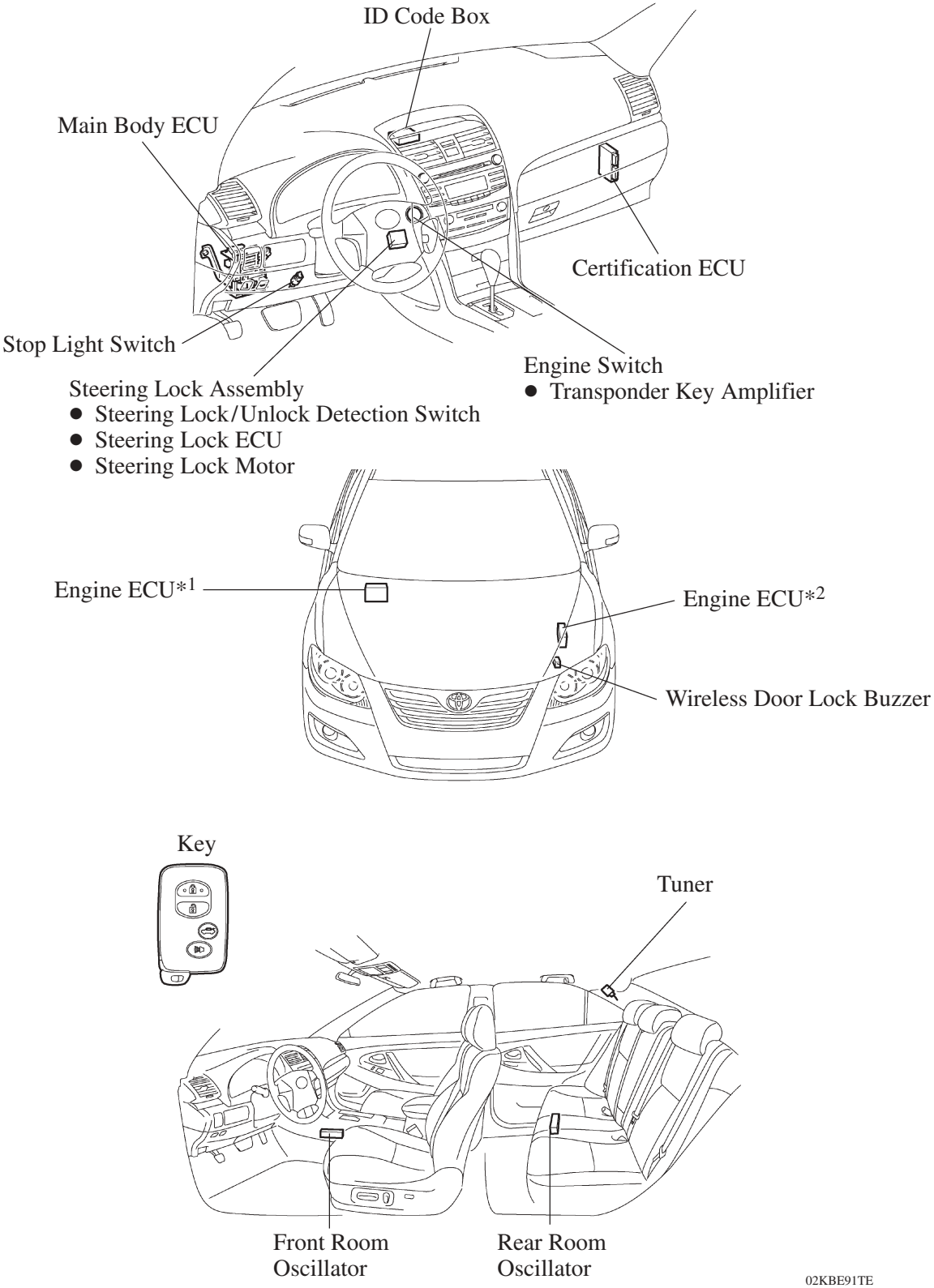
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2. System Diagram

The main body ECU controls the push button start function. The system diagram below shows the components that relate to this function.



