

## GROUP 42B

# KEYLESS OPERATION SYSTEM (KOS)

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**GENERAL INFORMATION**

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*NOTE: In this manual, F.A.S.T.-key (Free-hand Advanced Security Transmitter) is described as Keyless Operation System (KOS).*

The keyless operation system (KOS) enables the driver to unlock all the doors\* and the liftgate by just pulling the front door outside handle or operating the liftgate lock release handle, without taking the key out from his/her pocket or bag when he/she is carrying a keyless operation key which has been registered in the vehicle's KOS-ECU. KOS also allows the driver to lock all the doors and the liftgate by pressing the lock switch on the front door outside handle or on the liftgate lock release handle (door entry function), and start the engine without using the conventional mechanical key (engine start function). KOS has the following features:

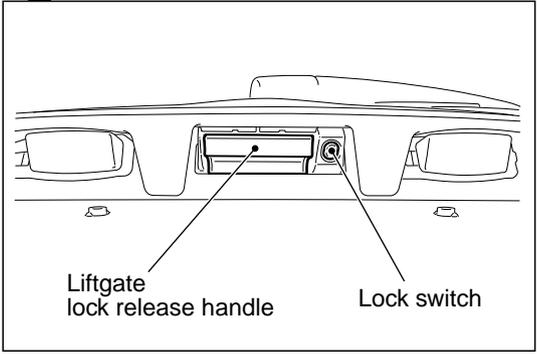
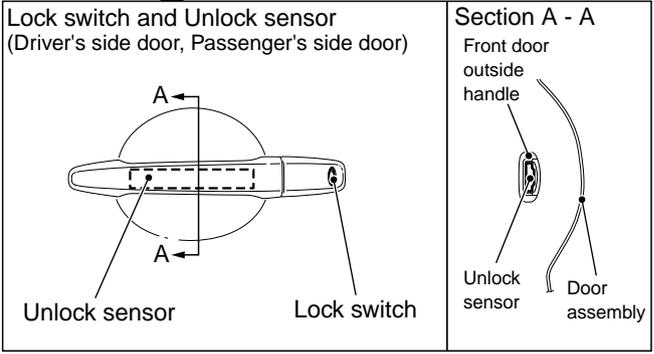
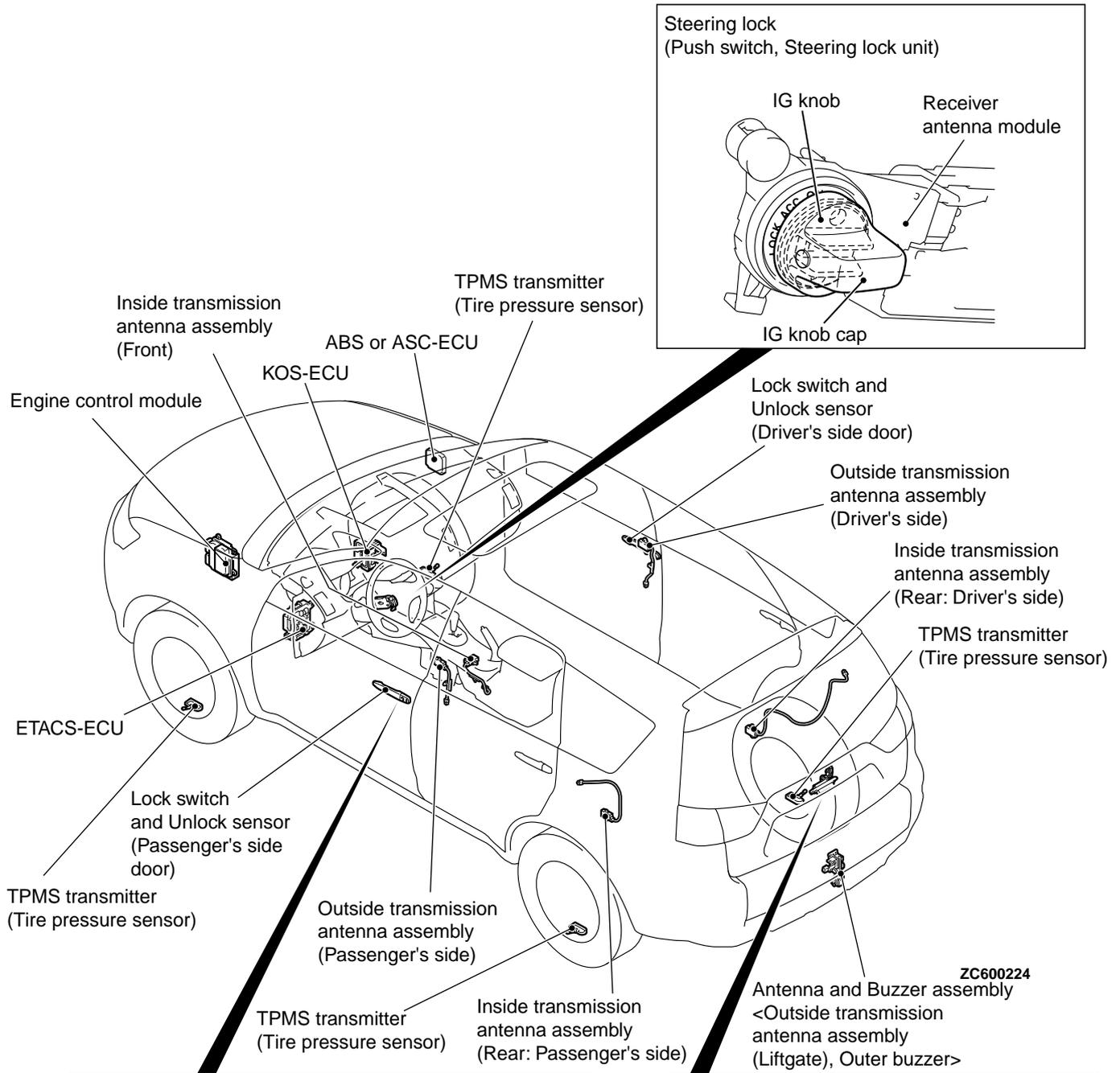
- The keyless operation key incorporates the lock and unlock switches on it. Like the conventional keyless entry system, remote control operation can be performed by using these switches. The keyless operation key also incorporates an indicator light that enables the driver to check if the signal is

transmitted correctly or if the battery in the key is discharged. (Refer to P.42B-15.)

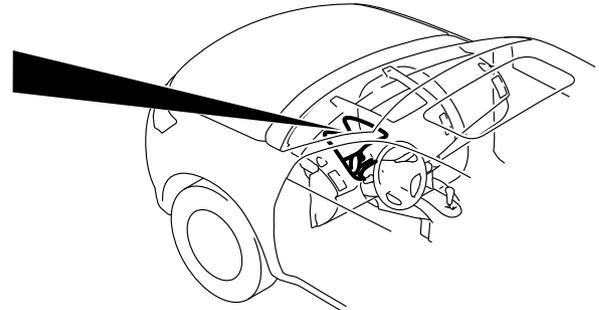
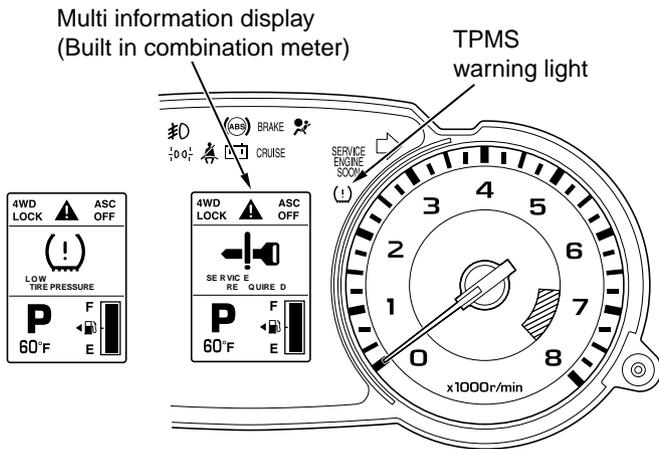
- The keyless operation key incorporates the immobilizer function that inhibits starting the engine by using an unauthorized key.
- The incorporated TPMS function monitors the air pressure of all the tires.
- Each vehicle is provided with two keyless operation keys, and up to four keyless operation keys can be registered in the vehicle's KOS-ECU.
- The keyless operation key incorporates an emergency key with a transponder to lock/unlock the doors and start the engine in case the battery in the keyless operation key is discharged or the keyless operation system is not working normally.
- The driver can customize KOS; enabling/disabling all the system functions, enabling the door locking/unlocking function only, or enabling the engine starting function only.

*NOTE: When the driver's front door outside handle is operated, only the driver's door is unlocked.*

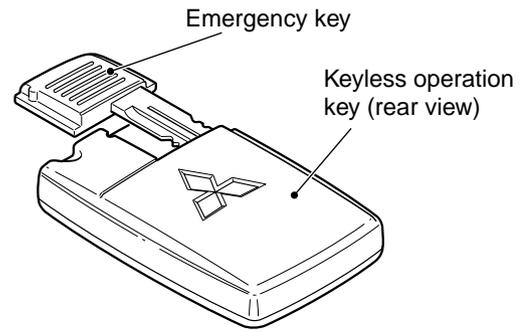
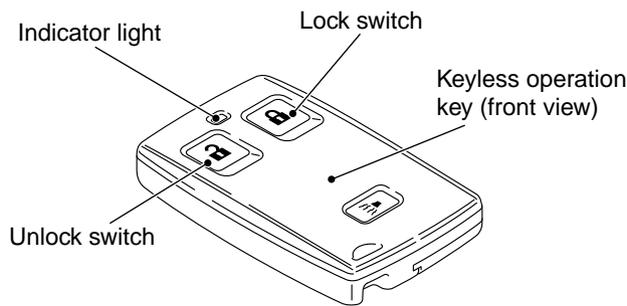
CONSTRUCTION DIAGRAM



KEYLESS OPERATION SYSTEM (KOS)  
GENERAL INFORMATION



ZC6037020000



ZC6008490000

Main components and functions

Parts name	Functional description
KOS-ECU	Controls KOS by using the following inputs/outputs and communications. <ul style="list-style-type: none"> <li>▪ Input from the unlock sensor and lock switch on each door, input from the push switch on the IG knob</li> <li>▪ Communications with ETACS-ECU, ECM, ABS or ASC-ECU and combination meter via CAN</li> <li>▪ Wire communication with the steering lock unit</li> <li>▪ Wireless communication with the keyless operation key via the receiver antenna module and interior/exterior transmitter antennas</li> <li>▪ Wireless communication with the TPMS transmitter</li> <li>▪ Output to the outer tone alarm</li> </ul>
Steering lock (incorporates push switch and steering lock unit)	The steering lock has two unlocking mechanisms; a mechanical mechanism that uses an emergency key and an electrical mechanism. In the electrical unlocking mechanism, the steering lock communicates with KOS-ECU via wire, and when requested by KOS-ECU, the steering lock unlocks for two seconds.

