
GROUP 42B

KEYLESS OPERATION SYSTEM (KOS)

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GENERAL INFORMATION

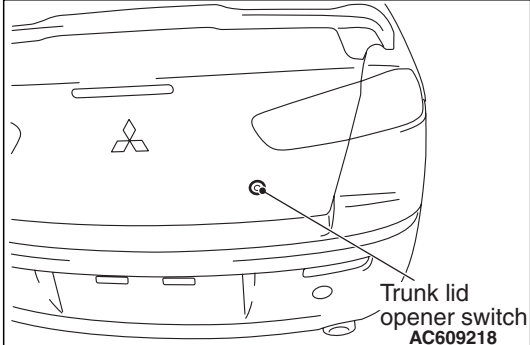
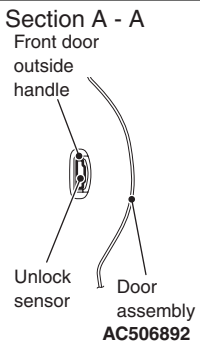
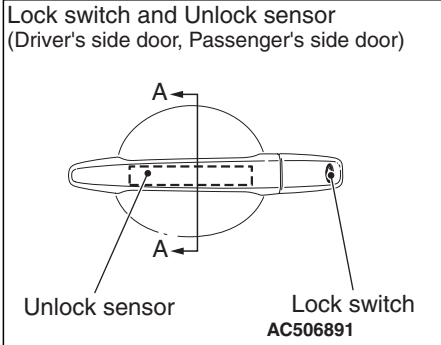
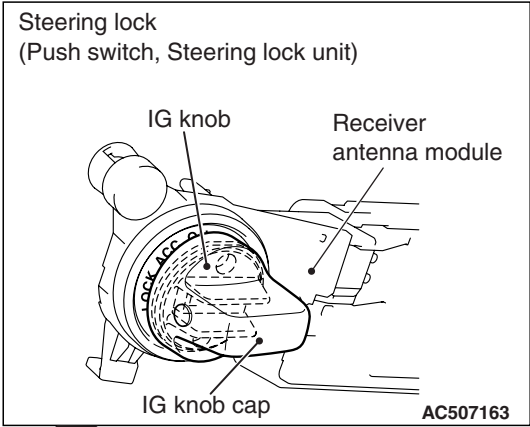
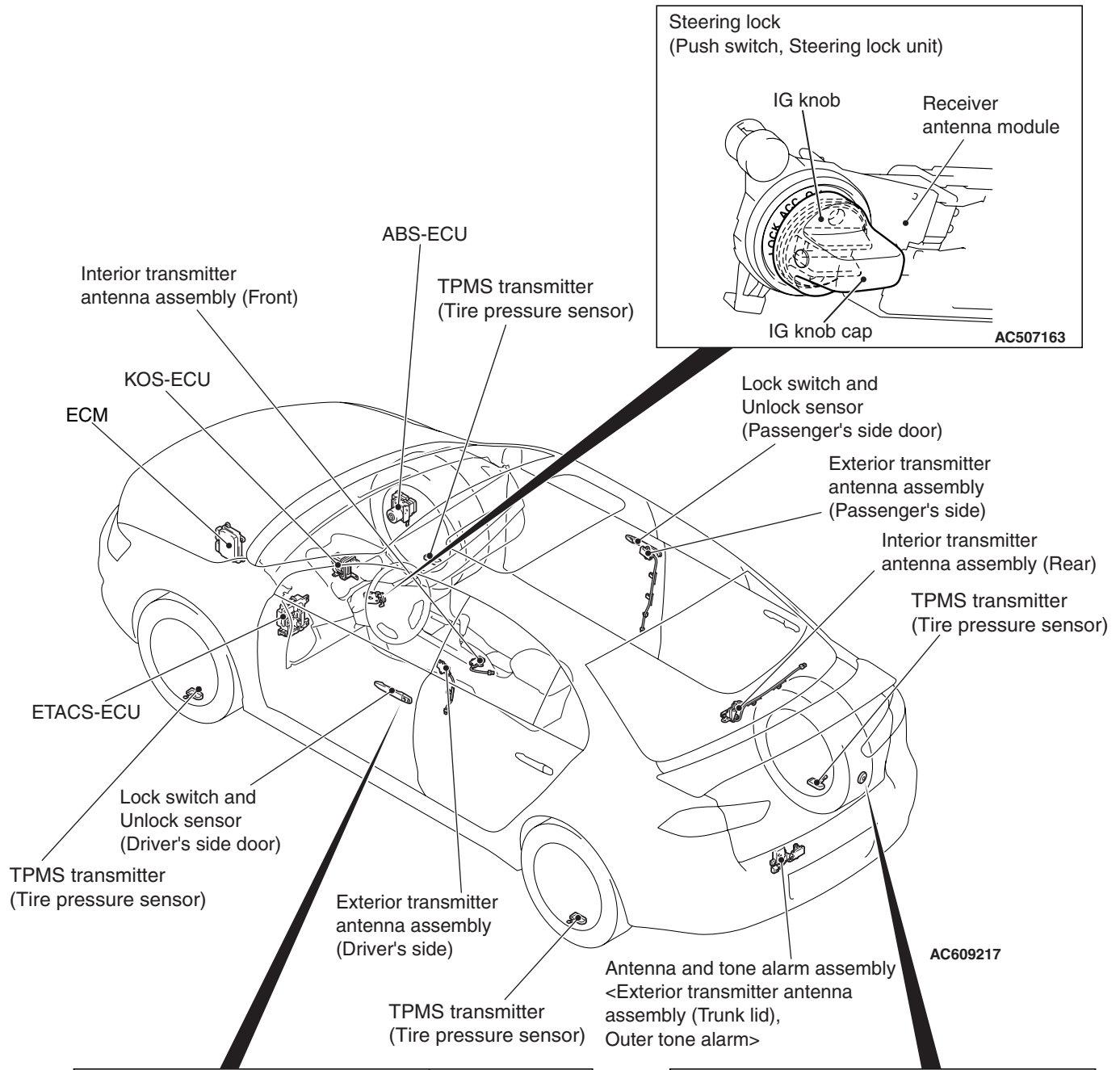
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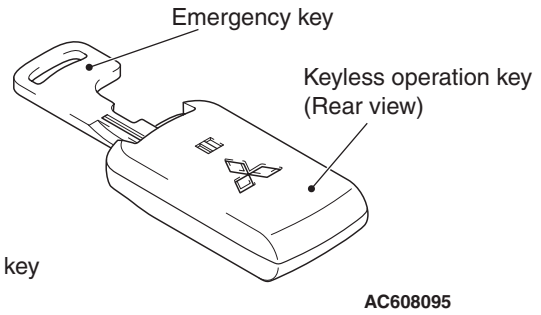
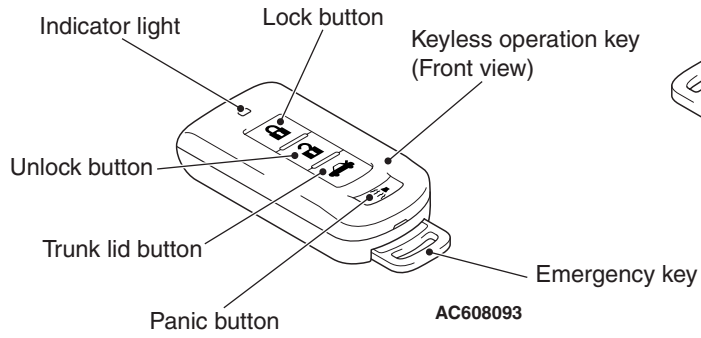
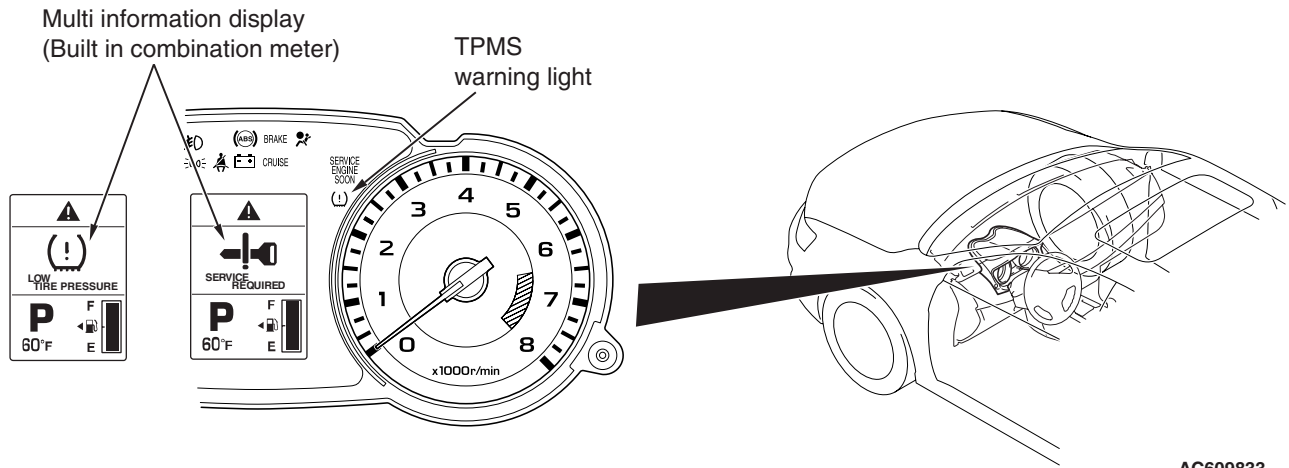
NOTE: In this manual, F.A.S.T.-key (Free-hand Advanced Security Transmitter) is described as Keyless Operation System (KOS). (KOS is indicated as F.A.S.T. in the M.U.T.-III display.)

