Description

Power Liftgate system is an electro-mechanical system that can open and close the liftgate automatically, by using local switch (push button switch inside of the liftgate, and outside handle switch), and wireless remote key (FOB), or can halt the liftgate. The Power Liftgate module (PTGM) sends and receives the vehicle's information via BCM, instrument panel, SJB and CAN communication, so that it can decide the opening/closing of the liftgate and self diagnosis.

There's a safety function to reverse its direction, when an obstacle is detected during the operation.

If power mode is disabled due to discharged battery or disabled Power Tail Gate Module (PTGM), manual opening/closing is possible by using the emergency lever on the liftgate latch after unlocking the liftgate.

Location and Direction of the Liftgate

PTG system measures the location of the liftgate through the total hall sensor inside of the spindle unit motor.

Also, the direction of the liftgate can be confirmed by analyzing the direction of spindle operation.

The signal counting (location confirmation) of the hall sensor is valid both in power operation mode and general operation mode.

PTG automatic operation mode can be changed to Manual operation mode by changing the cluster settings.

Components

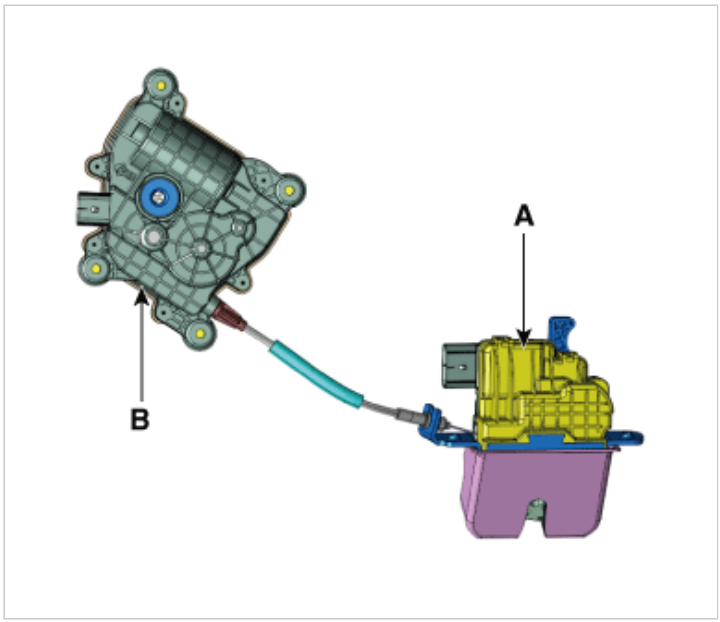
1. Power Liftgate Module (PTGM)

PTGM is installed inside the right-hand side luggage side trim in the back.

PTGM operates two spindle drive motors.

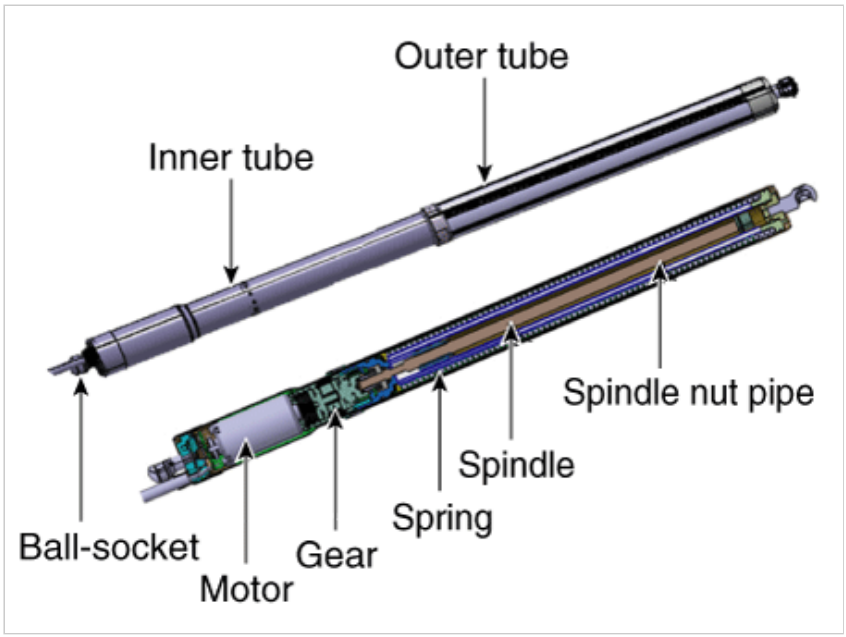
It also controls the anti-pinching function by analyzing anti-pinch sensor and the hall sensor in the spindle.

