

## GROUP 42C

# WIRELESS CONTROL MODULE (WCM)

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## GENERAL INFORMATION

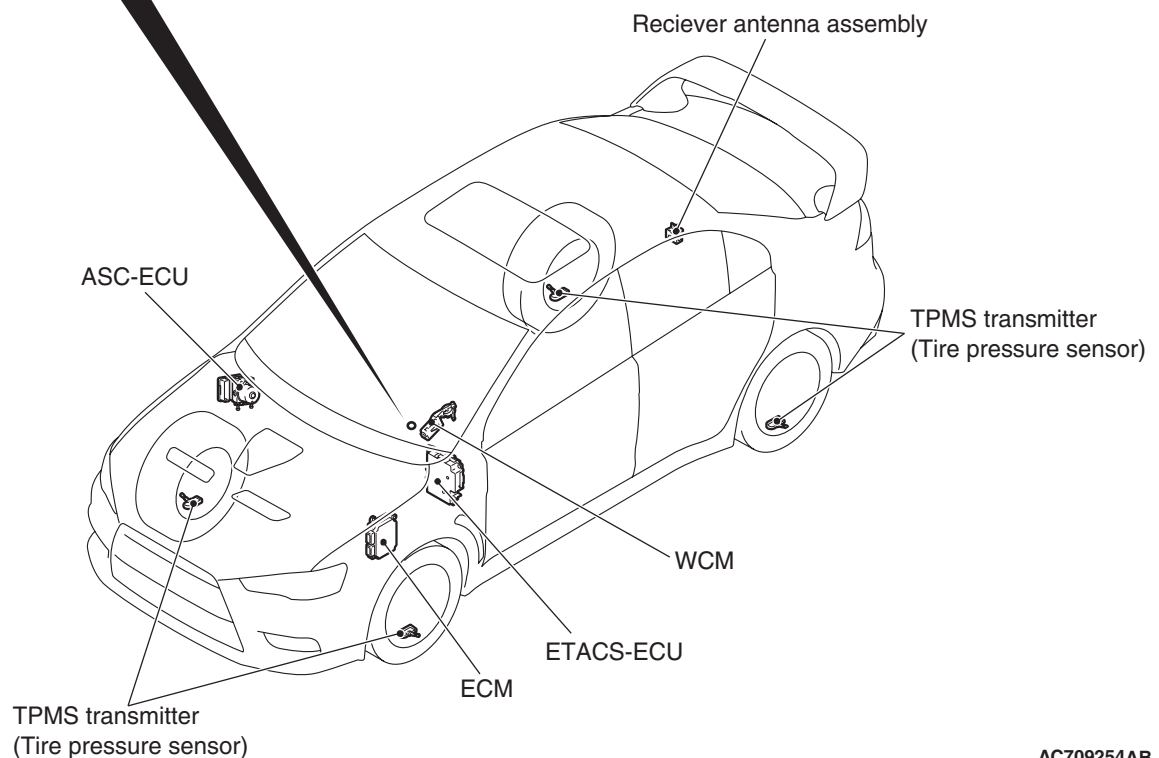
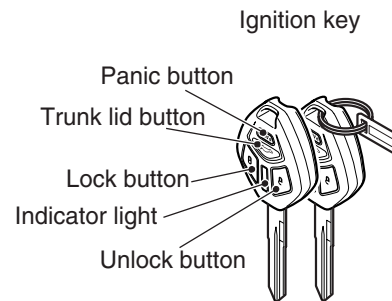
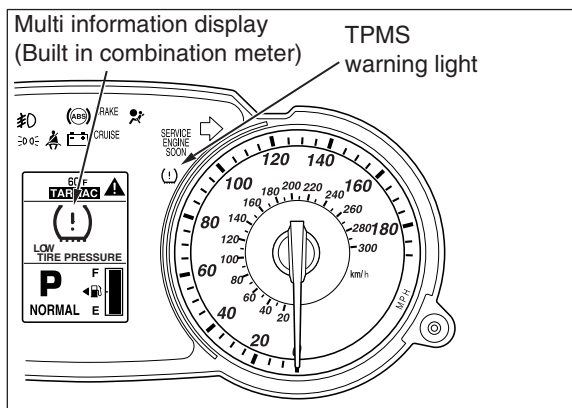
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The wireless control module (WCM) is a system that integrates the keyless entry function, with which remote operation (opening/closing of all doors, opening of trunk lid, and operation of warning function that warns a person who intends to damage the vehicle\*), can be performed by operating the lock/unlock button, trunk lid button or panic button on the ignition key (transmitter). Also, WCM incorporates the immobilizer function, which prohibits the starting of engine using an unauthorized key, and the tire pressure monitoring system (TPMS), which issues a warning to a driver by illuminating or flashing the warning light if an abnormality to the tire pressure or the system error is detected. WCM has the following features:

- The ignition key has 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.42C-5.)
- Each vehicle is provided with two ignition keys, and up to eight ignition keys can be registered.
- Settings of the keyless entry function can be adjusted using a customization function (Refer to P.42C-14).

**NOTE:** \*: Horn sounds, and headlights and taillights flash.

## CONSTRUCTION DIAGRAM



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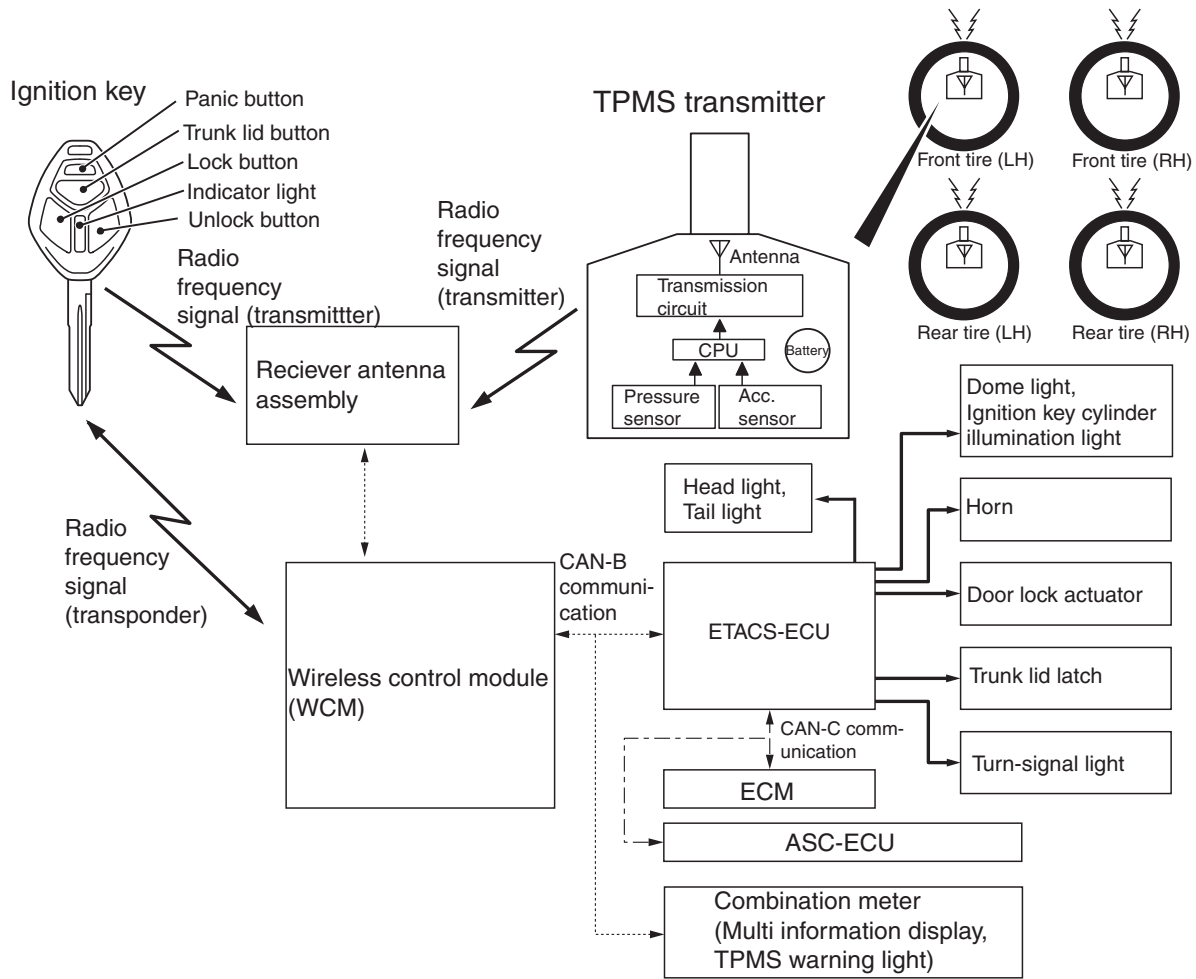
**Main components and functions**