The keyless operation system (KOS) is an integrated system of the following functions: the door entry function which enables the driver to unlock the door (only the driver's door when the driver's door outside handle is operated, and all the doors when the front passenger's door outside handle is operated) by gripping the front door outside 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. It also allows the driver to unlock the trunk lid by operating the trunk opener switch and to lock all the doors by pressing the lock switch on the front door outside handle or to lock the trunk lid just by closing; the engine start function which starts the engine without using the conventional mechanical key; and the tire pressure monitoring system (TPMS) which warns the driver of low tire pressure by illuminating the warning light. The KOS has the following features:

- The keyless operation key incorporates a lock/unlock button, trunk lid button, and panic button, and can be operated by remote control in the same manner as the conventional keyless entry system. 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-13.](#))
- The keyless operation key incorporates the immobilizer function that inhibits the engine start-up by using an unauthorized key.
- Two keyless operation keys are provided for each vehicle, and up to four keyless operation keys can be registered.
- The keyless operation key incorporates an emergency key to lock/unlock the doors and start the engine when the battery in the keyless operation key is discharged or the keyless operation system malfunction occurs.
- The driver can customize KOS; enabling the door entry/engine start function, disabling the door entry/engine start function, enabling the door locking/unlocking function only, or enabling the engine starting function only. (Refer to [P.42B-27.](#))

CONSTRUCTION DIAGRAM





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Main components and functions

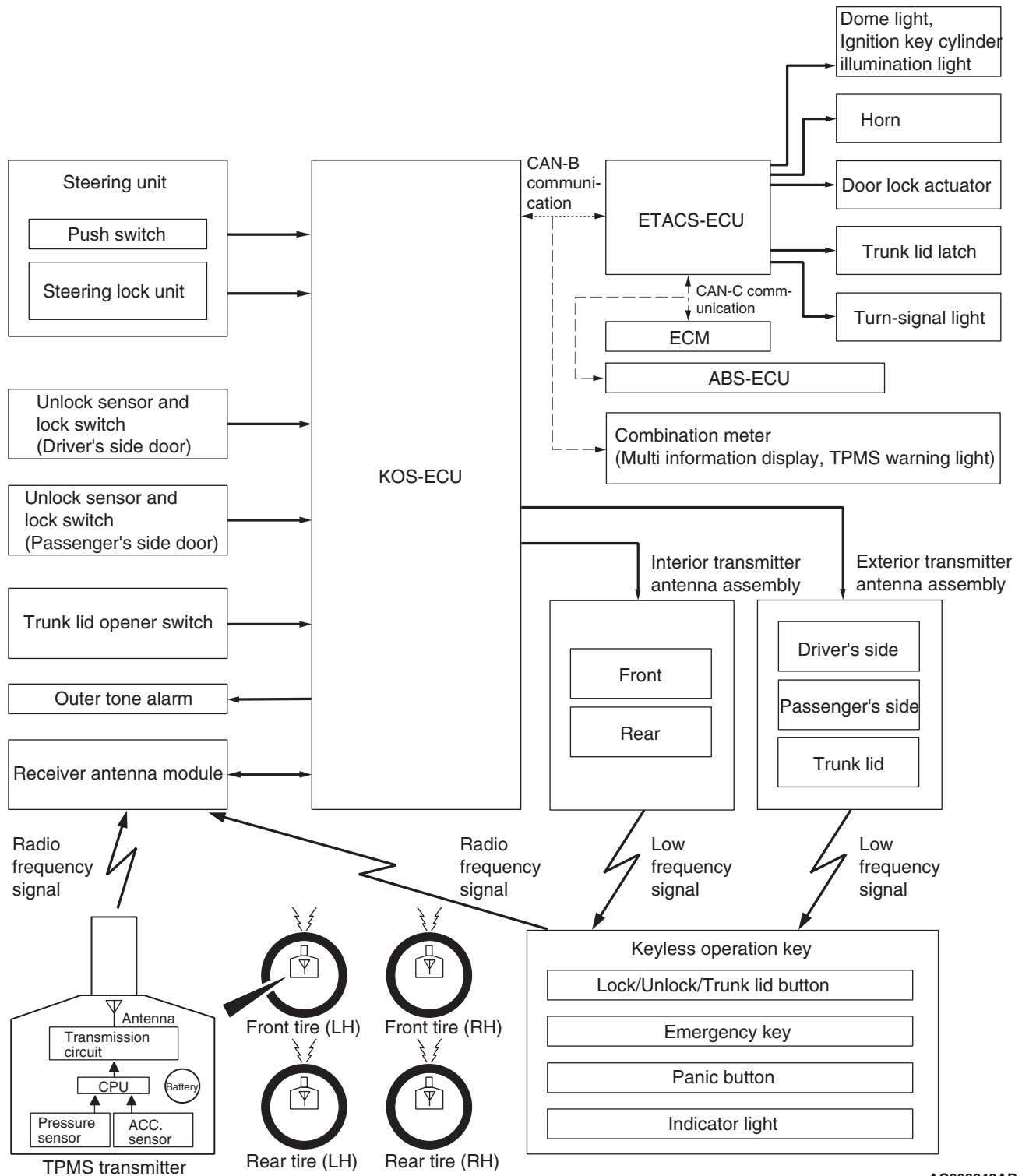
Parts name		Functional description
KOS-ECU		<p>Controls KOS by using the following inputs/outputs and communications.</p> <ul style="list-style-type: none"> • Input from the unlock sensor and lock switch on each door, input from the push switch on the IG knob • Communications with ETACS-ECU, ECM, ABS or ASC-ECU and combination meter via CAN • Wire communication with the steering lock unit • Wireless communication with the keyless operation key via the receiver antenna module and interior/exterior transmitter antennas • Wireless communication with the TPMS transmitter • Output to the outer tone alarm
Steering lock (incorporates push switch and steering lock unit)		<p>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.</p>
Keyless operation key (incorporates emergency key)		<ul style="list-style-type: none"> • The keyless operation key receives signals sent from each interior/exterior transmitter antenna, certifies the keyless operation key ID code, calculates the key ID, and sends the reply data signal to KOS-ECU via the receiver antenna module. The lock button, unlock button, and trunk lid button operations of keyless operation key transmit signals to KOS-ECU via the receiver antenna module. • 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^{*1} data, and the keyless operation keys respond in accordance with this priority.
Lock switch	Driver's door	<p>Locks all the doors when a driver carrying the keyless operation key presses the lock switch on the front door outside handle.</p>
	Front passenger's door	
Unlock sensor	Driver's door	<p>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.</p>
	Front passenger's door	<p>The unlock sensors incorporated in the passenger's front door outside handles unlock all the doors when a driver carrying the keyless operation key pulls the front door outside handle.</p>
Trunk lid opener switch		<p>By pressing the trunk lid opener switch on the trunk lid while he/she is carrying the keyless operation key, the trunk lid is unlocked.</p>
Exterior transmitter antenna assembly	Driver's side	<p>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.)</p>
	Front passenger's side	