2. PTG Latch Assembly



PTG latch assembly consists of power latch (A) and power closing unit (B).
PTG latch assembly is installed at the end of the liftgate and operates power lock/unlock mode under the PTGM control.

3. PTG Spindle



PTG spindle controls the liftgate’s opening and closing using the torque of the motor inside.

Recognize the liftgate''s driving direction by sending motor''s revolving direction signal inside of spindle to PTGM.

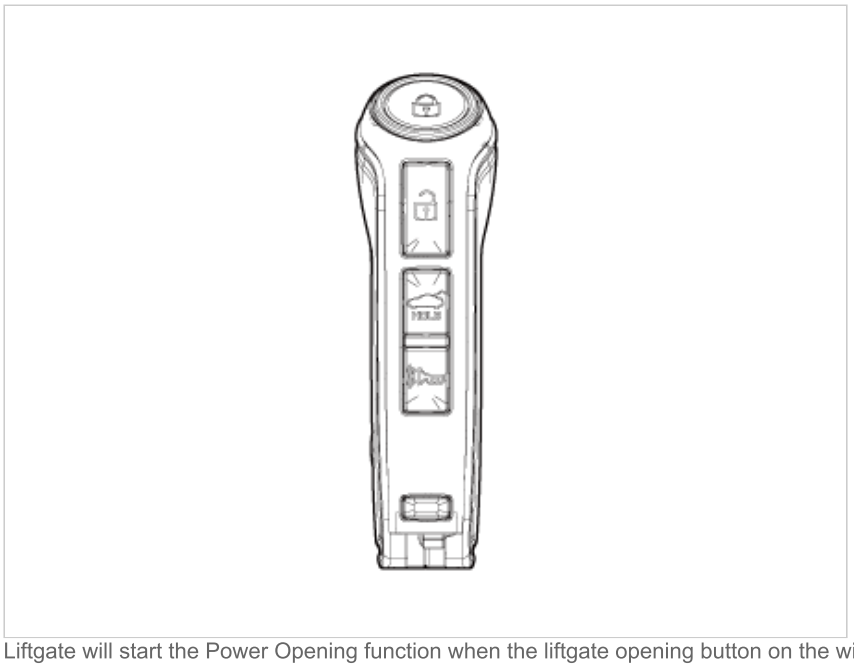
4. Anti-pinch Strip

APS(Anti-pinch strip) is installed on the left and righthand sides of the liftgate and detects jamming of an object during Power Liftgate closing operation.

When jamming is detected, PTGM will immediately reverse liftgate to full open status.

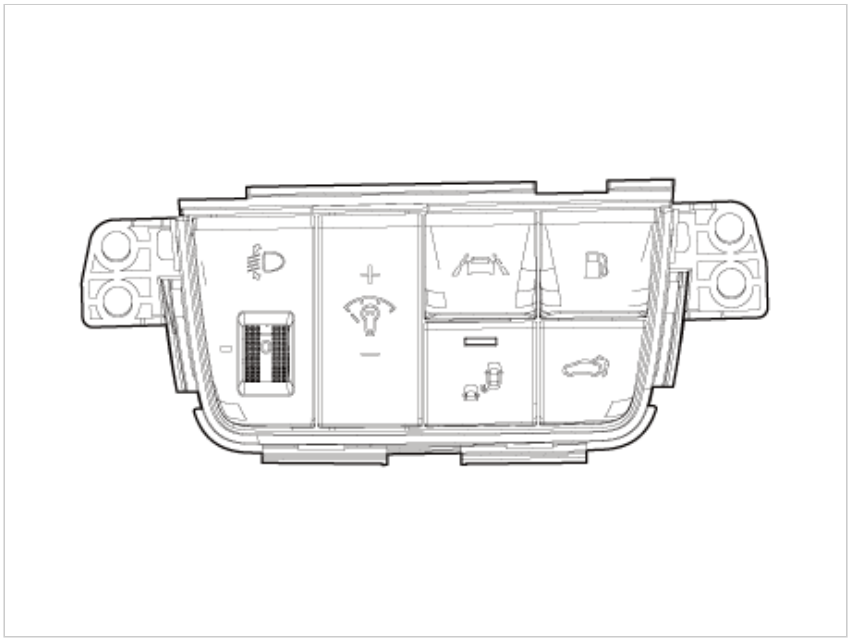
Antipinch strip does not operate when liftgate is fully closed or fully open, is stationary or while opening.