<b>Parts name</b>	<b>Functional description</b>
WCM	Controls the keyless entry functions, TPMS functions and starting of the engine by using the following communications. <ul style="list-style-type: none"> <li>• Communications with ETACS-ECU, ECM, ASC-ECU and combination meter via CAN</li> <li>• Wireless communication with the ignition key (transponder)</li> <li>• Wireless communication with the ignition key (transmitter) via the receiver antenna assembly</li> </ul>
Receiver antenna assembly	Receives the operation signals from the lock/unlock buttons, trunk lid button, and panic button on the ignition key (transmitter) as well as the tire pressure signal from the TPMS transmitter. Then, transmits them to WCM.
Ignition key	The ignition key (transponder) receives signals sent from WCM, certifies the key ID code, calculates the key ID, and sends the reply data signal to WCM. The ignition key (transmitter) also sends signals to receiver antenna assembly when the lock/unlock/trunk lid button and the panic button on it are operated.
Combination meter (Multi information display, TPMS warning light)	Communicates with WCM via CAN. Send ignition switch status. Receives the warning request or warning information about TPMS from WCM, activates* the TPMS warning light. Warning symbol and message is additionally displayed on the multi information display.
ETACS-ECU	Communicates with WCM via CAN. By the door lock/unlock request, trunk open request, or panic alarm request from WCM, ETACS-ECU outputs the lock/unlock signal, trunk open signal, or panic alarm signal. When the door lock/unlock signal is output, ETACS-ECU flashes or illuminates the turn signal light and dome light to notify that the lock/unlock operation is performed.
ASC-ECU	Communicates with WCM via CAN. Sends the vehicle speed data.
ECM	Communication with WCM via CAN. Send atmospheric pressure data..
TPMS transmitter	Measure tire pressure directly, then send radio frequency signal to receiver antenna assembly.

**NOTE:**

- \*: *Illuminates for tire pressure warning.*
- \*: *Flashes for about 1 minute and then continuously illuminated for TPMS malfunction warning.*

