
GROUP 54B

SMART WIRING SYSTEM (SWS)

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GENERAL INFORMATION

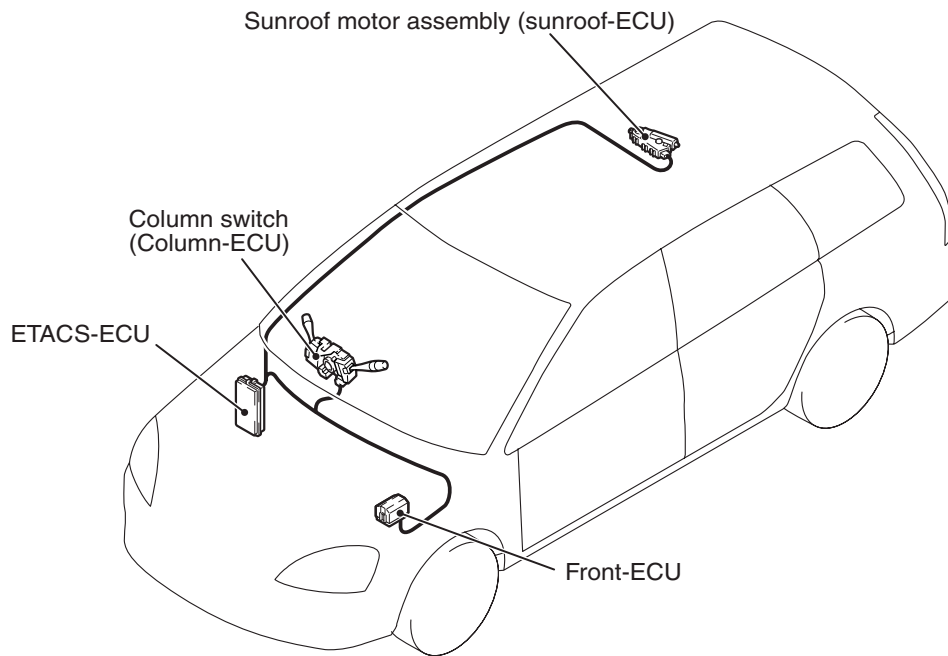
M2541000100598

SWS is a simplified wiring system which transmits numerous signals using one wiring to control against increased weight and complication of harnesses which result from the increase in electronic accessories.

To transmit numerous signals, the ETACS^{*}-ECU, column switch (incorporating inside the column-ECU), front ECU and sunroof motor assembly (sunroof-ECU) incorporate multi-distribution circuits to carry out communication between control units.

NOTE: *: ETACS (Electronic Time and Alarm Control System)

CONSTRUCTION DIAGRAM

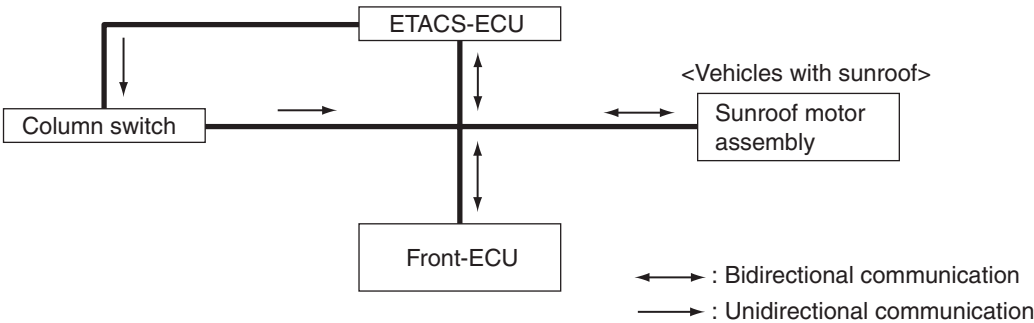


AC403298AB

COMMUNICATION METHOD

M2541001000389

The exclusive signal lines for transmitting the multi-distribution data are connected as follows between the ETACS-ECU, column switch (incorporated inside the column-ECU), front-ECU, and sunroof motor assembly (incorporated inside the sunroof-ECU) for internal communication.



AC403280

MULTI-DISTRIBUTION INPUT/OUTPUT BY CIRCUIT

M2541002000564

Multi-distribution is employed by the following circuits. The relation of the input switches, sensors, ECUs connected by multi-distribution lines, and outputs are also shown below.

Buzzer

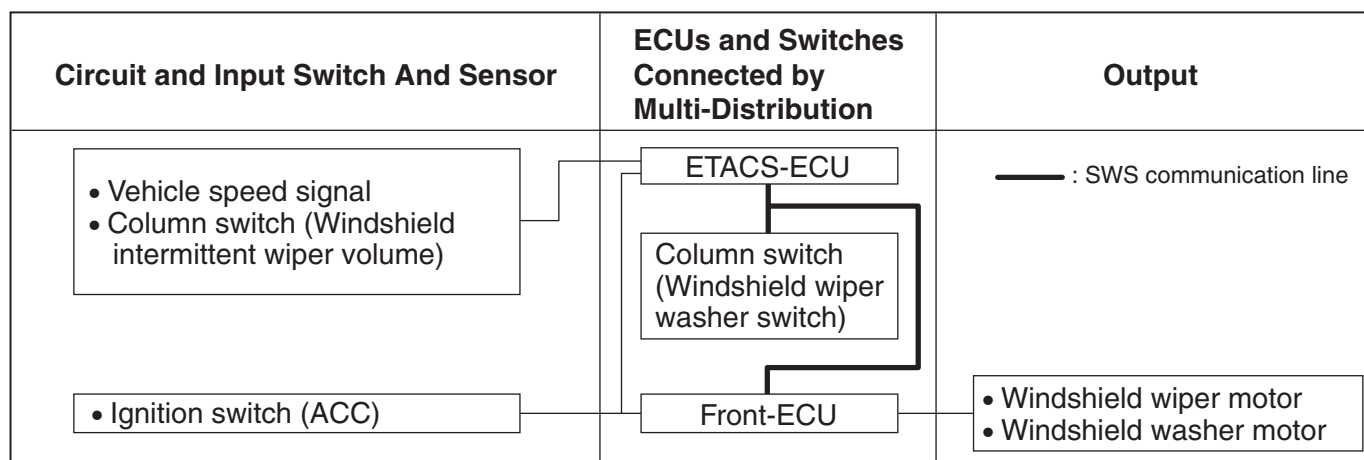
- Lamp reminder buzzer function

Circuit and Input Switch	ECUs and Switches Connected by Multi-Distribution	Output
<ul style="list-style-type: none">Ignition switch (IG1)Driver's door switch	<div>Column switch (Lighting switch)</div> <div>ETACS-ECU</div>	<div>Buzzer (built-in ETACS-ECU)</div> <p>— : SWS communication line</p>