5. Wireless Transmitter



Liftgate will start the Power Opening function when the liftgate opening button on the wireless transmitter is pressed for more than 1.0 second.
If the button is pressed shortly while the power liftgate is opening or closing, the power liftgate will stop its movement.
If the button is pressed for 1.0 second while the power liftgate is opening or closing, the power liftgate will reverse its direction.

6. Side Crash Pad Switch



If the side crash pad switch is pushed for 1.0 second, the liftgate will operate power opening or closing function.
If the side crash pad switch is pressed shortly while the power liftgate is opening or closing, the power liftgate will stop its movement.
If the side crash pad switch is pressed for 1.0 second while the power liftgate is opening or closing, the power liftgate will reverse its direction.

7. Power Liftgate Inner Switch

If the switch inside of the liftgate is pushed, the liftgate will start the power closing function.

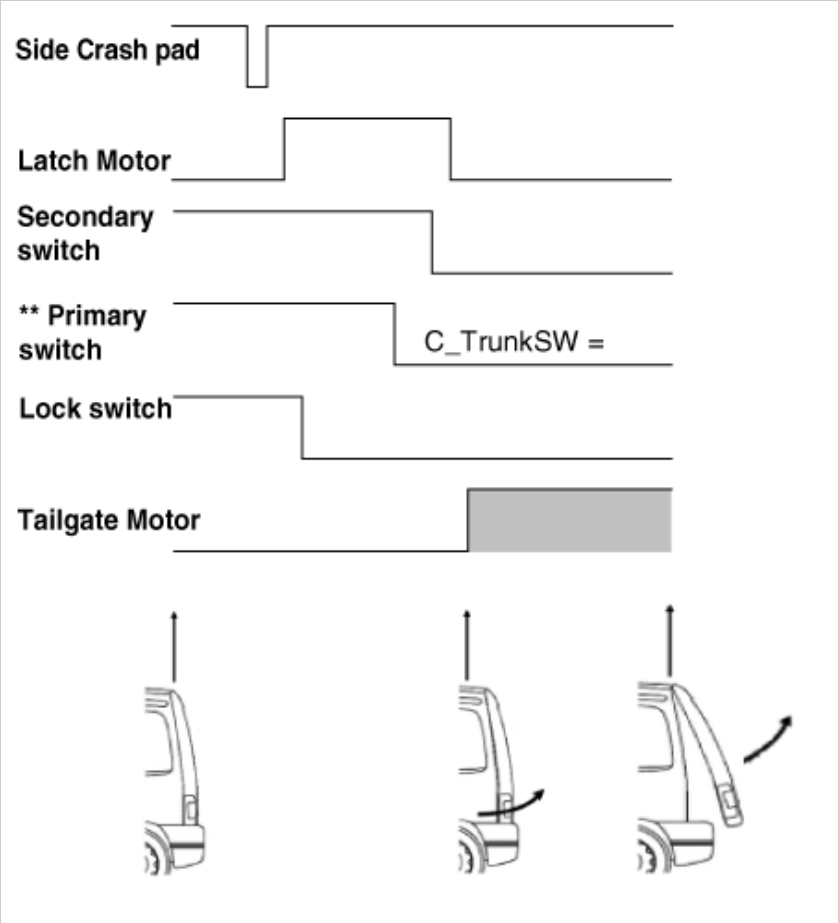
8. Power Liftgate Buzzer

When an obstacle is detected or power function is not performed properly in accordance to the user"s order, the alarming buzzer will sound for 3 times.