3. Layout of Main Components



*1: U660E Automatic Transaxle Models
*2: U250E Automatic Transaxle Models

4. Function of Main Components

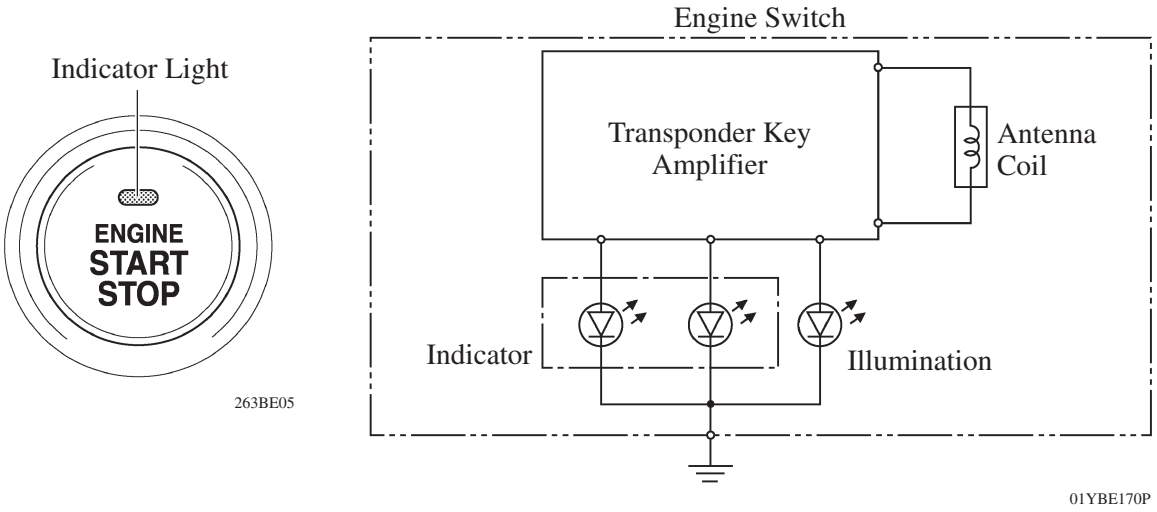
Component		Function
Engine Switch ● Transponder Key Amplifier		● Transmits the engine switch signal to the main body ECU. ● Informs the driver of any power source or system abnormality through the illumination stage of the indicator light. ● Receives the ID code and transmits it to the certification ECU 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 tuner. For details, see page BE-153.
Room Oscillator ● Front and Rear		Receives a request signal from the certification ECU and forms the actuation area in the vehicle interior.
Tuner		Receives the ID code from the key and transmits it to certification ECU.
Main Body ECU		● Switches the power source among four modes (OFF, ACC, IG-ON, START) in accordance with the shift position and the state of the stop light switch. ● Controls the smart entry and start system in accordance with the signals received from the switches and each ECU.
Certification ECU		Certifies the ID code received from the tuner and transmits the certification results to the ID code box and steering lock ECU.
Stop Light Switch		Outputs the state of the brake pedal to main body ECU.
ID Code Box		Receives the steering unlock or engine immobilizer disengage/engage signals from the certification ECU, certifies them, and transmits each disengage/engage signal to the steering lock ECU or engine ECU.
Steering Lock ECU		Receives the steering unlock/lock signal from ID code box, and activates the steering lock motor.
Engine ECU		● Receives the engine start request signal from the main body ECU, turns ON the ST relay, and starts the engine. ● Receives the signal from the ID code box and performs engine ignition and injection.
Combination Meter	Multi-information Display	Informs the driver of malfunctions in the smart entry and start system.
	Master Warning Light	Illuminates simultaneously with a buzzer sound to inform the driver of malfunctions in the smart entry and start system.

5. Construction and Operation

Engine Switch

The engine switch consists of a momentary type switch, two color (Amber, Green) LEDs, and transponder key amplifier.

- The amber and green LEDs are for the indicator light.
- The driver can determine the present power source and check whether the engine can start or not in accordance with the illumination state of the indicator light.
- When the main body ECU detects an abnormality with the smart entry and start system, it makes the amber indicator light flash. If the engine is stopped in this state, it might not be possible to restart it.