AC212519AD

Windshield wiper washer

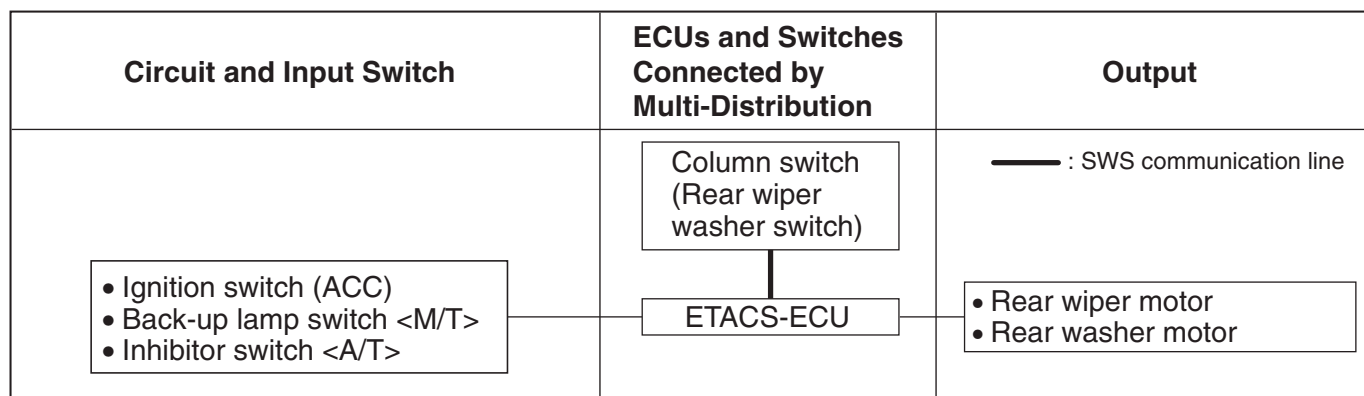
- Windshield mist wiper
- Vehicle speed-dependent variable windshield intermittent wiper
- Windshield low speed wiper
- Windshield high speed wiper
- Windshield washer



AC212521AC

Rear wiper washer

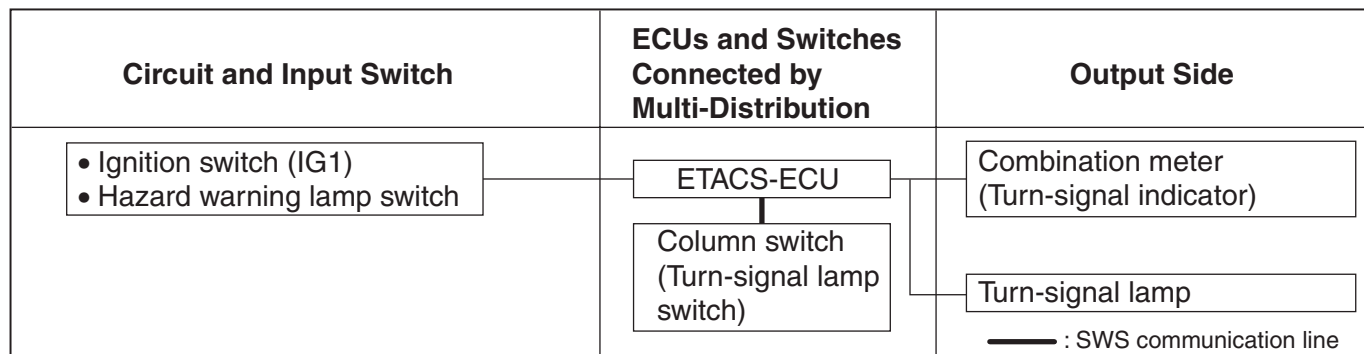
- Rear wiper
- Rear washer



AC212522AD

Turn-signal lamp

- Turn-signal lamp
- Hazard warning lamp



AC212524AB

DIAGNOSTIC FUNCTION

M2541003000556

DIAGNOSIS CODE READING

The ETACS-ECU sends diagnosis codes if the communication line is faulty when the M.U.T.-II/III is connected.

CAUTION

Although the ETACS-ECU can deal with impact detection door unlock function, the vehicles is not equipped with the function. Therefore, the SRS-ECU and vehicles harness are not provided as part of the function in the vehicle. Consequently, whenever inspection of the ETACS-ECU is carried out with diagnosis codes, code No.31 and No.32 (communication system with the SRS-ECU) are output. Display of these diagnosis codes do not mean any abnormality in the ETACS-ECU.

Code number	Trouble content
11	Trouble related to the ETACS-ECU
12	Trouble related to the column switch or improper communication with the ETACS-ECU
13	Trouble related to the front-ECU or improper communication with the ETACS-ECU
21	Short circuit in SWS communication line
31	Open circuit in the signal line between the SRS-ECU and the ETACS-ECU (impact detection signal)
32	Short circuit in the signal line between the SRS-ECU and the ETACS-ECU (impact detection signal)

NOTE: Refer to the Service Manual for details of the diagnostic items.

SWS INPUT SIGNAL CHECK BY M.U.T.-II

When the M.U.T.-II is connected to the diagnosis connector, and input switches for the SWS are operated, the buzzer in the M.U.T.-II sounds, indicating whether the operations of the switches are satisfactory or not.

SWS INPUT SIGNAL CHECK BY M.U.T.-III

When the M.U.T.-III is connected to the diagnosis connector and any of the SWS-linked switches is operated, the PC buzzer sounds to evaluate whether the switch is normal or not.

SWS INPUT SIGNAL CHECK AND ECU CHECK BY USING SWS MONITOR

The switch signals sent by ECUs and the operations of these ECUs can be confirmed by using the SWS monitor and the M.U.T.-II/III

INPUT SIGNALS THAT CAN BE CHECKED

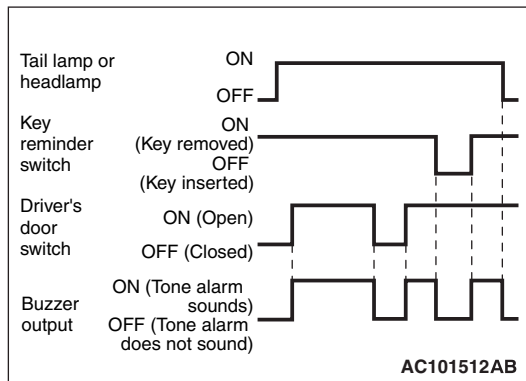
Input signal		Conditions for sounding buzzer	
Ignition switch (ACC)		Turn from "LOCK" (OFF) to "ACC" position	
Ignition switch (IG1)		Turn from "ACC" to "ON" position	
Back-up lamp switch <M/T> or inhibitor switch <A/T>		When the ignition switch is turned ON and the shift lever <M/T> or the selector lever <A/T> is moved to the R position.	
Key reminder switch		Remove the ignition key from ignition key cylinder (form inserted position)	
Hazard lamp switch		Turn from OFF to ON	
Fog lamp switch			
Driver's door switch		Open the driver's door	
Front passenger's door switch		Open the front passenger's door	
All door switch		Open any door when all the doors are closed.	
Front passenger's door lock key cylinder switch		Turn the key to the lock or unlock position	
Driver's door lock actuator switch		Move the door lock knob from lock position to unlock position or vice versa	
Speed signal		When the speed changes from less than 10 km/h to more than 10 km/h	
Keyless entry transmitter		When each switch is pressed	
Column switch	Tail lamp switch	When the lighting switch is turned from one position to the tail lamp position	
	Headlamp switch	When the lighting switch is turned from one position to the headlamp position	
	Dimmer switch	When the switch is turned from the OFF to the ON position	
	Passing switch		
	Turn-signal lamp LH switch		
	Turn-signal lamp RH switch		
	Windshield mist wiper switch		
	Windshield intermittent wiper switch		
	Windshield low speed wiper switch		
	Windshield high speed wiper switch		
	Windshield intermittent wiper interval adjusting knob		When the interval adjusting knob is turned from "FAST" to "SLOW" while the ignition switch is ON. (A pulse is sent around the centre).
	Windshield washer switch		When the switch is turned from the OFF to the ON position
	Rear wiper switch		
	Rear washer switch		
Interior lamp loaded signal		Illuminates the interior lamps	
Sunroof switch		When the sunroof switch is opened or closed	