Parts name		Functional description
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-17.)
	Rear	
Antenna & tone alarm assembly	Exterior transmitter antenna assembly (trunk lid)	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	The outer tone alarm sounds when: <ul style="list-style-type: none"> • The doors are locked or unlocked by the door entry function. • 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. • The lock switch is pressed on the keyless operation key from inside the car. • The lock switch on the keyless operation key is pressed when the door is ajar.
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, activates ^{*2} the warning light. Warning symbol and message is additionally displayed on the multi information display
ETACS-ECU		Communicates with KOS-ECU via CAN. 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. Sends the vehicle speed data <Vehicles without ABS>.
ABS-ECU <Vehicles with ABS>		Communicates with KOS-ECU via CAN. Sends the vehicle speed data <Vehicles with ABS>.

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 continuously illuminated for TPMS malfunction warning.

System configuration



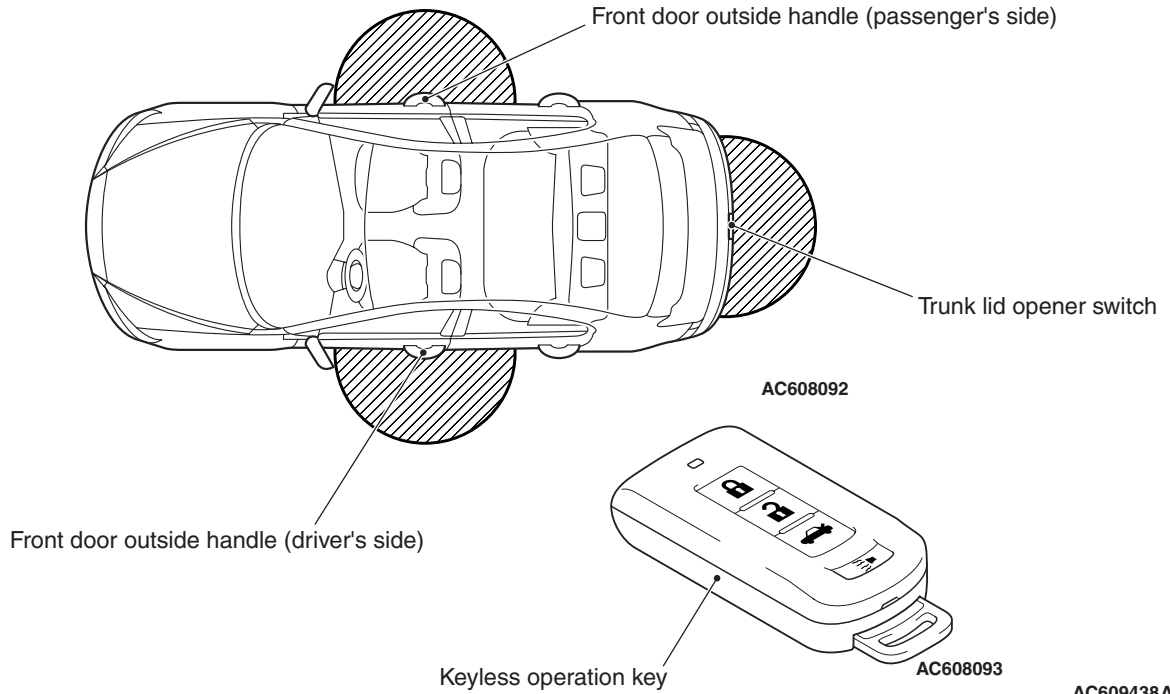
SYSTEM OPERATION

DOOR ENTRY FUNCTION

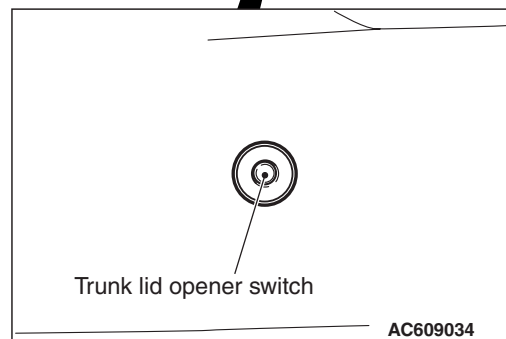
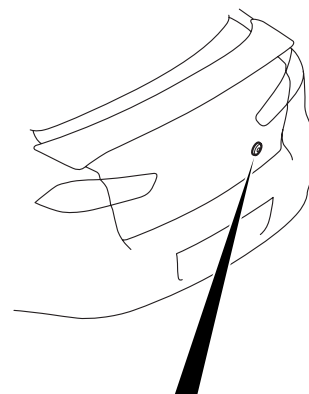
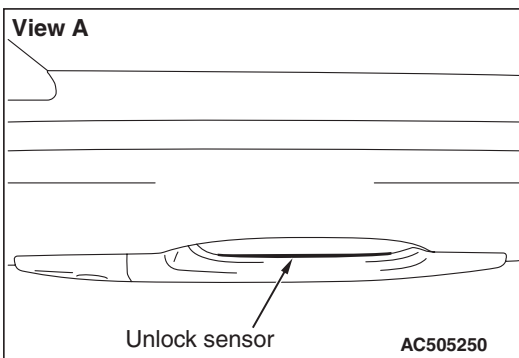
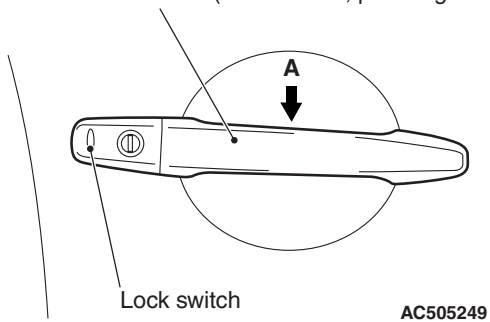
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DESCRIPTION OF CONSTRUCTION AND OPERATION

<Vehicles outside area>



Front door outside handle (driver's side, passenger's side)



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When a driver carrying a keyless operation key presses the lock switch and the unlock sensor (door outside handle) on the driver's/passenger's door outside handle or the trunk lid opener switch, 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 the outer side of the vehicle, it requests ETACS-ECU to lock/unlock the doors (Even within this range, the key may not be certified when it is positioned too high or too low).