System configuration



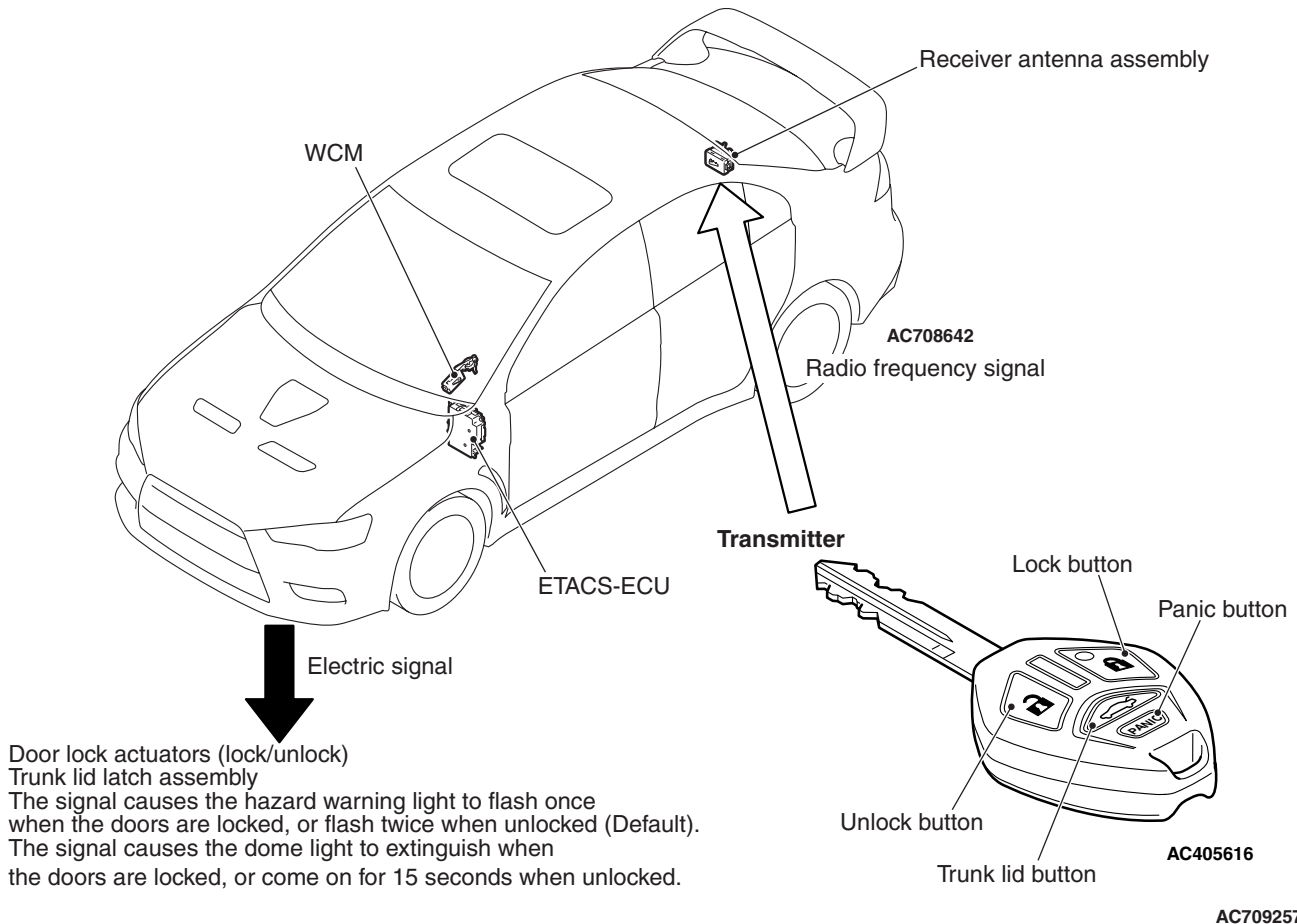
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*NOTE: In case of replacement of WCM, all keyless ID, key ID and tire pressure sensor ID should be re-registered using scan tool MB991958 (M.U.T.-III sub-assembly).*

## SYSTEM OPERATION

### KEYLESS ENTRY FUNCTION

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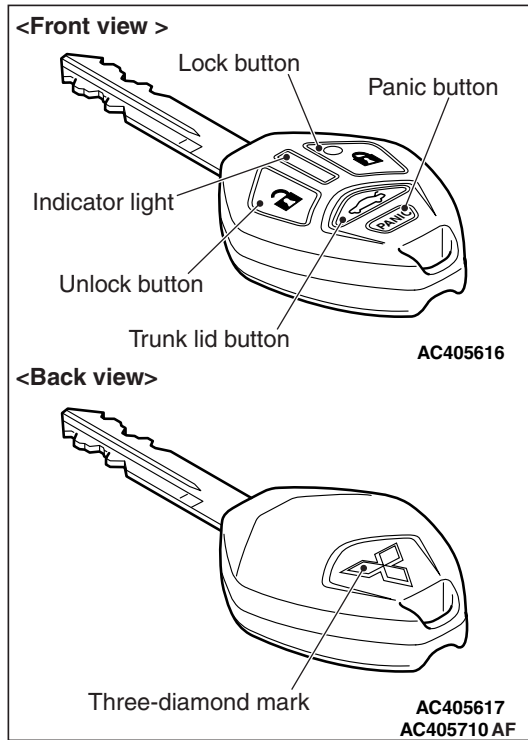
This keyless entry function has the following features: A keyless entry system enables locking and unlocking of all doors, the trunk lid from 12m (39.4 feet) away from the vehicle. The following features are also available.

- A four-knob type transmitter with lock, unlock, trunk lid and panic buttons.
- The receiver antenna assembly incorporates a receiver and a receiving antenna.