ECU FUNCTIONS AND CONTROLS IN THE SWS

M2541004000678

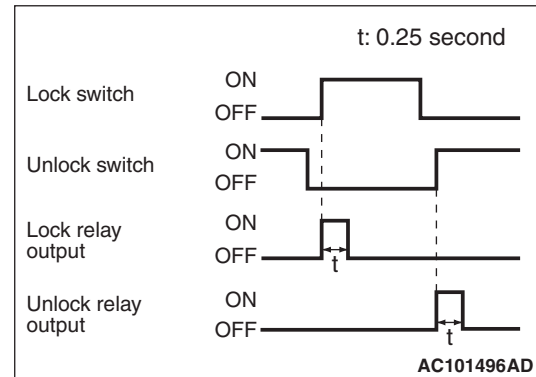
Following functions are controlled by ECUs of SWS.

Function		Control ECU	Explanation of function
Buzzer	Lamp reminder buzzer function	ETACS-ECU, column switch	P.54B-8
Central door locking system	Central door locking control function	ETACS-ECU	P.54B-8
	Key reminder function		P.54B-8
Keyless entry system	Keyless entry hazard lamp answerback function	ETACS-ECU	P.54B-9
	Keyless entry interior lamp answerback function		P.54B-9
	Timed locking mechanism		P.54B-9
Power window	Power window timer function	ETACS-ECU	P.54B-9
Windshield wiper and washer	Intermittent control	ETACS-ECU, column switch	P.54B-10
	Mist wiper control		P.54B-11
	Low speed wiper and high speed wiper control		P.54B-11
	Windshield wiper linked with washer function		P.54B-12
Rear wiper and washer	Rear wiper control		P.54B-13
	Rear wiper linked with washer function		P.54B-14
Flasher timer function	Turn-signal lamp	ETACS-ECU, column switch	P.54B-14
	Hazard warning lamp		P.54B-14
Fog lamp	Fog lamp control function		P.54B-15
Interior lamp	Dimmer interior lamp control function	ETACS-ECU	P.54B-15
	Interior lamp automatic-shutdown function		P.54B-16
Seat belt warning lamp	Seat belt warning lamp function		P.54B-16
Configuration function		ETACS-ECU, column switch	—

BUZZER**LAMP REMINDER BUZZER FUNCTION**

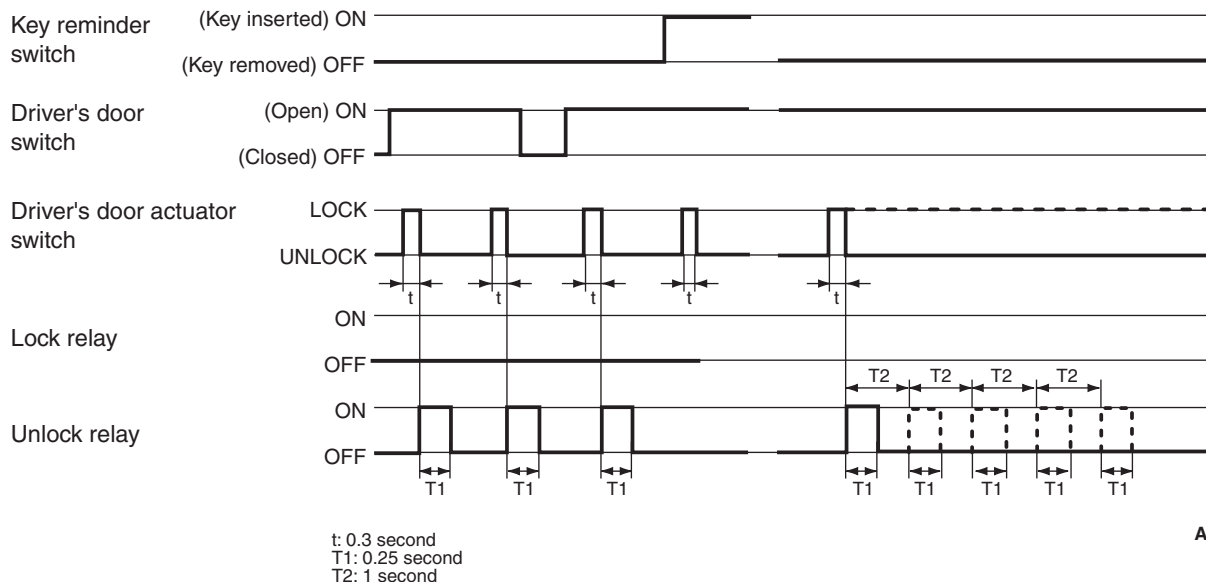
When the ignition key is removed and then the driver's door is opened with turning ON the tail lamp or the headlamp, the buzzer sounds continuously to alert the driver that the lamp is still ON.

However, if the tail lamp or the headlamp is turned off, the buzzer does not sound.

CENTRAL DOOR LOCKING SYSTEM**CENTRAL DOOR LOCKING CONTROL FUNCTION**

When the front door is locked (when the lock switch turns ON after turning OFF the unlock switch in the driver's door lock actuator or front passenger's door lock key cylinder switch), ETACS-ECU turns ON the lock relay output for 0.25 second, and locks all doors (including the tailgate).

When the front door is unlocked (when the unlock switch turns ON after turning OFF the lock switch on the driver's door lock actuator or front passenger's door lock key cylinder switch), ETACS-ECU turns ON the unlock relay output for 0.25 second, and unlocks all doors (including the tailgate).