And when power function is performed properly, the alarming buzzer will sound twice.

Operating Principle

Opening of the Power Liftgate



Primary switch signal is sent to PTGM via CAN communication. (sent by SJB)

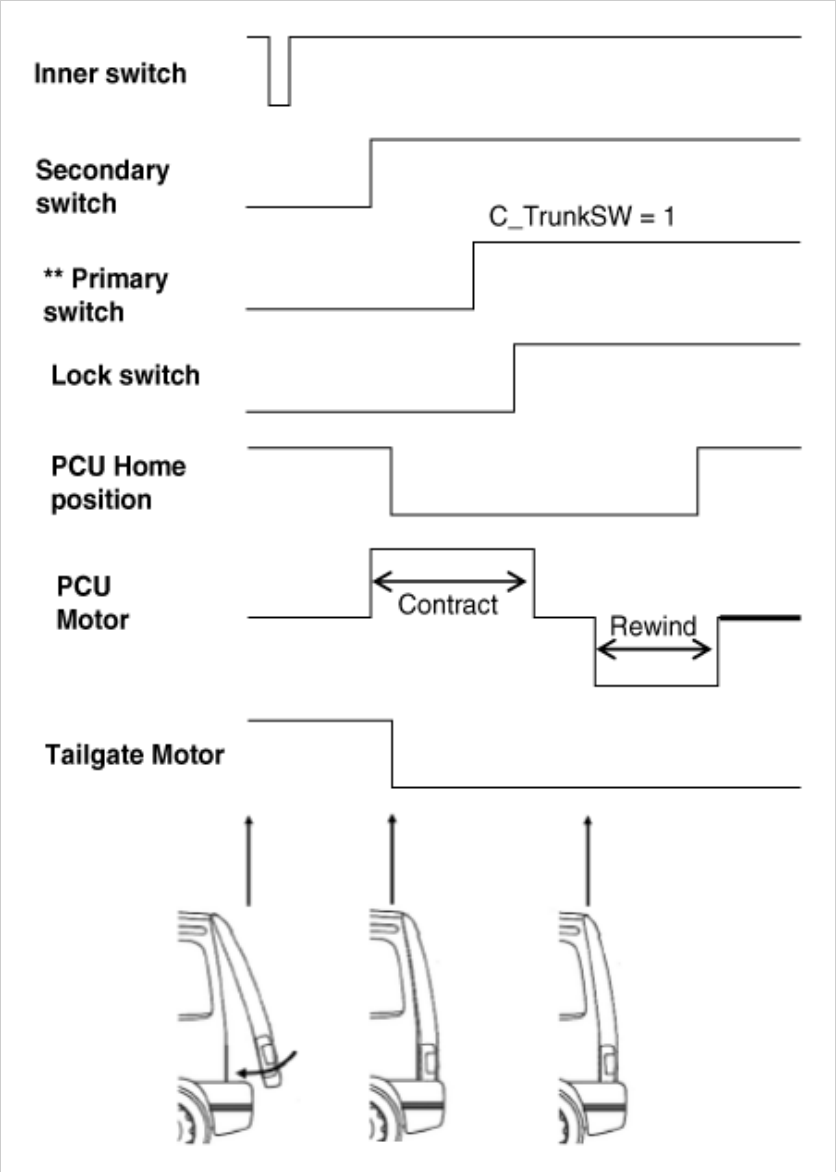
Power Liftgate Opening Process

1. Opening will start after signals from crash pad lower switch, liftgate handle switch, or wireless remote key(FOB) are received.
2. The latch motor will unlatch the liftgate by releasing the striker (via the SJB).
3. To open the liftgate, the PTG module will activate the liftgate spindle motors.
4. The speed of the spindle motors is monitored via a hall sensor in the motor.
5. Opening angle of the liftgate will be calculated from the number of pulses of the hall sensor.

⚠ CAUTION

- When the motor's movement is restricted PTGM will sense it as an obstacle and either reverse in opposite direction or halt the motor movement.