- Up to eight key ID can be registered using scan tool MB991958 (M.U.T.-III sub-assembly).
- Answerback functions  
*NOTE: The answerback function can be changed using a customization function (Refer to P.42C-14).*
- Keyless entry timer lock  
*NOTE: Timer of the keyless entry timer lock can be changed using a customization function (Refer to P.42C-14).*

**DESCRIPTION OF CONSTRUCTION AND OPERATION**

**TRANSMITTER**

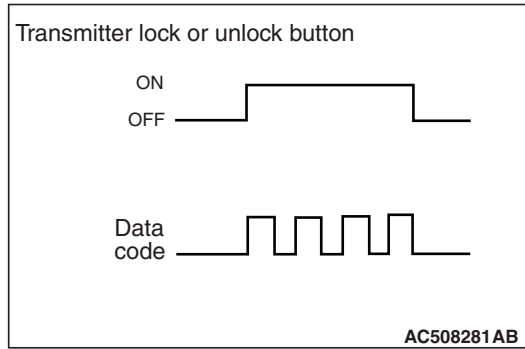


- The transmitter is integrated into the master key. The four-knob button is adopted, and the specific encrypted code is transmitted as radio wave signal.
- An indicator light, which illuminates when signals are sent, is added on the key grip. This indicator light informs you of the signal transmission 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, CR1620 is used in the transmitter.
- The functions of the immobilizer system are integrated (Refer to P.42C-9).
- Using a customization feature, the transmitter button operation can be changed (Refer to P.42B-28).
- The transmitter button operation allows the system to operate as follows:

**KEYLESS ENTRY FUNCTION OPERATION TABLE (DEFAULT)**

Operation of transmitter		Operation of keyless entry function	
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 assembly together with the receiving antenna. The receiver outputs the signal which the antenna received from transmitter to WCM, and WCM compares it with the registered encrypted code. Only when the signal and the code match, a signal is output from WCM to ETACS-ECU. By connecting the scan tool MB991958 (M.U.T.-III sub-assembly) to the data link connector, encrypted codes of up to eight transmitters can be registered.

*NOTE: 1A transmitter can be added without using the scan tool. <USA only>*

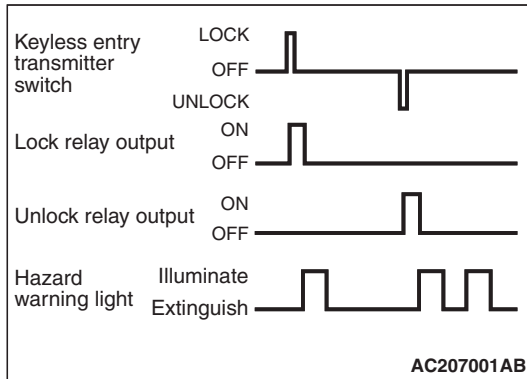
## FUNCTION FOR CONFIRMING RECEIVER ANTENNA ASSEMBLY OUTPUT AND OPERATION

When WCM receives an electric wave signal of the identification code (lock/unlock signal) stored in WCM, WCM outputs the lock/unlock signal to ETACS-ECU. When the lock/unlock signal is input, ETACS-ECU outputs the lock/unlock signal and, at the same time, notifies using the light and horn that the keyless entry is operated (answerback). The initial setting at factory for the answerback function is as following table. Using a customization feature, the answerback function can be changed (Refer to P.42C-14).