KEY REMINDER FUNCTION

AC101499AB

When the driver's door is opened with the ignition key inserted to the ignition cylinder and the door is locked (when the lock switch turns ON after turning OFF the unlock switch in the driver's door lock actuator), after approximately 0.3 second, ETACS-ECU

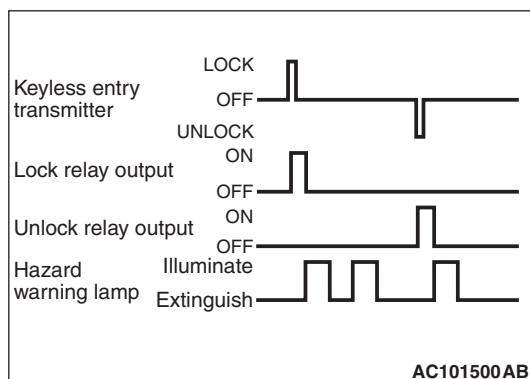
turns ON the unlock relay output for 0.25 second to discourage the door lock operation so that the ignition key left in the ignition cylinder is prevented.

If the discouraging the door lock operation fails, the current supply will be retried (The unlock relay output is turned ON for 0.25 second up to five times with 1 second interval).

NOTE: The broken line in the graph indicates the current supply retry state if the discouraging door lock operation fails.

KEYLESS ENTRY SYSTEM

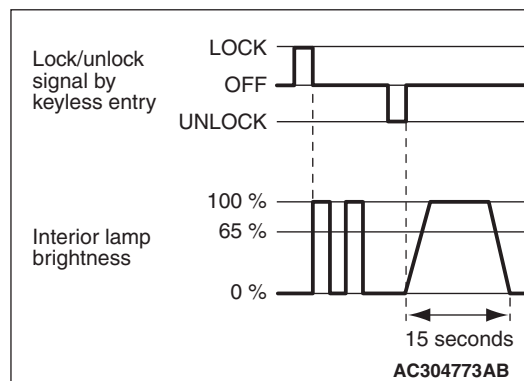
KEYLESS ENTRY HAZARD LAMP ANSWERBACK FUNCTION (THE INITIAL CONDITION: WITH FUNCTION OF LOCK/UNLOCK)



The hazard answerback function that allows checking the lock/unlock state of the door easily even in the daytime is adopted. When the lock signal from the keyless entry transmitter is received into ETACS-ECU, all doors (including the tailgate) are locked, and the hazard warning lamps blink twice. When the unlock signal is received, all doors (including the tailgate) are unlocked, and the hazard warning lamps blink once.

NOTE: The answerback blink time can be adjusted by the configuration function (Refer to [P.54B-17](#)).

KEYLESS ENTRY INTERIOR LAMP ANSWERBACK FUNCTION



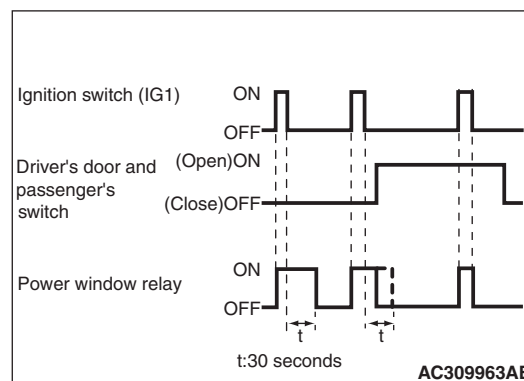
The interior lamp blinks two times while locking the door for easy checking the keyless entry function. When the door is unlocked, the interior lamps on for 15 seconds (100%), and turns off.

TIMED LOCKING MECHANISM

After unlocking the doors with the keyless entry transmitter, if no doors are opened, if the ignition key is not inserted or if the locking function is not operated, the ETACS-ECU automatically locks the doors in 30 seconds.

POWER WINDOW

POWER WINDOW TIMER FUNCTION

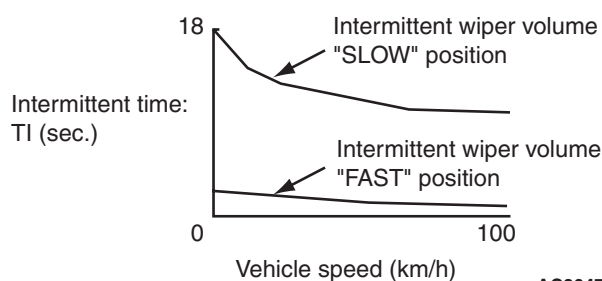
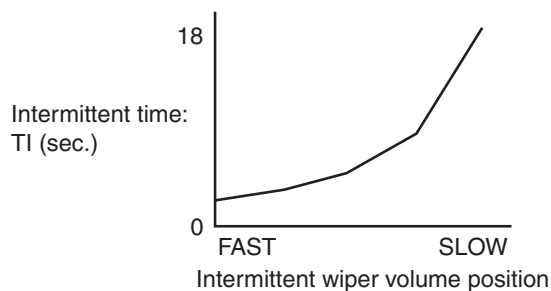


When the power window relay is turned ON with the ignition switch ON, the power window relay is kept ON for 30 seconds even after the ignition switch is turned OFF, enabling the door window to be opened and closed with the power window switch.

If the driver's or the front passenger door is opened during timer operation, the power window relay is turned OFF at the same time.

WINDSHIELD WIPER AND WASHER

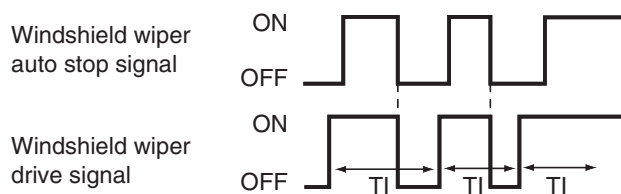
INTERMITTENT CONTROL (THE INITIAL CONDITION: WITH FUNCTION)



AC304771AC

ETACS-ECU calculates the intermittent time TI from the windshield intermittent wiper volume of the column switch and the vehicle speed calculated from the vehicle speed signals (vehicle speed sensor <M/T> or engine-A/T-ECU <A/T>), and sends it to the front ECU as SWS data.

NOTE: The vehicle speed-dependent wiper function can be invalidated by the configuration function. (Refer to P.54B-17).



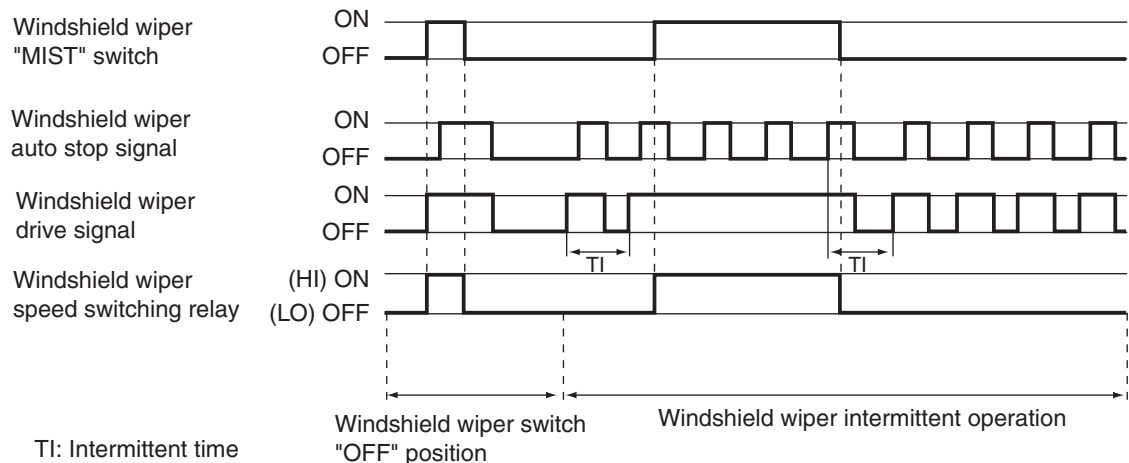
TI: Intermittent time

AC304772AB

The front ECU determines the intermittent time TI from the input SWS data, and turns ON the windshield wiper drive signal. When the wiper comes to the stop position, the windshield wiper auto-stop signal is turned OFF, and the windshield wiper drive signal turns OFF.

