

## CONTENTS

- ETACS
- REAR WIPER SYSTEM
- AUTO LIGHTING SYSTEM
- RAIN SENSOR
- MULTIMETER

# SORENTO

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# ETACS



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 KIA MOTORS

## ETACS General information

**Actually, ETACS starts by the needs to control time and alarm related electric device of the vehicle in one controller.**

**The controlled items can be more or less according to the vehicle grades or trim levels but the basic concept is similar.**

**That is why a system of a vehicle is familiarized, easy to understand other systems.**

## ETACS Module Function Control Items

Washer Related Wiper

Variable INT Wiper

Seat Belt Warning

Defog Timer

IGN. Key Hole Illumination Lamp Control

Crash Unlock

Over Speed Warning(Only Middle East)

Panic Function

Super Lock Function

Speed Sensing Door Lock

Power Window Time Lag

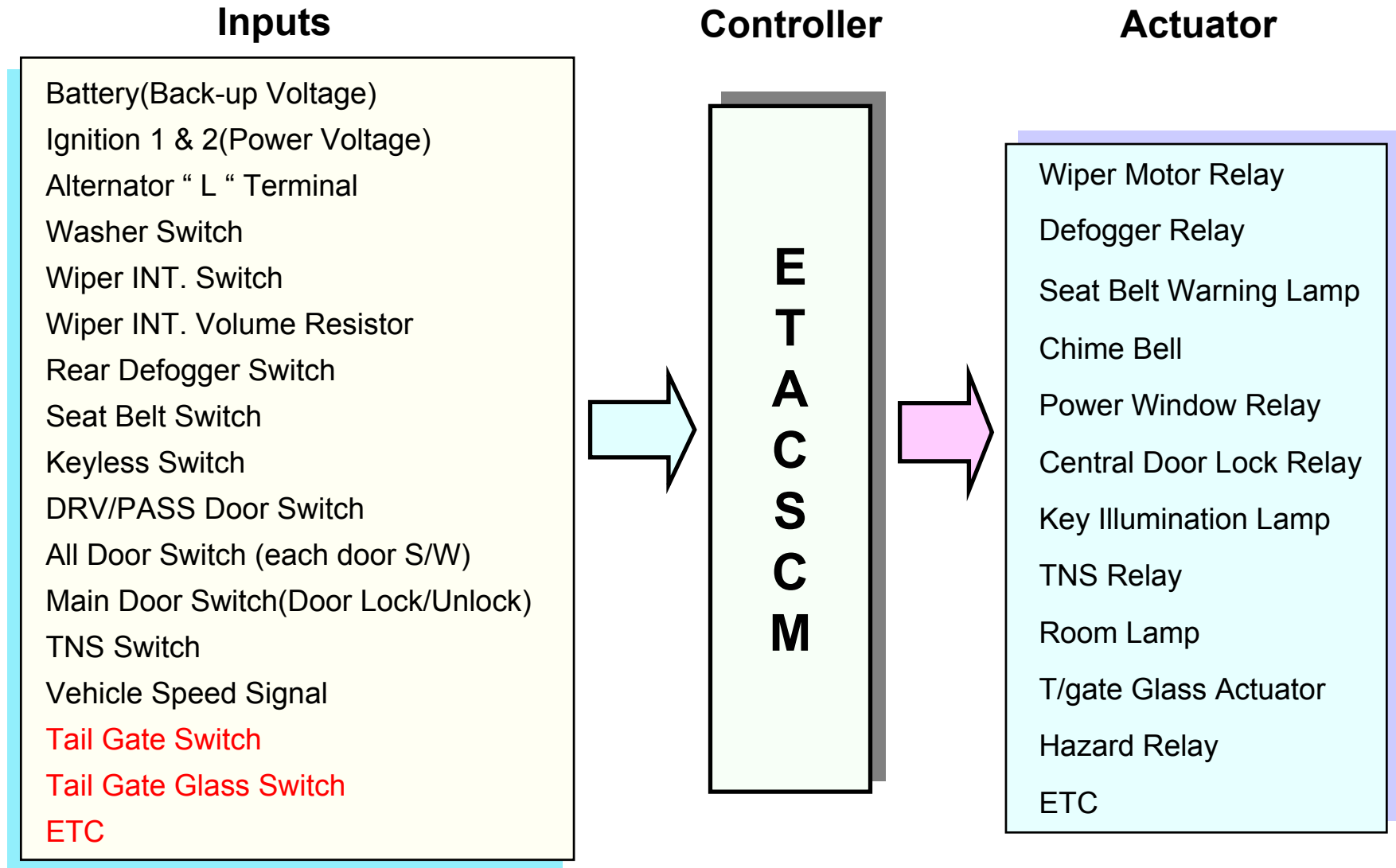
Tail Gate Glass Open

Central Door Lock/ Unlock

Battery Saver

Keyless Receiver

## ETACS INPUT & OUTPUT Diagram



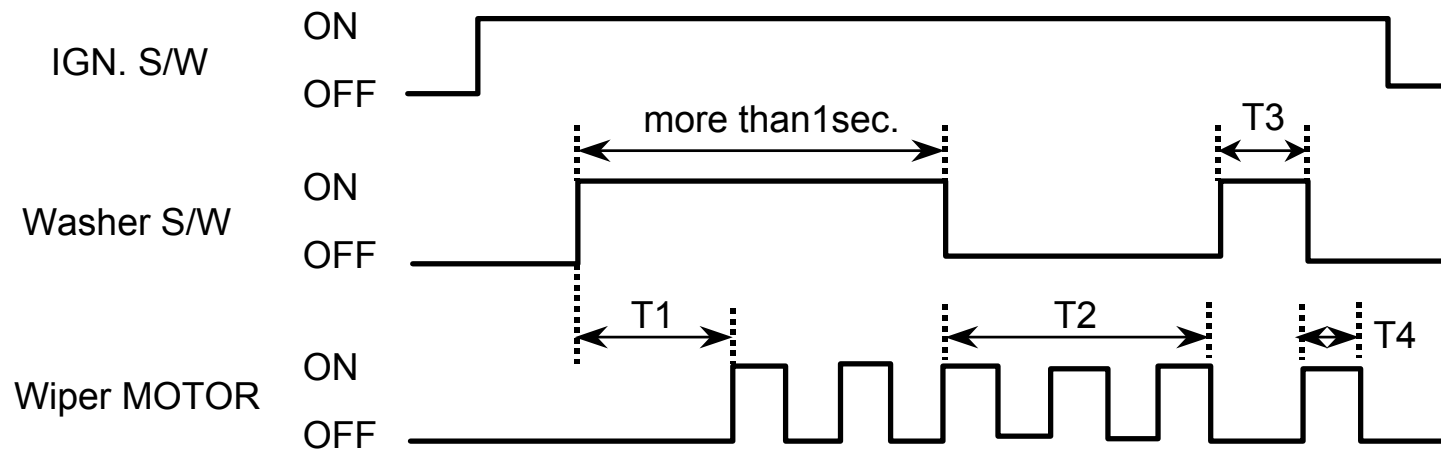
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# ETACS

## FUNCTION

### Detail

## Washer Related Wiper Control



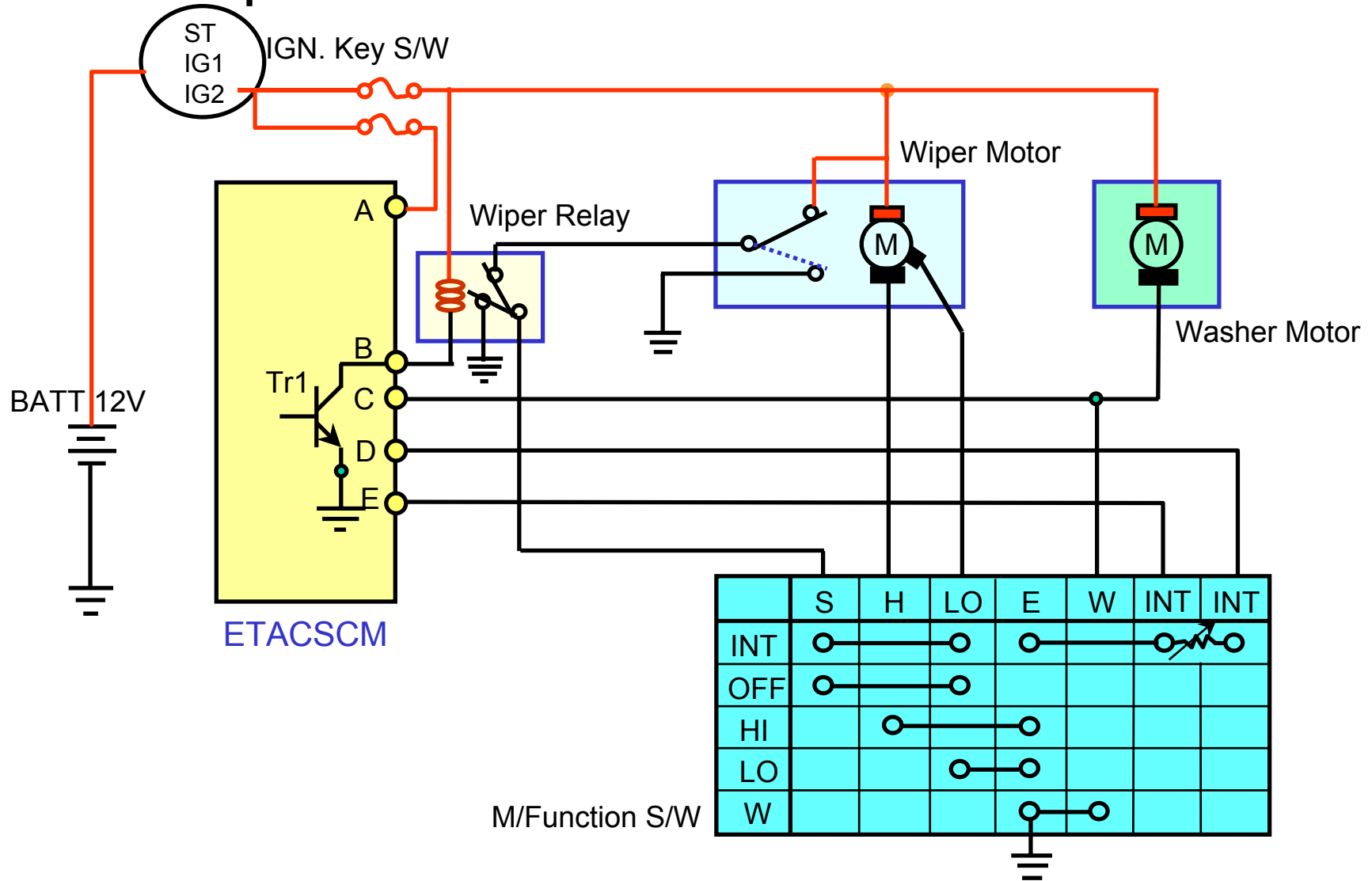
\* T1 :  $0.6 \pm 0.1$  sec. \* T2 : 2.5~3.8 sec. \* T4 :  $0.7 \pm 0.1$  sec. \* T3 : 0.2~0.6 sec.(MAX) T4 : MIST FUNCTION

### Description

1. Wiper is activated for T2 when the Washer Switch is depressed for more than T1 while INT Wiper is working.
2. MIST Function:  
Wiper is activated for T4 when Washer Switch is operated for more than T3 same as Wiper Mist.