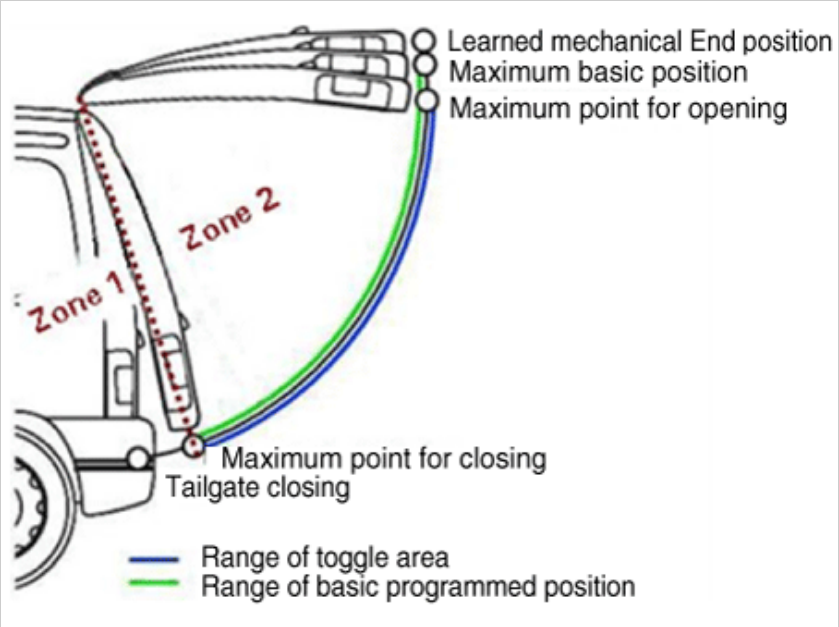
Power Liftgate closing



Power Liftgate Procedure :

1. Closing will start after signals from crash pad switch, liftgate inner switch, or wireless remote key(FOB) are received.
2. To close the liftgate, the PTGM will operate the Spindle motors.
3. The PTGM monitors the Closing angle of the liftgate by counting the pulses from the hall sensors.
4. The liftgate latch is put on the striker, and if the seal force is not too weak the latch will be on the Half Lock position. (latch full open → latch half lock)
5. After the Half Lock switch signal from the latch is received, PTGM will stop the liftgate spindle motor operation.
6. PTGM will engage voltage to PCU and the PCU will start cinching operation until PTGM receives Full Lock signal from the latch.
7. The liftgate is fully closed, and the latch is fully locked.

Learning/Calculation/Program Location



1. Maximum Point for Opening
   The movement of opening direction beyond this position will make the liftgate to reach the maximum basic position, and overload the mechanical system(hinge).
   So, opening movement beyond this position is impossible.
   But, if the movement started from lower position, the liftgate will move beyond this point.
2. Learned Mechanical End Position
   Mechanical End Position is the mechanical limited position, and is regarded as 100% opened.
   This position is being Learnt in the process of the first opening of the liftgate.
   After the learning, the liftgate will not go beyond the maximum basic position that is defined as soft stop.
   All of the positions will be defined by parameters that are designated by ECU.

Open maximum Programming (Garage Position)