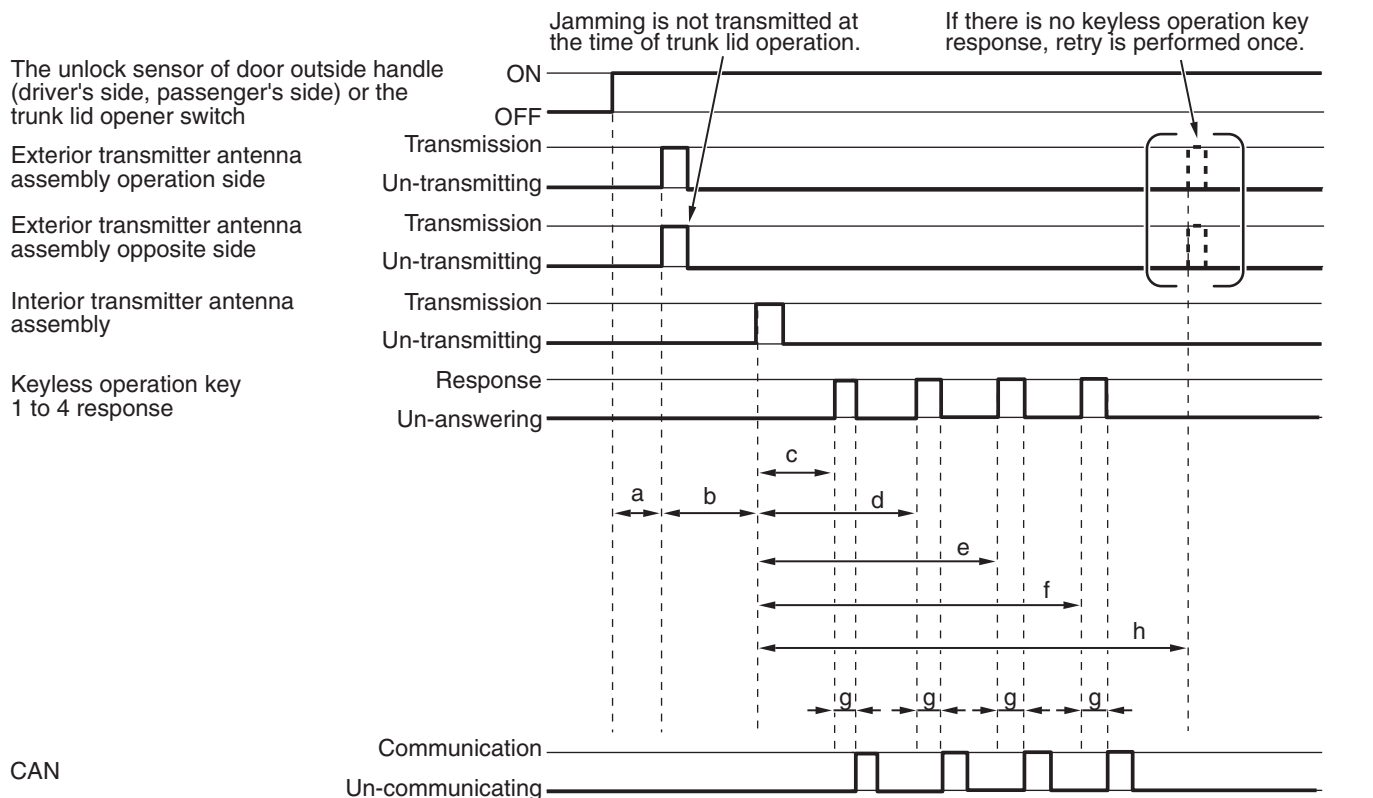
NOTE: *: In the communication for certification of the keyless operation key, KOS-ECU judges if the keyless operation key ID (specified to keyless operation key) contained in the response data from the keyless operation key coincides with the ID that has been stored in ECU by registration operation. 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 an 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 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 trunk lid opener 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: Keyless operation key 4 response time of onset 0.205 to 0.26 sec
g: CAN communication time of onset: to 0.3 sec
h: Retry time: It is variable by the registration number (at the time of 4 pieces registration 3.1 sec).

1. When KOS-ECU detects that the unlock sensor on the driver-side/front passenger-side door outside handle or the trunk lid opener 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 trunk lid opener switch 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 is transmitted from the exterior transmitter antenna assembly, the interior data is transmitted from the interior transmitter antenna assembly (front, rear).
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 received 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

Considering the customer pulls the door outer handle to make sure the doors are locked, unlocking operation is inhibited for three seconds after the doors are locked by the lock switches on the driver-side/front passenger-side door outside handle or on the trunk lid opener switch. This duration can be selected from zero, three seconds, and five seconds, and can be switched using a customization function (Refer to P.42B-27). The initial setting at factory is 3 seconds.

UNLOCKING OPERATION INHIBITION CONDITIONS

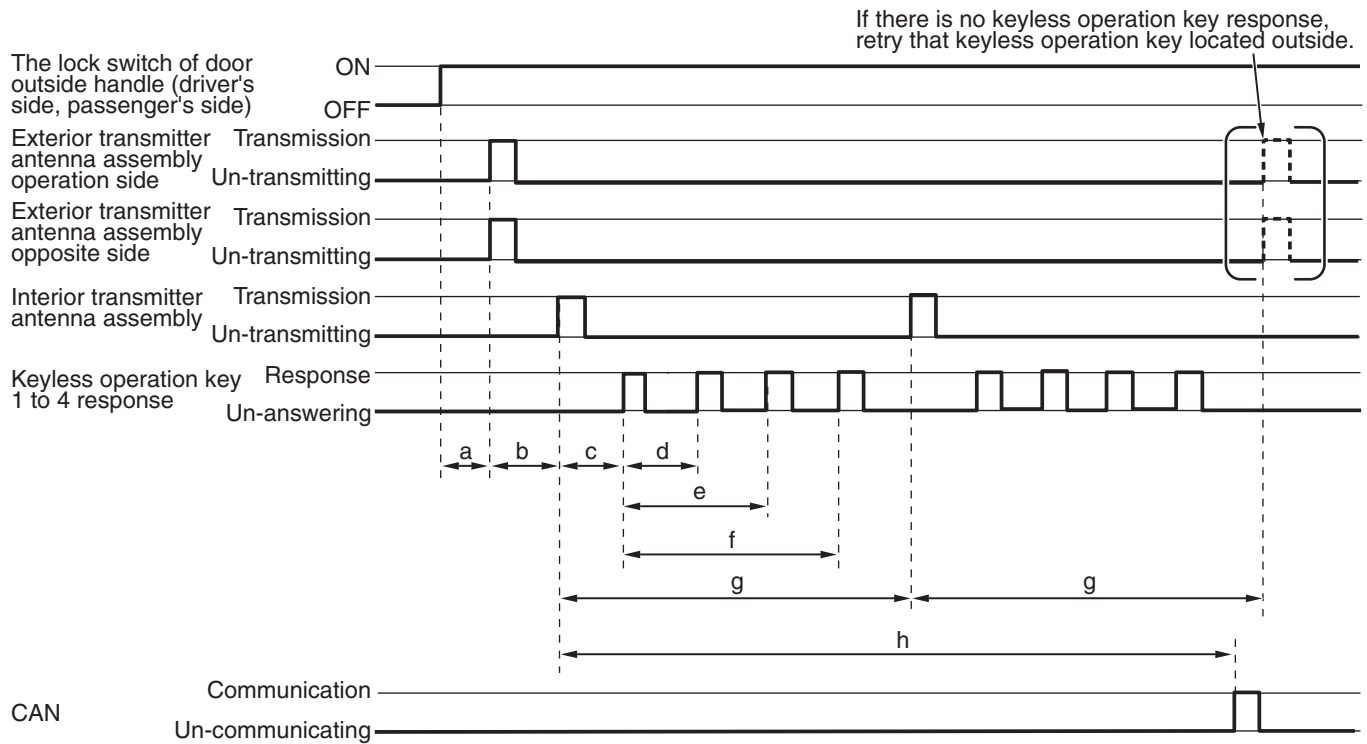
The door unlocking operation is inhibited when:

- The emergency key is in the ignition switch.
- The push switch in the steering lock is ON.
- The IG knob is in other than LOCK (OFF) position.
- 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 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.

CONTROL OF LOCKING OPERATION



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1. When KOS-ECU detects that the lock switch on the driver-side/front passenger-side door outside 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.)
2. After the exterior data is transmitted from the exterior transmitter antenna assembly, the interior data is transmitted from the interior transmitter antenna assembly (front, rear).
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 the locking operation.
4. KOS-ECU transmits the interior data from the interior transmitter antenna 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 the locking operation.
 - When all the responding keyless operation keys receive the exterior data only, KOS-ECU transmits the lock request to ETACS-ECU.
 - 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 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.)