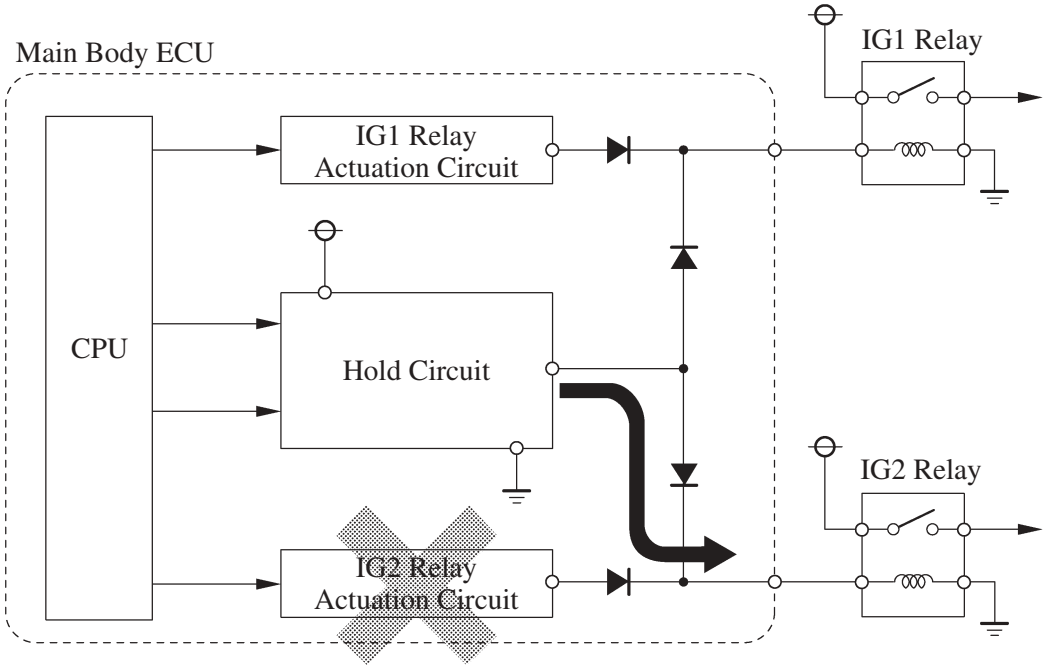


▶ Indicator Light Condition ◀

Power Source Condition	Indicator Light Condition	
	Brake pedal released	Brake pedal depressed with shift lever in “P” or “N”
OFF	OFF	ON (Green)
ACC, IG-ON	ON (Amber)	ON (Green)
Engine Running	OFF	OFF
Steering lock not unlocked	Flashes (Green) for 15 seconds	Flashes (Green) for 15 seconds
Smart Entry and Start System Malfunction	Flashes (Amber) for 15 seconds	Flashes (Amber) for 15 seconds

Main Body ECU

- Main body ECU consists of the IG1 relay 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 IG1 relay and/or IG2 relay actuation circuits while driving.



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Service Tip

The main body ECU constantly stores the present power source state in its memory. Therefore, if the power to main body ECU is interrupted due to the removal of the battery, the main body ECU restores the power source after the battery is reconnected.
For this reason, if the battery is removed when the engine 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 main body ECU (by reconnecting the battery).
Therefore, before removing the battery, be sure to turn the engine switch OFF.

6. Start Function Operation

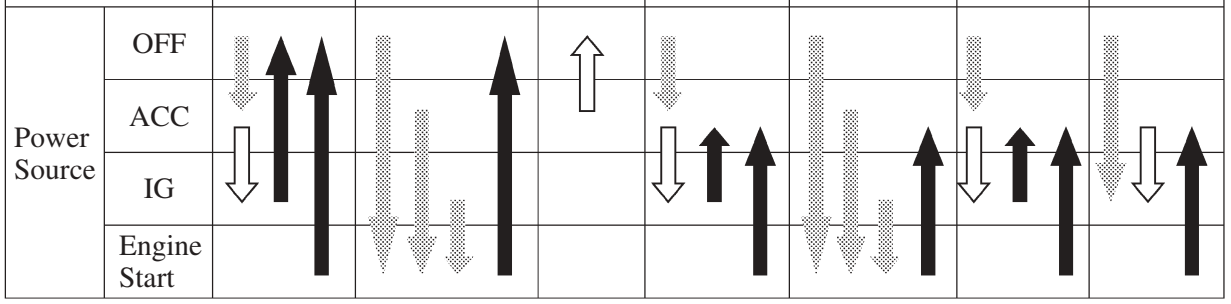
General

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

Pattern	Brake Pedal	Shift Lever	Power Source Pattern
A	Depressed	P or N Position	When the engine switch is pushed once. ● OFF → IG ON (after the engine is started)
B	Released	P Position	The power source mode changes repeatedly in the following sequence when the engine switch is pushed: OFF → ACC → IG ON → OFF
C		Any position other than P	The power source mode changes repeatedly in the following sequence when the engine switch is pushed: OFF → ACC → IG ON → ACC
D	—	P Position	When the engine switch is pushed in the IG-ON condition.
E	—	Any position other than P	When the engine switch is pushed in the IG-ON condition.