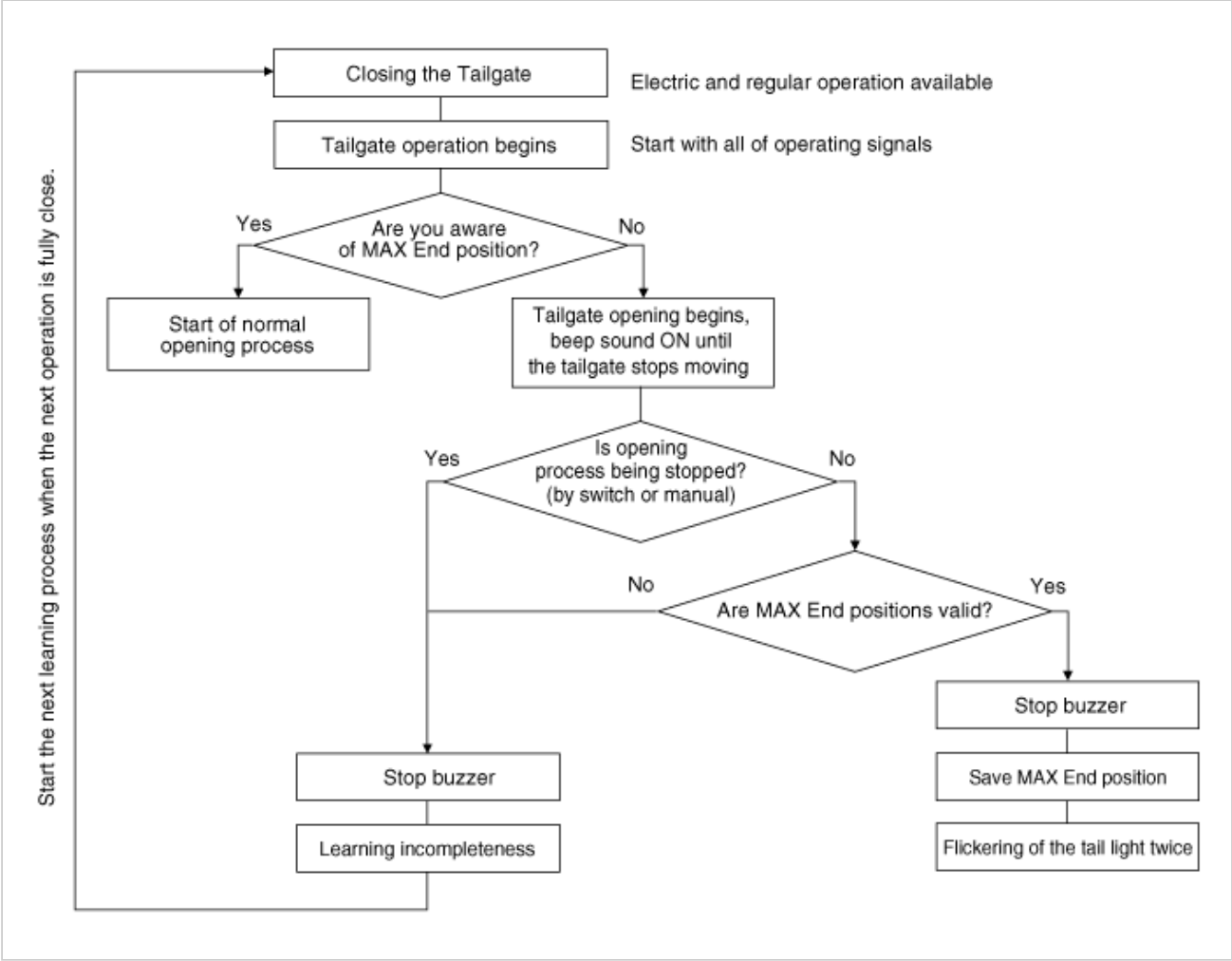
1. After mechanical End Position is learned, the basic position defined by user will be regarded as same as the maximum basic position.
   – The user may shift the learned basic position to any position. (within the range between Maximum position For Closing and Maximum Basic Position)
   – If the user wishes to move the new basic position lower than the old basic position, he or she has to move the liftgate to the new position automatically or manually and push the internal switch of the liftgate for five seconds. (Time may differ in accordance with parameters.)
   – If the user wishes to set the liftgate position above the maximum basic position, ECU will set the basic position as the maximum basic position.