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.
- 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.

- Any door 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.
- The IG knob is in other than LOCK (OFF) position.

**LOCKING OPERATION INHIBITION
CONDITIONS**

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

	Lock signal received	Unlock signal received
ETACS-ECU	Lock signal output	Unlock signal output
Hazard warning light	Flashes once	Flashes twice
Outer buzzer	Sounds once (initial setting) or none	Sounds twice (initial setting) or none

ANSWERBACK FUNCTIONS

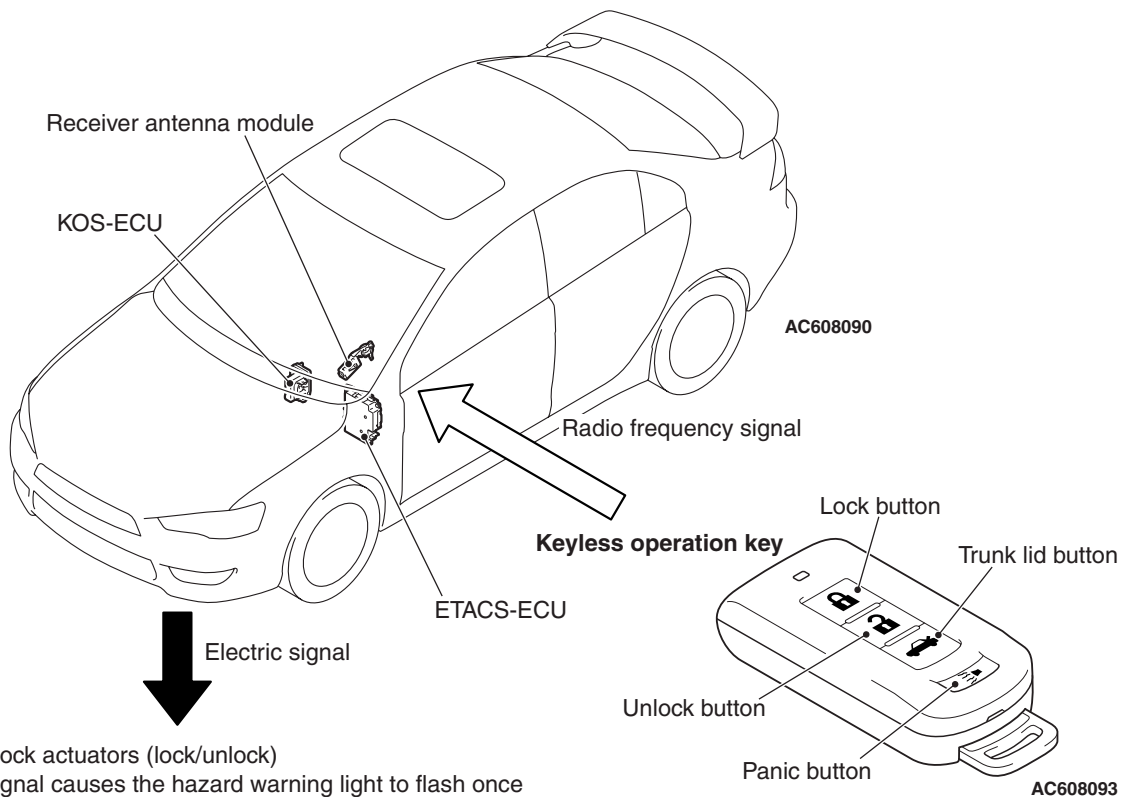
When KOS-ECU sends a signal to ETACS-ECU, ETACS-ECU outputs the lock/unlock signal and activates the hazard warning light and the outer buzzer to notify the driver the doors are locked/unlocked.

KOS TIMER LOCK FUNCTION

When none of the doors are 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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- Door lock actuators (lock/unlock)
- The signal causes the hazard warning light to flash once when the doors are locked, or flash twice when unlocked (Initial setting).
- The signal causes the dome light to extinguish when the doors are locked, or come on for 15 seconds when unlocked.

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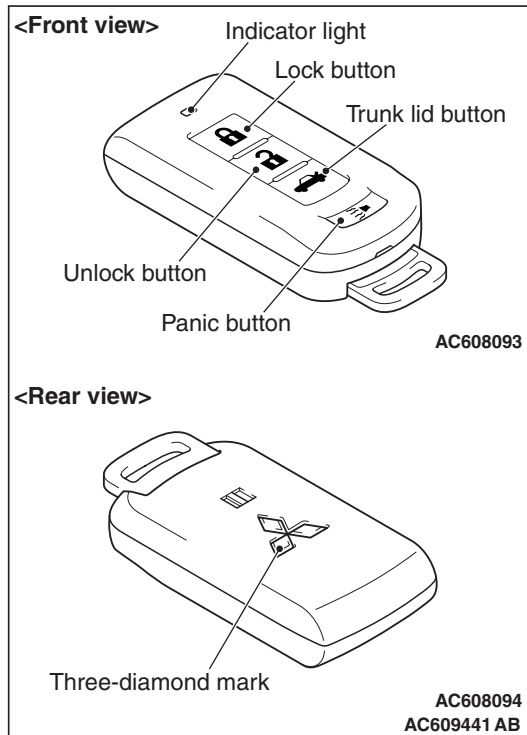
This keyless entry function has the following features: A keyless entry system enables locking and unlocking of all doors, the trunk lid from 12m (39.4 feet) away from the vehicle. The following features are also available.

- A four-knob type keyless operation key with lock, unlock, trunk lid and panic buttons.
- The receiver antenna module incorporates a receiver and a receiving antenna.

- Up to four encrypted codes can be registered using scan tool MB991958 (M.U.T.-III sub-assembly).
- Answerback functions
NOTE: The answerback function can be changed using a customisation function (Refer to P.42B-27).
- Keyless entry timer lock
NOTE: Timer of the keyless entry timer lock can be changed using a customization function (Refer to P.42B-27).

DESCRIPTION OF CONSTRUCTION AND OPERATION

KEYLESS OPERATION KEY

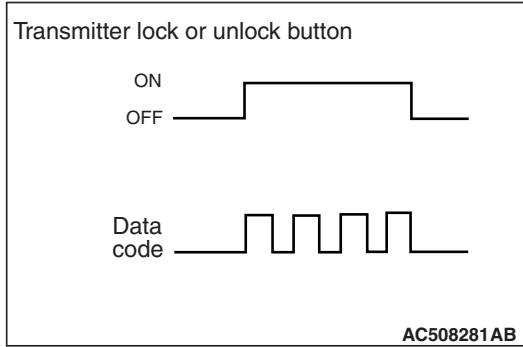


- The keyless operation key is integrated into the master key. The four-knob button is adopted, and the specific encrypted code is transmitted as radio wave signal.
- A brilliant silver three-diamond mark is stamped on the back side of the key grip to improve appearance.
- An indicator light, which illuminates when signals are sent, is added on the key grip. This indicator light informs you of the signal transmission status and warns you of flat battery.
- A signal transmission circuit (printed circuit) and a battery are housed in one case. The case is housed in the key grip, thus improving resistance to water ingress.
- A coin type battery, CR2032 is used in the keyless operation key.
- Using a customization feature, the keyless operation key operation can be changed (Refer to P.42B-27).
- The keyless operation key button operation allows the system to operate as follows:

KEYLESS OPERATION SYSTEM OPERATION TABLE (DEFAULT)

OPERATION OF KEYLESS OPERATION KEY		SYSTEM OPERATION	
Lock button	Press once	Lock all doors	
Unlock button	Press once	Unlock the driver's door	
	Press twice	Unlock all doors	
Trunk lid button	Press twice (press once, and then press again within 5 seconds)	Open the trunk lid	
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, trunk lid 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.