Parts name		Functional description
Keyless operation key (incorporates emergency key)		<ul style="list-style-type: none"> <li>▪ The keyless operation key receives signals sent from each interior/exterior transmitter antenna, certifies the keyless operation key ID code, calculates the encrypted code, and sends the reply data signal to KOS-ECU via the receiver antenna module. When the lock/unlock switch on the keyless operation key is pressed, corresponding signal is sent to KOS-ECU via the receiver antenna module.</li> <li>▪ If two or more keyless operation keys registered in KOS-ECU respond at the same time, their signals would interfere. To avoid this interference, each signal from KOS-ECU is given the priority <sup>*1</sup> data, and the keyless operation keys respond in accordance with this priority.</li> </ul>
Lock switch	Driver's door	Locks all the doors and the liftgate when a driver carrying the keyless operation key presses the lock switch on the front door outside handle or on the liftgate lock release handle.
	Front passenger's door	
	Liftgate	
Unlock sensor	Driver's door	The unlock sensors incorporated in the driver's front door outside handles unlock driver's the door when a driver carrying the keyless operation key pulls the driver's door outside handle.
	Front passenger's door	The unlock sensors incorporated in the passenger's front door outside handles unlock all the doors and the liftgate when a driver carrying the keyless operation key pulls the front door outside handle.
Liftgate lock release handle		Locks all the doors and the liftgate when a driver carrying the keyless operation key presses the lock switch on the front door outside handle or on the liftgate lock release handle.
Exterior transmitter antenna assembly	Driver's side	Converts the data output from KOS-ECU via wire into a signal, and sends it to the keyless operation key. (For the transmission area, refer to Operation Manual - Engine Start Function P.42B-20.)
	Front passenger's side	
Interior transmitter antenna assembly	Front	Converts the data output from KOS-ECU via wire into a signal, and sends it to the keyless operation key. (For the transmission area, refer to Operation Manual - Engine Start Function P.42B-20.)
	Rear	
Antenna & tone alarm assembly	Exterior transmitter antenna assembly (liftgate)	Converts the data output from KOS-ECU via wire into a signal, and sends it to the keyless operation key. (For the transmission area, refer to Operation Manual -Door Entry Function P.42B-8.)
	Outer tone alarm	<p>The outer tone alarm sounds when:</p> <ul style="list-style-type: none"> <li>▪ The doors are locked or unlocked by the door entry function.</li> <li>▪ The keyless operation key is brought out of the vehicle when the IG knob is in the "LOCK" (OFF) position and the push switch is in other than the ON position.</li> <li>▪ The lock switch on the keyless operation switch is pressed when the IG knob is in the "LOCK" (OFF) position and the push switch is in other than the ON position.</li> </ul>

KEYLESS OPERATION SYSTEM (KOS)  
GENERAL INFORMATION

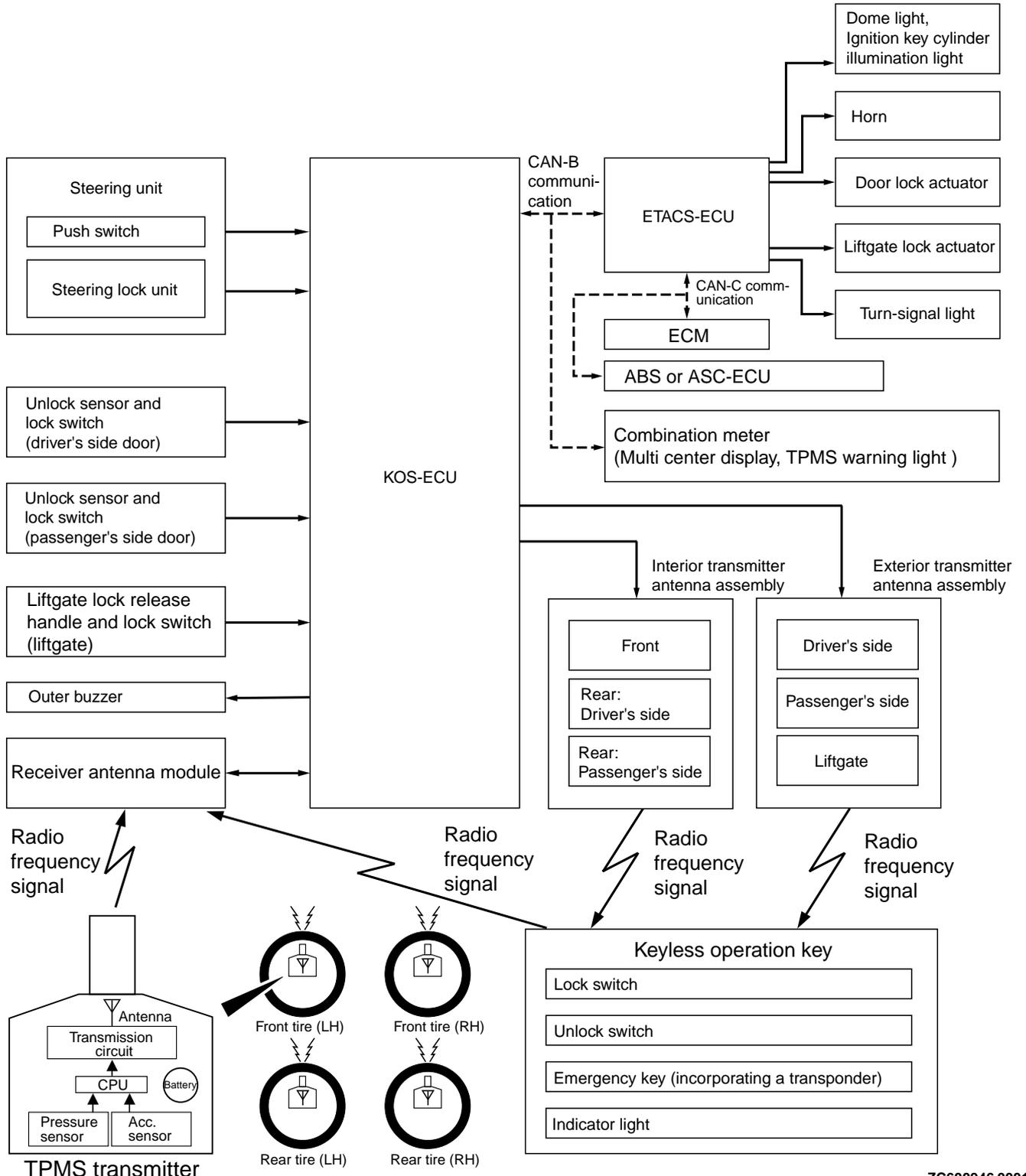
Parts name	Functional description
	<ul style="list-style-type: none"> <li>*The lock switch on the keyless operation key is pressed from inside the car.</li> <li>*The lock switch on the keyless operation key is pressed when the door is ajar.</li> </ul>
Receiver antenna module	Receives the operation signals from the lock/unlock switches and panic alarm switch on the keyless operation key, and the air pressure signal from the TPMS transmitter, and then converts them into data and sends them to KOS-ECU.
TPMS transmitter	Measure tire pressure directly, then send radio frequency signal to receiver antenna module.
Combination meter (Multi information display, TPMS warning light)	Communicates with KOS-ECU via CAN. Receives the warning request or warning information from KOS-ECU, flashes or activates <sup>*2</sup> the warning indicator or warnig light. Warning symbol and message is additionally displayed on the multi information display
ETACS-ECU	Communicates with KOS-ECU via CAN. Send ignition switch status. Receives the door lock/unlock request from KOS-ECU, outputs the lock/unlock signal, and flashes the turn signal light to inform the driver that the doors are locked/unlocked.
ECM	Communicates with KOS-ECU via CAN. Permits/inhibits the engine starting and controls the engine operation. Send atmospheric pressure data.
ABS or ASC-ECU	Communicates with KOS-ECU via CAN. Sends the vehicle speed data.

**NOTE:** \*1: When registering the keyless operation keys, KOS-ECU numbers each key (1 to 4) in the order they are registered (initial priority). This priority is renewed each time the doors are locked/unlocked and the IG knob is pressed. For example, when only keys 1 and 3 have responded to the signal sent from KOS-ECU, the new priority of

the keys would be 1-3-2-4. When keys 3 and 4 have responded, then the priority of the keys becomes 3-4-1-2.

**NOTE:** \*2: Illuminates for tire pressure warning. Flashes for about 1 minute and then coutinuously illuminated for TPMS malfunction warning.

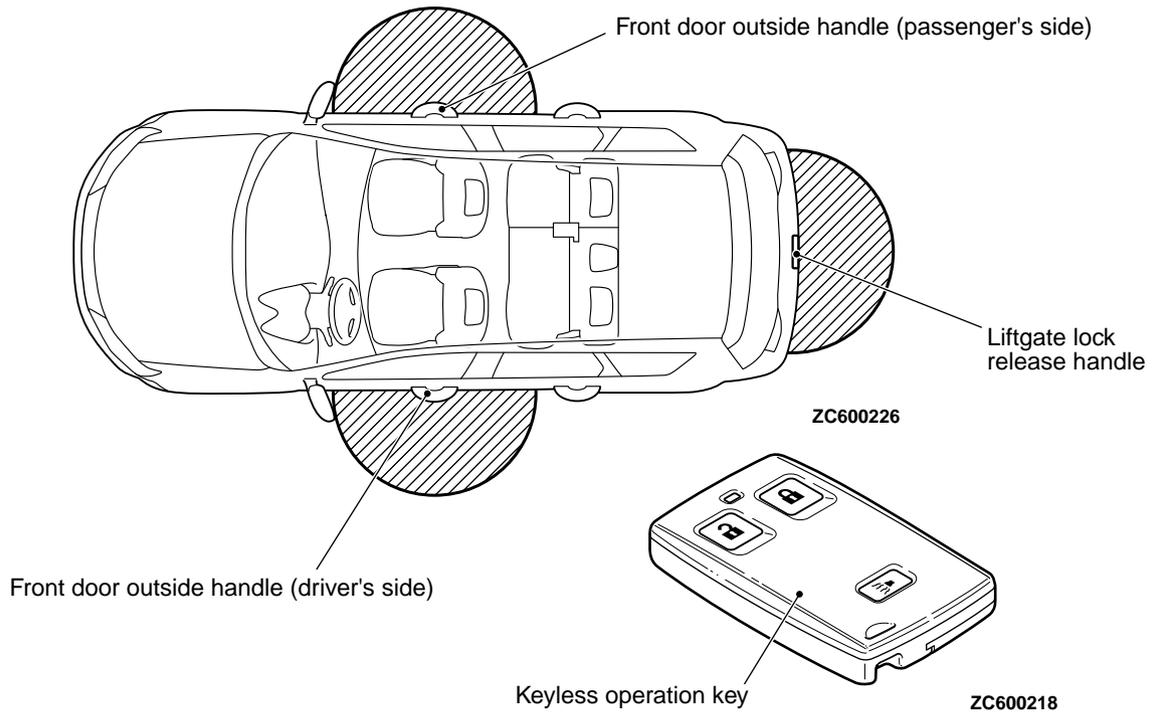
System configuration



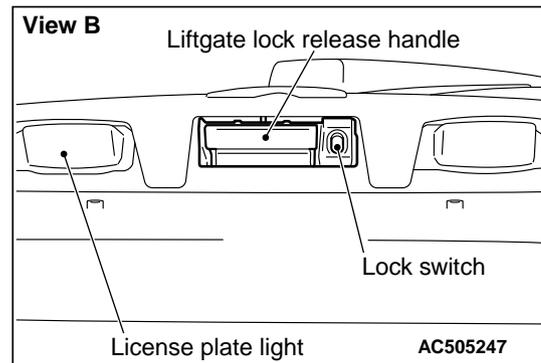
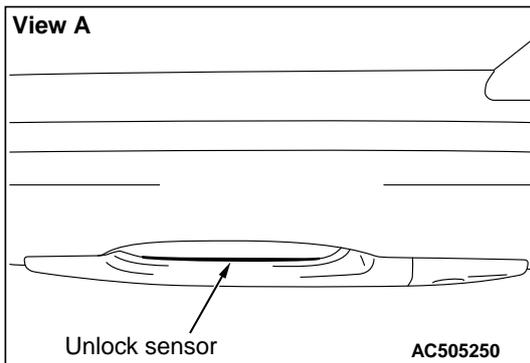
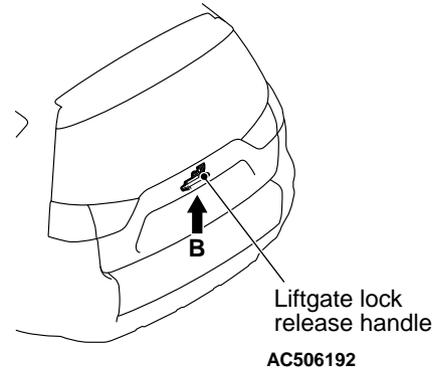
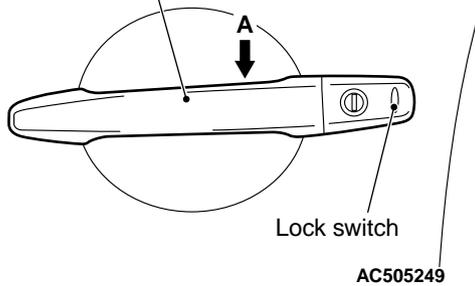
SYSTEM OPERATION

DOOR ENTRY FUNCTION

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Door outside handle (Driver's side, front passenger' side)



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When a driver carrying a keyless operation key presses a lock switch on the driver-side/front passenger-side door outside handle or on the liftgate lock release handle, unlock sensor on the door outside handle, or liftgate lock release handle (switch) (Refer to GROUP 42A, Door and Liftgate Lock P. 42A-12), the keyless operation key and KOS-ECU communicate to certify\* the keyless operation key. When KOS-ECU certifies the registered keyless operation key within 70 cm (28 inches) in radius from these switches and sensors on outer side of the vehicle, it requests ETACS-ECU to lock/unlock the doors. (The key may not be certified even it is within this range, when it is positioned too high or too low).