▶ Transition of Power Source ◀

Shift Position		**P**			**N**		**Any position other than P or N**	
Pattern		B or D	A or D	—	C or E	A or E	C or E	—
Engine Switch		Push	Push	—	Push	Push	Push	Push
Brake		—	Depressed	—	—	Depressed	—	Depressed
Hour		—	—	After 1 hour	—	—	—	—
Power Source	OFF							
	ACC							
	IG							
	Engine Start							



⇦ : Transition

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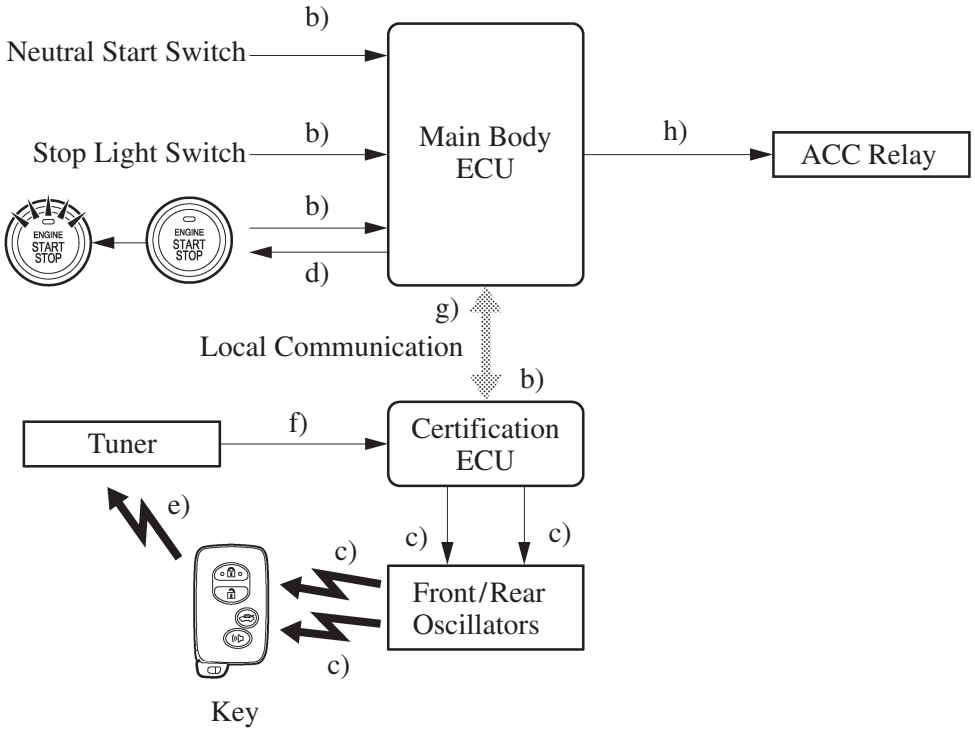
⇦ : Only when the key certification is OK

⇦ : Only when the vehicle is stopped

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

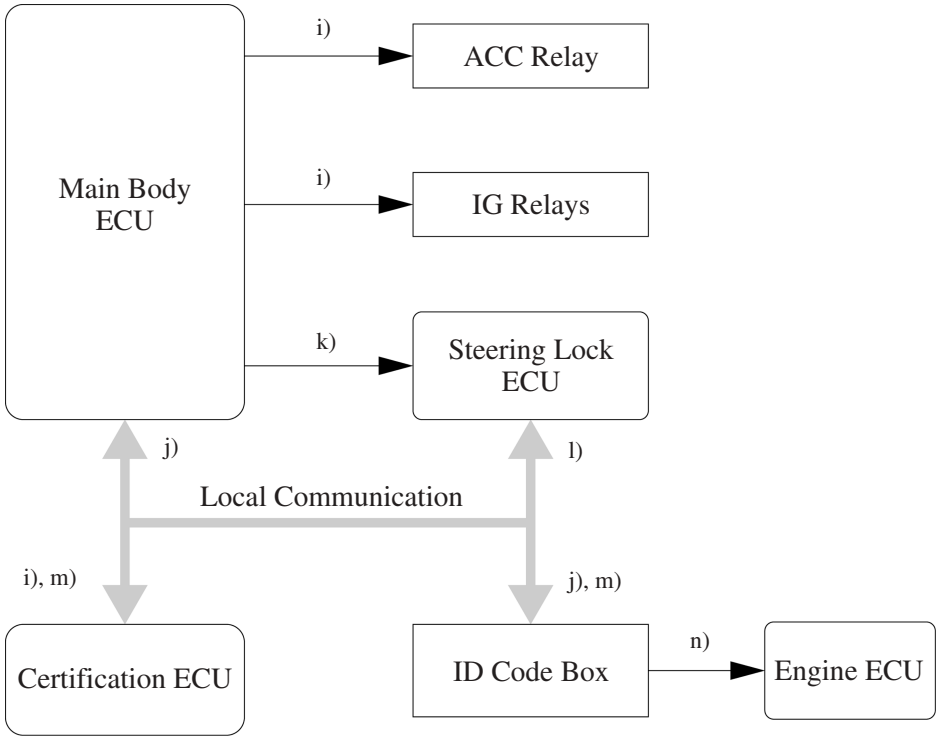
Pattern A: OFF → IG-ON (after the engine is started)