NOTE: 1A keyless operation key can be added without using the scan tool. <USA only>

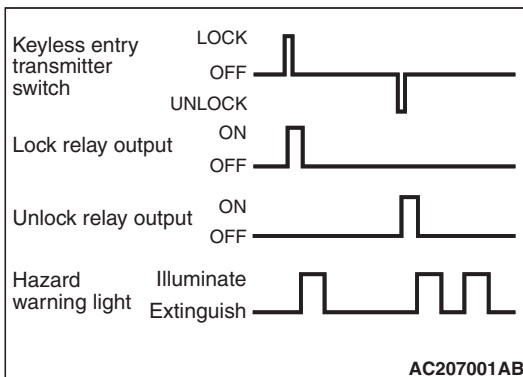
FUNCTION FOR CONFIRMING RECEIVER ANTENNA MODULE OUTPUT AND OPERATION

When the KOS-ECU receives an electric wave signal of the identification code stored in the receiver antenna module, the KOS-ECU outputs LOCK/UNLOCK signal to the ETACS-ECU and informs the driver of the keyless entry system operation by flashing the light and blowing horn (Answerback). The initial setting at factory for the answerback function is as the following table. Using a customization feature, the answerback function can be changed (Refer to P.42B-27).

FUNCTION TABLE FOR CONFIRMING KEYLESS ENTRY OPERATION (DEFAULT)

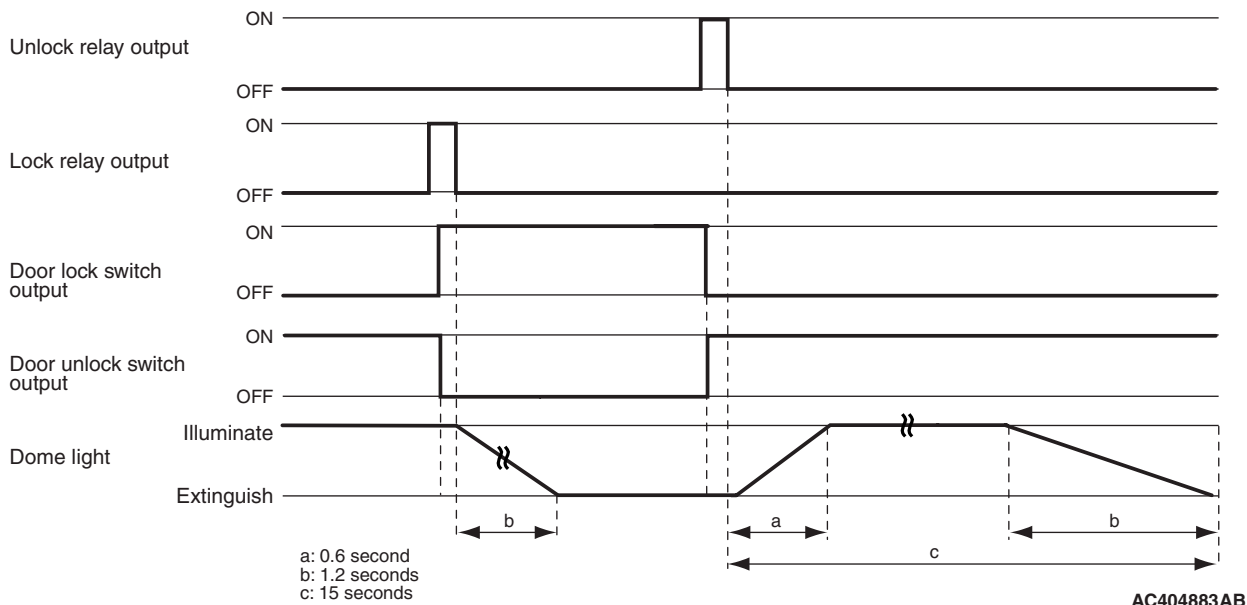
ITEM	OPERATION	
	DOORS LOCKED	DOORS UNLOCKED
ETACS-ECU (receiver antenna module)	Sends lock signal	Sends unlock signal
Dome light	Flashes once	Illuminates for 15 seconds
Turn-signal lights (RH and LH)	Flashes once	Flashes twice
Horn	Sounds once if doors are already locked	—

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, all doors are locked and the hazard warning light flashes once. When UNLOCK signal is input, all doors 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 extinguish*. 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

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 are 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 from being unlocked unexpectedly by operation errors. Using a customization function, the timer lock period can be changed (Refer to [P.42B-27](#)).

OPERATION INHIBITION CONDITIONS

The operation of the system is inhibited when:

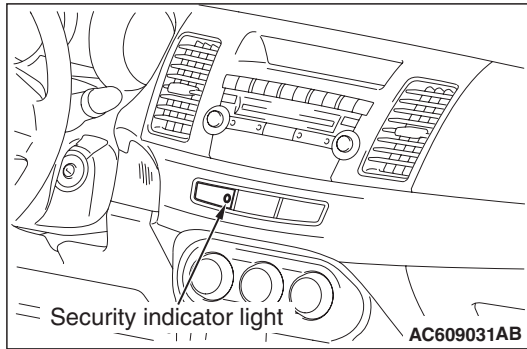
- The ignition key is in the ignition switch.

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 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 GROUP 54A, Security alarm [P.54A-37](#)). This customization function is described in the owner's manual.