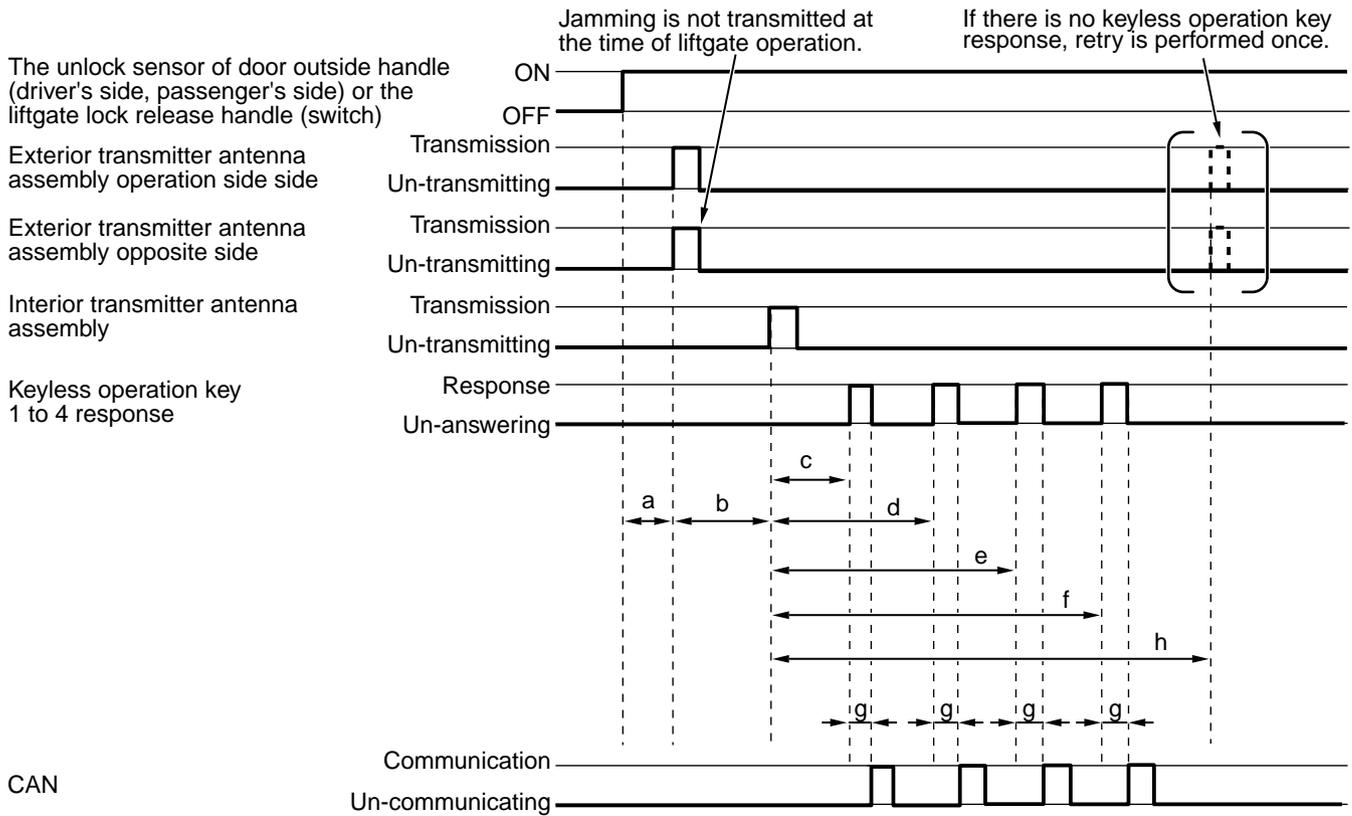
**NOTE:** \*: In the communication for certification of the keyless operation key, KOS-ECU judges if the keyless operation key ID (specified to keyless operation key) contained in the response data from the keyless operation key coincides with the ID that has been stored in ECU by registration operation. The keyless operation key sends the response to KOS-ECU only when the KOS ID (specific

to KOS-ECU) contained in the received data coincided with the stored ID. In the beginning of the communication for certification, KOS-ECU creates a encrypted code calculation factor in random number, and sends it to the keyless operation key together with the transmit data. The keyless operation key calculates the code by using the received factor, and sends the result to KOS-ECU together with the response data. KOS-ECU determines that the communication is established only when the code calculation results of the both parties coincided.

### UNLOCKING OPERATION OF DOOR ENTRY FUNCTION

The keyless operation key and KOS-ECU communicate to certify the keyless operation key when the unlock sensor on the driver-side/front passenger-side door outside handle or the liftgate lock release handle (switch) is turned ON. When KOS-ECU certifies the registered keyless operation key on the outer side of the vehicle, it requests ETACS-ECU to unlock the doors.

CONTROL OF UNLOCKING OPERATION



a: Exterior data transmitting start: 0.015 to 0.04 sec  
 b: Interior data transmitting start: 0.03 to 0.05 sec  
 c: Keyless operation key 1 response time of onset 0.035 to 0.06 sec  
 d: Keyless operation key 2 response time of onset 0.08 to 0.115 sec  
 e: Keyless operation key 3 response time of onset 0.135 to 0.18 sec  
 f: CAN communication time of onset: to 0.03 sec  
 g: CAN communication time of onset: to 0.03 sec  
 h: Retry time: It is variable by the registration number (at the time of 4 pieces registration 0.31 sec).

ZC6002510000

1. When KOS-ECU detects that the unlock sensor on the driver-side/front passenger-side door outside handle or the liftgate lock release handle (switch) is turned ON, it transmits the exterior data from the exterior transmitter antenna assembly on the operation side. At the same time, KOS-ECU transmits the interfering radio wave\* (reversal code) from the exterior transmitter antenna assembly on the other side (The interfering radio wave will be transmitted from the front passenger-side antenna assembly when the driver-side door outside handle is operated, and vice versa. It will not be transmitted when the liftgate lock release handle is operated).

*NOTE: \*: The interfering radio wave is transmitted to disable the door lock operation by a person without the keyless operation key*

*while a user with the keyless operation key is operating the door lock from the opposite side of the vehicle.*

2. After the exterior data are transmitted from the exterior transmitter antenna assembly, the interior data are transmitted from the interior transmitter antenna assembly (front).
3. For the specified time period (varies with the number of the keyless operation keys registered in KOS-ECU), KOS-ECU monitors the response from the keyless operation key that meets the unlock conditions.

\*When the keyless operation key receives the exterior data only, KOS-ECU transmits the unlock request (request to unlock the applicable position) to ETACS-ECU.

•When KOS-ECU receives no response that enables the unlocking after the specified time period has passed, it performs the retry cycle once (When no response after the retry, KOS-ECU terminates the unlocking operation).

**UNLOCKING OPERATION INHIBITION TIME**

If the customer pulls the door outer handle to make sure the doors are locked, unlocking operation is inhibited for three seconds after the doors and the liftgate are locked by the lock switches on the driver-side/front passenger-side door outside handle or on the liftgate lock release handle. This duration can be selected from zero, three seconds, and five seconds, and can be switched using a customization function. (Refer to P.42B-29.) The default factory setting is 3 seconds.

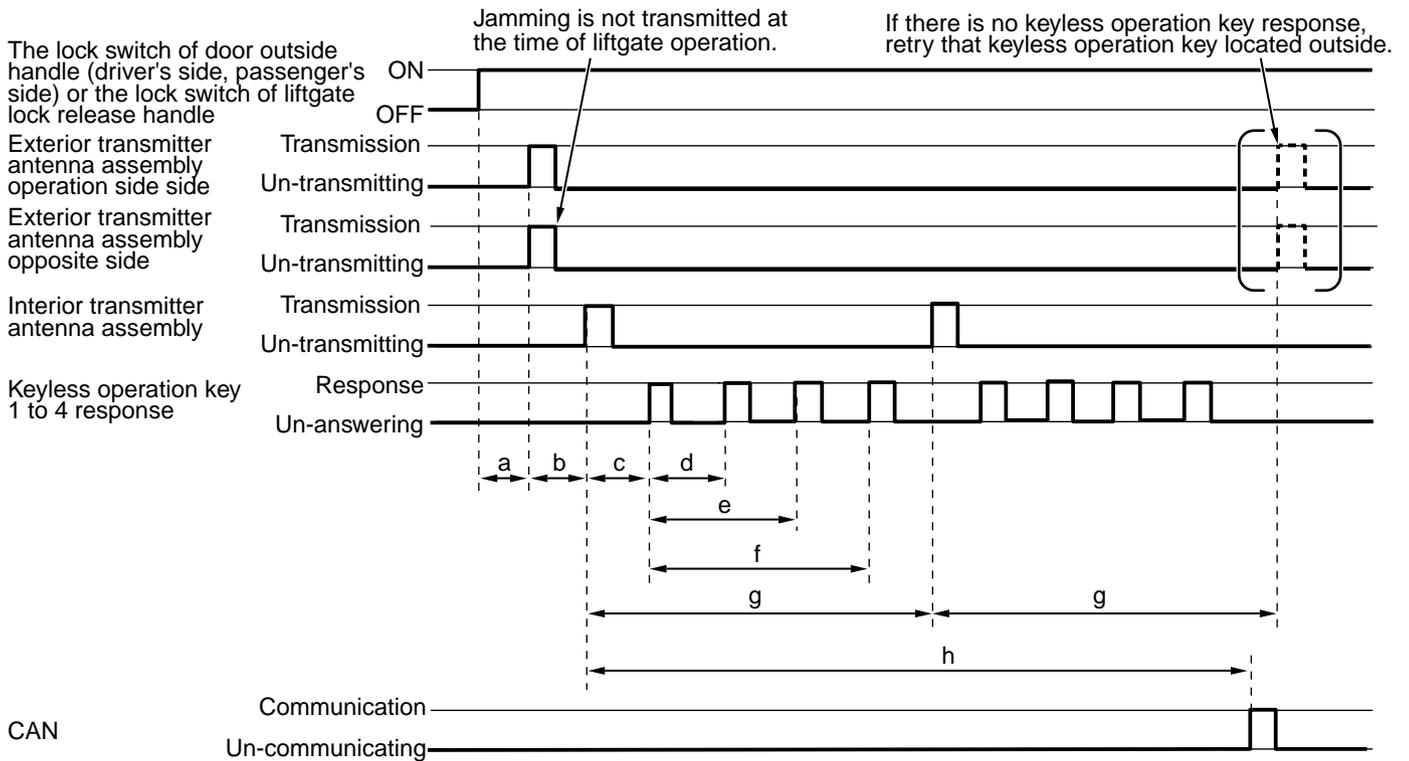
**UNLOCKING OPERATION INHIBITION CONDITIONS**

- The door unlocking operation is inhibited when:
- The emergency key is in the ignition switch.
  - The push switch in the steering lock is ON.
  - During the unlocking operation inhibition time

**LOCKING OPERATION OF DOOR ENTRY FUNCTION**

The keyless operation key and KOS-ECU communicate to certify the keyless operation key when the lock switch on the driver-side/front passenger-side door outside handle or on the liftgate lock release handle is turned ON. When KOS-ECU certifies the registered keyless operation key only on the outer side of the vehicle, it requests ETACS-ECU to lock all the doors (including the liftgate).