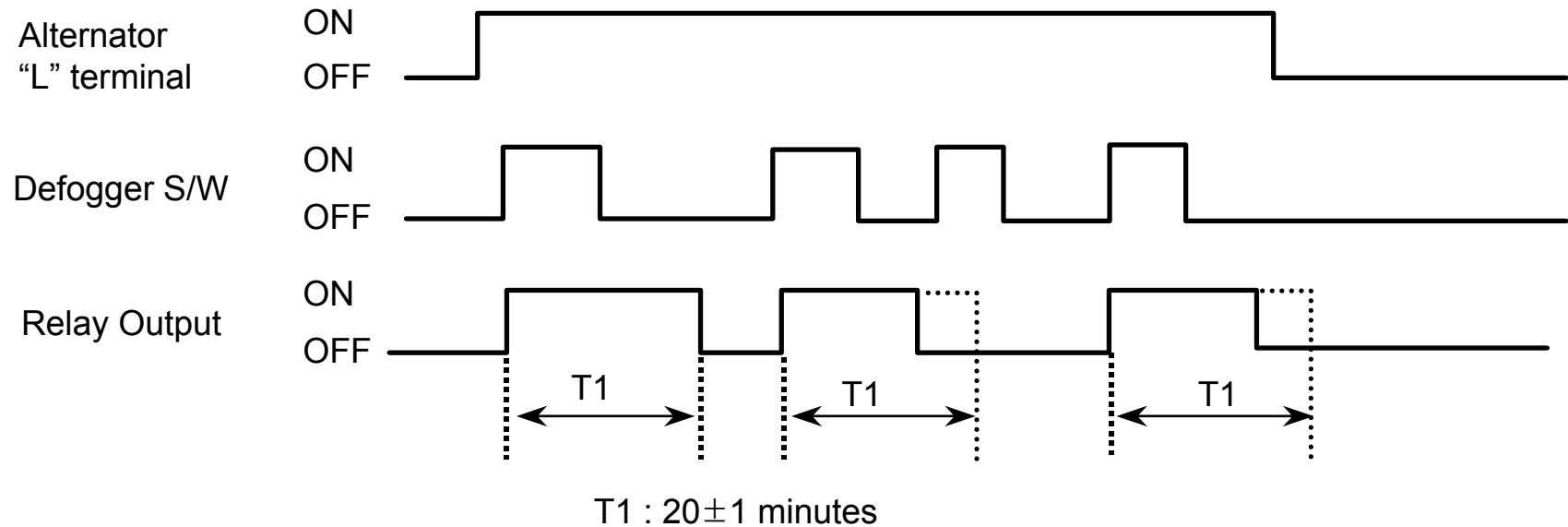
# ETACS -- FUNCTION

## Washer & Wiper Circuit





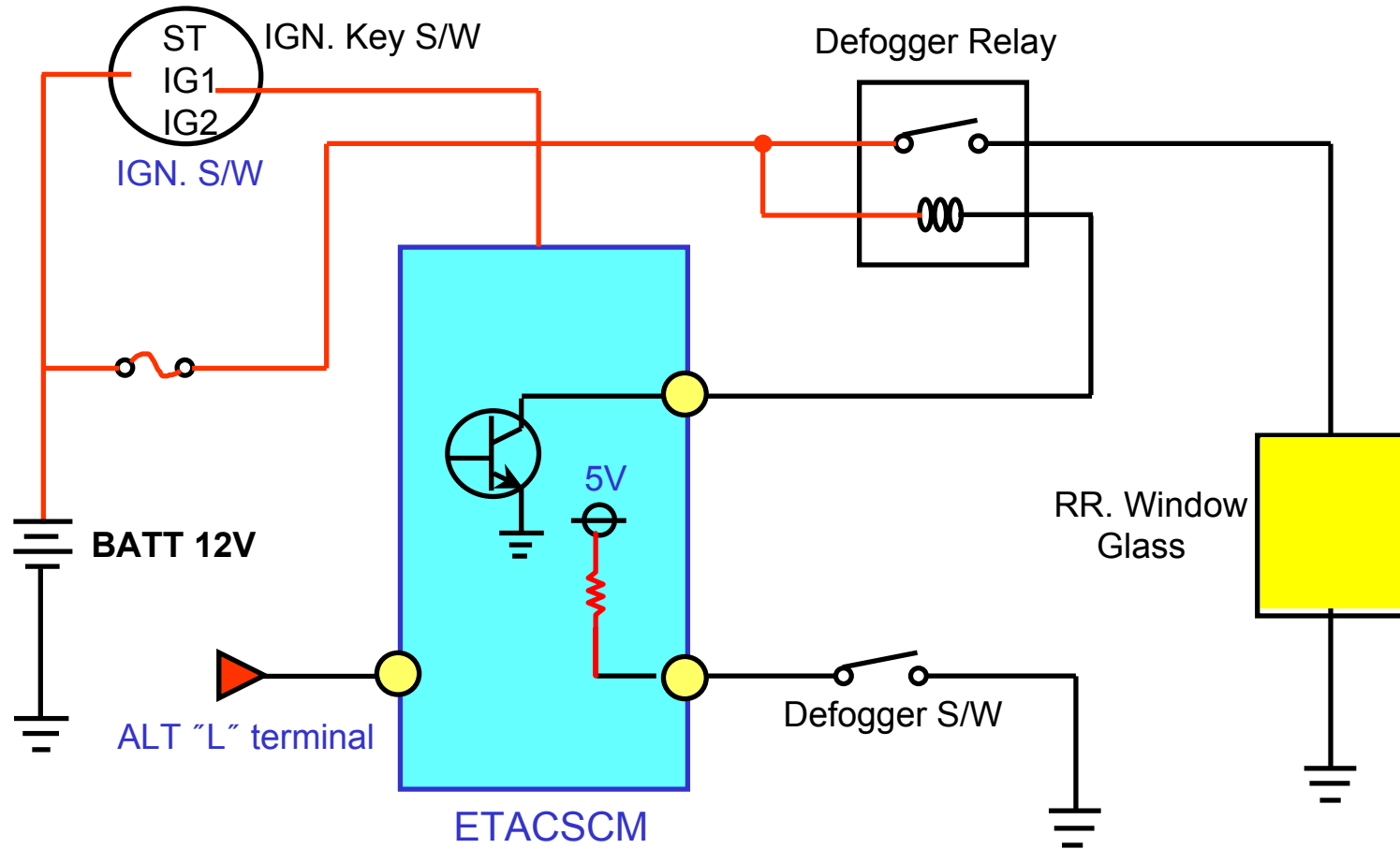
## Rear Window Defogger Timer



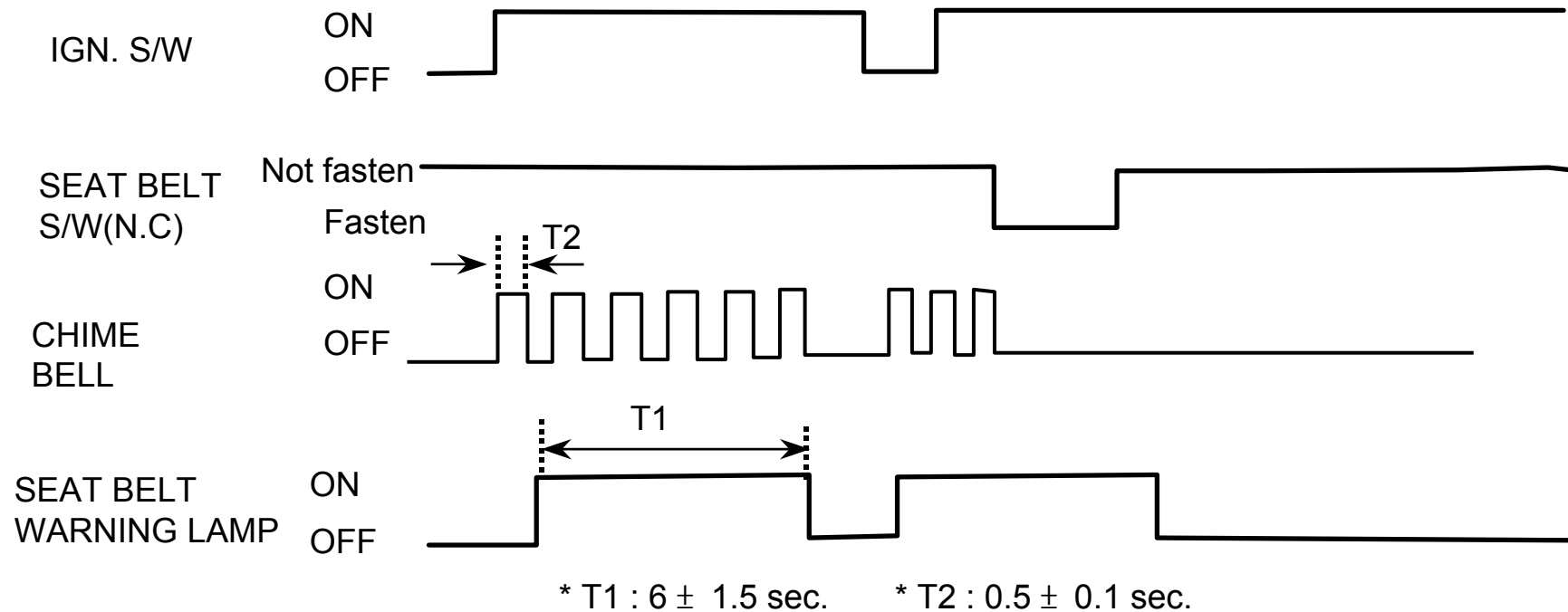
### Description

1. Defogger output (include outside mirror heater) should be ON during 20 minutes, after defogger switch "ON" when alternator "L" terminal is charging "ON".
2. In case of the defogger switch is "ON" again while defogger output is "ON", the defogger (include outside mirror heater) output should be "OFF".
3. If the IG1 is "OFF", There is no ALT "L" is OFF, Output of Defog Relay will be "OFF".

## Defogger System Circuit



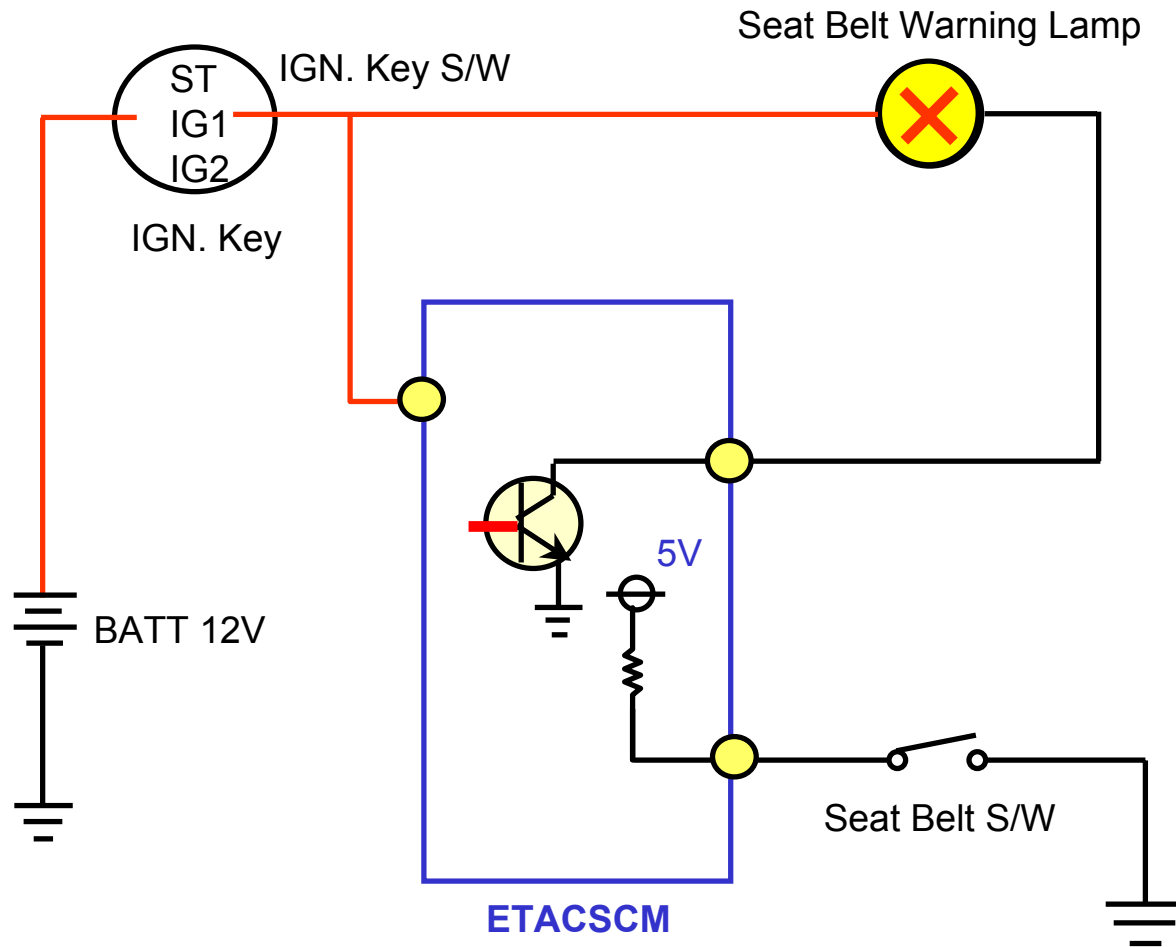
## Seat Belt Warning Timer



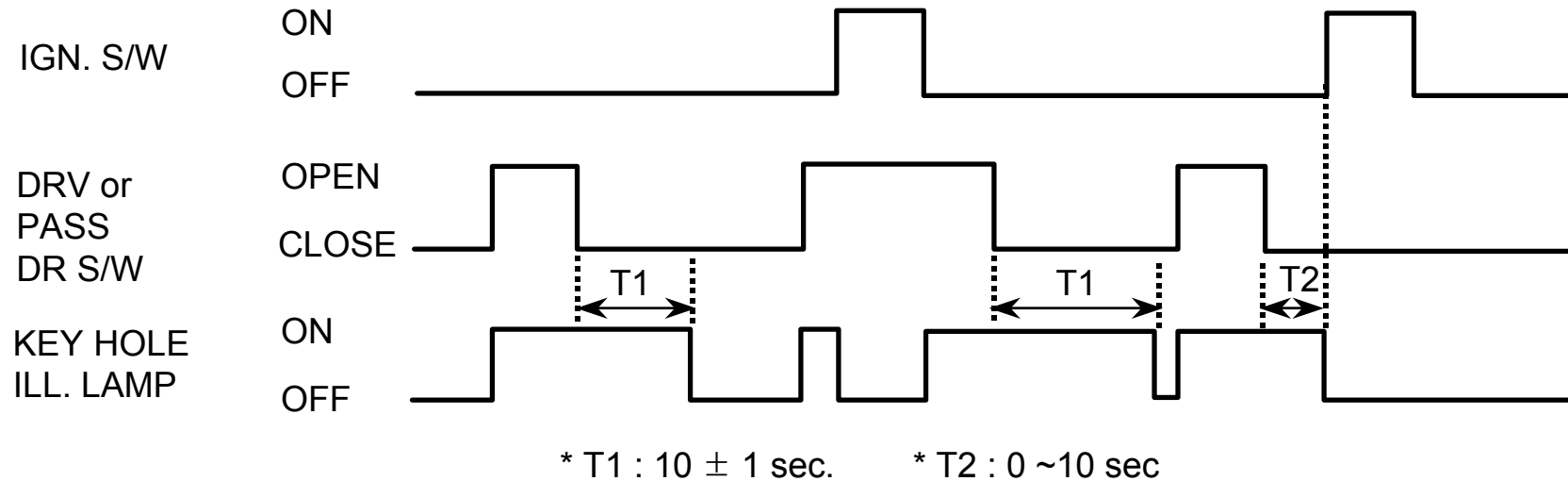
### Description

1. After IG1 on condition, Chime Bell will be ringing with 1sec frequency during T1.
2. If the Seat Belt is fasten, Chime Bell should be stopped immediately but Seat Belt Warning Lamp is on until rest of time.
3. If the seat belt is not fastened while IG1 ON condition, the warning lamp and chime bell output should be repeated continuously until the seat belt is fastened.

## Seat Belt Warning Timer Circuit



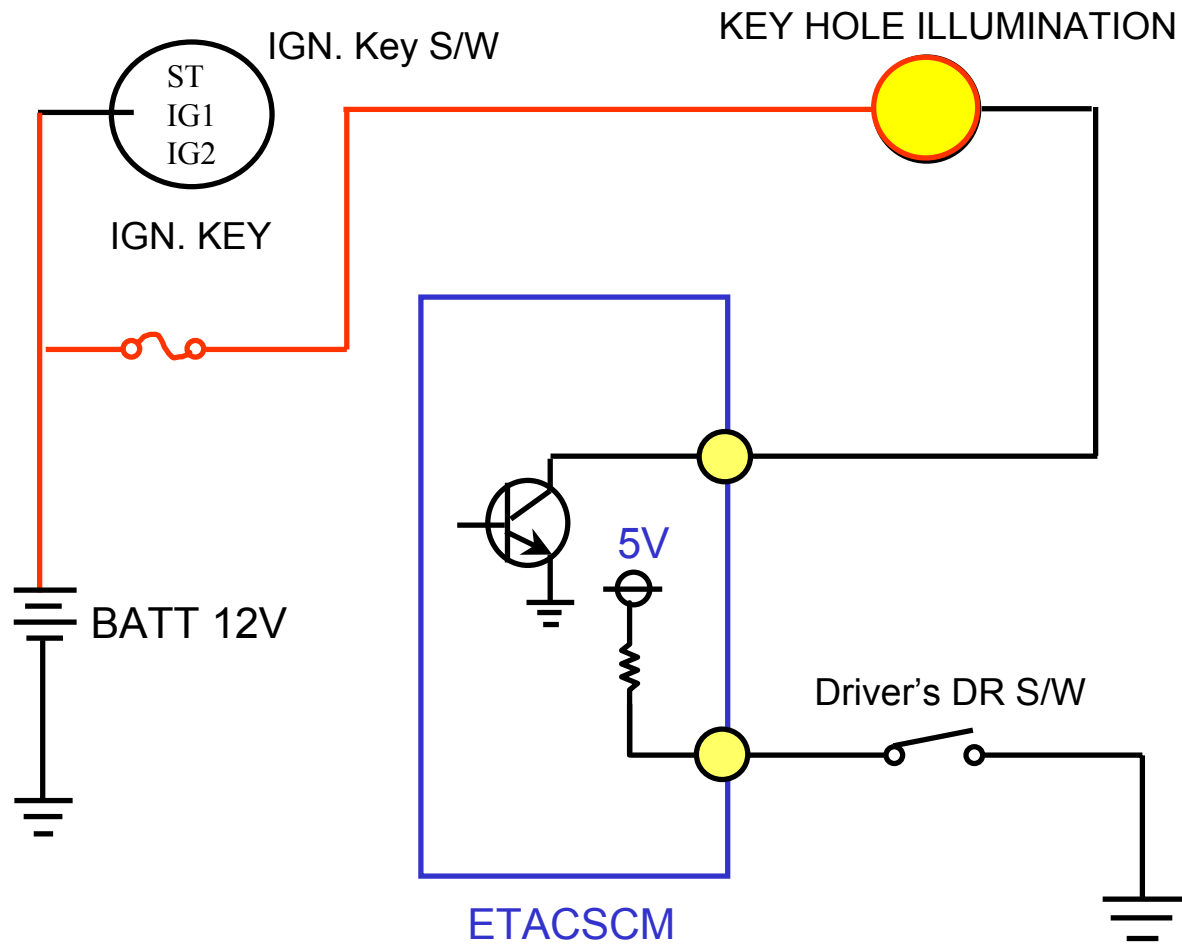
## Key Hole Illumination



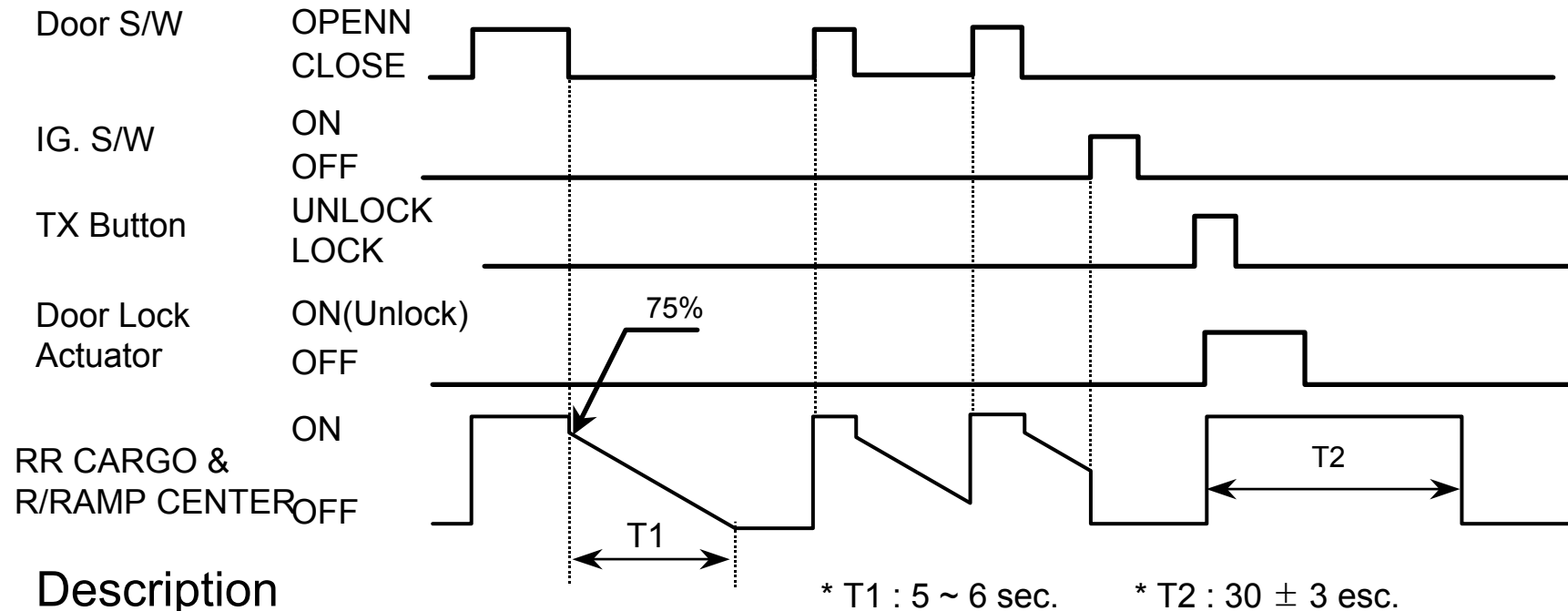
## Description

1. Ignition key hole should be illuminated when driver or passenger door is opened under the condition of IG. switch "OFF".
2. If the driver or passenger door is opened after step 1). (above), the IG. key hole should be "ON" for 10 seconds and turned OFF.
3. In the case of 1). or 2), IG. key hole illumination must be "OFF" (extinguished) immediately at the moment of the IG. "ON".