SECURITY INDICATOR LIGHT

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

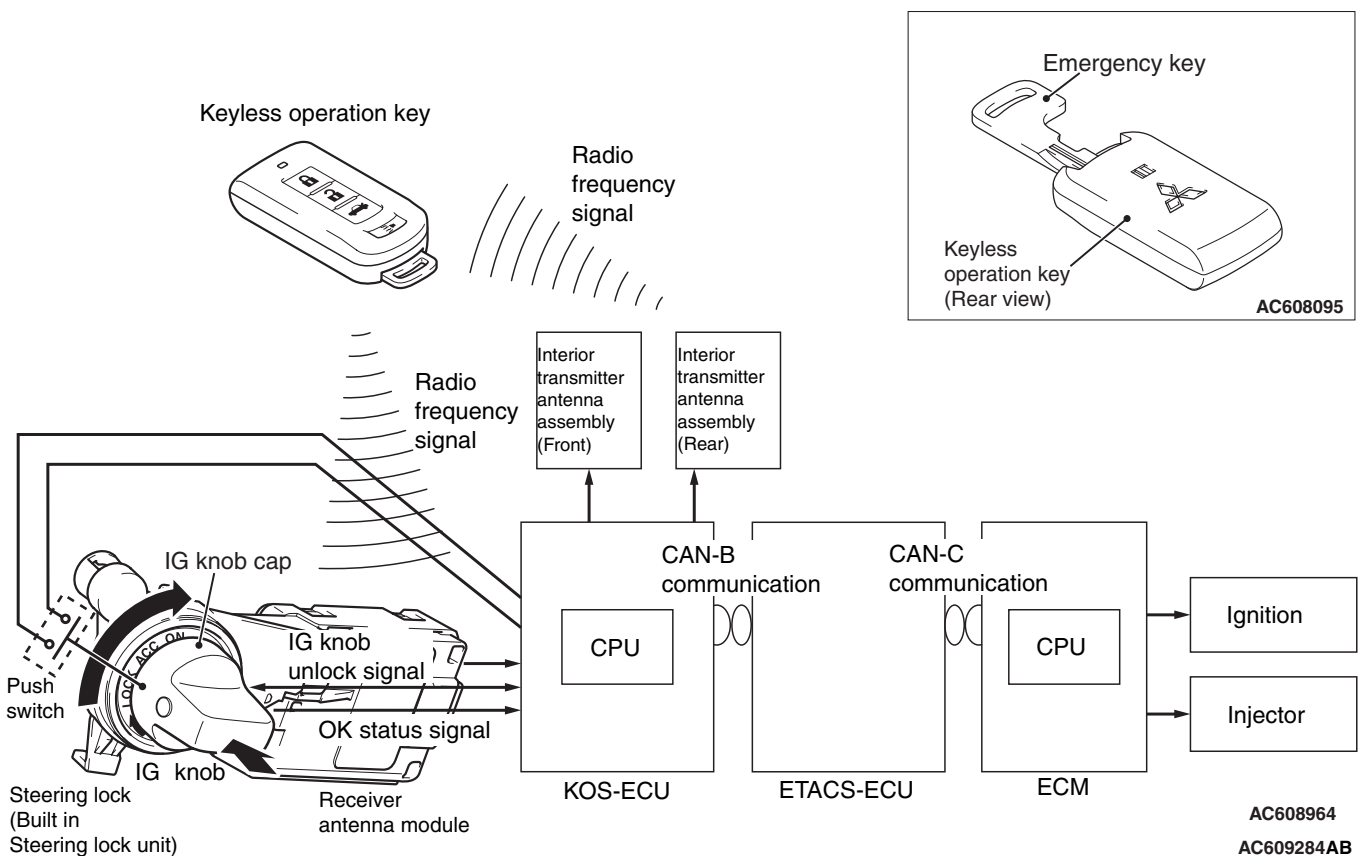


ENGINE STARTING FUNCTION

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When carrying the keyless operation key, a driver can start/stop the engine by operating the IG knob, not 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 key ID 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 .)
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 this data coincides, 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.

KEYLESS OPERATION KEY TAKE OUT MONITORING FUNCTION

To prevent the engine from starting 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.

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 ECM 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.*

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 regis-

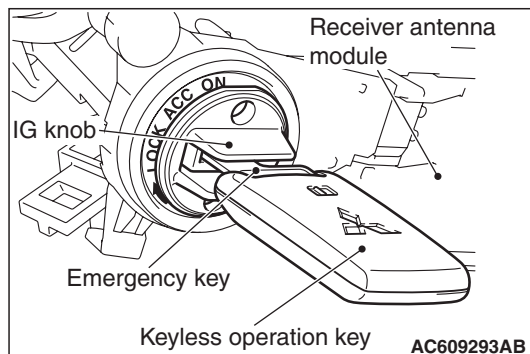
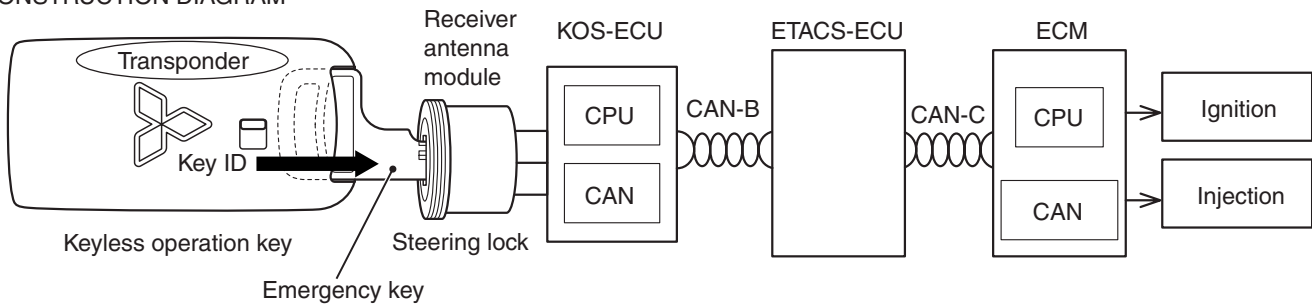
tered keyless operation keys sends a response, KOS-ECU determines that the key has been brought into the vehicle (replaced), and sets the keyless operation key certification agreement memory to "exist," and permits starting of the engine.

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



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

1. Inversely insert the emergency key in the keyless operation key, insert that in KOS steering lock, and then press and turn the emergency key using the keyless operation key.
2. When the emergency key is turned to the ON position, the transponder (a small transmitter) incorporated in the keyless operation key transmits a key-specific ID code (key ID) to the receiver antenna module by radio wave.

3. The KOS-ECU compares the ID code that was sent with pre-registered ID codes, and only when the code matches, the KOS-ECU controls the ECM.
4. Since the power to the transponder incorporated in the keyless operation key is supplied from the receiver antenna module, the keyless operation key can be used even when its battery is discharged. Two keyless operation keys are provided for each vehicle, and up to four keys can be registered as needed. In addition, the emergency keys can be registered as many as the keyless operation keys. There are one trillion possible combination for the registered ID codes which improves security by preventing theft using a copied ID code.

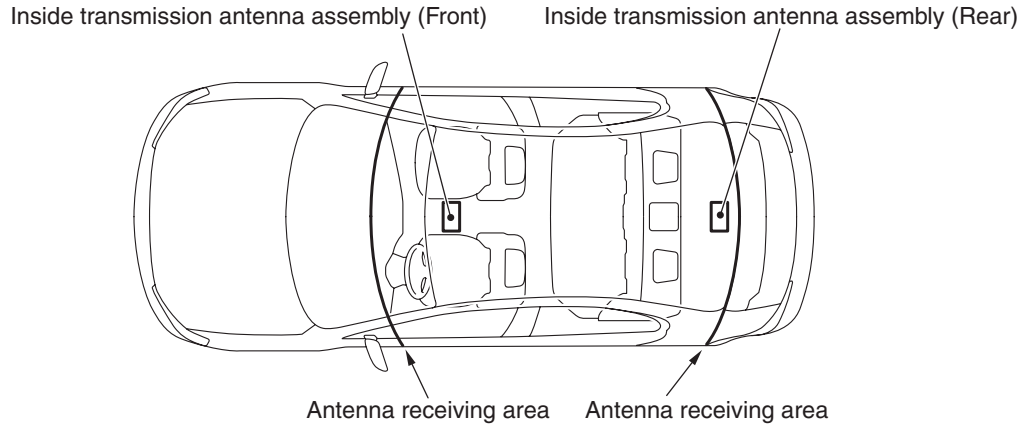
NOTE: If KOS-ECU is replaced, or if the keyless operation key is lost or the additional key is added, all the keyless operation key ID codes must be re-registered using the scan tool. (A key can be added without using the scan tool. <USA only>)

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ENGINE STARTING FUNCTION VALID AREA

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



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TIRE PRESSURE MONITORING SYSTEM (TPMS) FUNCTION

M2421000600011

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 transmitter 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. It receives the atmospheric pressure signal from ECM, and when the atmospheric pressure is low (such as at high altitude), it calibrates the tire pressure received from TPMS transmitter and makes a judgment of warning. 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.

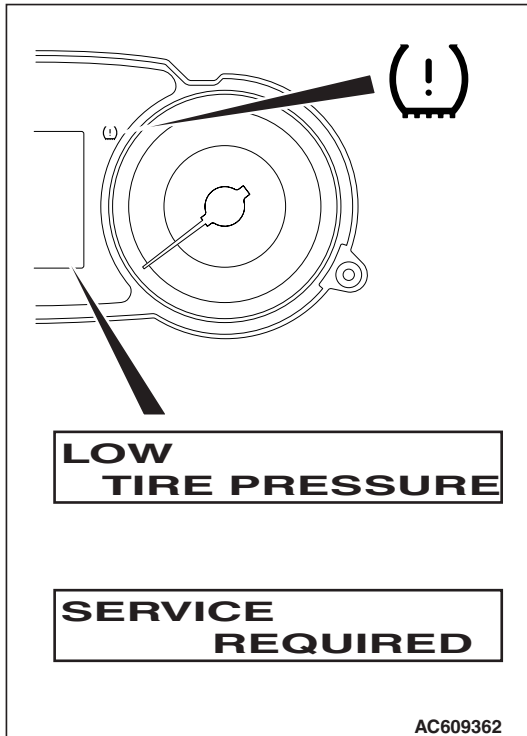
NOTE: If the TPMS transmitter is replaced, register the ID codes of all the TPMS transmitters again using the M.U.T.-III.

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 (25.2) or less
Alarm OFF pressure	189 (27.4) or more

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, and change tire pressure sampling and data transmission timing when vehicle is running.