**CONTROL OF LOCKING OPERATION**



- a: Exterior data transmitting start: 0.03 to 0.04 sec
- b: Interior data transmitting start: 0.03 to 0.05 sec
- c: Keyless operation key 1 response time of onset 0.035 to 0.06 sec
- d: Keyless operation key 2 response time of onset 0.08 to 0.115 sec
- e: Keyless operation key 3 response time of onset 0.135 to 0.18 sec
- f: Keyless operation key 4 response time of onset 0.205 to 0.26 sec
- g: Retry time: It is variable by the registration number (at the time of 4 pieces registration 0.31 sec).
- h: CAN communication time of onset: to 0.65 sec

ZC6002520000

1. When KOS-ECU detects that the lock switch on the driver-side/front passenger-side door outside

- handle or on the liftgate lock release handle is turned ON, it transmits the exterior data from the exterior transmitter antenna assembly on the operation side. At the same time, KOS-ECU transmits the interfering radio wave (reversal code) from the exterior transmitter antenna assembly on the other side (The interfering radio wave will be transmitted from the front passenger-side antenna assembly when the driver-side door outside handle is operated, and vice versa. It will not be transmitted when the liftgate lock release handle is operated).
2. After the exterior data are transmitted from the exterior transmitter antenna assembly, the interior data are transmitted from the interior transmitter antenna assembly (front).
  3. After the specified time period (varies with the number of the keyless operation keys registered in KOS-ECU) has passed, confirm that there is no keyless operation key in the interior.
    - When KOS-ECU receives the response from the keyless operation keys that received the interior data, KOS-ECU cancels without the locking operation.
  4. The interior data are transmitted from the interior transmitter assembly (front).
  5. After the specified time period (varies with the number of the keyless operation keys registered in KOS-ECU) has passed, confirm that the lock conditions are met.
    - When KOS-ECU receives the response from the keyless operation keys that received the interior data, KOS-ECU cancels without the locking operation.
    - When all the responding keyless operation keys receive the exterior data only, KOS-ECU transmits the lock request to ETACS-ECU.
  6. KOS-ECU transmits the exterior data from the exterior transmitter antenna assembly on the operation side. At the same time, KOS-ECU transmits the interfering radio wave (reversal code) from the exterior transmitter antenna assembly on the other side. (The interfering radio wave will be transmitted from the front passenger-side antenna assembly when the driver-side door outside handle is operated, and vice versa. It will not be transmitted when the liftgate lock release handle is operated.)
  7. After the specified time period (varies with the number of the keyless operation keys registered in KOS-ECU) has passed, confirm that the lock conditions are met.
    - If there is no response from the keyless operation keys, perform Step 6 once.
    - When the responded keyless operation keys after the retry receives the exterior data only, KOS-ECU transmits the lock request (request to lock the actuated position) to ETACS-ECU.

#### **LOCKING OPERATION INHIBITION CONDITIONS**

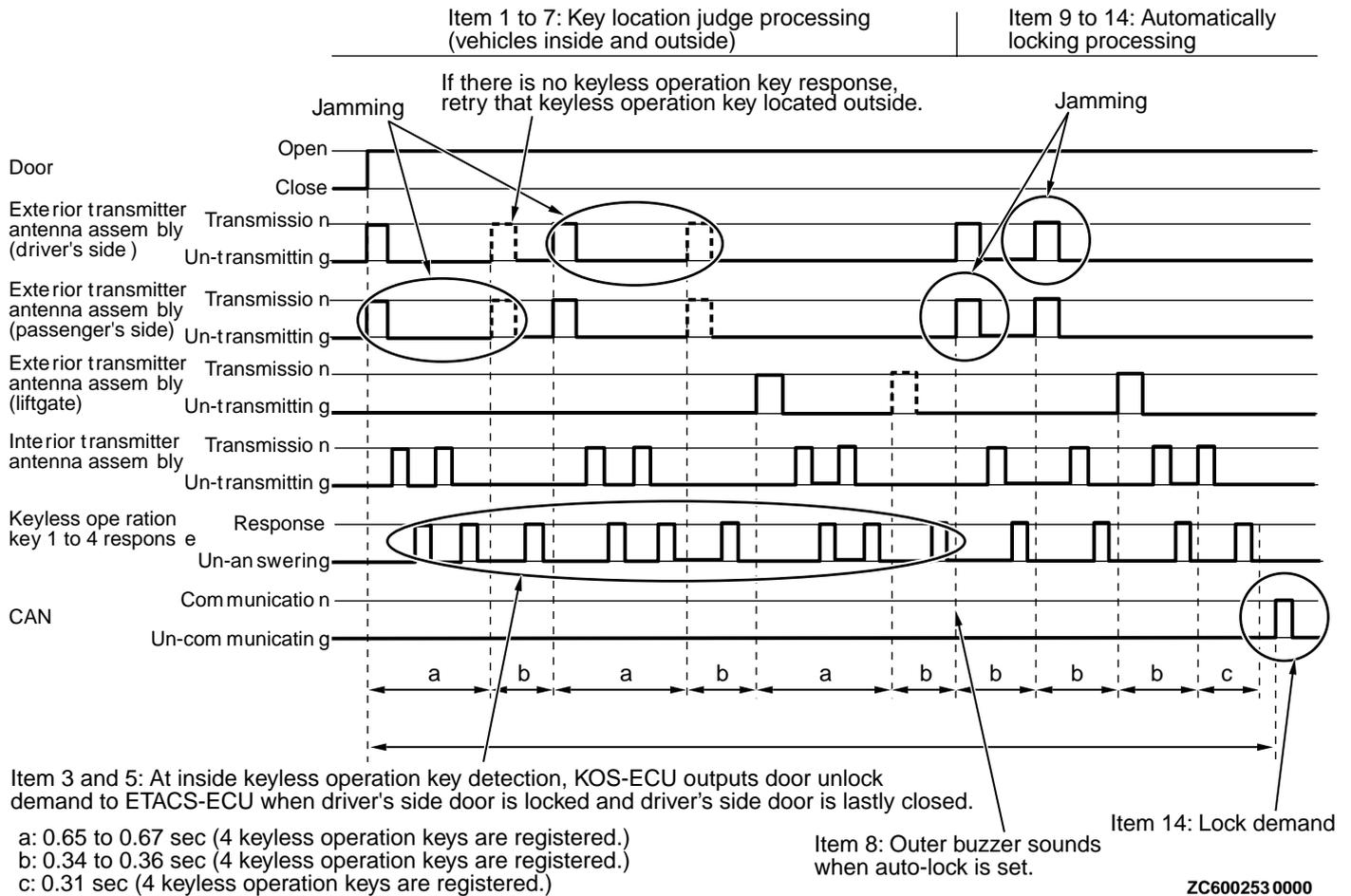
In the following cases, the door locking operation is inhibited.

- Any door or the liftgate is open/ajar (door switch is ON). (including door ajar)
- The emergency key is in the ignition switch.
- The push switch in the steering lock is ON.

#### **AUTO LOCK FUNCTION**

The auto lock function locks the doors automatically when a driver carrying the keyless operation key left the car with all the doors closed and unlocked. This function prevents the doors from being unlocked accidentally. Using a customization function, the auto lock function can be selected between "Auto lock" and "No auto lock". (Refer to P.42B-29.) The initial setting is "No auto lock".

CONTROL OF AUTO LOCK FUNCTION



Interior/exterior judgment (Keyless operation key certification communication to detect if all the doors are closed)

1. KOS-ECU transmits the exterior data from the exterior transmitter antenna assembly (driver's side, passenger's side, liftgate).
2. After Step 1 is completed, KOS-ECU transmits the interior data from the interior transmitter antenna assembly (Front).
3. After the specified time period (varies with the number of the keyless operation keys registered in KOS-ECU) has passed, KOS-ECU performs the following condition judgments.
  - When KOS-ECU receives the response from the keyless operation keys that received the interior data, KOS-ECU terminates the interior/exterior judgment.
4. The interior data are transmitted from the interior transmitter assembly (front).

5. After the specified time period (varies with the number of the keyless operation keys registered in KOS-ECU) has passed, KOS-ECU performs the following condition judgments.
  - When KOS-ECU receives the response from the keyless operation keys that received the interior data, KOS-ECU terminates the interior/exterior judgment.
  - If there is no response from the keyless operation keys, perform Step 6 once.
6. KOS-ECU transmits the exterior data from the exterior transmitter antenna assembly (driver's side, passenger's side, liftgate).
7. After the specified time period (varies with the number of the keyless operation keys registered in KOS-ECU) has passed, KOS-ECU performs the following condition judgments.

- All the responded keyless operation keys receive the exterior data only.

*NOTE: The retry cycle for each door will be performed twice when no keyless operation key exists inside the vehicle.*

*NOTE: When a keyless operation key is detected inside the vehicle and the driver's side door is locked, and when the door closed last time is driver's door, KOS-ECU requests ETACS-ECU to unlock the doors to prevent the key from locked inside the vehicle.*

- When all the responding keyless operation keys have received the exterior data only during a series of the keyless operation key certification communications (driver's door → front passenger's door → liftgate), KOS-ECU moves to Step 8.

Auto lock judgment (Keyless operation key certification communication after interior/exterior judgment)

8. When the auto lock function has been selected, KOS-ECU activates the auto lock answerback function.
9. KOS-ECU transmits the exterior data from the exterior transmitter antenna assembly (driver's side, passenger's side, liftgate).
10. After the Step 9 is completed, KOS-ECU transmits the interior data from the interior transmitter data assembly (Front).
11. After the specified time period (varies with the number of the keyless operation keys registered in KOS-ECU) has passed, KOS-ECU performs the following condition judgments.
  - When KOS-ECU receives the response from the keyless operation keys that received the interior data, KOS-ECU terminates the auto lock judgment.

*NOTE: Steps 9 to 11 are performed in the order of the driver's door → front passenger's door → liftgate.*

12. The interior data are transmitted from the interior transmitter assembly (front).
13. After the specified time period (varies with the number of the keyless operation keys registered in KOS-ECU) has passed, KOS-ECU performs the following condition judgments.
  - When KOS-ECU receives the response from the keyless operation keys that received the interior data, KOS-ECU terminates the auto lock judgment.

- When all the responded keyless operation keys receive the exterior data only during a series of the keyless operation key certification communications, KOS-ECU continues monitoring the keyless operation key. (Repeat from Step 9.)

- When no response is received during a series of the keyless operation key certification communications, KOS-ECU moves to Step 14.

*NOTE: The retry cycle for each door are not performed.*

14. KOS-ECU requests ETACS-ECU to lock the doors. ETACS-ECU locks the doors and sends the answerback request to KOS-ECU. By this request, KOS-ECU sounds the outer tone alarm answerback.

#### **AUTO LOCK FUNCTION INHIBITION CONDITIONS**

The door auto lock function is inhibited when:

- Any door or the liftgate is open/ajar (door switch is ON). (including door ajar)
- The emergency key is in the ignition switch.
- The push switch in the steering lock is ON.

#### **AUTO LOCK FUNCTION CANCELLATION CONDITION**

The auto lock function is cancelled when:

- No keyless operation key is detected on the outer side of the vehicle during the keyless operation key certification communication performed to detect if all the doors are closed.
- Any of the keyless operation switches (on driver-side door, front passenger-side door, or liftgate) is pressed after all the doors are detected closed.
- All the auto lock function inhibition conditions are met.
- A keyless operation key is detected inside the vehicle.

### ANSWERBACK FUNCTIONS

When KOS-ECU sends a signal to ETACS-ECU, ETACS-ECU outputs the lock/unlock signal and activates the hazard warning light and the outer tone alarm to notify the driver the doors are locked/unlocked. Using a customization function\*, the outer tone alarm operation can be selected between "Tone

alarm sounds" and "Tone alarm not sound" (Refer to P.42B-29). The default factory setting is "Tone alarm sounds".