System Parameter

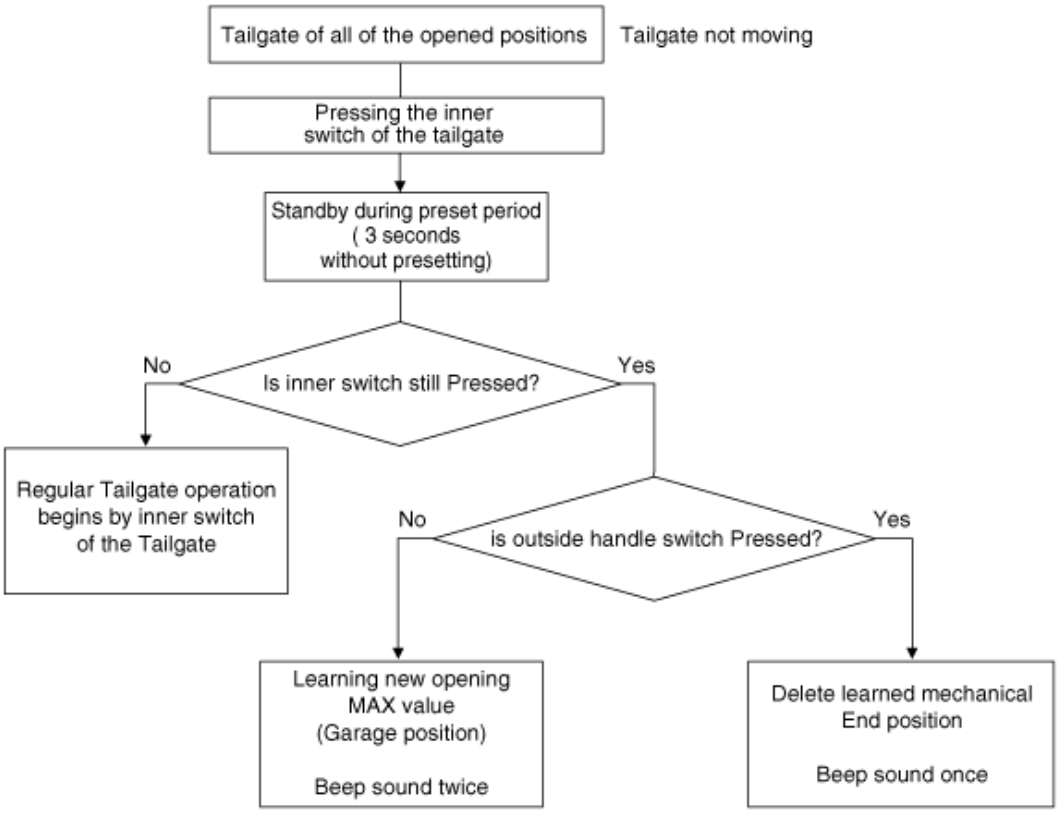
Before the normal operation is guaranteed, mechanical tolerance and adjustment at vehicle production line and the maximum movement range correction by Power Liftgate assembling are required.

From the end point that is limited by mechanical binding when the liftgate is fully closed (latch locked), the maximum movement range of the liftgate in operation is expressed by the number of the hall pulse signal of spindle speed and location sensor that are sent by ECU.

Calibration Mode



Manual De-calibration Mode



Buzzer Operation Mode

Operation	Request source	Number of buzzer cycles	Number of hazard cycles	Comment
Start opening	Outside Switch	2	2	Delay start of liftgate until first cycle is over
	Inner Switch			
	Console Switch			
	Remote Key			
	Smart Key			
Start closing	Outside Switch	2	2	
	Inner Switch			
	Console Switch			
	Remote Key			
	Smart Key			
Direct direction change (Open -> Close) (Area : Closed - Maximum end point for closing)	Outside Switch	2	2	No delay (Reversing and buzzing at the same time) - Only delay due to mechnical system
	Inner Switch			
	Console Switch			
	Remote Key			
	Smart Key			
Obstacle detection (Reverse operation start)	-	3	-	-
Vehicle speeds when liftgate is open	-	10	-	Stop condition 1. Complete 10 times. 2. Liftgate full lock.
Adjust height	Inner Switch	2	-	-
Initialization	Inner Switch & Outside Switch	1	-	-

(Deleting end position and basic position)				
Initialization (Learning end point)	-	-	2	-
Initialization (During calibration)	-	Continuous	-	-
Liftgate not closed	-	10	10	Liftgate closed but lock switch not off (Still open)
Error detect	-	3	-	- APS error - Spindle error - Hall sensor error - System error (EEPROM error) - Voltage error (Over/Under) - PCU error - Latch position error - Stuck switches. (Switch pressed more than 30 sec) - Thermal protection