Step	System Operation
a)	The driver holds the key and enters the vehicle.
b)	When the driver presses the engine switch once with the following conditions satisfied, the main body ECU recognizes the engine switch signal and transmits the key certification request to the certification ECU. ● Shift position is "P" or "N". ● Brake pedal depressed. ● Power source is at "OFF".
c)	The certification ECU receives the certification request and transmits a request signal to the front/rear oscillators. These oscillators then transmit the request signal.
d)	The brake pedal is depressed, so the main body ECU turns ON the green indicator light of the engine switch.
e)	The moment the key receives the request signal, it transmits its ID code to the tuner. The signal includes the response code.
f)	The tuner receives this code and transmits it to the certification ECU.
g)	The certification ECU judges and certifies the ID code, and transmits a key certification OK signal to the main body ECU.
h)	After receiving the key certification OK signal, the main body ECU turns ON the ACC relay.



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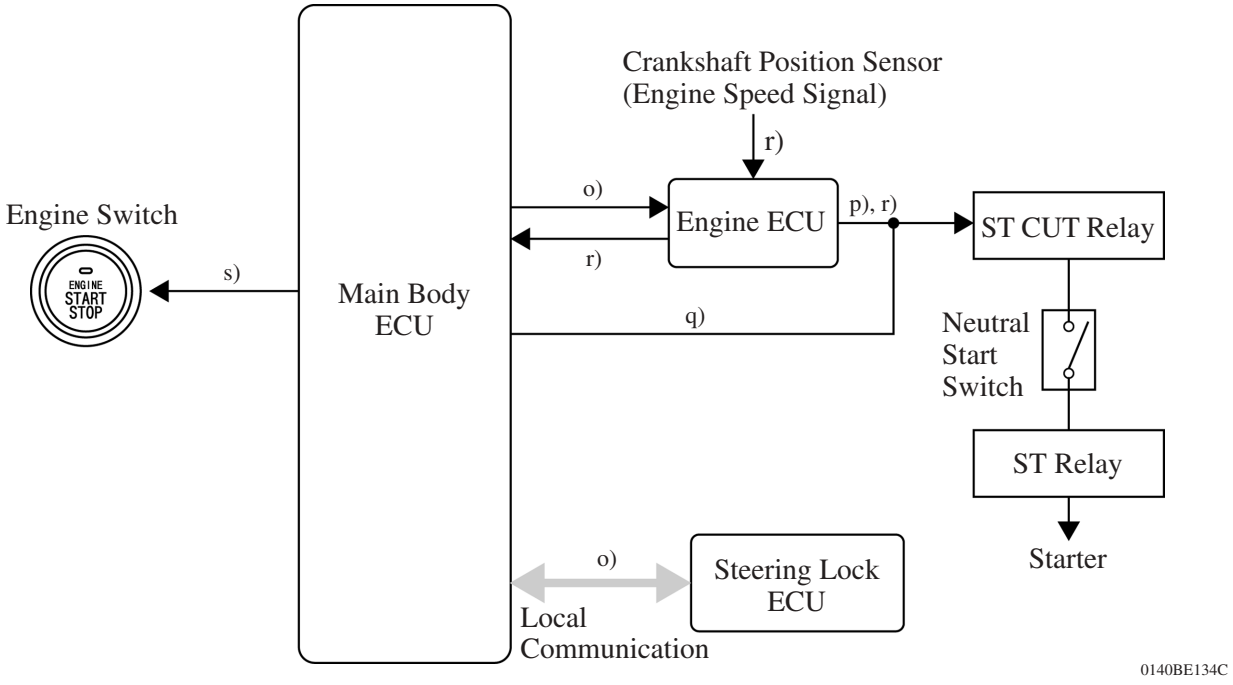
Step	System Operation
i)	The main body ECU turns ON the ACC relay, and then turns ON the IG relays.
j)	The certification ECU checks that the power source has switched from OFF to IG-ON, and transmits a steering unlock signal to the main body ECU and ID code box.
k)	The main body ECU receives this signal and supplies power to the steering lock ECU.
l)	The steering lock ECU receives the steering unlock signal via the ID code box, and releases the steering lock.
m)	After checking the steering unlock condition, the certification ECU transmits an engine immobilizer disengage signal to the ID code box.
n)	The ID code box certifies the disengage signal of the certification ECU, transmits the engine immobilizer disengage signal to the engine ECU, and disengages the engine immobilizer.