When the intermittent time TI is elapsed after being turned ON the windshield wiper drive signal, the windshield wiper drive signal is turned ON again, and the above-mentioned operation is repeated.

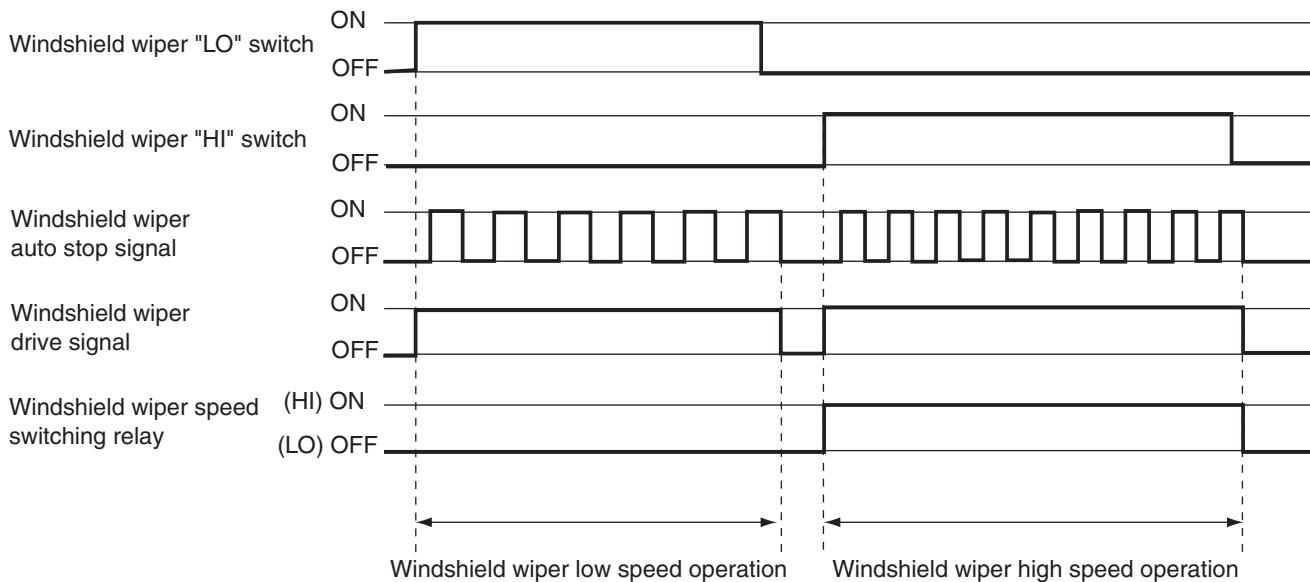
MIST WIPER CONTROL



AC300283AD

When the windshield wiper mist switch of the column switch is turned ON while the ignition switch is ACC or ON, the column switch turns ON the windshield wiper drive signal. At the same time, the wiper speed switching relay turns to ON (HI). When the windshield mist wiper switch is ON, the windshield wipers operate at the high speed.

LOW SPEED WIPER AND HIGH SPEED WIPER CONTROL

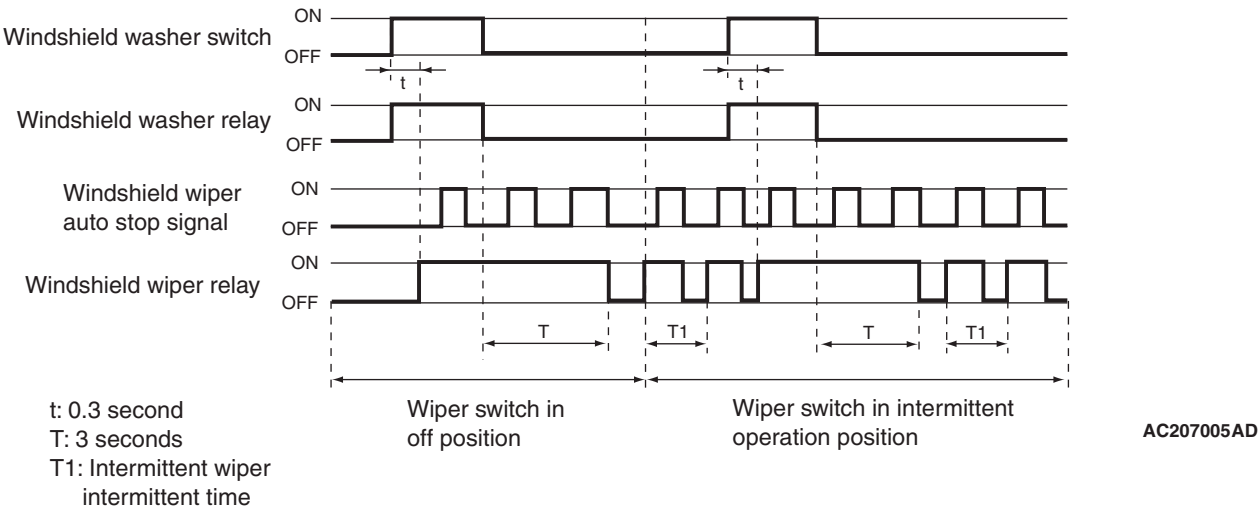


AC300284AC

When the windshield low speed wiper switch of the column switch is turned ON while the ignition switch is ACC or ON, the column switch turns ON the windshield wiper drive signal. Also, the wiper speed switching relay turns to OFF (LO), and the windshield wipers operate at the low speed.

When the windshield high speed wiper switch is turned ON, the windshield wiper drive signal turns ON. Also, the wiper speed switching relay turns ON (HI), and the windshield wipers operate at the high speed.