### FUNCTION TABLE FOR CONFIRMING KEYLESS ENTRY OPERATION (DEFAULT)

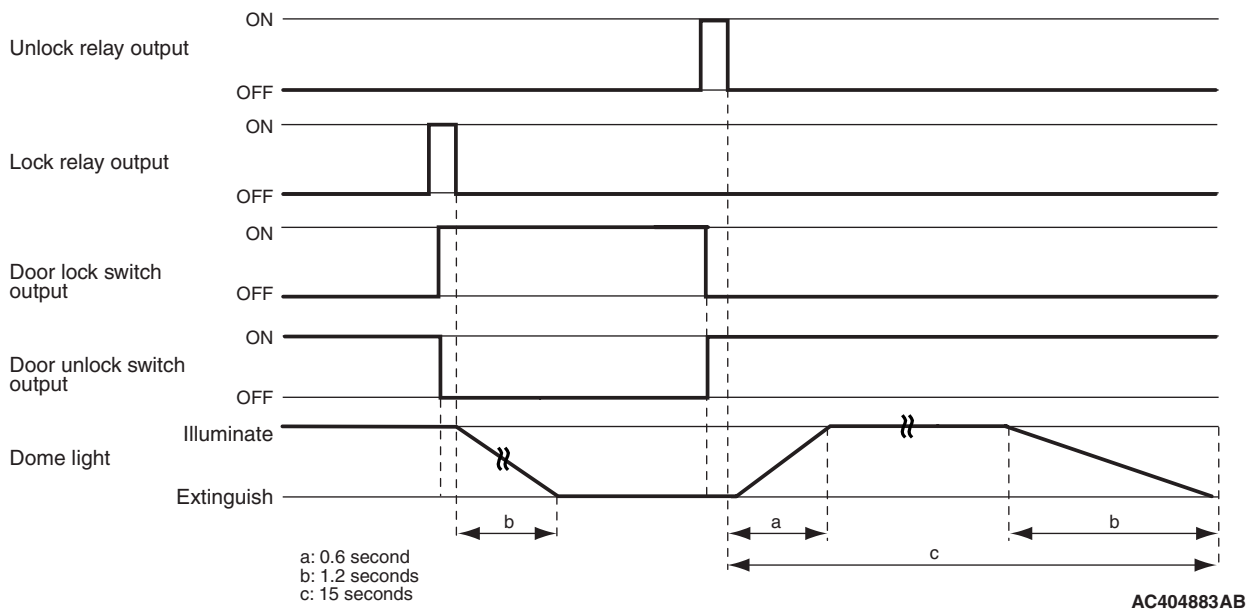
Item	Operation	
	Doors locked	Doors unlocked
ETACS-ECU (WCM)	Sends lock signal	Sends unlock signal
Dome light	Flashes once	Illuminates for 15 seconds
Turn-signal lights (RH and LH)	Flashes once	Flashes twice
Horn	Sounds once if doors are already locked	–

**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 transmitter 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 transmitter is input from WCM to ETACS-ECU, all doors are locked, and the dome light is turned off in synchronization with the hazard light answerback (when the dome light is illuminated, the light extinguishes). Also, when UNLOCK signal from the transmitter is input from WCM to ETACS-ECU, all doors are unlocked, and the dome light illuminates for 15 seconds in synchronization with the hazard light answerback.

*NOTE: \*: If doors are locked with the transmitter 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 transmitter when the dome light is OFF, the dome light does not work.*

**KEYLESS ENTRY HORN ANSWERBACK FUNCTION**

When WCM receives the LOCK signal from the transmitter and send LOCK signal to ETACS-ECU, all doors are locked and the horn sounds. If the driver's door cannot be locked even when the keyless entry transmitter is operated, the horn does not sound.



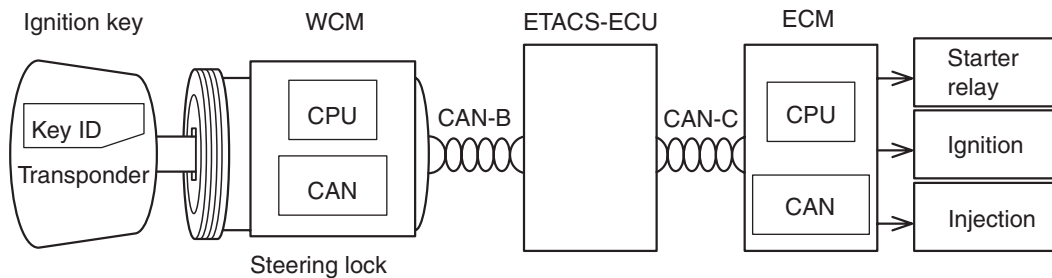
## KEYLESS ENTRY TIMER LOCK TIME

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 from being unlocked unexpectedly by operation errors. Using a customization function, the timer lock time can be changed (Refer to P.42C-14).

## IMMOBILIZER FUNCTION

The immobilizer function prevents the engine from starting and immobilizes the vehicle if a key other than the key registered for that vehicle is used in an attempt to start the engine after forced entry.