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(Continued)

Step	System Operation
o)	After checking that the steering is in the unlocked condition, the main body ECU transmits a starter request (STSW) signal to the engine ECU.
p)	The engine ECU receives this signal, outputs an ST relay (STAR) signal, and actuates the starter. (For details see the cranking hold function on page EG-56.)
q)	The engine ECU and main body ECU both output the starter relay signal in order to actuate the starter. Both the engine ECU and main body ECU output the signal in order to prevent situations where the starter may fail to operate, such as when the battery voltage supplied to the engine ECU is low.
r)	When the engine ECU judges from the engine speed that engine start is completed, it stops the starter relay (STAR) signal, and stops the starter.
s)	The main body ECU receives this signal, checks that engine start is completed, and turns OFF the indicator light of the engine switch.



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Pattern B: OFF → ACC → IG ON → OFF

1) OFF → ACC

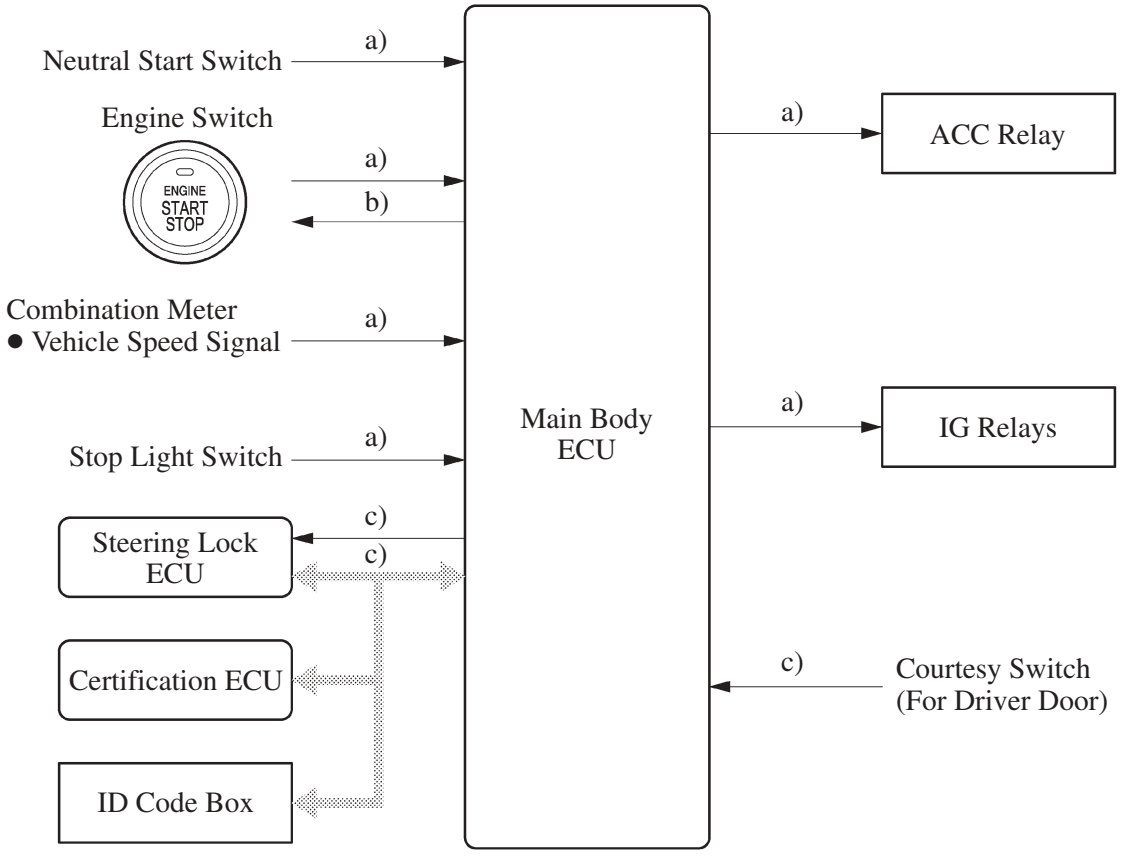
Step	System Operation
a)	The driver has the key in their possession and enters the vehicle.
b)	When the driver presses the engine switch once with the following conditions satisfied, the main body ECU recognizes the engine switch signal and transmits the key certification request to the certification ECU. ● Shift position is “P”. ● Brake pedal is released. ● Power source is “OFF”.
c)	Due to the brake pedal not being depressed, the main body ECU will turn ON the amber indicator light of the engine switch.
d)	The rest of the system operation is the same as **d) to h) in pattern “A”**. For details, see page BE-145.