WINDSHIELD WIPER LINKED WITH WASHER FUNCTION (INITIAL CONDITION:
FUNCTION AVAILABLE)

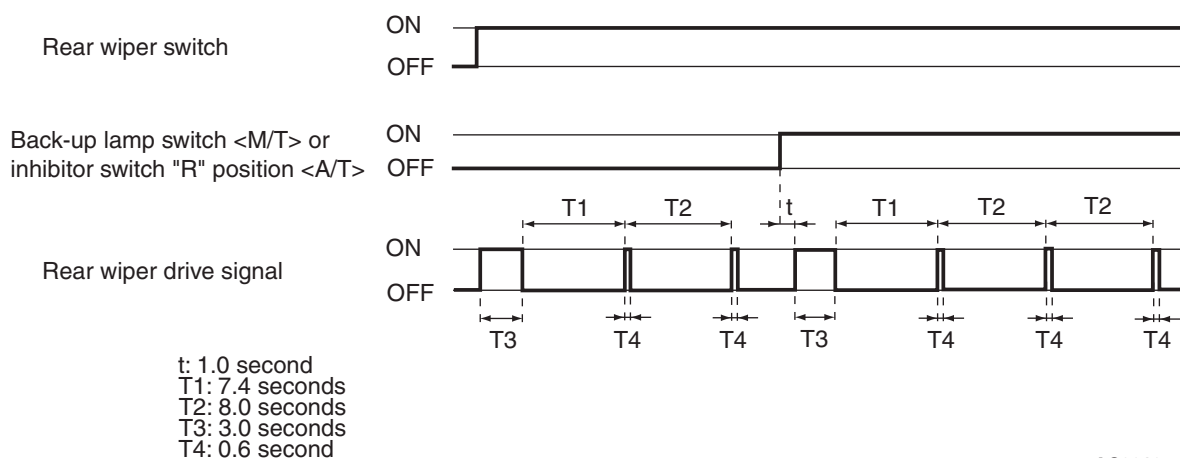


Wiper switch	OFF position				Intermittent operation position				Low speed or high speed operation position
Washer switch ON time	0.3 second or less	0.3 to 0.5 second	0.5 to 0.7 second	0.7 second or more	0.2 second or less	0.2 to 0.5 second	0.5 to 0.7 second	0.7 second or more	-
T1	0 second	1 second	2 seconds	3 seconds	0 second	1 second	2 seconds	3 seconds	3 seconds

- When the front-ECU receives a windshield washer switch signal from the column switch with the ignition switch in the ACC or the ON position, the ECU turns on the windshield washer relay. When the windshield washer relay becomes ON, the windshield washer motor starts to run to spray the washer fluid in the washer tank onto the windshield through the washer nozzles. When the windshield washer switch signal remains on for 0.3 second or more, the signal turns on the windshield wiper relay (The wiper interval depends. For details, see the list) to operate the windshield wiper at high speed. Turning off the windshield washer switch causes the front-ECU to turn off the windshield wiper relay "T" seconds later, thus operating the wiper to the auto stop position at low speed.
 - When the windshield washer switch is turned ON during the intermittent operation of the windshield wiper, the windshield wiper switches to continuous operation and then resumes intermittent operation.
- NOTE: The function to interlock the washer with windshield wiper operation can be enabled or disabled with its adjustment function (Refer to [P.54B-17](#)).*

REAR WIPER AND WASHER

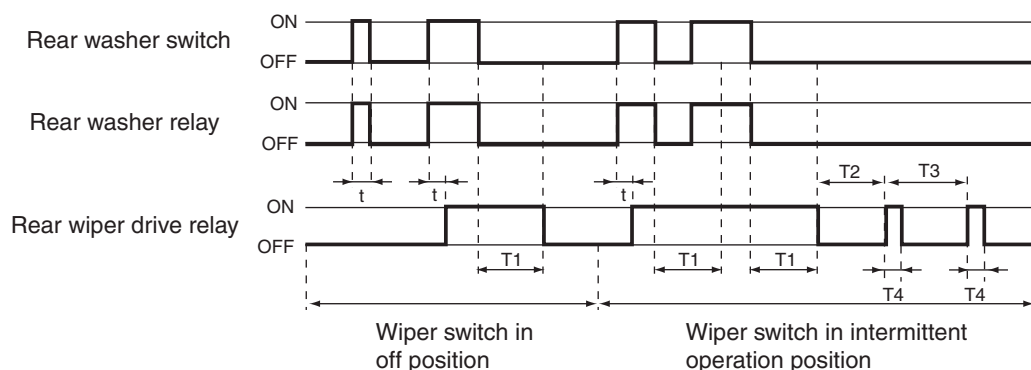
REAR WIPER CONTROL [THE INITIAL CONDITION: 8 SECONDS (WITHOUT SUCCESSIVE OPERATIONS)]



AC301877AC

1. When the rear wiper switch on the column switch is turned ON with the ignition switch at the ACC or ON position, ETACS-ECU turns ON the rear wiper drive signal for 3 seconds (approximately 2 operations) and performs the intermittent action at 8 seconds intervals.
 2. By the special operation of the rear wiper switch on the column switch (successive 2-time operations), the rear wiper operates continuously regardless of the set intermittent time.
- When the shift lever <M/T> or selector lever <A/T> is moved to R position during the rear wiper operation, the back-up lamp switch <M/T> or inhibitor switch R position <A/T> turns ON 1 second after that, ETACS-ECU sends the rear wiper drive signal for 3 seconds (approximately 2 operations), and operates the intermittent action in 8 seconds interval.

NOTE: The rear wiper intermittent time can be adjusted or cancelled for continuous operation by the configuration function (Refer to [P.54B-17](#)).

REAR WIPER LINKED WITH WASHER FUNCTION (INITIAL CONDITION: FUNCTION AVAILABLE)

AC207003AD

t: 0.3 second

T1: 3 seconds T3: 8 seconds

T2: 7.4 seconds T4: 0.6 second

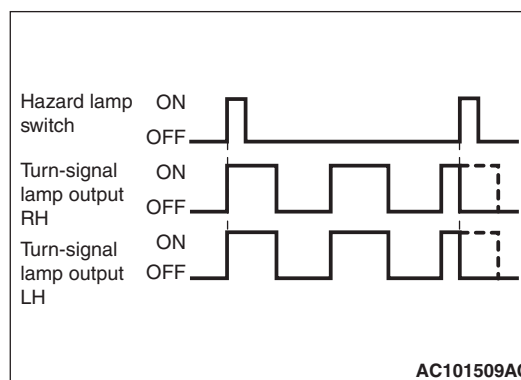
When the rear washer switch on the column switch is turned on with the ignition switch ACC or ON, ETACS-ECU turns on the rear washer relay. When the rear washer switch signal from the column switch remains on for 0.3 second or more, ETACS-ECU turns on the rear wiper relay to operate the rear wiper continuously. Turning off the rear washer switch turns off the rear wiper relay 3 seconds later, thus operating the wiper to the auto stop position and parking it in the position.

Even turning on the rear washer switch during rear wiper operation causes the rear wiper relay to switch the operation to continuous operation, and then the rear wiper resumes intermittent operation at intervals of 8 seconds, 7.4 seconds after the completion of the continuous operation.