## Key Hole Illumination Circuit



## Room Lamp Delay Out



### Description

#### 1. Room lamp delay out

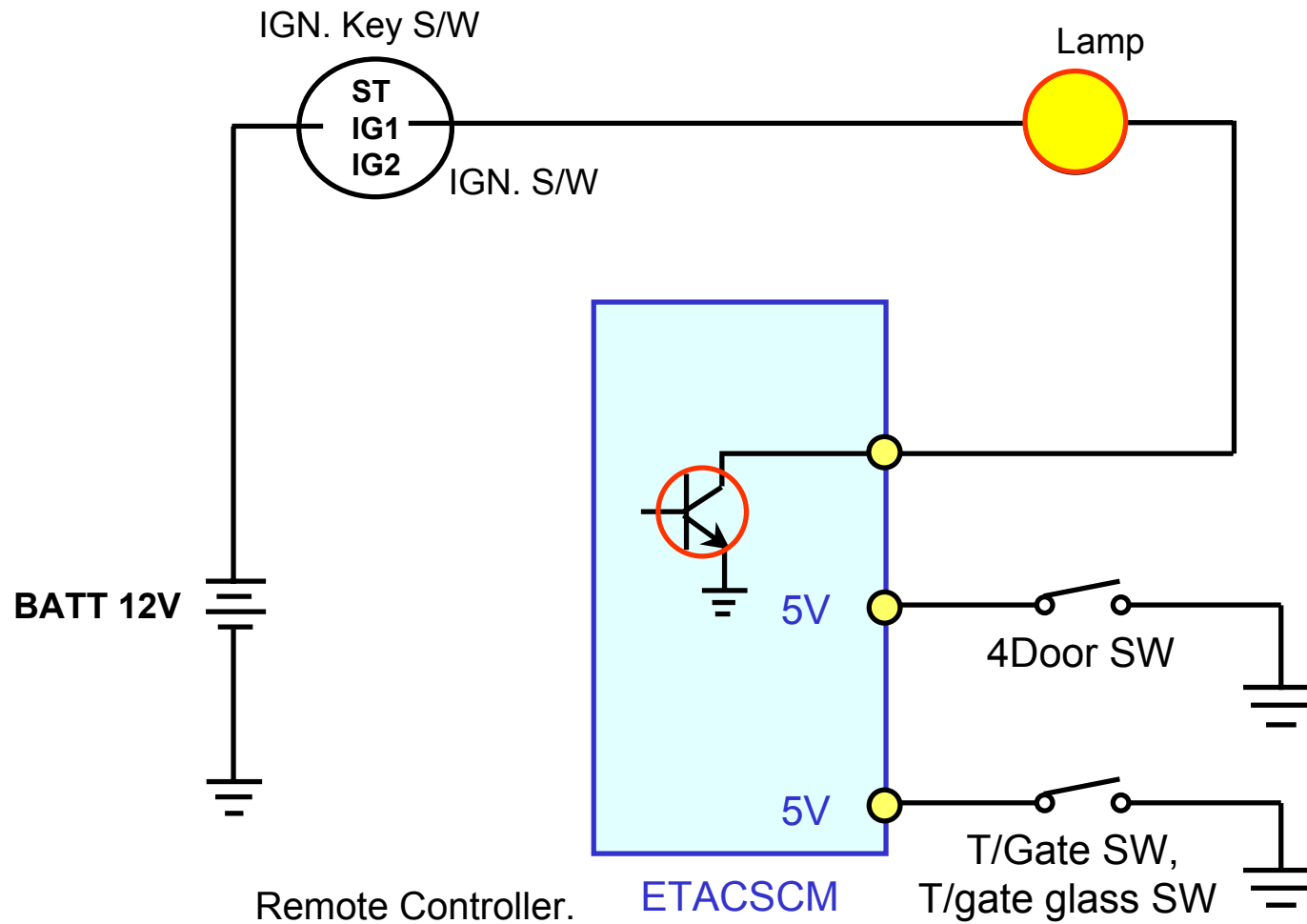
1.1 Room lamp must be light ON when the door is opened. (door switch is ON)

2.2 The brightness of room lamp should be reduced to 75% immediately, and be dimmed off gradually till the room lamp is OFF within 5 - 6seconds after the door is closed (door switch is OFF).

3.3 In case of the door open (door switch is ON) time is less than 0.1 second, then this function should not be operated.

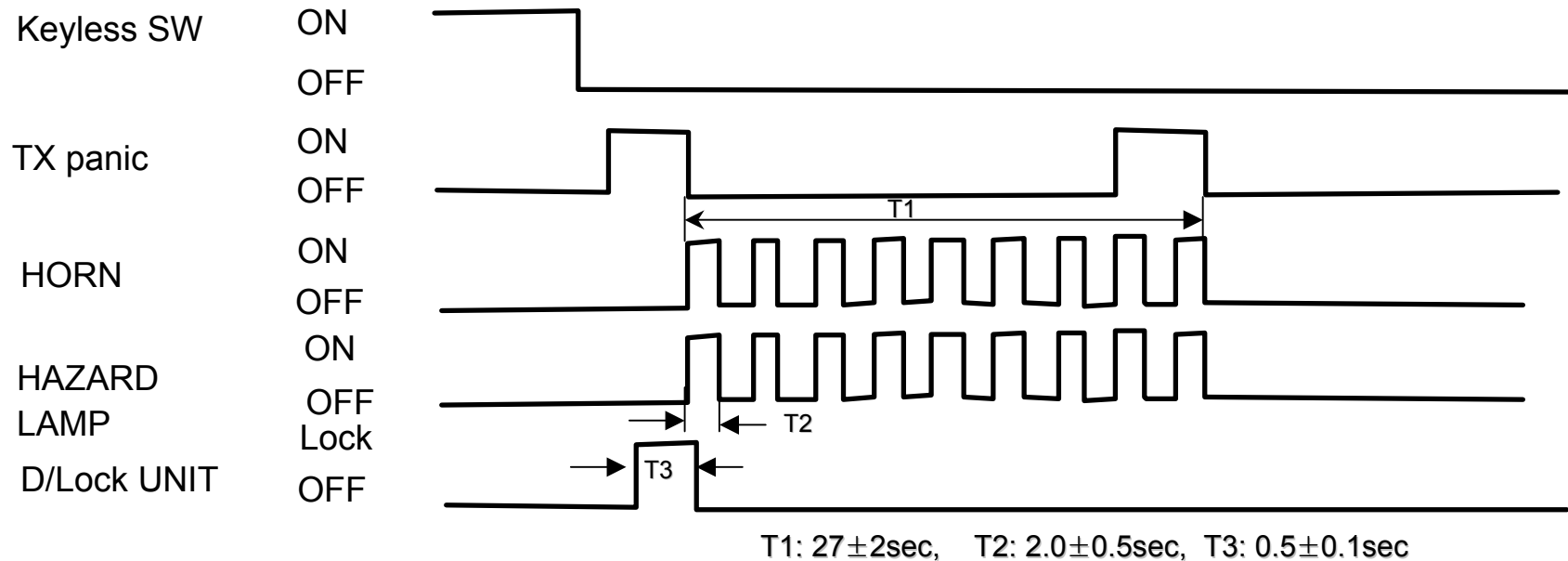
# ETACS -- FUNCTION

## Room Lamp Delay Out





## Panic Function

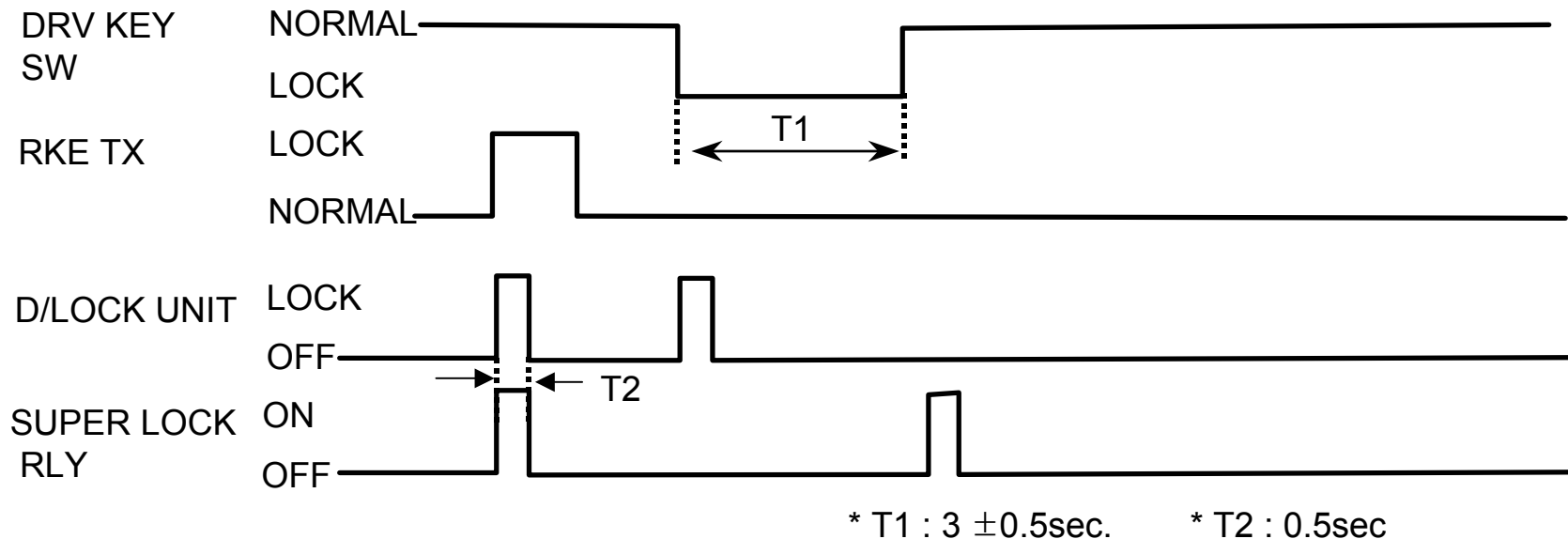


### Description

When ETACSCM receive the TX panic signal, Horn and Hazard lamp is activated for 27sec one time. TX panic signal is made when lock button of TX is pressed for 2.7sec or more.

RKE UNLOCK or Panic signal input again in the ETACSCM while the panic is working, HORN and HAZARD LAMP is quit at once.

## Super Lock Function(only EU)

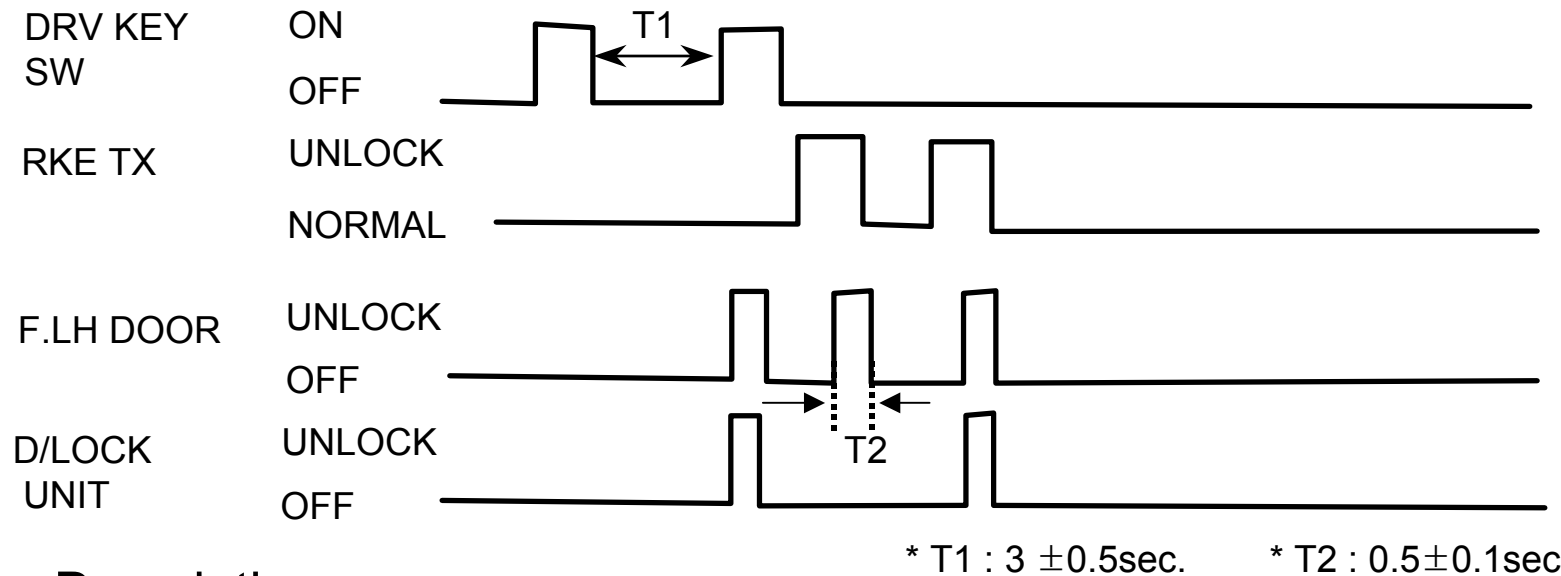


### Description

It is used to prevent vehicle from thief as a supplementary device

When Door Lock Signal from drive key switch or RKE is input to ETACSCM for more than 3sec, SUPER LOCK RELAY is activated so that super lock function is valid.