## CONSTRUCTION DIAGRAM



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## OPERATION

1. With the ignition key turned ON, the transponder (a small transmitter) integrated in the ignition key transmits its own ID code (key ID) to WCM via radio wave.
2. According to the sent key ID, WCM controls the ECM only when the sent ID code agrees with the pre-registered one.
3. The system is designed to be maintenance-free because the power source for the transponder is supplied by WCM. Two ignition keys are provided, and up to eight ignition keys can be registered to one vehicle as needed. More than one trillion of 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: In case of replacement of WCM, or loss or addition of the ignition key, all key ID codes should be re-registered using scan tool. (A key can be added without using the scan tool. <USA only>)*

### **CAUTION**

**Do not register the key that has already been registered for other vehicle.**

**TIRE PRESSURE MONITORING SYSTEM (TPMS) FUNCTION**

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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 receiver antenna assembly and sent to WCM.
- WCM processes input signals from each TPMS transmitter as well as vehicle speed signals from the ABS-ECU if equipped. 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.*

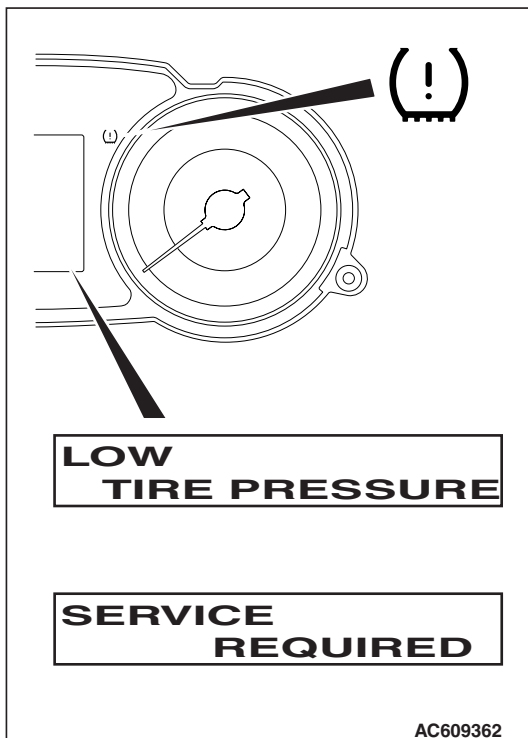
- For 3 seconds after the ignition switch is turned to the "ON" position, WCM illuminates the TPMS warning light to check any breaks in the TPMS warning light circuit.
- By connecting the scan tool to the data link connector, data stored in WCM (data of tire pressure and TPMS transmitter ID, the alarm 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 scan tool.*

**TPMS WARNING LIGHT**

The TPMS warning light on the combination meter illuminates or flashes\* to alert the driver by request from WCM. 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

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

**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 WCM via receiver antenna assembly. 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  $\pm 10$  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**

If the TPMS fails or the tire pressure is low, the WCM 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	
Not displayed	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.
	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	
b 	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.
		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.

## CUSTOMIZATION FUNCTION

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By operating the ETACS system or MMCS of scan tool MB991958, 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	0 sec	0 second (no delay shutdown time)
		7.5 sec	7.5 seconds
		15 sec	15 seconds
		30 sec	30 seconds (default)
		60 sec	60 seconds
		120 sec	120 seconds
		180 sec	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 <Vehicles with TC-SST>	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

<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 keyless	Horn chirp by keyless entry system <vehicles without auto light>	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)
	Horn chirp by keyless entry system <vehicles with auto light>	Not sound horn	No horn answerback function
		Lock any time	The horn sounds when the lock button of keyless entry transmitter is pressed once.
		Lock/auto ON	During daytime, while the lighting switch is in the AUTO position, the horn sounds once when the lock is pressed once.
		W lock any time	The horn sounds when the lock button of keyless entry transmitter is pressed twice. (default)
	Timer lock timer	Timer lock period adjustment	30 sec
60 sec			60 seconds
120 sec			120 seconds
180 sec			180 seconds
Panic alarm switch	With/without panic alarm function	Disable	No function
		Enable	With function (default)

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## NOTES