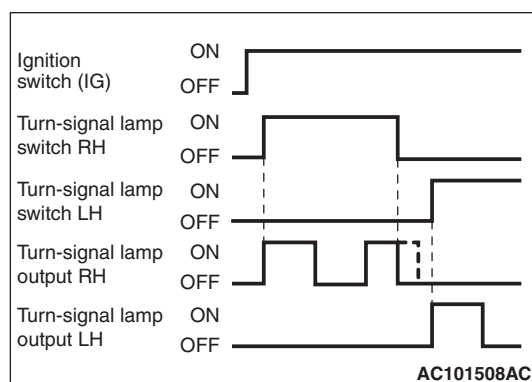
NOTE: The function to interlock the washer with rear wiper operation can be enabled or disabled with its adjustment function (Refer to P.54B-17).

When the turn-signal lamp switch is ON (LH or RH) with the ignition switch ON, the turn-signal lamp output (flash signal) is turned ON.

If the lamp bulb of the front or rear turn-signal lamp has burned out, the flashing speed becomes faster to alert the driver that the lamp bulb has burned out.

HAZARD WARNING LAMP

AC101509AC

**FLASHER TIMER FUNCTION
TURN-SIGNAL LAMP**

AC101508AC

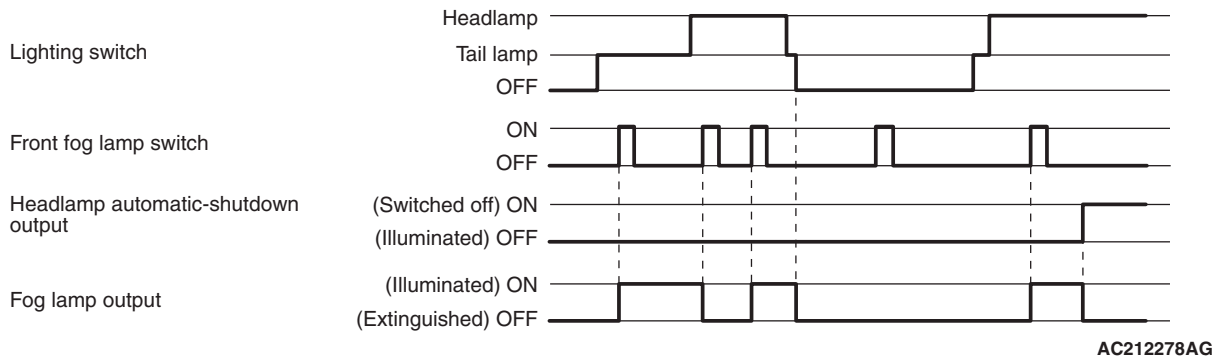
When the hazard lamp switch input signal turning from OFF to ON is detected, the flashing states turns over by the signal (When the hazard lamp is not blinking, it blinks. If it is blinking, it turns off).

NOTE:

1. The push-return-switch is adopted for the hazard lamp switch.
2. Even if the lamp bulb has burned out, the flashing speed of the hazard lamp is not changed.

FOG LAMP

FOG LAMP CONTROL FUNCTION



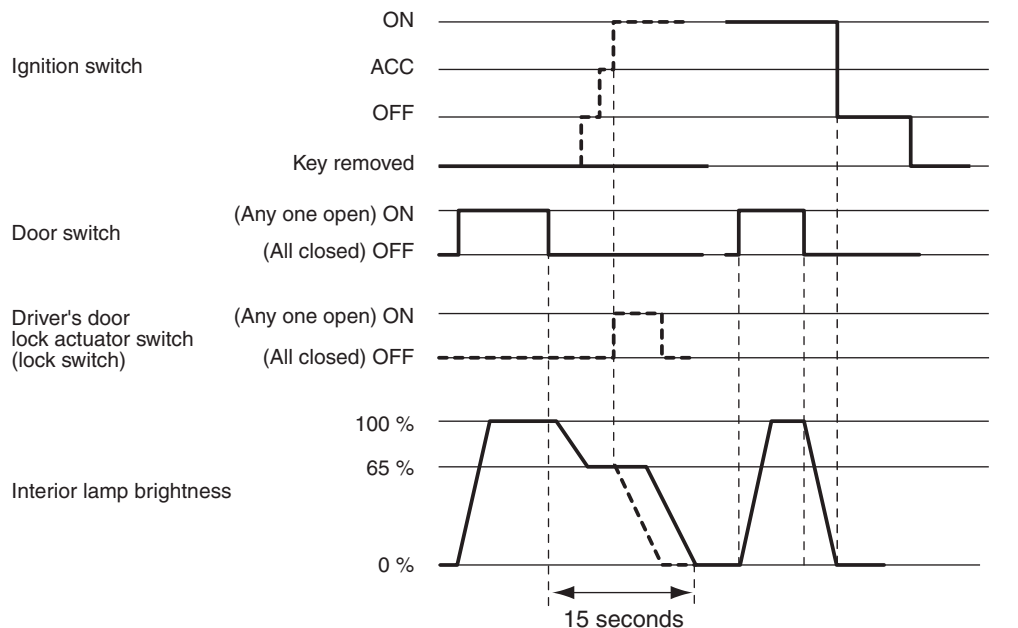
When the fog lamp switch is turned to ON with the tail lamp or the headlamp lit (the tail lamp switch or the headlamp switch is ON), the fog lamp relay turns ON, and the fog lamps are illuminated.

If the tail lamp or the headlamp is turned off with the lighting switch OFF while the fog lamps lit, the fog lamps turn off at the same time to prevent unintended operation.

If the tail lamp is turned off, the fog lamps turn off at the same time. However, if the tail lamps are illuminated again, the fog lamps are not.

INTERIOR LAMP

DIMMER INTERIOR LAMP CONTROL FUNCTION (THE INITIAL CONDITION: FUNCTION AVAILABLE)



AC304774AB

When the interior lamp switch is on the door position, ETACS-ECU controls the interior lamp illuminates as follows.

1. When the ignition switch is OFF:

By opening any door or tailgate, the lamp turns ON (100%), and dims (65%) when the door or tailgate is closed, then and turns off after 15 seconds.

However, when the ignition switch is turned ON or the door lock is operated, the lamps turn off at that time.

2. When the ignition switch is ON:

By opening any door or tailgate, the lamp (100%) turns ON and OFF when the door or tailgate is closed.