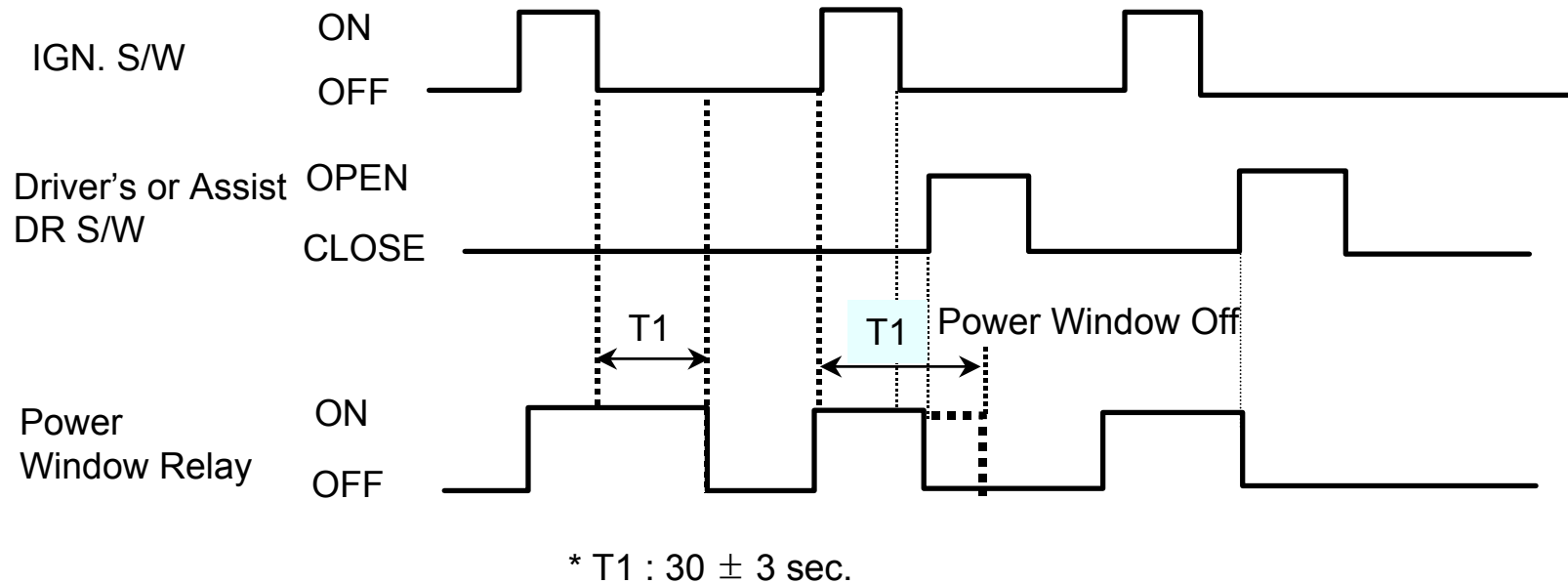
## 2-Turn Unlock Function(only NA)



### Description

It is very useful function to prevent vehicle from unexpected attacking through the passenger door or rear door side. When a driver open the door with key or TX, normally all doors are unlocked . But, this function is different. If a driver turns the key to open the door one time. Only the driver's door is unlocked.and then, one more key is turned to open within 3sec from the first action, the rest of doors are unlocked immediately. In case of using the RKE TX, follow the same procedure above mentioned.

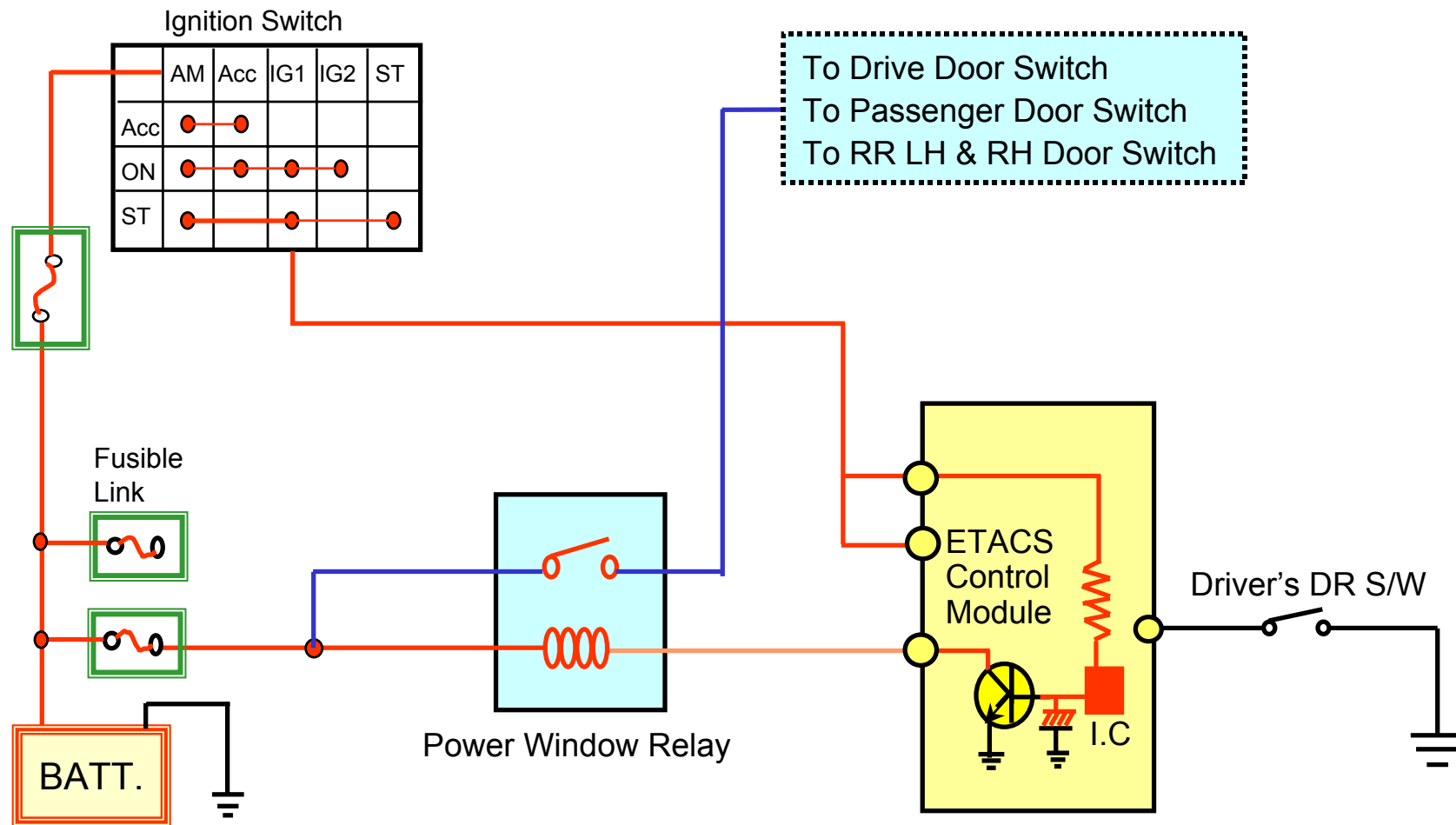
## Power Window Time Lag



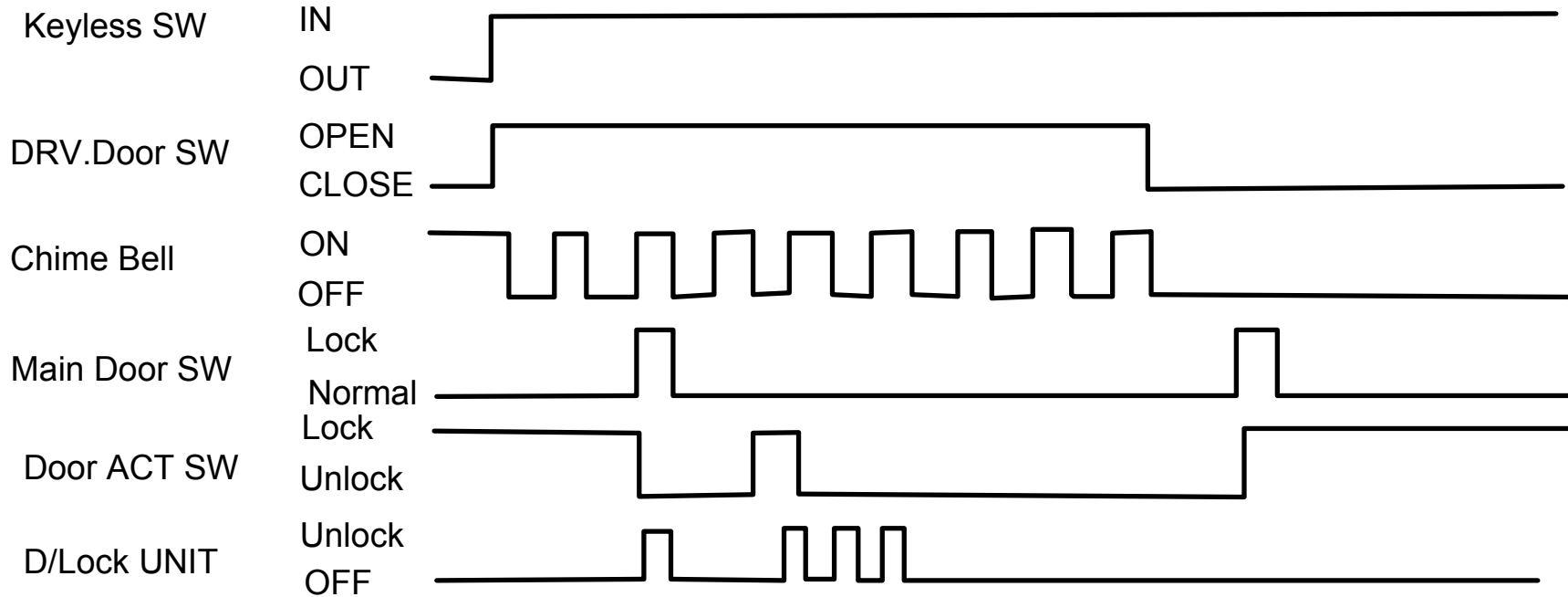
## Description

1. Power window can be activated for T1 even though IG. switch is turned "OFF".
2. Power window output should be OFF as soon as Driver or Passenger door is opened.

## Power Window Circuit



## Ignition Key Reminder Control

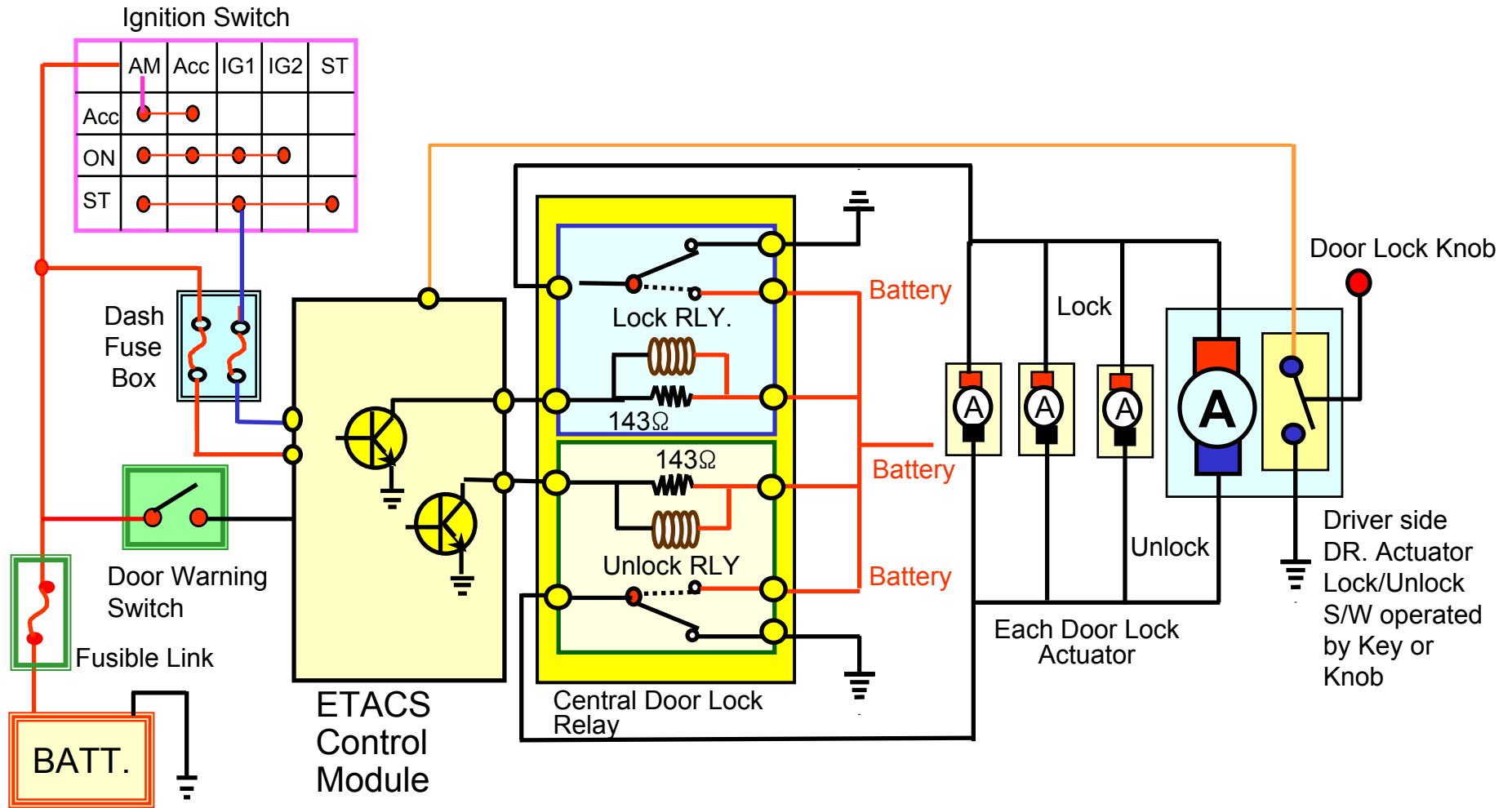


### Description

This function is to prevent vehicle from Door Lock remaining the key in the key cylinder.

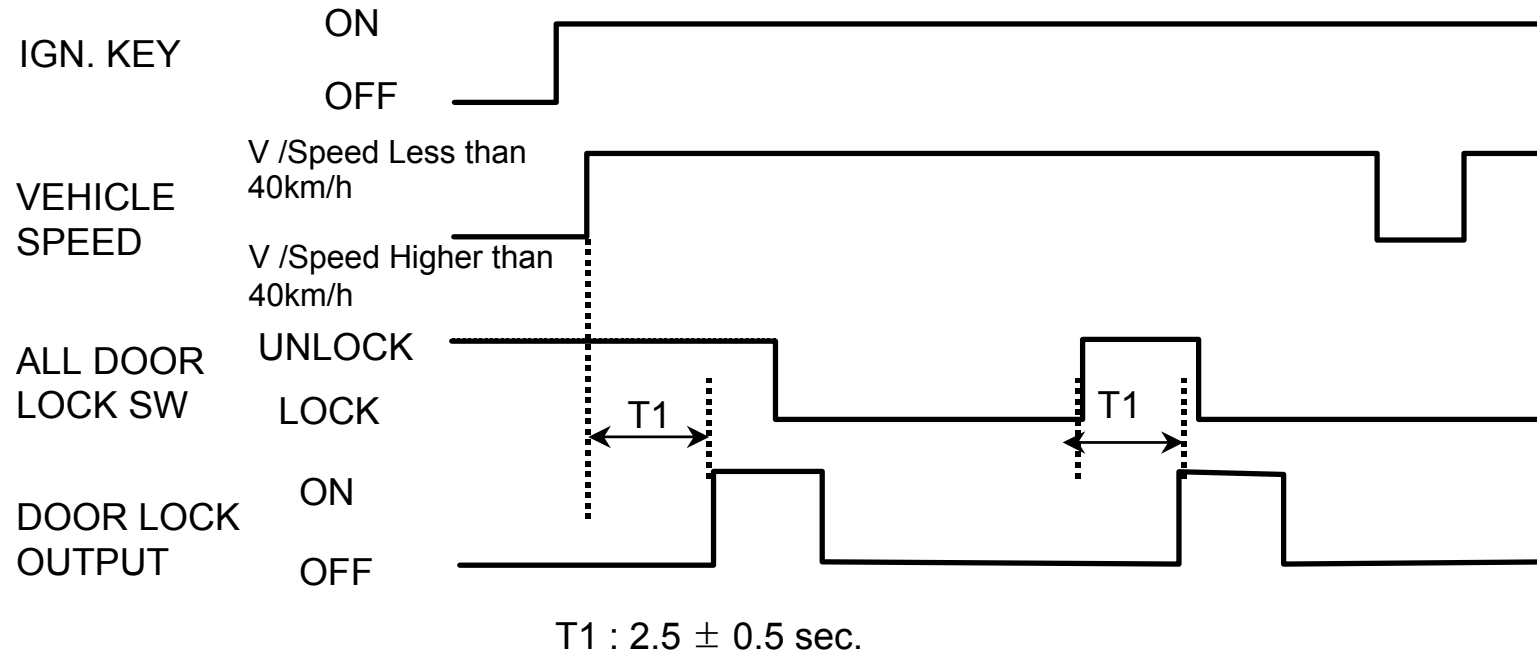
- Door Unlock output is performed just one time and when DOOR actuator "LOCK" is confirmed, D/Lock is actuated 3times