2) ACC → IG ON

Step	System Operation
a)	When the power source is at “ACC” and the driver pressed the engine switch again, the main body ECU recognizes the engine switch signal and turns ON the IG relays.
b)	The rest of the system operation is the same as **j) to n) in pattern “A”**. For details, see page BE-145.

3) IG ON → OFF

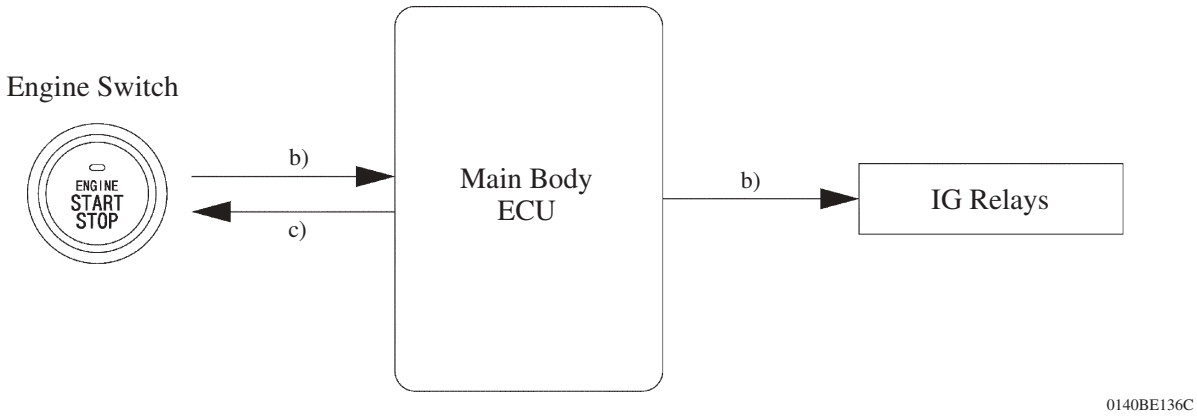
Step	System Operation
a)	When the engine switch is pressed once with the following conditions satisfied, the main body ECU recognizes the engine switch signal and turns OFF the ACC, IG relays. ● Shift position is "P". ● Brake pedal is released. ● Vehicle speed is 0 km/h (0 mph). ● Power source is in "IG-ON" mode.
b)	When the power source is switched from IG-ON to OFF, the main body ECU will turn OFF the indicator light of the engine switch.
c)	When the driver's door is opened, the main body ECU receives a signal from the courtesy switch (for driver door). The certification ECU monitors the courtesy switch signal and transmits the steering lock signal to the main body ECU and ID code box accordingly. Then, the main body ECU receives this signal and supplies power to the steering lock ECU. The steering lock ECU receives the steering lock signal via the ID code box, and locks the steering.



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Pattern C: OFF → ACC → IG ON → ACC

Step	System Operation
a)	The system operations for the power source "OFF → ACC → IG ON" are the same as those in pattern B. For details, see page BE-148.
b)	When the engine switch is pressed once with the following conditions satisfied, the main body ECU recognizes the engine switch signal and turns OFF the IG relays. ● Shift position is in any position except "P". ● Brake pedal is released. ● Vehicle speed is 0 km/h (0 mph). ● Power source is in "IG-ON" mode.
c)	Even after the power source switches from IG ON to ACC, the indicator light of the engine switch will remain illuminated in amber.



Pattern D: IG ON → OFF

This system operation is the same as IG ON → OFF for pattern "B". For detail, see page BE-148.