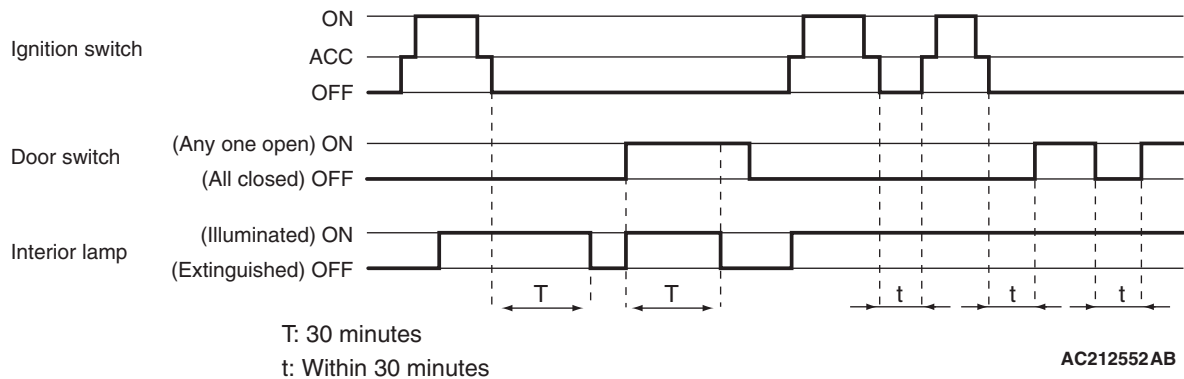
3. When all doors and the tailgate are closed, and the ignition key is removed <Vehicles with keyless entry system>:

By removing the ignition key with all doors and the tailgate closed, the lamp turns ON 100%, and turns off after 15 seconds.

By inserting the ignition key again or operating the door lock with the lamp lit, the lamps turns off.

NOTE: For the vehicles with the keyless entry system, the delayed interior lamp turning off duration can be changed by the configuration function (Refer to P.54B-17).

INTERIOR LAMP AUTOMATIC-SHUTDOWN FUNCTION (THE INITIAL CONDITION: FUNCTION AVAILABLE)



When the interior lamp such as the interior lamp [all interior lamps connecting to the interior lamp fuse (the front room lamp, the map lamp, the rear room lamp, the rear personal lamp and the luggage room lamp)] is lit, but either one of the conditions is met, the interior lamp is turned off automatically for preventing the battery discharge caused by the unattended operation or the door-ajar.

- After 30 minutes with the interior lamp lit while the ignition switch is OFF, the lamp turns off automatically.
- After 30 minutes with any door opened while the ignition switch is OFF, the lamp turns off automatically.

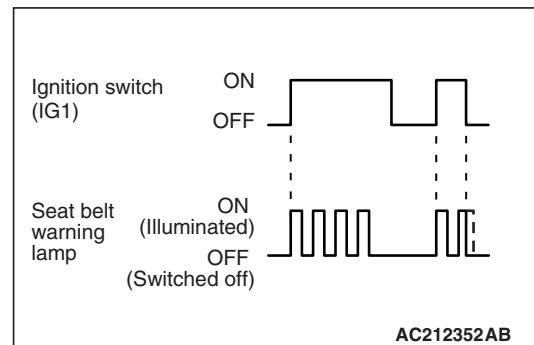
After automatic-shutdown function, the interior lamp turns ON when any of the following condition is met.

- Open and close doors.
- Operate the keyless entry transmitter.
- Turn the ignition switch to ACC or ON.

NOTE:

1. The interior lamp automatic-shutdown function can be disabled or enabled by the configuration function (Refer to P.54B-17).
2. After illuminating again, the lamp turns off after 30 minutes, when the interior lamp automatic-shutdown function is met.

SEAT BELT WARNING LAMP SEAT BELT WARNING LAMP FUNCTION



When the ignition switch is turned to ON, the seat belt warning lamp flashes 4 times (over 6 seconds).

CONFIGURATION FUNCTION

M2541000400298

According to the configuration mode entry conditions of the input switch, the following functions can be adjusted. The data on configuration will be memo-rized even if the battery is disconnected.

- Keyless entry system hazard answerback func-tion
- Vehicle speed-dependent wiper function
- Interior lamp automatic-shutdown function
- Delayed lamp-off time of the interior lamp
- Initialisation of all functions (Returns to initial set-tings)

1. Conditions for entering the configuration mode

i. Set each switch to the following state.

- Hazard lamp switch: OFF
- Diagnosis control: ON (Connect the M.U.T.-II/III or earth No.1 pin of the 16-pin diagnosis connector).
- Key reminder switch: OFF (Insert the igni-tion key)
- Ignition switch: "LOCK" (OFF) position

- Driver's door switch: OFF (driver's door closed)

ii. When the windshield washer switch is ON for more than ten seconds, the buzzer in the ETACS-ECU sounds for three seconds, and the configuration mode will be set.

2. Conditions for exiting the configuration mode

- Diagnosis control: OFF (Disconnect the M.U.T.-II/III or the earth of No.1 pin of the 16-pin diagnosis connector disconnected).
- Key reminder switch: ON (Remove the igni-tion key)
- Ignition switch: Turning to any position other than "LOCK" (OFF) position
- Driver's door switch: ON (driver's door opened)
- When three minutes pass without configura-tions performed
- When the other warning buzzer output is gen-erated

3. Configurations of various functions

Function	Configuration procedure
Keyless entry system hazard answerback function	<p>When the lock button of the transmitter is pressed twice continuously within two seconds, the hazard answerback function during the lock state will be switched between available or unavailable.</p> <ul style="list-style-type: none"> • Function available: Buzzer sounds once. (Initial state) • Function not available: Buzzer sounds twice. <p>When the unlock button of the transmitter is pressed twice continuously within two seconds, the hazard answerback function during the unlock state will be switched between available or unavailable.</p> <ul style="list-style-type: none"> • Function available: Buzzer sounds once. (Initial state) • Function not available: Buzzer sounds twice.
Vehicle speed-dependent wiper function	<p>When the windshield wiper mist switch is turned ON for more than two seconds, the vehicle speed-dependent wiper function is switched between available or unavailable.</p> <ul style="list-style-type: none"> • Function available: Buzzer sounds once. (Initial state) • Function not available: Buzzer sounds twice.
Interior lamp automatic-shutdown function	<p>When the hazard switch is turned ON for more than two seconds, the interior lamp automatic-shutdown function is switched between available or unavailable.</p> <ul style="list-style-type: none"> • Function available: Buzzer sounds once. (Initial state) • Function not available: Buzzer sounds twice.

Function	Configuration procedure
Delayed lamp-off time of the interior lamp	<p>When the turn-signal lamp switch is set in the order of RH to LH to RH to LH within three seconds from the LH position, the delayed lamp-off time switches (Returns to a after e, and repeats from a in order).</p> <ul style="list-style-type: none">a. 15 seconds: Buzzer sounds four times. (Initial state)b. 7.5 seconds: Buzzer sounds five times.c. 30 seconds: Buzzer sounds once.d. 10 seconds: Buzzer sounds twice.e. 0 second (No delay time): Buzzer sounds three times.
Initialisation of all functions	<p>When the windshield washer switch is ON for more than 20 seconds continuously, the buzzer sounds twice, and all functions will be initialised. (Settings are returned to their initial states). The configuration mode entry buzzer sounds after 10 seconds, however to initialise all functions, the ON state should be continued for 20 seconds. When the windshield washer switch is ON for more than 20 seconds continuously without the configuration mode set, the configuration mode will be set after 10 seconds without the initialisation of all functions.</p>