## Ignition Key Reminder Control Circuit



## Speed Sensing Door Lock

- Optional : General Area



### Description

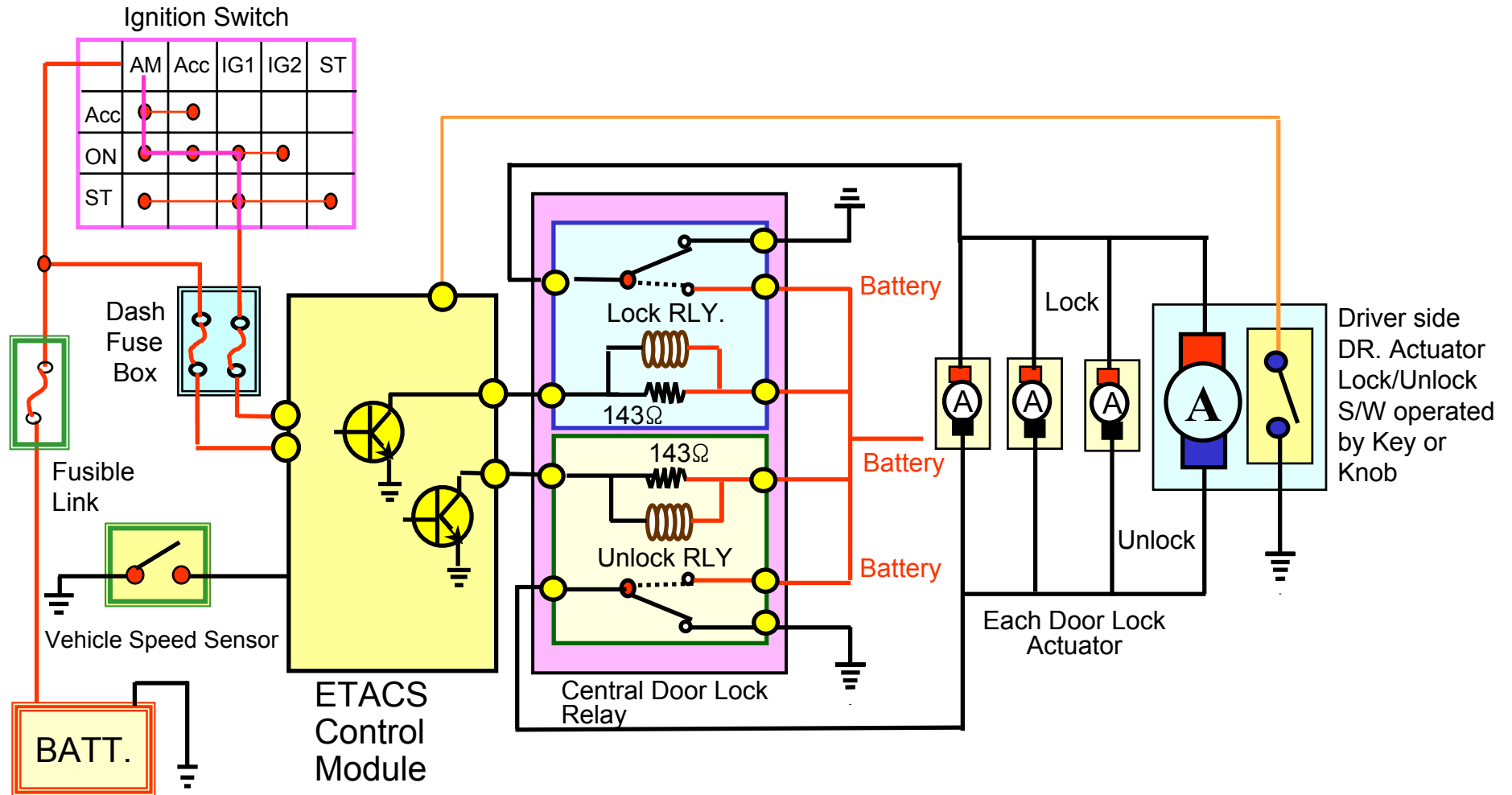
Door lock function is operated automatically, when vehicle speed is more than 40 Km/h.

1. IG. switch is ON.
2. Vehicle speed is more than 40 Km/h.

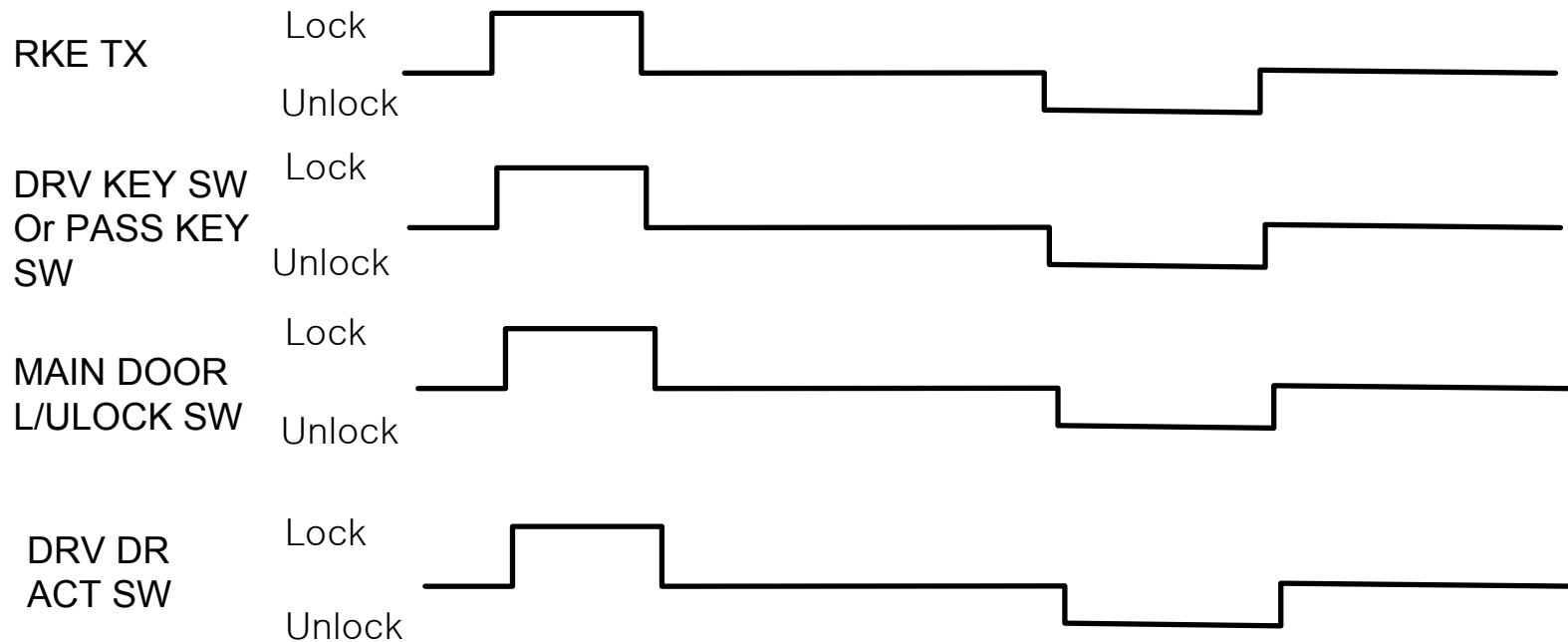
ETACSCM receive the vehicle speed from the vehicle speed sensor directly.



## Speed Sensing Door Lock Circuit



## Central Door Lock Control

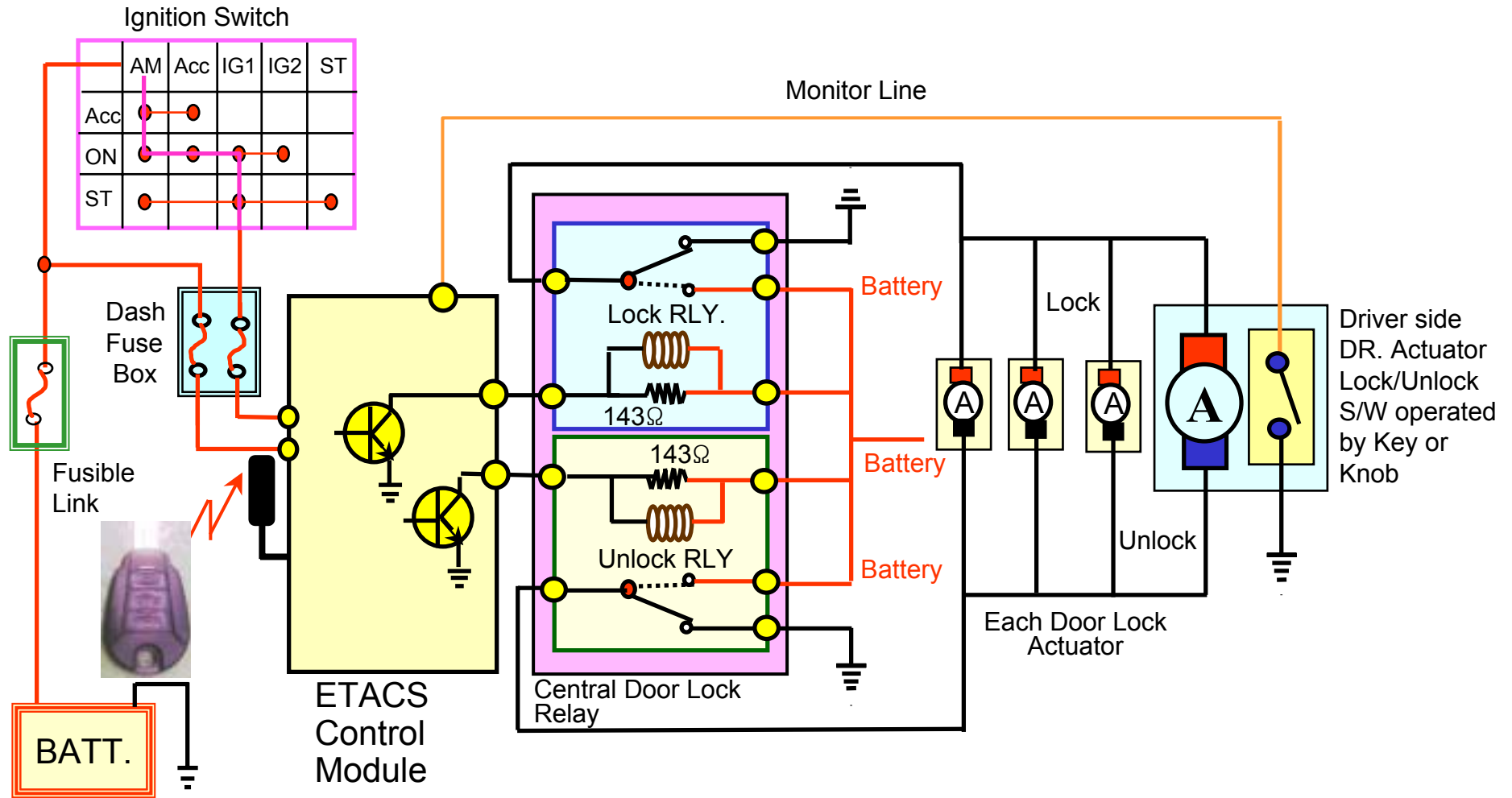


## Description

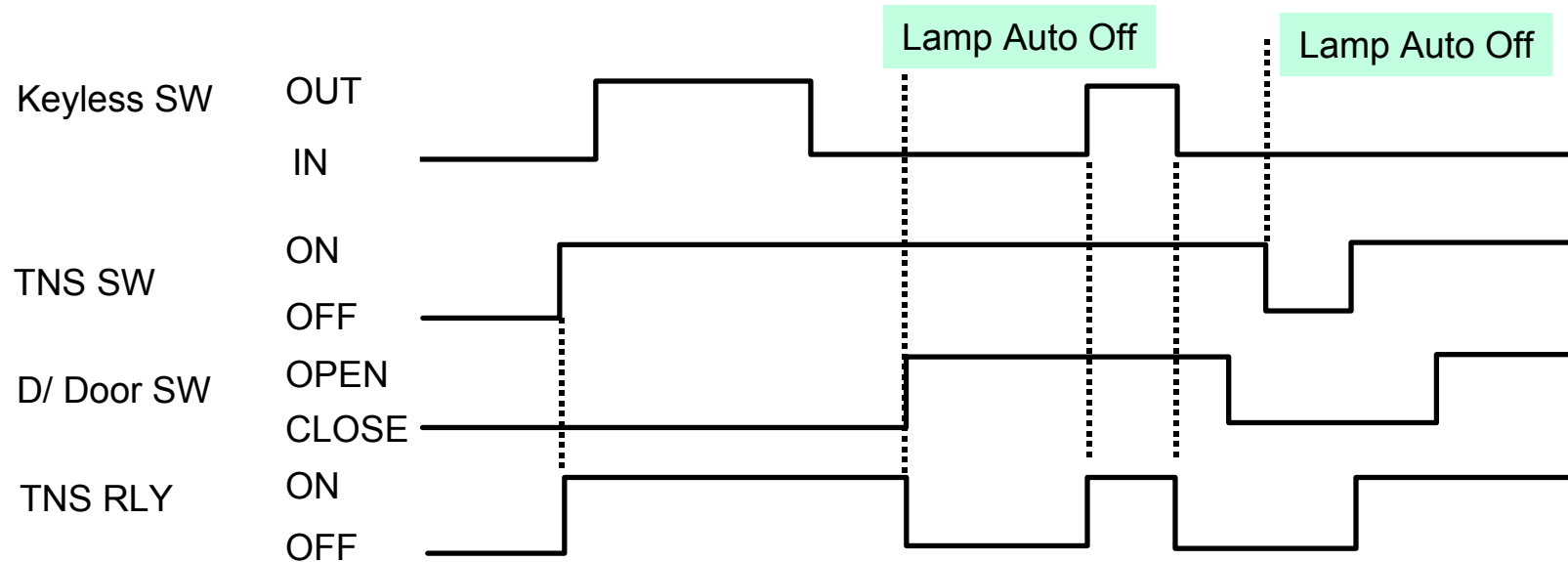
The ETACS module receives “Lock/Unlock” signal from the transmitter and carry out door “Lock or Unlock actuator.

- After receive the UNLOCK signal form the RKE, if DOOR OPEN is not performed, All Door Lock is activated again
- Door Lock/Unlock is activated regardless of Lock or Unlock signal of RKE.

## Central Door Lock Control Circuit



## TNS CONTROL(Battery saver)

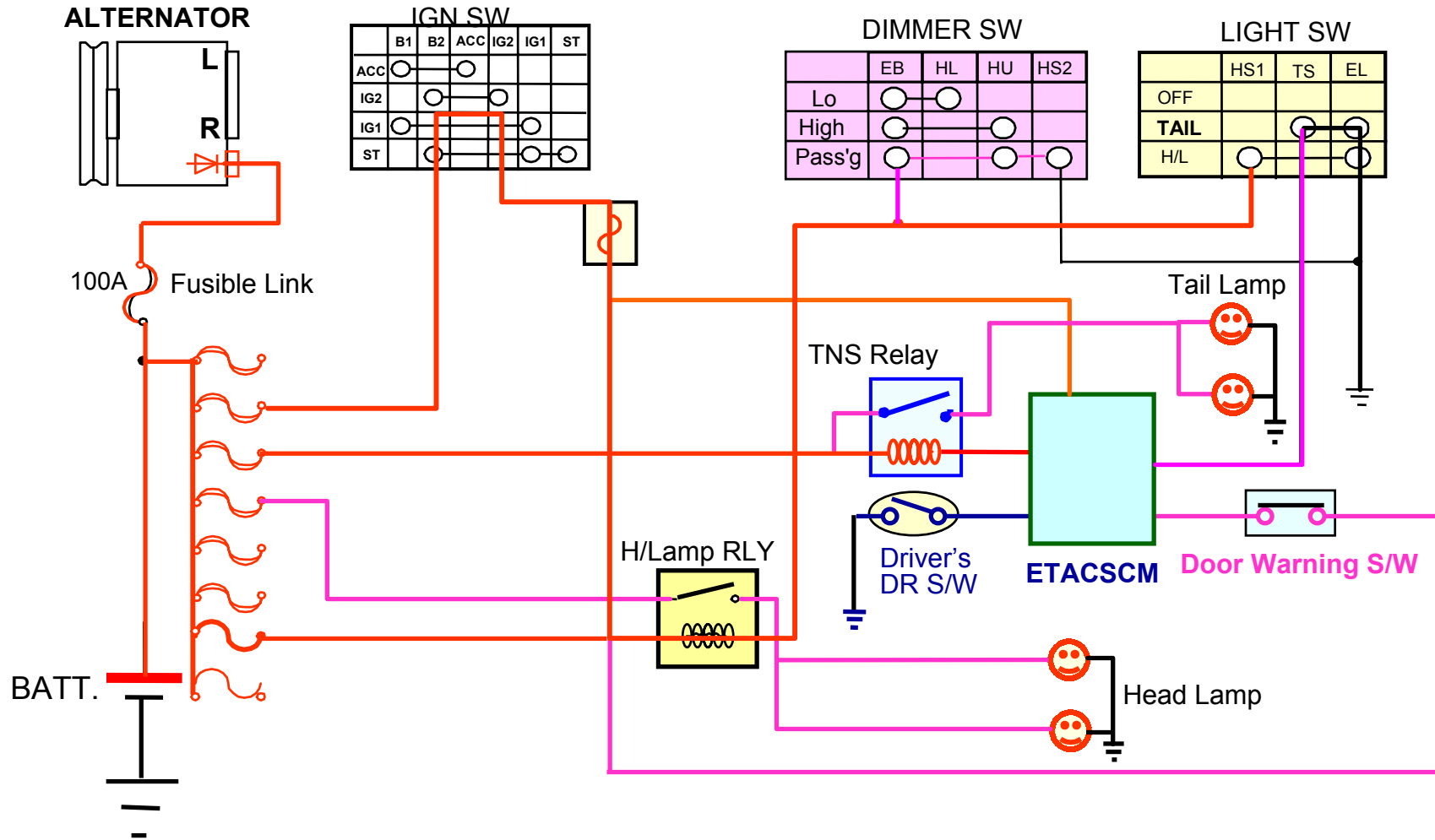


### Description

1. If a driver open the drive door while the TNS SW is on condition.  
The TNS relay is turned OFF by the ETACSCM as soon as door switch is turned ON.
2. Whenever keyless switch is inserted In key cylinder, TNS relay is turned ON automatically.
- 3 After automatic extinguish, if the tail lamp switch is turned ON again, then, the tail lamp will be ON (illuminating) and the auto cut function will be released.