*NOTE: Operation of the outer tone alarm for the warnings, alarms, and auto lock function are fixed to "Tone alarm sounds" regardless of the customization.*

	Lock signal received	Unlock signal received	When received auto lock signal
ETACS-ECU	Lock signal output	Unlock signal output	Lock signal output
Hazard warning light	Flashes once	Flashes twice	Flashes once
Outer tone alarm	Sounds once (initial setting) or none	Sounds twice (initial setting) or none	Sounds once

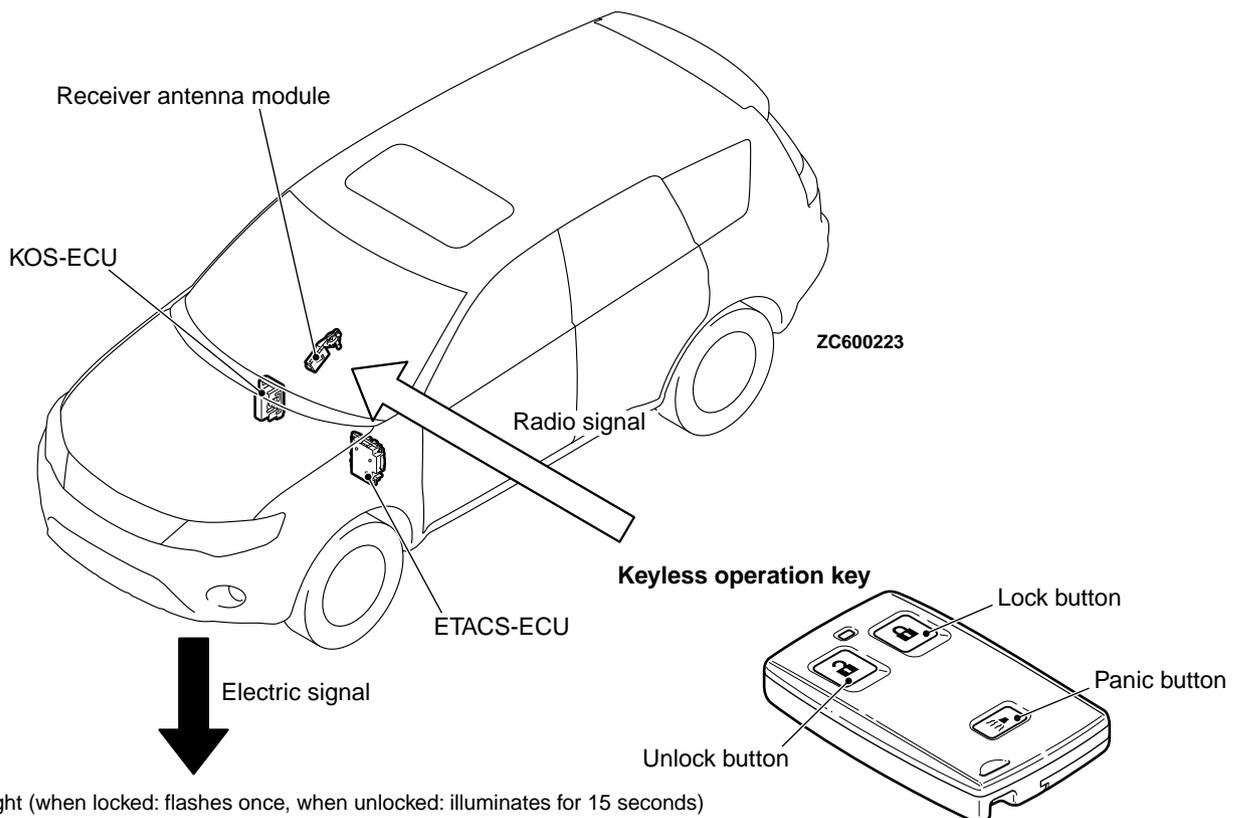
### KOS TIMER LOCK FUNCTION

When none of the doors is opened within 30 seconds after the doors are unlocked by KOS, ETACS-ECU

automatically outputs the door lock signal to lock the doors. This function prevents the doors from being unlocked accidentally.

### KEYLESS ENTRY FUNCTION

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- Dome light (when locked: flashes once, when unlocked: illuminates for 15 seconds)
- Turn signal lights (when locked: flashes once, when unlocked: flashes twice)
- Horn (when locked while driver's side door is locked: sounds once, when unlocked: no sound)
- Door lock actuator (when locked: locking, when unlocked: unlocking)
- Liftgate actuator (when opened: opening)

ZC6002600000

A keyless entry system enables locking and unlocking of all doors, and the liftgate from 12m (39.4 feet) away from the vehicle. The following features are also available:

- Three-button type keyless operation key with lock, unlock and panic buttons
- Receiver antenna module incorporates a receiver and a receiving antenna.
- Up to 4 security codes can be registered using scan tool MB991958 (M.U.T.-III sub-assembly).
- Answerback functions

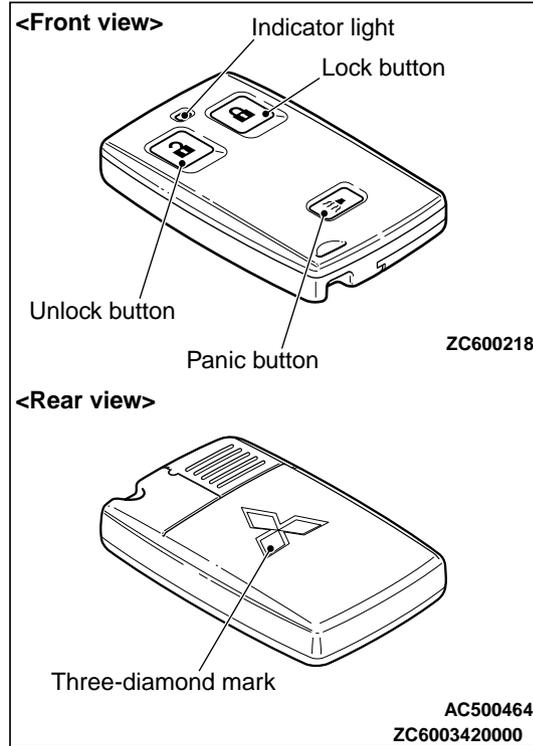
*NOTE: The answerback function can be enabled/disabled using a customization function (Refer to P. 42B-29).*

- Keyless entry timer lock

*NOTE: Timer of the keyless entry timer lock can be enabled/disabled using a customization function (Refer to P. 42B-29).*

**DESCRIPTION OF CONSTRUCTION AND OPERATION**

**KEYLESS OPERATION KEY**



- The keyless operation key has three-knob type buttons and transmits encrypted code peculiar to each key in an electric wave signal.
- A shiny three-diamond mark on the back of the keyless operation key gives it a classy look.
- An indicator light, which illuminates when signals are received, is on the keyless operation key. This indicator light informs you of the signal transmission status and warns you of flat battery.
- A coin type battery, CR2032 is used in the keyless operation key.
- The button operation of the keyless operation key allows the system to operate as follows:

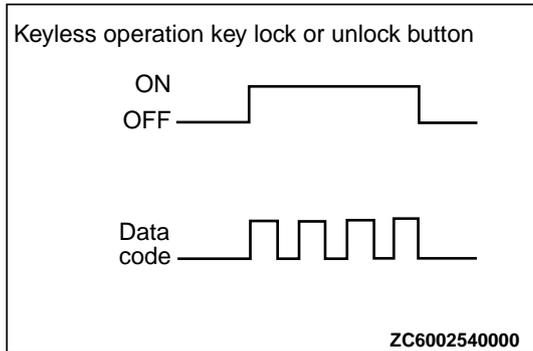
SYSTEM OPERATION	KEYLESS OPERATION KEY OPERATION
All doors (including the liftgate) are locked.	Press the lock button once.
All doors (including the liftgate) are unlocked.	Press the unlock button once.

**KEYLESS ENTRY SYSTEM OPERATION TABLE**

OPERATION OF KEYLESS OPERATION KEY		SYSTEM OPERATION
Lock button	Press once	Lock all doors (including the liftgate)
Unlock button	Press once	Unlock the driver's door
	Press twice	Unlock all doors (including the liftgate)

OPERATION OF KEYLESS OPERATION KEY			SYSTEM OPERATION
Panic alarm system	Panic button	Press once (press and hold for 1 second).	Starts the panic alarm (headlights flash and horn honks for three minutes)
	Lock button, unlock button or panic button	Press again	Stops the panic alarm in progress

**ENCRYPTED CODE**



Four data codes are transmitted when a switch is operated once. The encrypted code for user identification is a combination of 0 and 1, and more than 1 million different combinations are available. To

prevent theft by copying signal codes, the data code includes a rolling code with the encrypted code. The rolling code changes each time a signal is sent.

**RECEIVER**

The receiver is incorporated into the receiver antenna module together with the receiving antenna. It sends the signal the antenna received from the keyless operation key to KOS-ECU. KOS-ECU compares this signal with the ID code registered in it, and when they coincided, a signal is output from ETACS-ECU. By connecting scan tool MB991958 (M.U.T.-III sub-assembly) to the data link connector, up to four encrypted codes of keyless operation keys can be registered.

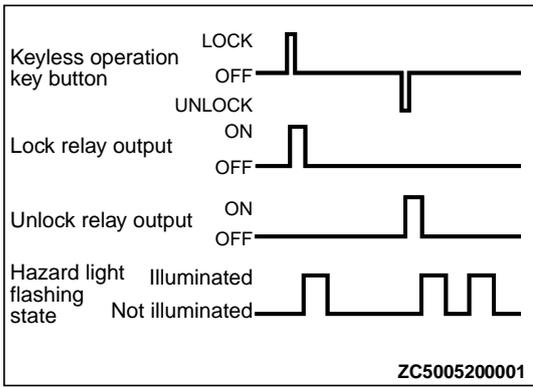
**FUNCTION FOR CONFIRMING ETACS-ECU (RECEIVER) OUTPUT AND OPERATION**

When the ETACS-ECU receives an electric wave signal of the identification code stored in the receiver antenna module, the ETACS-ECU outputs LOCK/UNLOCK signal and informs the driver of the keyless entry system operation by flashing the light (Answerback). Using a customization feature, the flashing patterns for the answerback function can be changed according to the table below. The initial

setting at factory for the answerback function is as follows: "Hazard warning light: LOCK, Flash once, UNLOCK, Flash twice/Dome light: LOCK, Flash once, UNLOCK, Stay on for 15 seconds/Horn: LOCK (driver's side door is locked), Sound once, UNLOCK, No sound." Using a customization feature, the hazard answerback function can be changed (Refer to P.42B-29).

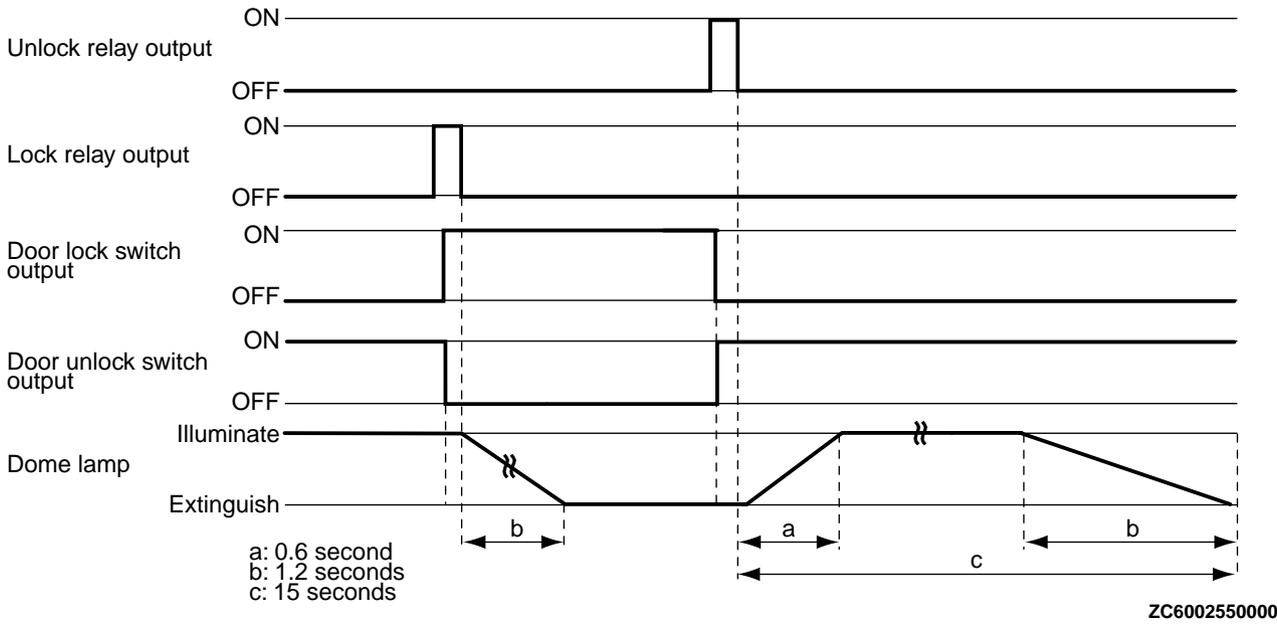
ITEM	OPERATION	
	DOORS AND LIFTGATE LOCKED	DOORS AND LIFTGATE UNLOCKED
ETACS-ECU (receiver)	Sends lock signal	Sends unlock signal
Dome light	Flashes once	Illuminates for 15 seconds
Turn-signal lights (RH and LH)	Flashes once	Flashes twice
Horn	Sounds once if doors are already locked	-

**KEYLESS ENTRY HAZARD LIGHT ANSWERBACK FUNCTION**



The hazard answerback function that allows checking the lock/unlock state of the door easily even in the daytime is installed. When the LOCK signal from the keyless operation key is input to ETACS-ECU via receiver antenna module, all doors (including liftgate) are locked and the hazard warning light flashes once. When UNLOCK signal is input, all doors (including liftgate) are unlocked and the hazard warning light flashes twice.