NOTE: Use only genuine wheels. The use of non-genuine wheels may cause the improper installation of the TPMS transmitters, possibly resulting in air leakage and damage to the TPMS transmitter.

TIRE PRESSURE SAMPLING TIMING

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

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*
At vehicle stationary	once every 13 hours

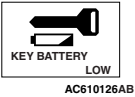

If a sampled pressure varies by ± 10 kPa (1.5psi) from the last transmitted pressure value, an additional transmission will occur.



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


WARNINGS/ALARMS

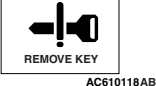

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If the KOS failed, operated improperly, KOS-ECU warns the driver of this by setting off the outer tone alarm and the keyless operation warning indicator, on the multi information display in the combination meter. If the TPMS fails or the tire pressure is low, KOS-ECU warns the driver of that state by the TPMS warning light and the multi information display in the combination meter.

Display contents	Item	State	Warning operations		Warning cancellation conditions (Cancels warning operations when one of the conditions met)
			TPMS warning light	Multi information display	
 KEY BATTERY LOW AC610126AB	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"> Warning indicator flashes for 30 seconds. The outer tone alarm will not sound. 	<ul style="list-style-type: none"> IG knob in "LOCK" (OFF) position and push switch OFF are detected. 30 seconds have passed after the warning output started.
 KEY MISSING AC610127AB	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"> The warning indicator flashes for 5 minutes. The outer tone alarm will not sound. 	<ul style="list-style-type: none"> IG knob in "LOCK" (OFF) position and push switch OFF are detected. 5 minutes have passed after the warning output started.

Display contents	Item	State	Warning operations		Warning cancellation conditions (Cancels warning operations when one of the conditions met)
			TPMS warning light	Multi information display	
	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"> • The warning indicator flashes for 5 minutes. • The outer tone alarm will not sound. • Key reminder warning tone alarm sounds until closing of the driver's door is detected. 	<ul style="list-style-type: none"> • 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. • The driver's door is detected closed from the open position. • 5 minutes have passed after the warning output started.
	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"> • The warning indicator flashes for 5 minutes. • Outer tone alarm sounds for 5.69 seconds in pattern 2. 	<ul style="list-style-type: none"> • IG knob in "LOCK" (OFF) position and push switch OFF are detected. • KOS-ECU has detected a keyless operation key inside the vehicle. • 5 minutes have passed after the warning output started.

Display contents	Item	State	Warning operations		Warning cancellation conditions (Cancels warning operations when one of the conditions met)	
			TPMS warning light	Multi information display		
	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"> Warning indicator flashes for 5 seconds. Outer tone alarm sounds for 2.96 seconds in pattern 1. 	<ul style="list-style-type: none"> IG knob in "LOCK" (OFF) position and push switch OFF are detected. 5 seconds have passed after the warning output started. 	
		Push switch is pressed ON when the keyless operation key is inside the car.				<ul style="list-style-type: none"> Lock switch on the keyless operation switch is pressed again. 5 seconds have passed after the warning output started.
		Push switch is pressed ON when the door is ajar.				

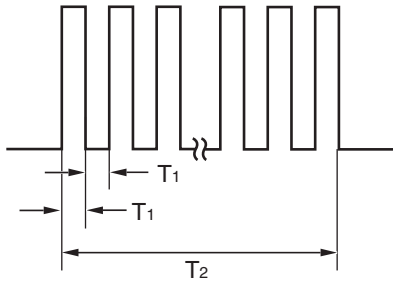
Display contents	Item	State	Warning operations		Warning cancellation conditions (Cancels warning operations when one of the conditions met)
			TPMS warning light	Multi information display	
	System error	Push switch is pressed ON from OFF when an error has been detected in EEPROM in KOS-ECU.	-	<ul style="list-style-type: none"> The warning indicator flashes for 5 minutes. The outer tone alarm will not sound. 	5 minutes have passed after the push switch was pressed ON and IG knob is in "LOCK" (OFF) position.
		Push switch is pressed ON from OFF while open circuit in the transmitter antennas are being detected.			
		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.			
		Steering lock communication error has been detected when the push switch was pressed ON.			
		The IG knob is in other than the LOCK position while some error is being detected.			
	TPMS warning light bulb open circuit check	The ignition switch is turned from "LOCK" (OFF) to "ON."	Illuminates for 3 seconds.	-	3 seconds have passed after the TPMS warning light is lit.
^a 	Tire pressure alarm	The received tire pressure value is under the alarm ON threshold value.	Illuminates.	Symbol and "LOW TIRE PRESSURE" is displayed.	The received tire pressure value is over the alarm OFF threshold value.

Display contents	Item	State	Warning operations		Warning cancellation conditions (Cancels warning operations when one of the conditions met)	
			TPMS warning light	Multi information display		
	TPMS failure warning	ID not stored	The TPMS transmitter ID is not registered in the KOS-ECU.	Flashes *	Symbol and "SERVICE REQUIRED" is displayed.	ID is registered normally.
		Defective EEPROM	Abnormality of data in the EEPROM of the KOS-ECU is detected.			Data in the EEPROM of the KOS-ECU is checked to be normal.
		Problem in signal reception	The signals from TPMS transmitters cannot be received while driving for about 20 minutes.			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:

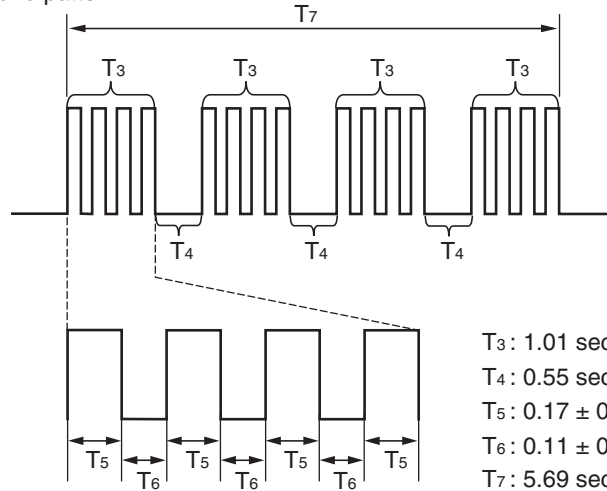
*: Change to continuous illumination after flashing for about 1 minute.

<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

AC501053AC

CONFIGURATION FUNCTION

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Using the scan tool, the following functions can be programmed. The programmed information is held even when the battery is disconnected.

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) (default <Vehicles without central door locking system>)
		7.5sec	7.5 seconds
		15sec	15 seconds
		30sec	30 seconds (default <Vehicles with central door locking system>)
		60sec	60 seconds
		120sec	120 seconds
		180sec	180 seconds

Adjustment item (scan tool MB991958 display)	Adjustment item	Adjusting contents (scan tool MB991958 display)	Adjusting contents
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
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
Auto door unlock by P position	Auto door unlock by P position function <Vehicles with central door locking system>	Disable	No function (default)
		Always enabled	Always with function
Duration of horn chirp	Horn sounding time during horn answer back	Short	0.01 second (default)
		Long	0.02 second
Horn chirp by keyless	Horn chirp by keyless entry system	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)

Adjustment item (scan tool MB991958 display)	Adjustment item	Adjusting contents (scan tool MB991958 display)	Adjusting contents
Buzzer answer back	Adjusts the tone alarm answer back function.	Not sound buzzer	No function
		At keyless	Sounds when the keyless entry system is activated.
		At F.A.S.T.	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
Panic alarm switch	With/without panic alarm function	Disable	No function
		Enable	With function (default)
F.A.S.T. key out of car	With/without KOS key exterior detection function	Enable	No function
		Disable	With function (default)
F.A.S.T. 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.
F.A.S.T. unlock disable time	Adjusts the door unlock inhibition period after door lock is activated.	0sec	0 seconds
		3sec	3 seconds (default)
		5sec	5 seconds

NOTES