# ETACS -- FUNCTION

## Battery Saver Circuit



# RKE- Remote Keyless Entry System

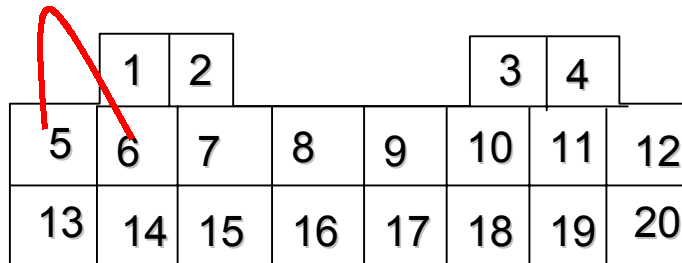
30

## Transmitter

### Specification

ITEM	SPECIFICATION
Rate Voltage	DC 3V
Operating Voltage	DC 2.5 ~ 3.2V
Operating temperature range	-20 ~+60°C
Modulation	AM
Frequency	315MHz(NAS & General) 433MHz(EC)
Code	Rolling Code(Hopping Algorithm)
Communication distance	5 m or more
Battery Life	2 Year(10 times/a day) - Lithium 3V 1EA

## Code Saving method



### 20pin D/Connector

No 5 : battery B+

No 6 : RKE set

### Only one TX cording procedure

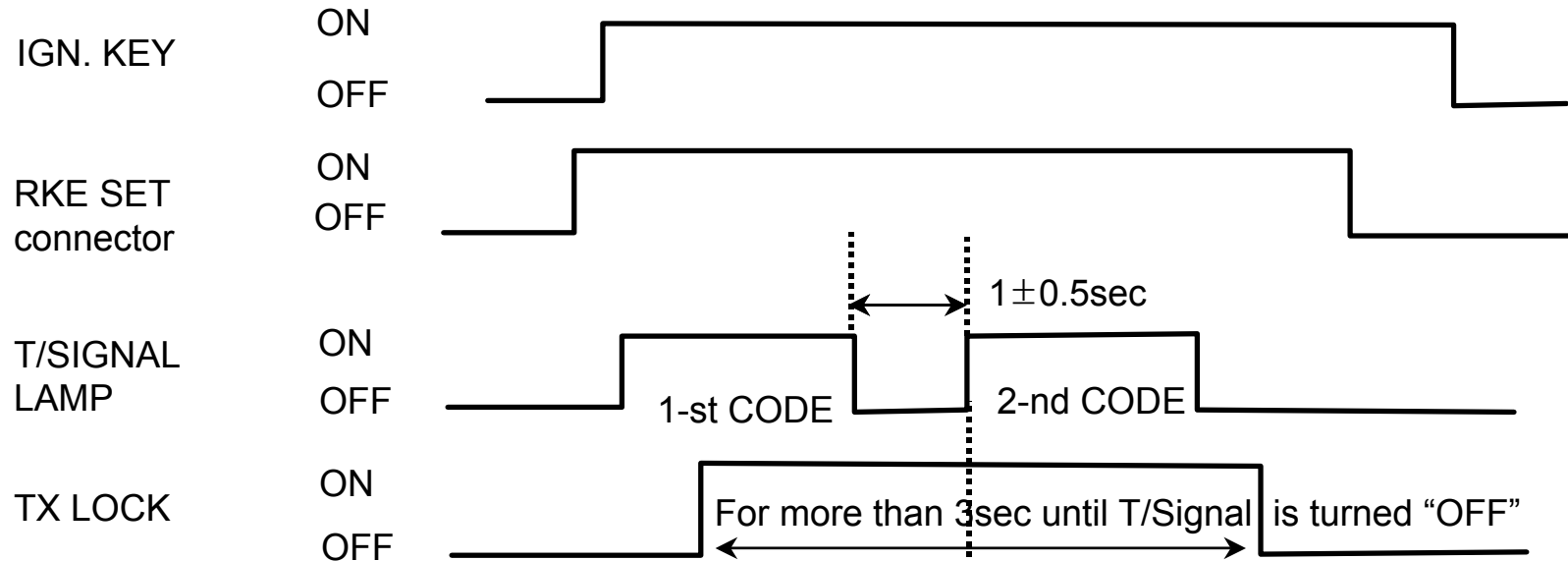
1. IGN. key is turned on
2. Connect both #5 and #6
3. Push lock button for 3sec or more while turn signal lamp is blinking twice, After stop the blinking, release the lock button and completed

### Two TX cording procedure

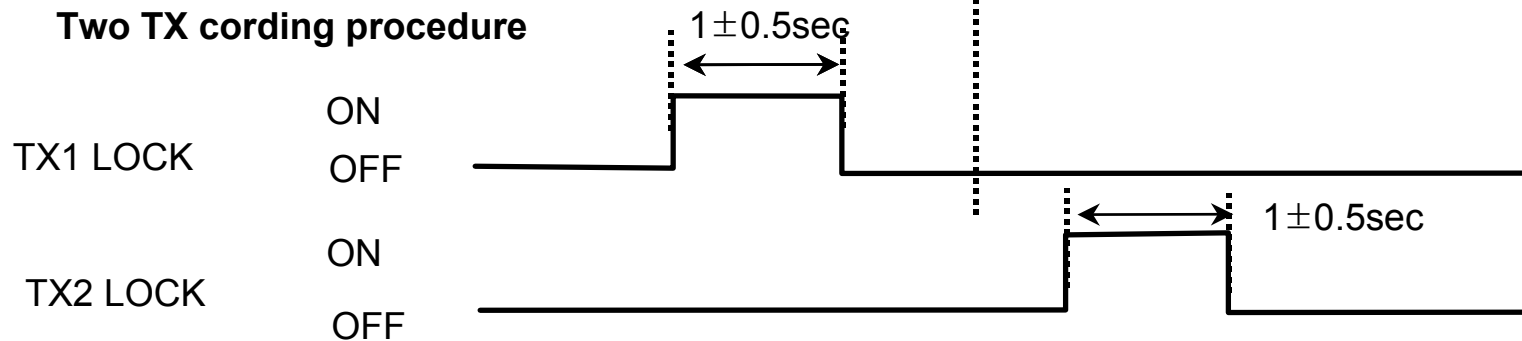
1. follow above 1. and 2.
2. Push lock button of one TX for 1sec or more while the first turn signal lamp is blinking. After stop blinking, release TX lock button. After 1sec or more push lock button of the other TX for 1sec or more while the second turn signal lamp is blinking. After stop the blinking, release the TX button of the second one and completed all procedure of cording method.

## Code Saving method

### One TX cording procedure



### Two TX cording procedure





## QUESTION

Q1 시동 중에 간헐적으로 와이퍼 motor가 작동한다. 무엇이 문제인가?

Q2 Transmitter로 lock후 잠시 후에 Siren이 울린다. 무엇이 문제인가?

Q3 Transmitter로 lock 시에 door Lock은 되는데 Arm 상태로 가지 않는다 무엇이 문제 인가?

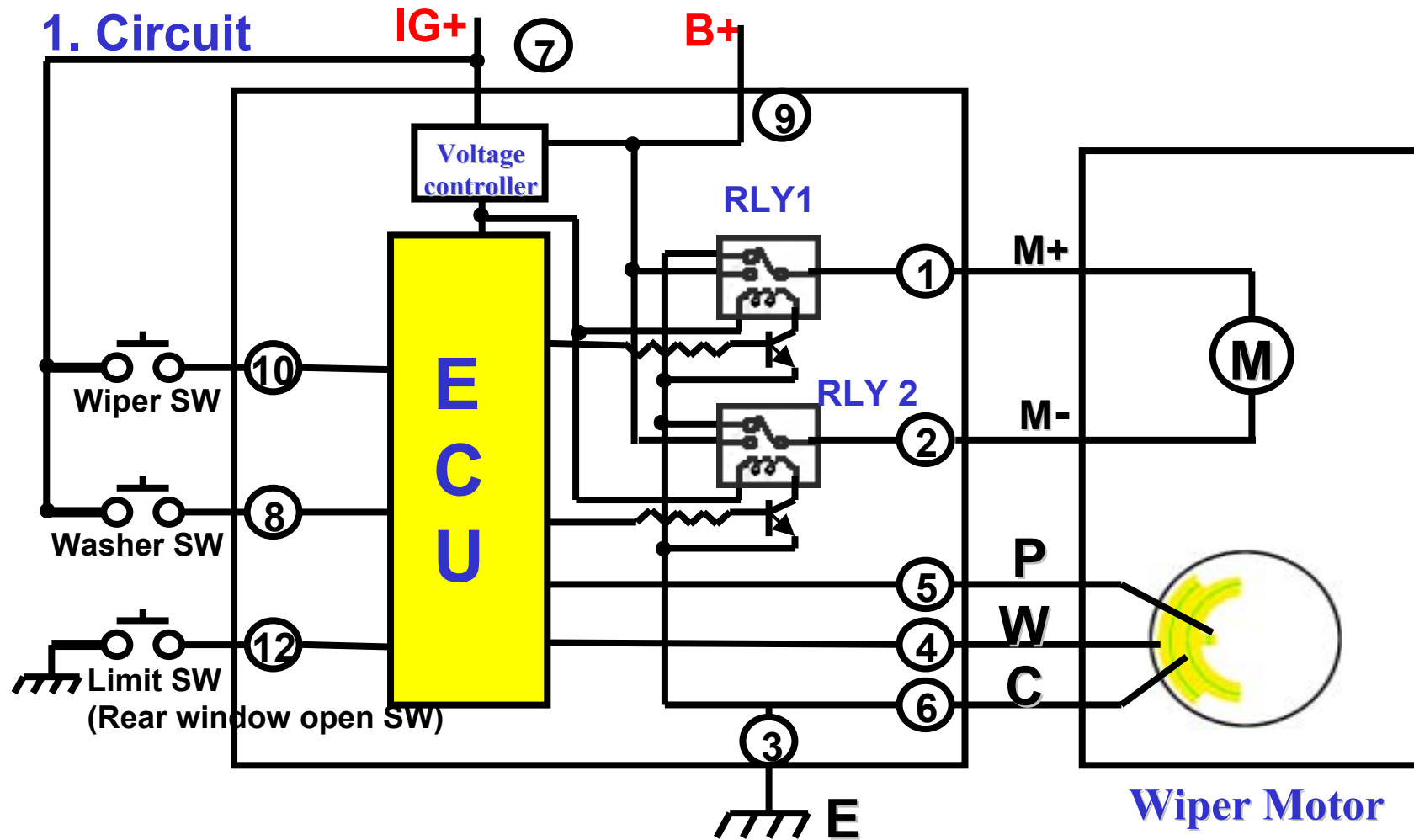
Q4 Transmitter로 Lock시에 Hazard Lamp는 1회 깜박거리는데 door lock은 작동하지 않는다면 무엇이 문제인가? 또한 이때 arm 상태로 가는가?

Q5 Transmitter Door Lock or Unlock Button Push시 아무런 응답이 없을 때 Check Procedure는?

Q6 Lock 상태에서 Transmitter 를 분실하였다면 어떻게 Arm 상태를 해제 할 수 있나

# REAR WIPER SORENTO

# REAR WIPER



※ **Wiper Motor rotate direction**

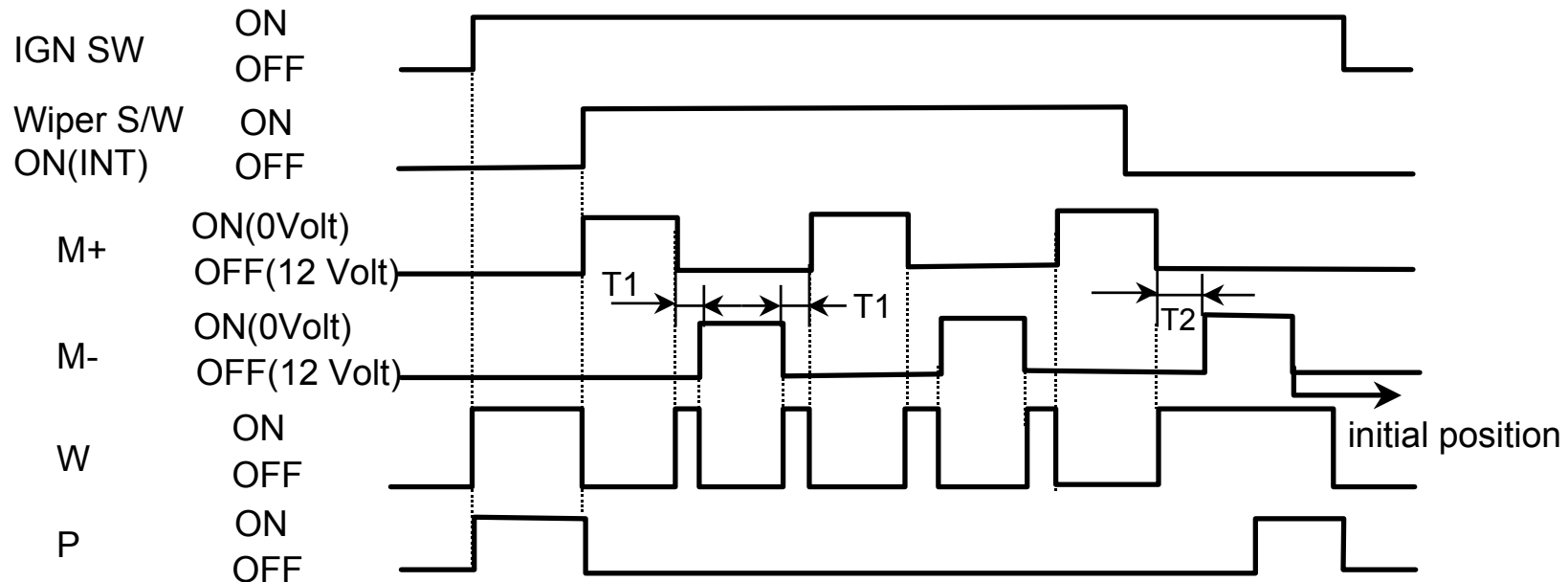
- M+ 12 Volt, M- 0 Volt : Wiper motor turn to right
- M- 0 Volt, M- 12 Volt : Wiper Motor turn left

## 1.1 Rear Wiper Motor Control Description

1. The window glass of tail gate in BL Car is possible to open,  
Therefore, it is impossible that the rear wiper can be operated by ECU while opening the rear window glass.
2. There are two pieces of relay in the controller. These relays control the motor rotation direction such as clockwise or counterclockwise according to the signal of “P, W, C”.
3. There are two condenser in the controller to use EMI(electromagnetic interference)filter.  
In case of malfunction of these condenser, It causes reverse electromotive force to controller.
4. Rear window glass S/W is LIMIT SWITCH on the crash pad . If this S/W is operated while operating the wiper motor, the wiper motor is no longer to work and go back to parking position.