**KEYLESS ENTRY DOME LIGHT ANSWERBACK FUNCTION**

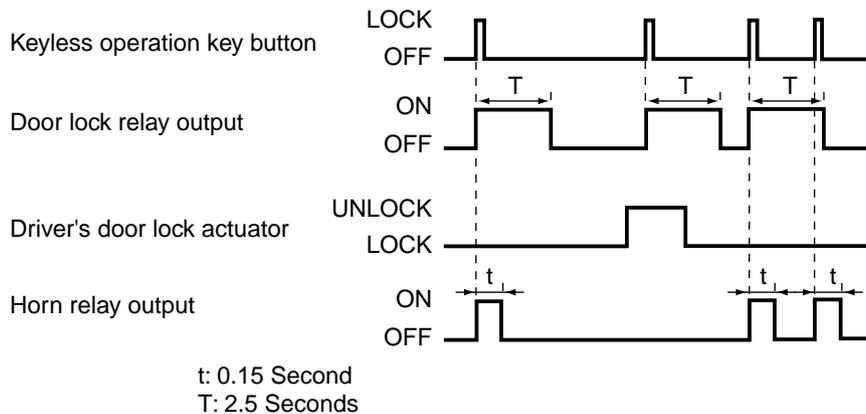


When LOCK signal from the keyless operation key is input to the ETACS-ECU via receiver antenna module, all doors are locked and the dome light will turn off\*. When UNLOCK signal is input, all doors are unlocked and the dome light illuminates for 15 seconds. The dome light fades in, keeps on, and

fades out in 15 seconds after the door unlock relay is operated.

*NOTE: \*: If doors are locked with the keyless operation key when the dome light is ON while doors are opened, the dome light is switched off in 1.2 seconds. In addition, if doors are locked with the keyless operation key when the dome light is OFF, the dome light does not work.*

**KEYLESS ENTRY HORN ANSWERBACK FUNCTION**



ZC6003450000

When the lock signal from the keyless operation key is received into ETACS-ECU via receiver antenna module, all doors are locked and the horn sounds. If the driver's door cannot be locked even when the keyless operation key is operated, the horn does not sound.

**KEYLESS ENTRY TIMER LOCK TIME**

When none of the doors is opened within 30 seconds after the doors are unlocked by the keyless entry system, ETACS-ECU automatically outputs the door lock signal to lock the doors. This function prevents the doors (including the liftgate) from being unlocked unexpectedly by operation errors. Using a customization function, the timer lock period can be changed (Refer to P.42B-29).

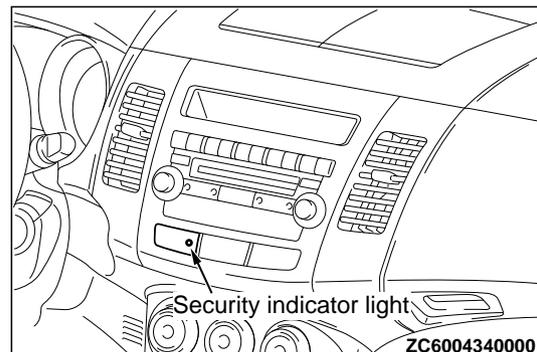
**OPERATION INHIBITION CONDITIONS**

- The operation of the system is inhibited when:
- The ignition key is in the ignition switch.
  - Any door or the liftgate is open (door switch is ON). (including door ajar)

**SECURITY ALARM**

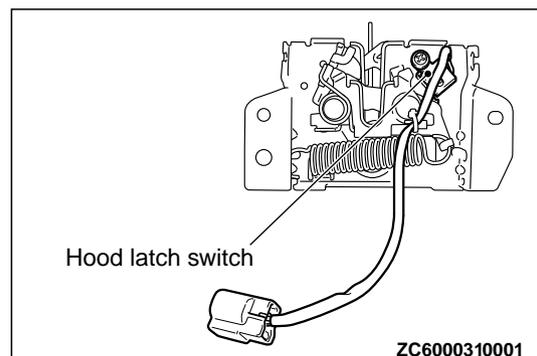
The security alarm function is based on the door lock operation by the keyless entry system or KOS. The function warns when the doors (including the liftgate) are opened by any operation other than the keyless entry system or KOS. Using a customization function, the security alarm can be enabled/disabled (Refer to P.42B-29). This customization function is described in the owner's manual.

**SECURITY INDICATOR LIGHT**



The security indicator light is installed on the center panel of the instrument panel.

**HOOD LATCH SWITCH**

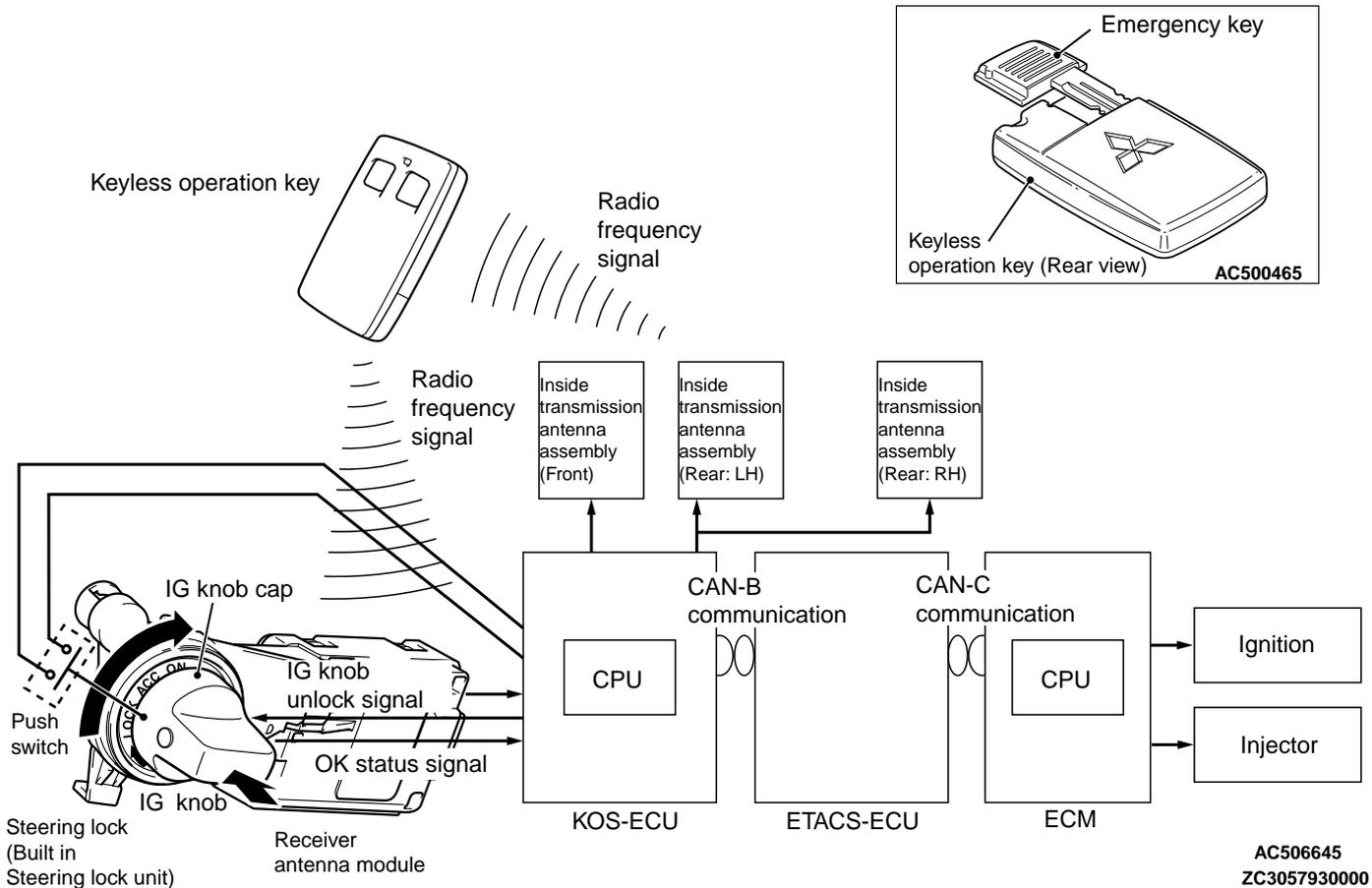


The hood latch switch has been provided to the hood latch. When the hood latch is operated, the hood latch switch detects this and sends a signal to ETACS-ECU.

## ENGINE STARTING FUNCTION

When carrying the keyless operation key, a driver can start/stop the engine by operating the IG knob, without using the ignition key.

### CONSTRUCTION DIAGRAM



## OPERATION

### WHEN THE USER IS CARRYING THE KEYLESS OPERATION KEY

1. Press the IG knob on the steering lock, and the push switch inside the steering lock is turned ON.
2. When the push switch inside the steering lock is turned ON, KOS-ECU activates the interior transmitter antenna assembly to send the transmitter signal to the keyless operation key.
3. On receiving the transmitter signal from KOS-ECU, the keyless operation key performs the keyless operation key certification and the encrypted code calculation, and sends the keyless operation key ID data to KOS-ECU. (The keyless operation key cannot receive the transmitter signal

from KOS-ECU when it is not located within the engine starting function valid area P.42B-22.)

4. The receiver antenna receives the signal from the keyless operation key, and then KOS-ECU compares the keyless operation key ID data sent from the key with the one registered in it.
5. When these data coincide, KOS-ECU sends the IG knob unlock signal to the steering lock unit inside the steering lock.

6. On receiving the IG knob unlock signal, the steering lock unit performs processing (verification of the KOS ID, etc.) based on the received data. When no problem is found during the processing, the unit sends the OK status signal to KOS-ECU, and at the same time, electrically disengages the steering lock mechanism to make the IG knob rotatable.
7. When a keyless operation key certification agreement memory "exists"\*1 in KOS-ECU when it received the OK status signal from the steering lock unit, the engine start permission communication (CAN communication) is performed between KOS-ECU and the engine ECU by turning the IG knob from the ACC position to the ON/START position, and the engine starts. If the keyless operation key certification agreement memory "does not exist"\*2, the engine does not start.

**NOTE:**

\*1: The keyless operation key certification agreement memory "exists" means that a registered keyless operation key has been recognized during the keyless operation key certification communication.

\*2: When the keyless operation key certification agreement memory "does not exist," the "keyless operation key bringing-out monitoring function" and the "keyless operation key replacement monitoring function" (keyless operation key monitoring controls) have judged that the keyless operation key has been carried out of the vehicle with the IG knob in the LOCK (OFF) position while turning ON the push switch or in the ACC, ON, or START position.

**KEYLESS OPERATION KEY TAKE OUT MONITORING FUNCTION**

To prevent the engine from started when the keyless operation key is carried out of the vehicle with the IG knob in the LOCK (OFF) position and the push switch OFF, KOS-ECU performs the certification

communication with the keyless operation key inside the vehicle and monitors if it is carried out of the vehicle.