Pattern E: IG ON → ACC

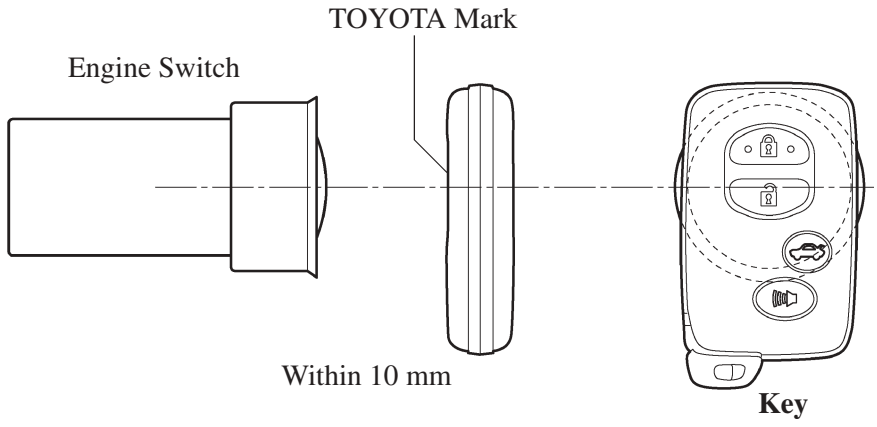
This system operation is the same as pattern "C". For details, see page BE-150. However, the indicator light of the engine switch will illuminate as follows:

- When the power source is switched from IG-ON to ACC, the main body ECU makes the amber indicator light of the engine switch continue to illuminate.
- When the power source is switched from engine running to OFF, the main body ECU turns OFF the indicator light of the engine switch.

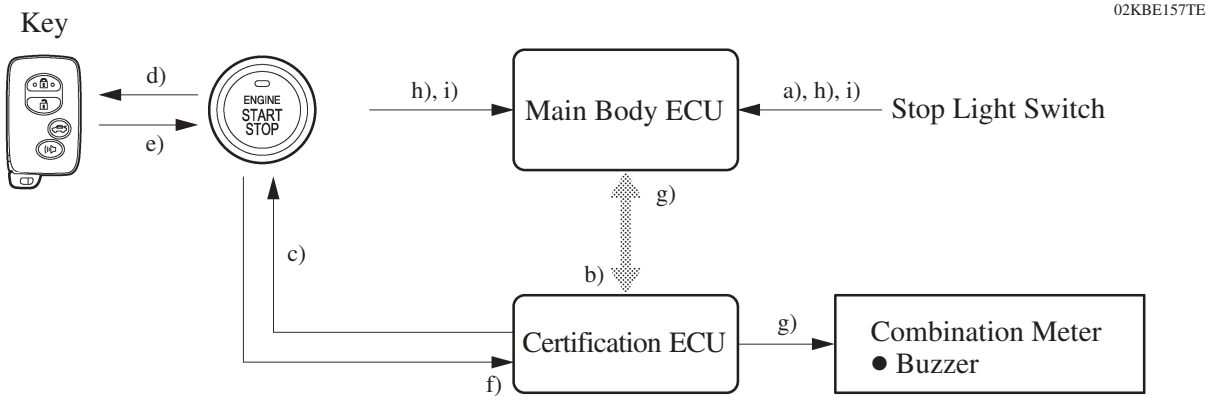
When key battery is low

Step	System Operation
a)	To operate the smart entry and start system when the key battery is low, hold the key against the engine switch as shown below while depressing the brake pedal.
b)	The main body ECU receives the stop light switch signal and transmits a key certification request signal to the certification ECU.
c)	The certification ECU does not receive an ID code response from the tuner, so it actuates the transponder key amplifier built into the engine switch.
d)	The transponder key amplifier outputs an engine immobilizer radio wave to the key.
e)	The key receives the radio wave, and returns a radio wave response to the transponder key amplifier.
f)	The transponder key amplifier combines the key ID codes with the radio wave response, and transmits it to the certification ECU.
g)	The certification ECU judges and verifies the ID code, and transmits a key certification OK signal to the main body ECU. The buzzer in the combination meter sounds at the same time.
h)	After the buzzer sounds, if the engine switch is pressed within five seconds while the brake pedal is depressed, the power source switches to start the engine running, the same as with normal smart entry and start operation.
i)	After the buzzer sounds, if the engine switch is pressed within five seconds while the brake pedal is released, the power source will be switched to ACC or IG-ON, the same as with normal smart entry and start operation.

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7. Diagnosis

Main body ECU and certification ECU can detect malfunctions in the smart entry and start system when the power source is in the IG-ON mode.
When the ECUs detect a malfunction, the amber indicator light of the engine switch flashes to warn the driver. At the same time, the ECUs store 5-digit DTC (Diagnostic Trouble Code) in their memories depending on the malfunction.

- The indicator light warning continues for 15 seconds even after the power source is switched to OFF.
- The DTC can be read by connecting an intelligent tester II to the DLC3.
- The smart entry and start system may not operate successfully if a malfunction occurs.