## 2. Function “1” -- Normal mode.

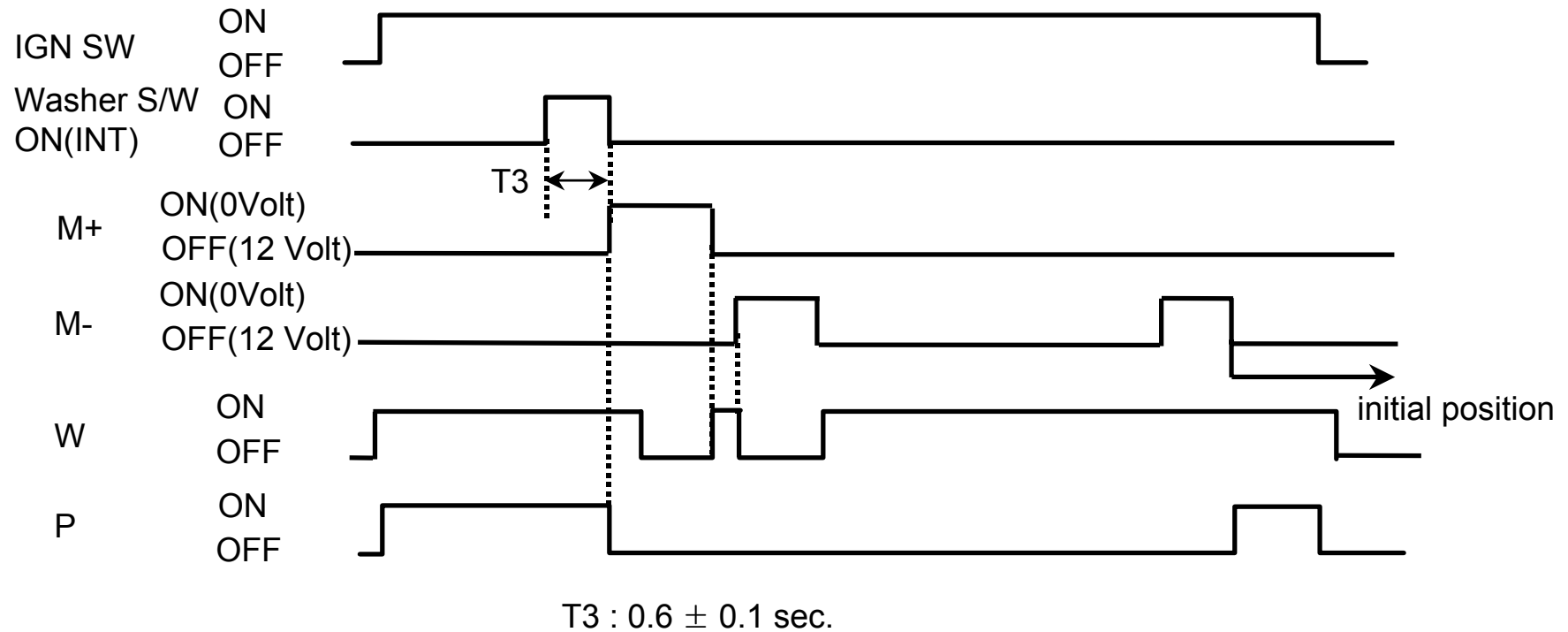
1. If the wiper S/W is “ON” condition at the IG1, the relay 1 is operated by controller so that wiper motor turns clockwise.
2. When controller receive the signal “W” from the wiper motor slit, the relay2 is operated by controller so that the motor turns reverse direction(counter-clockwise). Rotation angle of wiper motor is 260 degree
3. Even though the wiper S/W is turned OFF while operating the wiper motor, The wiper motor is working until wiper motor signal reaches to P position.



T1 retardation Time(in wipe mode) :  $200 \pm 50$  ms. T2 retardation Time :  $1200 \pm 100$ ms.

## 3. Function “2”-- Washer Linkage Mode

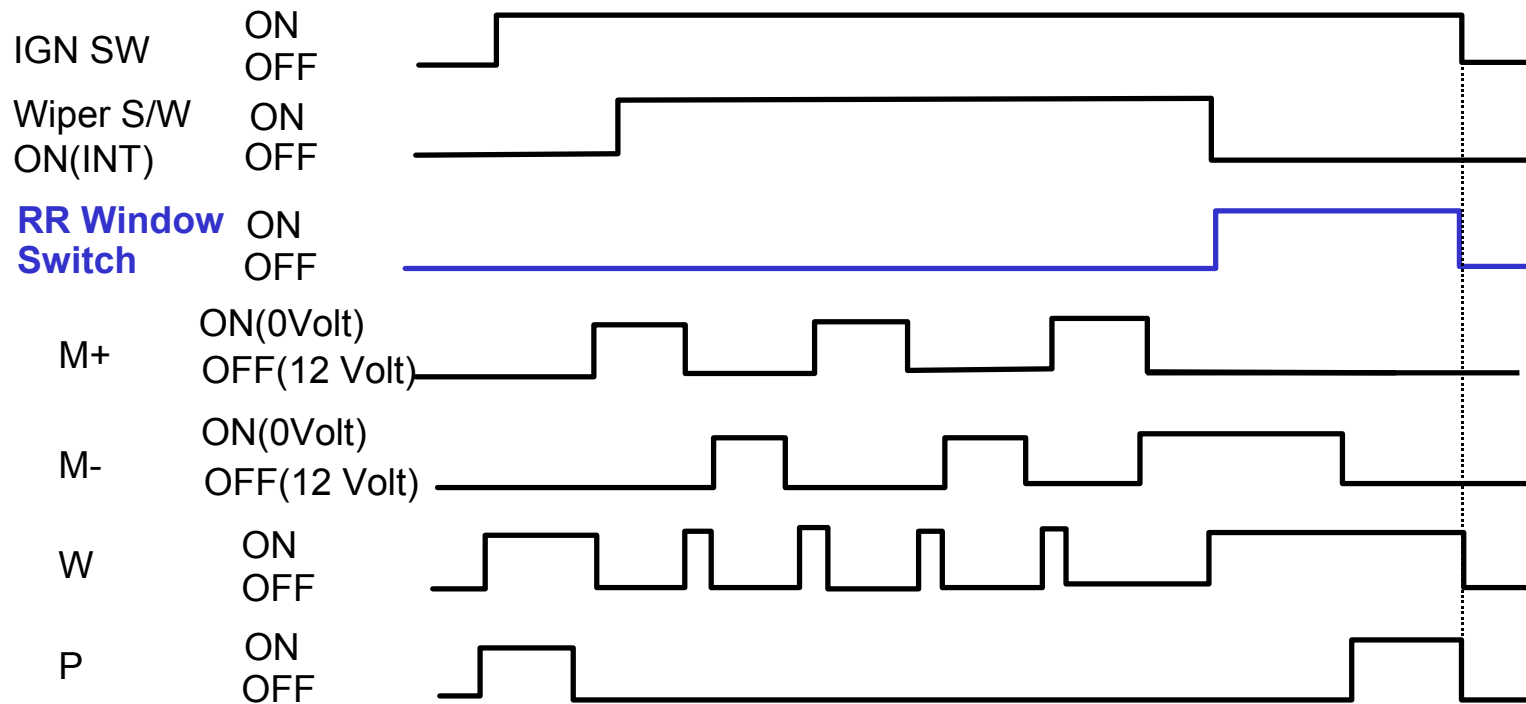
1. When wiper switch is “ON” more than 0.6sec at the IG1condition, Washer linkage wiper is operated.
2. If the washer S/W is OFF, the wiper motor go back to the initial position after 2 times operation.



# REAR WIPER

## 4. Function “3”-- Rear Window S/W(Limit Switch) “ON/OFF” Mode

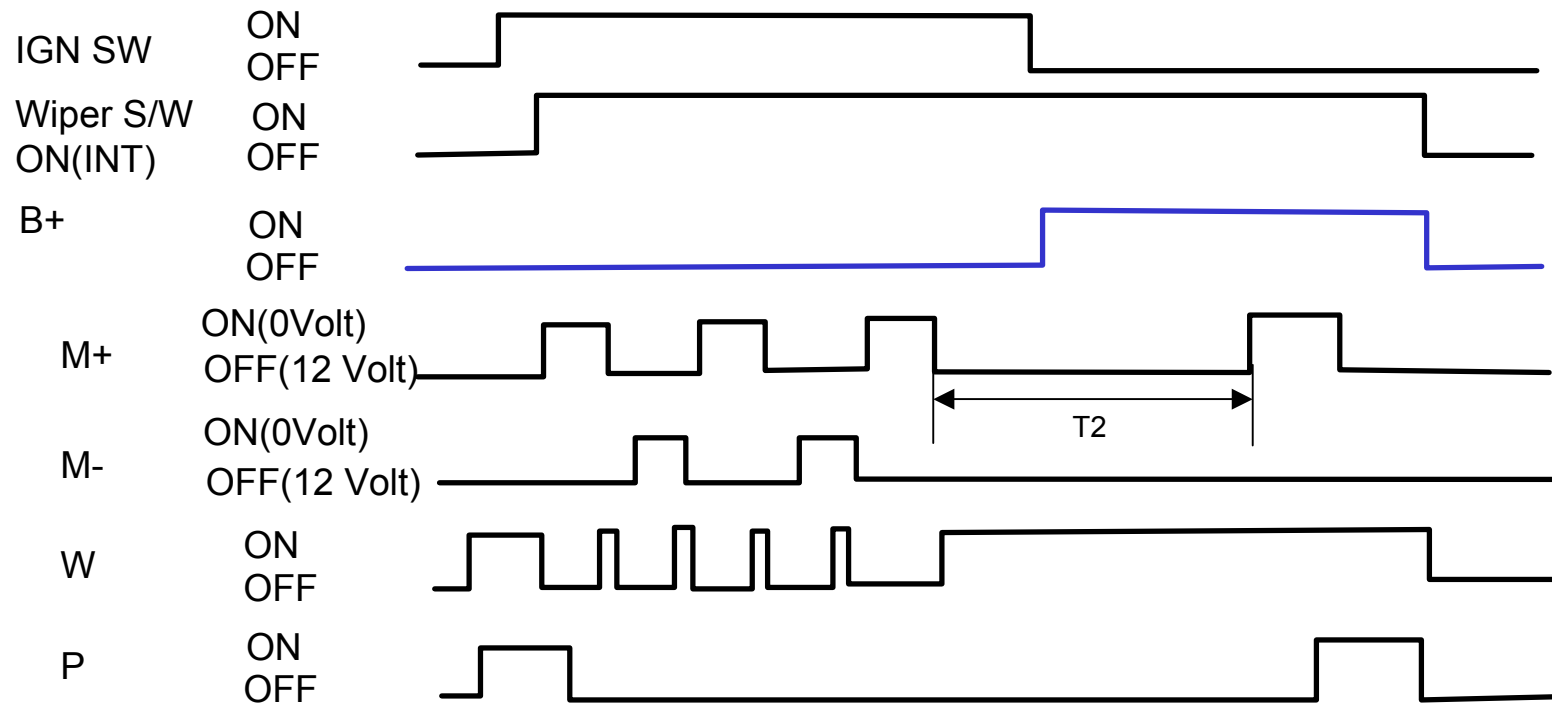
1. During the wiper motor operation, If the rear window glass S/W or tail gate S/W is turned “ON”  
The wiper motor goes to parking position immediately and stop the motor
2. While the rear window glass S/W or tail gate is turned “ ON” the wiper motor is not operated by the controller to prevent the interruption of brush with rear window.



# REAR WIPER

## 5. Function “4”– Auto Parking Mode

- If IG switch is turned “OFF” while wiper motor is working. Controller remain the B+ contact pointer to “ON” condition to allow the wiper goes back to parking position and than turned wiper motor to “OFF” condition





# AUTO LIGHTING

# AUTO LIGHT

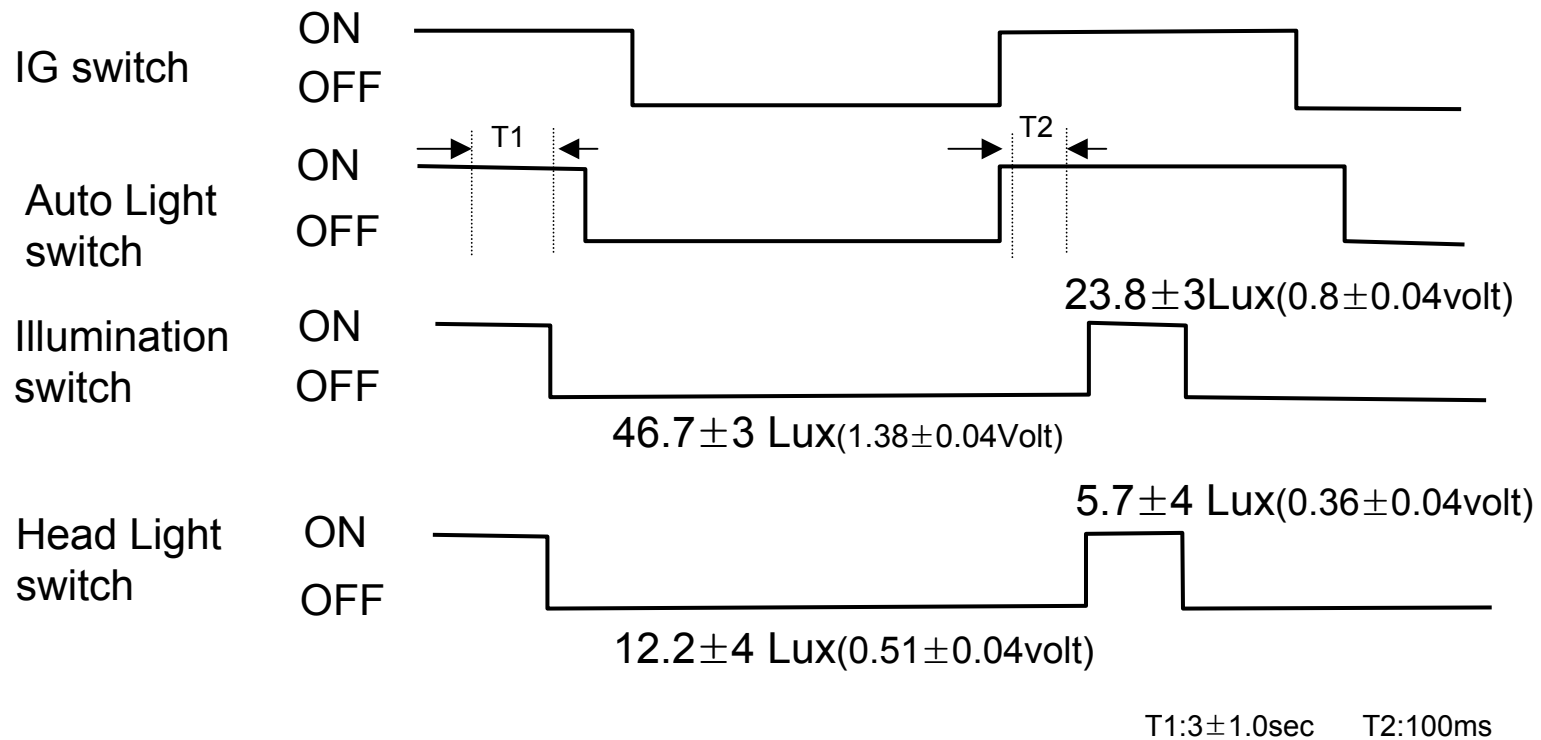
## Auto Lighting System (Tail & Head Light)

Switch Position		Lamp operation	Description
Manual	<b>Tail Lamp</b>	Tail Lamp ON	<ul style="list-style-type: none"><li>◆ According to the position of tail lamp Switch, the tail lamp is turned ON or OFF.</li><li>◆ If the driver's side door is opened with the tail lamp ON and Ignition Key OFF, lamp is OFF automatically.(Tail Lamp Auto Cut)</li></ul>
	<b>Head Lamp</b>	Head Lamp OFF	<ul style="list-style-type: none"><li>◆ According to the position of head lamp switch, the head lamp is turned ON and OFF.</li><li>◆ If ignition Key is turned OFF remaining the head lamp ON. The head lamp is turned OFF.</li></ul>
Auto	<b>Auto</b>	Head Lamp & Tail Lamp ON/OFF automatically	<ul style="list-style-type: none"><li>◆ The Tail lamp &amp; Head lamp is ON/OFF automatically regardless of a driver's intention according to the surroundings brightness.</li><li>◆ The auto ON and OFF of lamp is controlled by Auto Light Sensor.</li></ul>