When none of the registered keyless operation keys (up to four) respond during the communication, KOS-ECU determines that the key has been brought out of the car, and the keyless operation key certification agreement memory "does not exist," and does not permit starting of the engine.

**NOTE:** The monitoring function is inhibited when:

- \*The keyless operation key certification agreement memory "does not exist" from the start.
- \*The emergency key is in the IG knob.
- \*The IG knob is in LOCK (OFF) position and the push switch is OFF.
- \*The vehicle is judged running (shift lever in "P" or "N", or vehicle speed is 6 km/h or higher).

**KEYLESS OPERATION KEY REPLACEMENT MONITORING FUNCTION**

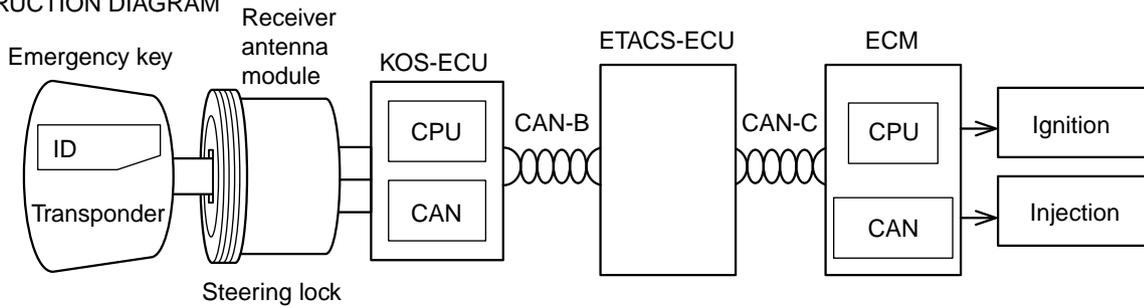
If the keyless operation key carrying-out monitoring function once detects that the key has been carried out of the vehicle with the IG knob in the LOCK (OFF) position and with the push switch in other than OFF, and then the key is brought into the vehicle, the engine must be started when the IG knob is turned to the ON or START position. For this purpose, KOS-ECU performs the certification communication with the keyless operation key inside the vehicle every 5 seconds to monitor the replacement of the keyless operation key. When any of the registered keyless operation keys sends a respond, KOS-ECU determines that the key has been brought into the vehicle (replaced), and sets the keyless operation key certification agreement memory to "exist," and permits starting of the engine.

**NOTE:** The monitoring function is inhibited when:

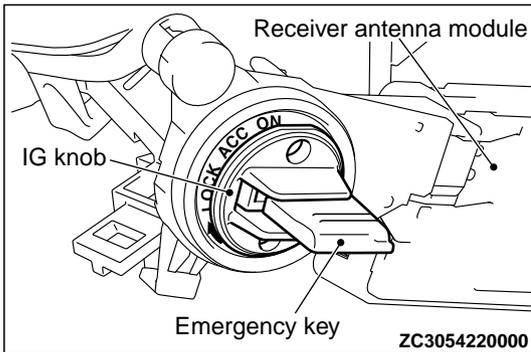
- \*The keyless operation key certification agreement memory "exists" from the start.
- \*The emergency key is in the IG knob.
- \*The IG knob is in LOCK (OFF) position and the push switch is OFF.
- \*The vehicle is judged running (shift lever in "P" or "N", or vehicle speed is 6 km/h or higher).

**WHEN USING EMERGENCY KEY**

## CONSTRUCTION DIAGRAM



ZC3064040000



The engine can be started by removing the IG knob cap and inserting the emergency key (incorporating a transponder ID) in KOS steering lock. In this case, the system operates as follows:

1. When the emergency key is turned to ON position, the transponder (a small transmitter) incorporated in the key transmits an ID code peculiar to each key (transponder ID) to the receiver antenna module by radio.
2. KOS-ECU compares the transponder ID with the ID code registered in it, and when they coincide, KOS-ECU controls the engine ECU.
3. The power to the transponder has been supplied from the receiver antenna module, and therefore, the transponder is maintenance-free. Each vehicle is provided with two keys, and up to eight emergency keys can be registered in the vehicle's KOS-ECU. More than one trillion ID code combinations can be registered, and parts of them are irregularly changed whenever the ignition key

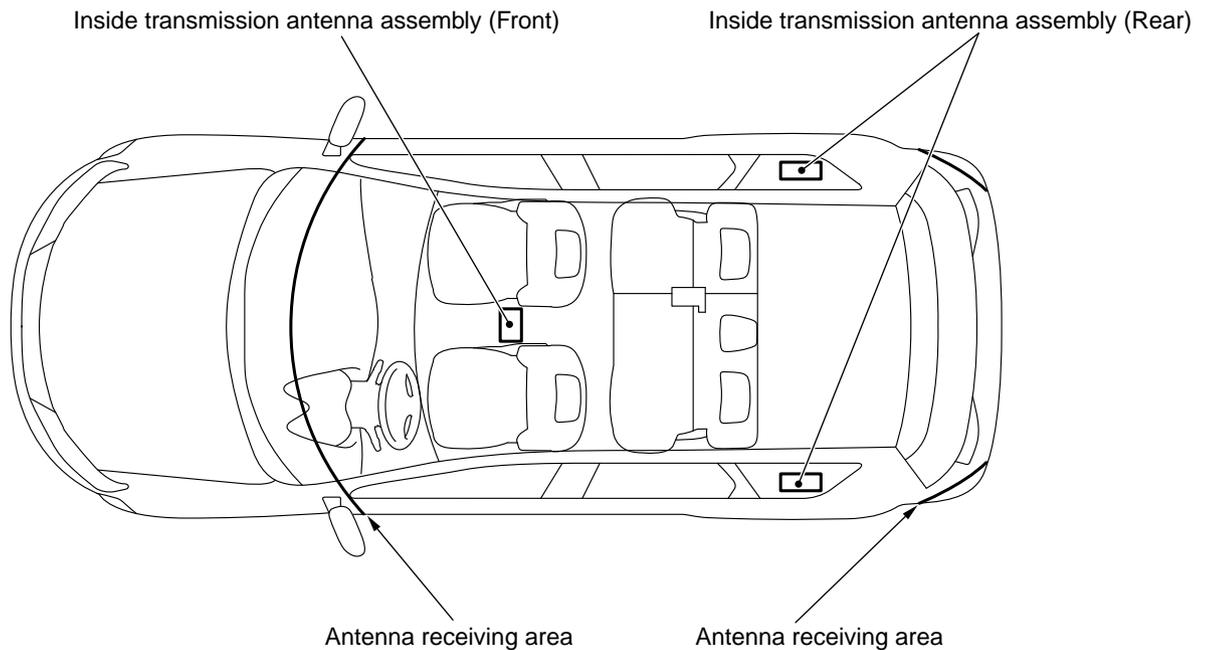
is turned ON. This feature prevents code copying, resulting in higher security of the system.

**NOTE:** When KOS-ECU is replaced or a key is lost or added, the ID codes of all the keys must be re-registered as follows using scan tool:

- When KOS-ECU is lost, all the emergency keys and keyless operation keys must be re-registered.
- When a key is lost, all the emergency keys and keyless operation keys other than the lost one must be re-registered to cancel the registration of the lost key.
- To add a key, all the emergency keys and keyless operation keys to be used for the vehicle and the additional one must be re-registered.

**ENGINE STARTING FUNCTION VALID AREA**

The engine can be started only when the keyless operation key is within the interior antenna receiving area.



ZC6009000000

## TIRE PRESSURE MONITORING SYSTEM (TPMS) FUNCTION

M24200100011USA0000010000

When the tire pressure becomes under the specified value, the TPMS function warns the driver of that state by illuminating the TPMS warning light.

### OPERATION

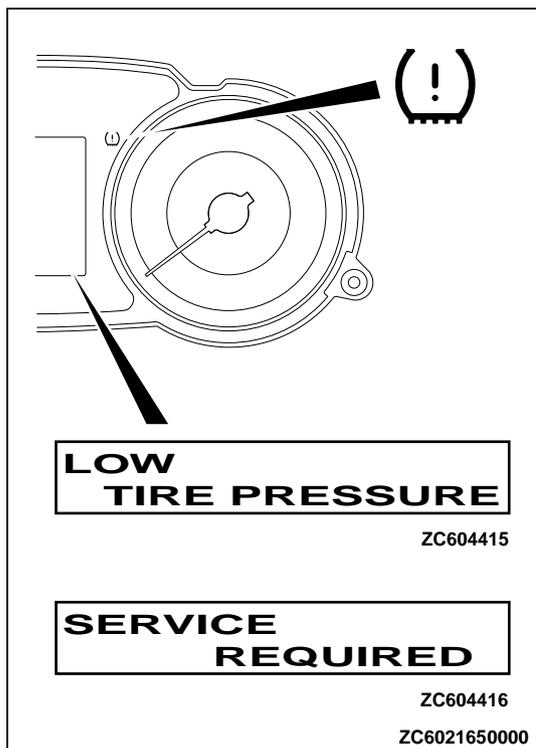
- The signals from the TPMS receiver are received by the KOS-ECU.
- KOS-ECU processes input signals from each TPMS transmitter as well as vehicle speed signals from the ABS-ECU or ASC-ECU. The WCM also receives the atmospheric pressure signal from the ECM. When the road tire pressure is low, it sends a warning signal causing the TPMS warning light to be illuminated. When the TPMS has problems, it

sends a warning signal causing the TPMS warning light to be flashed\*.

*NOTE: \*: Change to continuous illumination after flashing for about 1 minute.*

- For 3 seconds after the ignition switch is turned to the "ON" position, KOS-ECU illuminates the TPMS warning light to check any breaks in the TPMS warning light circuit.
- By connecting the scan tool to the data link connector, data stored in KOS-ECU (data of tire pressure and TPMS transmitter ID, the alarm status and warning history, etc.) can be displayed and TPMS transmitter ID can be registered.

*NOTE: If the TPMS transmitter is replaced, register the ID codes of all the TPMS transmitters again using the M. U. T. -III.*



### TPMS WARNING LIGHT

The TPMS warning light on the combination meter illuminates or flashes\* to alert the driver by request from KOS-ECU. When the tire pressure warning or the fault warning is activated, a warning symbol and a message are displayed on the multi information display.

#### WARNING DISPLAY PATTERN OF TPMS WARNING LIGHT AND MULTI INFORMATION DISPLAY

Circumstance	Warning light	Multi information display
For 3 seconds after the ignition switch is turned to the "ON" position (warning light circuit self-check)	Illuminates	No indication
TPMS problems	Flashes*	Symbol and "SERVICE REQUIRED" is displayed
Low tire pressure	Illuminates	Symbol and "LOW TIRE PRESSURE" is displayed

#### TIRE PRESSURE THRESHOLD VALUES

Item	Tire pressure kPa (psi)
Standard pressure at cold (reference)	220 (32)
Alarm ON pressure	174 (25) or less
Alarm OFF pressure	190 (28) or more

*of the TPMS transmitters, possibly resulting in air leakage and damage to the TPMS transmitter.*

### TPMS TRANSMITTER (TIRE PRESSURE SENSOR)

The TPMS transmitter combines the valve and tire pressure sensor in a single unit. The TPMS transmitters are mounted inside the tires. The TPMS transmitter measures tire pressure directly with its tire pressure sensor and sends radio frequency signals to KOS-ECU. The TPMS transmitter includes acceleration sensor that senses tire rotation. The KOS-ECU turns the warning light ON/OFF according to the signal from the acceleration sensor that tells whether the vehicle is running or stopped.

*NOTE: Use only genuine wheels. The use of non-genuine wheels may cause the improper installation*

#### TIRE PRESSURE SAMPLING TIMING

Vehicle status	Sampling timing
At vehicle moving	once every 5 seconds
At vehicle stationary	once every 1 minutes

*NOTE: Vehicle moving = vehicle speed: approximately 25 km/h (15 mph) or more*

#### DATA TRANSMISSION TIMING

Vehicle status	Transmission timing
At vehicle moving	once every 1 minute*

Vehicle status	Transmission timing
At vehicle stationary	once every 13 hours

If a sampled pressure varies by  $\pm 10$  kPa (1.5psi) from the last transmitted pressure value, an additional transmission will occur.

*NOTE: \*: Once every 15 seconds for first 30 transmission after vehicle starts moving.*

## WARNINGS/ALARMS

M24200100006USA0000010000

If the KOS failed, operated improperly, TPMS fails or the tire pressure is low, KOS-ECU warns the driver of this by setting off the outer tone alarm and the keyless

operation warning indicator, TPMS warning indicator, or TPMS warning light on the multi information display in the combination meter.

Item	State	Warning operations		Warning cancellation conditions (Cancels warning operations when one of the conditions met)
		TPMS warning light	Multi information display	
Low keyless operation key battery voltage warning	The keyless operation key with low battery voltage is detected when the IG knob is pressed.	-	<ul style="list-style-type: none"> <li>▪Warning indicator flashes for 30 seconds.</li> <li>▪The outer tone alarm will not sound.</li> </ul>	<ul style="list-style-type: none"> <li>▪IG knob in "LOCK" (OFF) position and push switch OFF are detected.</li> <li>▪30 seconds have passed after the warning output started.</li> </ul>
No keyless operation key detected inside the car	No keyless operation key is detected inside the car when the IG knob is pressed.	-	<ul style="list-style-type: none"> <li>▪The warning indicator flashes for 5 minutes.</li> <li>▪The outer tone alarm will not sound.</li> </ul>	<ul style="list-style-type: none"> <li>▪IG knob in "LOCK" (OFF) position and push switch OFF are detected.</li> <li>▪5 minutes have passed after the warning output started.</li> </ul>
IG knob is not returned properly.	Opening of the driver's door is detected when the IG knob is in ACC or LOCK position and the push switch is ON.	-	<ul style="list-style-type: none"> <li>▪The warning indicator flashes for 5 minutes.</li> <li>▪The outer tone alarm will not sound.</li> <li>▪Key reminder warning tone alarm sounds until closing of the driver's door is detected.</li> </ul>	<ul style="list-style-type: none"> <li>▪The IG knob in the "RUN" or "START" position, or the IG knob in the "LOCK" (OFF) position, and the push switch OFF are detected.</li> <li>▪The driver's door is detected closed from the open position.</li> <li>▪5 minutes have passed after the warning output started.</li> </ul>

KEYLESS OPERATION SYSTEM (KOS)  
SYSTEM OPERATION

Item	State	Warning operations		Warning cancellation conditions (Cancels warning operations when one of the conditions met)
		TPMS warning light	Multi information display	
Keyless operation key brought out of the car warning	The keyless operation key is brought out of the car when the IG knob is in other than the LOCK position.	-	<ul style="list-style-type: none"> <li>*The warning indicator flashes for 5 minutes.</li> <li>*Outer tone alarm sounds for 5.69 seconds in pattern 2.</li> </ul>	<ul style="list-style-type: none"> <li>*IG knob in "LOCK" (OFF) position and push switch OFF are detected.</li> <li>*KOS-ECU has detected a keyless operation key inside the vehicle.</li> <li>*5 minutes have passed after the warning output started.</li> </ul>
Door lock does not operate.	Push switch is pressed ON when the IG knob is in other than LOCK position.	-	<ul style="list-style-type: none"> <li>*Warning indicator flashes for 5 seconds.</li> <li>*Outer tone alarm sounds for 2.96 seconds in pattern 1.</li> </ul>	<ul style="list-style-type: none"> <li>*IG knob in "LOCK" (OFF) position and push switch OFF are detected.</li> <li>*5 seconds have passed after the warning output started.</li> </ul>
	Push switch is pressed ON when the keyless operation key is inside the car.			<ul style="list-style-type: none"> <li>*Lock switch on the keyless operation switch is pressed again.</li> <li>*5 seconds have passed after the warning output started.</li> </ul>
	Push switch is pressed ON when the door is ajar.			<ul style="list-style-type: none"> <li>*All doors are closed.</li> <li>*5 seconds have passed after the warning output started.</li> </ul>
System error	Push switch is pressed ON from OFF when an error has been detected in EEPROM in KOS-ECU.	-	<ul style="list-style-type: none"> <li>*The warning indicator flashes for 5 minutes.</li> <li>*The outer tone alarm will not sound.</li> </ul>	5 minutes have passed after the push switch was pressed ON and IG knob is in "LOCK" (OFF) position.

KEYLESS OPERATION SYSTEM (KOS)  
SYSTEM OPERATION

42B-27

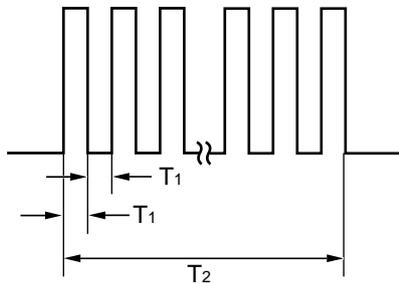
Item	State	Warning operations		Warning cancellation conditions (Cancels warning operations when one of the conditions met)	
		TPMS warning light	Multi information display		
	<p>Push switch is pressed ON from OFF while open circuit in the transmitter antennas are being detected.</p> <p>The push switch is pressed ON from OFF while short circuit in the power supply output (steering lock, transmitter antennas, receiver antenna module, etc.) is detected.</p> <p>Steering lock communication error has been detected when the push switch was pressed ON.</p> <p>The IG knob is in other than the LOCK position while some error is being detected.</p>				
TPMS failure warning	ID not stored	The TPMS transmitter ID is not registered in the WCM.	Flashes*	Symbol and "SERVICE REQUIRED" is displayed.	ID is registered normally.
	Defective EEPROM	Abnormality of data in the EEPROM of the WCM is detected.			Data in the EEPROM of the WCM is checked to be normal.

KEYLESS OPERATION SYSTEM (KOS)  
SYSTEM OPERATION

Item		State	Warning operations		Warning cancellation conditions (Cancels warning operations when one of the conditions met)
			TPMS warning light	Multi information display	
	Problem in signal reception	The signals from TPMS transmitters cannot be received while driving for 20 minutes or less.			The signal from the TPMS transmitter that was warned is received.
	Defective sensor	The sensor failure signal is received from the TPMS transmitter.			A normal signal is received from the TPMS transmitter that was warned.
	The battery voltage of the TPMS transmitter is low.	The reception problem warning is activated because of the low battery voltage of the TPMS transmitter.			The signal of normal battery voltage is received from the TPMS transmitter that was warned.
	Vehicle speed input problem	The vehicle speed is not input.			The vehicle speed is input.
	Abnormal vehicle speed value	The vehicle speed value is abnormal.			The normal vehicle speed value is received.

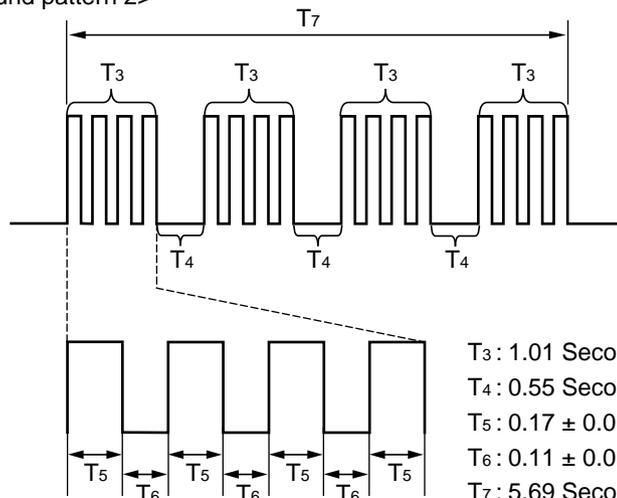
NOTE: \*: Change to continuous illumination after flashing for about 1 minute.

<Sound pattern 1>



T1 : 0.08 ± 0.01 Seconds  
T2 : 2.96 Seconds

<Sound pattern 2>



T3 : 1.01 Seconds  
T4 : 0.55 Seconds  
T5 : 0.17 ± 0.01 Seconds  
T6 : 0.11 ± 0.01 Seconds  
T7 : 5.69 Seconds

**CONFIGURATION FUNCTION**

M24200100010USA0000010000

By using ETACS functions, KOS functions can be adjusted.

- Horn answerback function of the keyless entry system  
A function that sounds the horn when the doors are locked/unlocked by the keyless operation key to let the driver confirm that the doors are locked/unlocked even when he/she is away from the car
- KOS auto lock function  
A function that automatically locks the doors when the driver left the car without locking the doors

- In-car keyless operation key search  
A function that monitors the keyless operation key being brought out of the car through the car window
- KOS outer tone alarm answerback function  
A function that sounds the outer tone alarm when the doors are locked/unlocked by the keyless operation key to enable the driver confirm that the doors are locked/unlocked
- All KOS functions  
Enables/disables all KOS functions or enables either door entry function or engine starting function respectively.

Adjustment item (scan tool MB991958 display)	Adjustment item	Adjusting contents (scan tool MB991958 display)	Adjusting contents
Hazard answer back	Adjustment of the number of keyless hazard warning light answer back flashes	Lock:1, Unlock:2	LOCK: Flashes once, UNLOCK: Flashes twice (default)
		Lock:1, Unlock:0	LOCK: Flashes once, UNLOCK: No flash
		Lock:0, Unlock:2	LOCK: No flash, UNLOCK: Flash twice
		Lock:2, Unlock:1	LOCK: Flash twice, UNLOCK: Flash once
		Lock:2, Unlock:0	LOCK: Flash twice, UNLOCK: No flash
		Lock:0, Unlock:1	LOCK: No flash, UNLOCK: Flash once
		Lock:0, Unlock:0	No function
Dome light delay timer with door	Adjustment of interior light delay shutdown time	0sec	0 second (no delay shutdown time)
		7.5sec	7.5 seconds
		15sec	15 seconds
		30sec	30 seconds (default)
		60sec	60 seconds
		120sec	120 seconds
		180sec	180 seconds
Door unlock mode	Door lock system	All doors unlock	All the doors are unlocked when the driver's side door is unlocked.
		Dr door unlock	Only the driver's side door is unlocked when the driver's side door is unlocked. (default)
Auto door unlock by P position	Auto door unlock by P position function	Disable	No function (default)
		Always enabled	Always with function
		P/W unlocked	With function (with power window unlocked)
Duration of horn chirp	Horn sounding time during horn answer back	Short	0.01 second (default)
		Long	0.02 second

**KEYLESS OPERATION SYSTEM (KOS)  
CONFIGURATION FUNCTION**

<b>Adjustment item (scan tool MB991958 display)</b>	<b>Adjustment item</b>	<b>Adjusting contents (scan tool MB991958 display)</b>	<b>Adjusting contents</b>
Horn chirp by RKE	Horn chirp by RKE	Not sound horn	No horn answerback function
		Lock any time	The horn sounds when the lock button of keyless entry transmitter is pressed once.
		W lock any time	The horn sounds when the lock button of keyless entry transmitter is pressed twice. (default)
Tone alarm answer back	Adjusts the tone alarm answer back function.	Not sound tone alarm	No function
		At keyless key	Sounds when the keyless entry system is activated.
		At keyless	Sounds when KOS is activated (default).
		At Both	Sounds when the keyless entry system or KOS is activated.
Timer lock timer	Timer lock period adjustment	30sec	30 seconds (default)
		60sec	60 seconds
		120sec	120 seconds
		180sec	180 seconds
Duration pre-alarm	Adjustment of pre-alarm continue time	10 sec	10 seconds (default)
		6 sec	6 seconds
Alarm	With/without theft-alarm function	Disable	No function
		Enable	With function (default)
Panic alarm switch	With/without panic alarm function	Disable	No function
		Enable	With function (default)
KOS auto lock	With/without KOS auto lock function	Enable	No function (default)
		Disable	With function
Fob out of car	With/without KOS key exterior detection function	Enable	No function
		Disable	With function (default)
KOS feature	KOS function adjustment	Both enable	All KOS functions are enabled (default).
		DoorEntry enable	Only door entry function is enabled.
		ENG strt enable	Only engine starting function is enabled.
		Both disabled	All KOS functions are disabled.
KOS unlock disable time	Adjusts the door unlock inhibition period after door lock is activated.	0sec	0 seconds
		3sec	3 seconds (default)
		5sec	5 seconds