# AUTO LIGHT

## Condition of Lamp “ON”

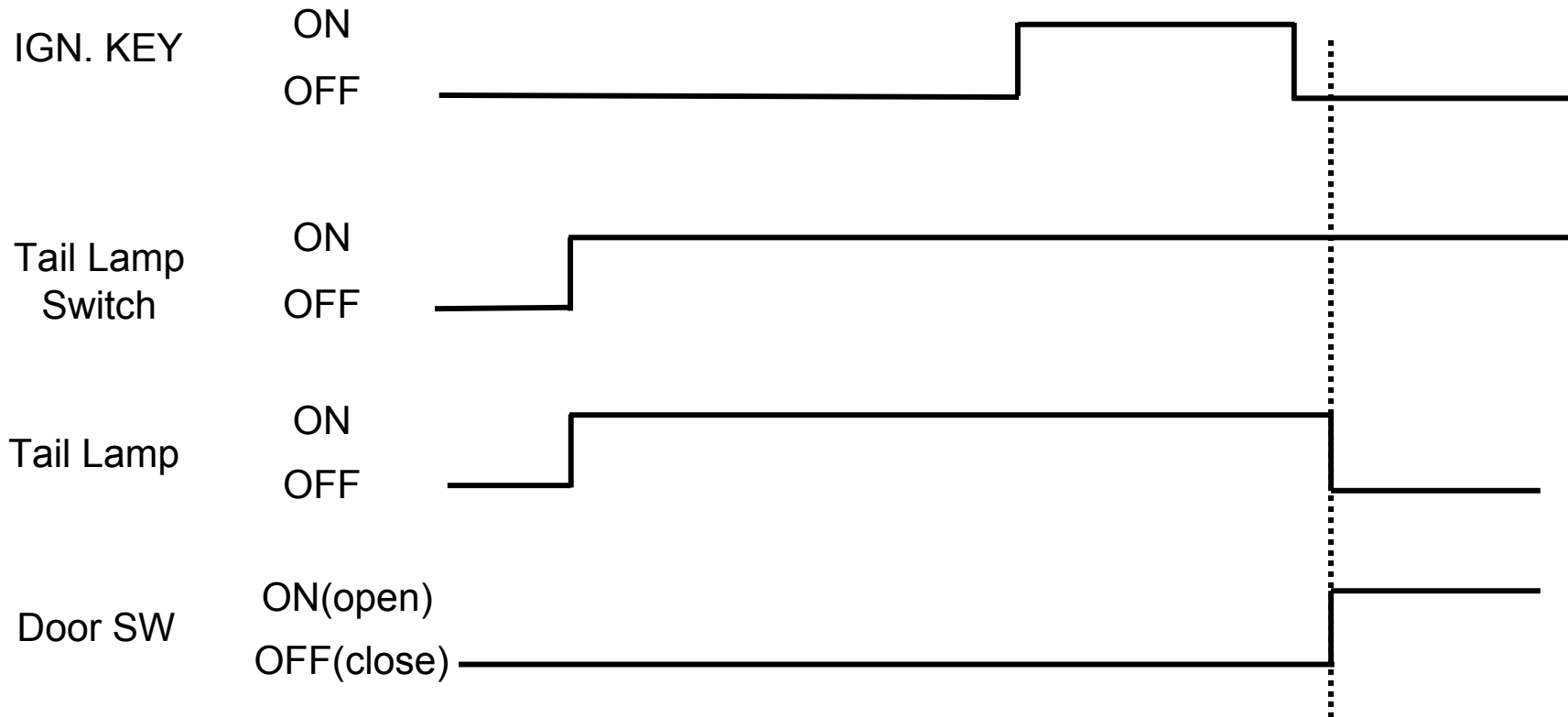
- Due to adopt the auto light sensor, the tail lamp and head lamp will be turned ON or OFF automatically depending on condition of surrounding brightness.
- Auto Light function condition.



# AUTO LIGHT

## Auto Light Operation Characteristics 1

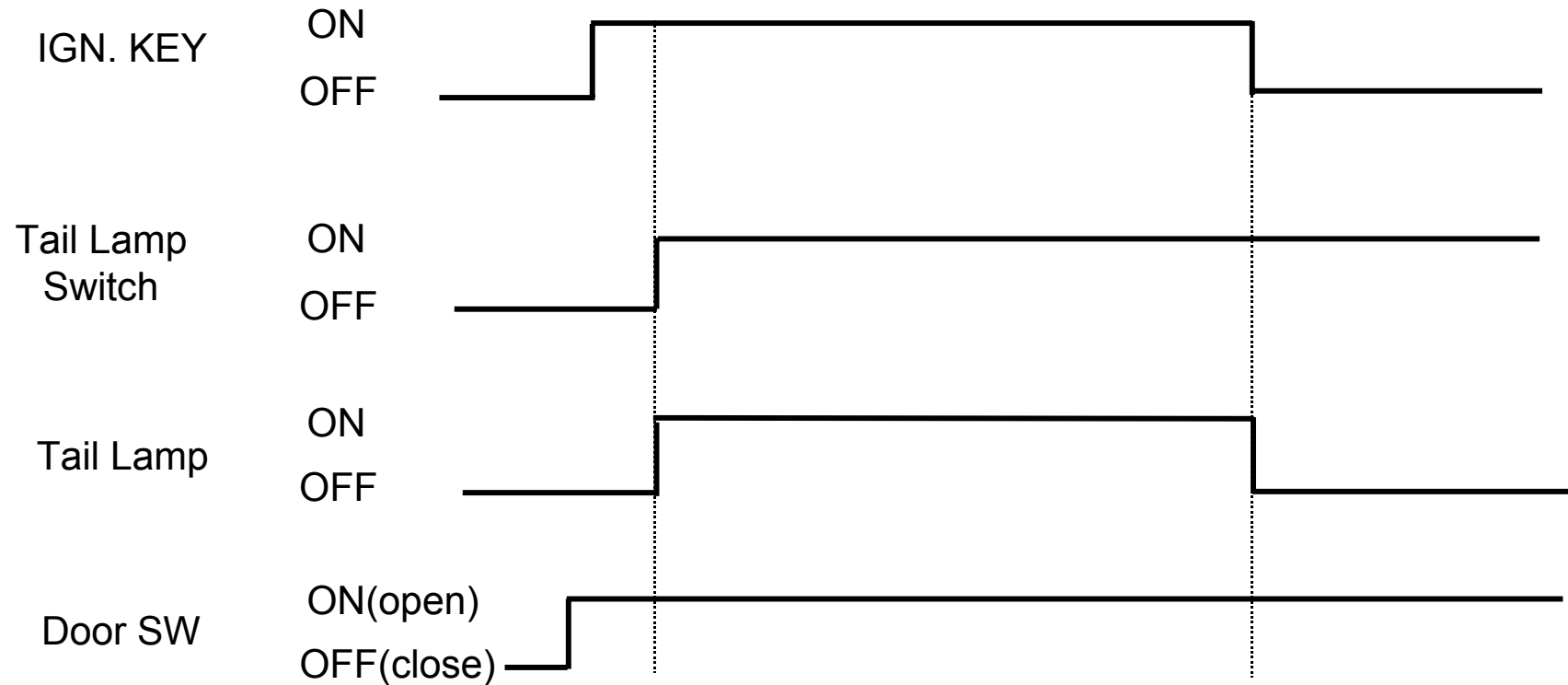
- Tail Lamp Auto Cut Function (IG S/W ON and Off and Door Open)



# AUTO LIGHT

## Auto Light Operation Characteristics 2

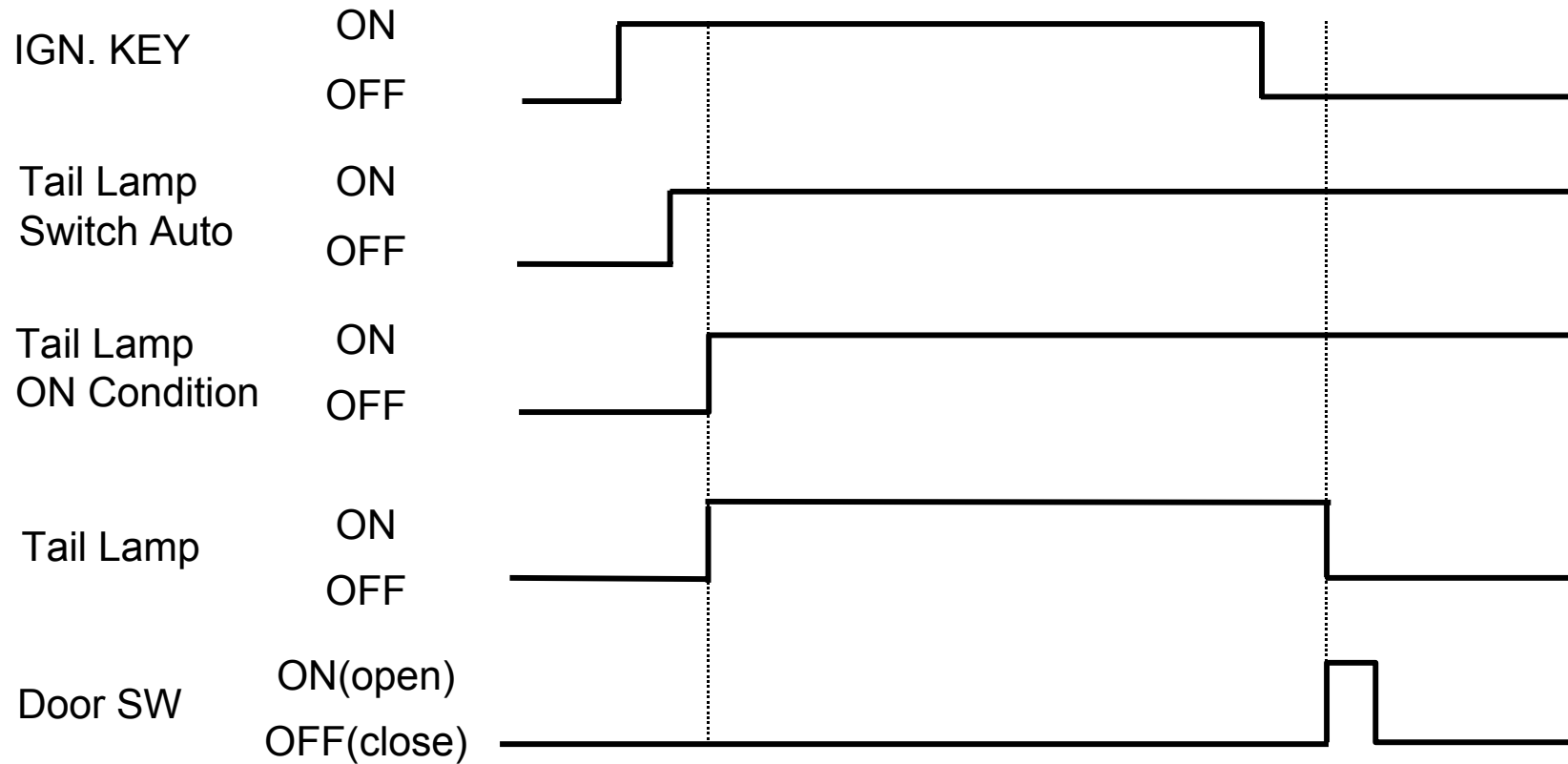
- Tail Lamp Auto Cut (IG. ON with Door Open)



# AUTO LIGHT

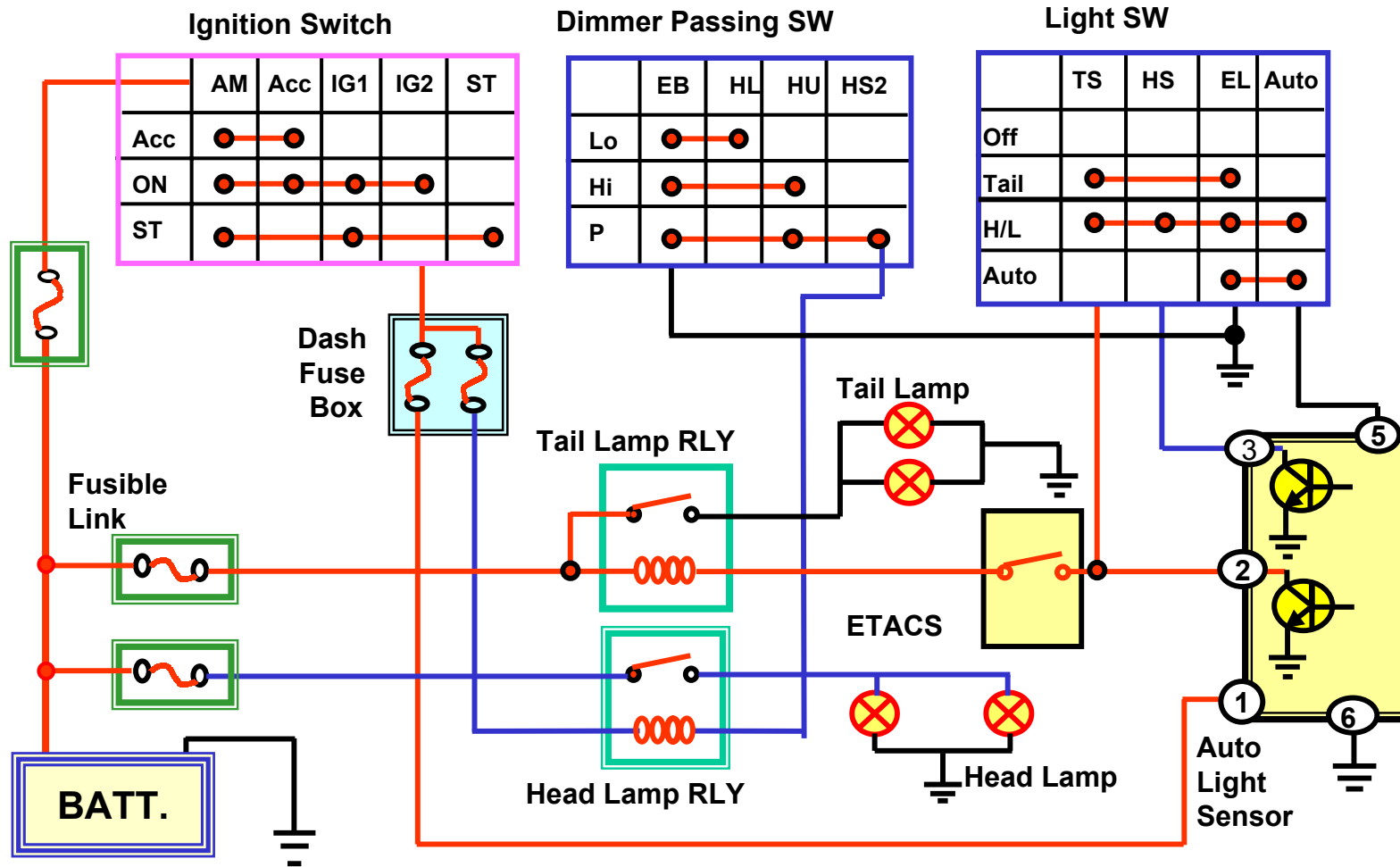
## Auto Light Operation Characteristics 3

- Tail Lamp Auto Cut (Auto S/W "ON" and Door Open)



# AUTO LIGHT

## Auto Lighting Circuit



## Auto Light Photo Diode Sensor Inspection

Photo Diode

- Tail Lamp ON : 0.52 - 0.56 Volt  
OFF : 0.86 - 0.98 Volt
- Head Lamp ON : 0.36 - 0.37 Volt  
OFF : 0.52 - 0.56 Volt

8 7 6 5 4 3 2 1

Pin N0 8 of CPU

CPU side

C4

Back side

The diagram illustrates the inspection process for a photo diode sensor. It shows two views of the sensor's control unit: the 'CPU side' and the 'Back side'. A multimeter is used to measure the voltage at specific points. The 'CPU side' view shows a red arrow pointing to Pin N0 8 of the CPU, which is labeled with a circled '8'. The 'Back side' view shows a black arrow pointing to a component labeled 'C4'. The multimeter is shown with a red lead connected to the positive terminal and a black lead connected to the negative terminal. The multimeter's display shows a needle pointing to a value on a scale from 0 to 100. The voltage specifications for the Tail Lamp and Head Lamp are provided for both ON and OFF states.



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# RAIN SENSOR

# RAIN SENSOR

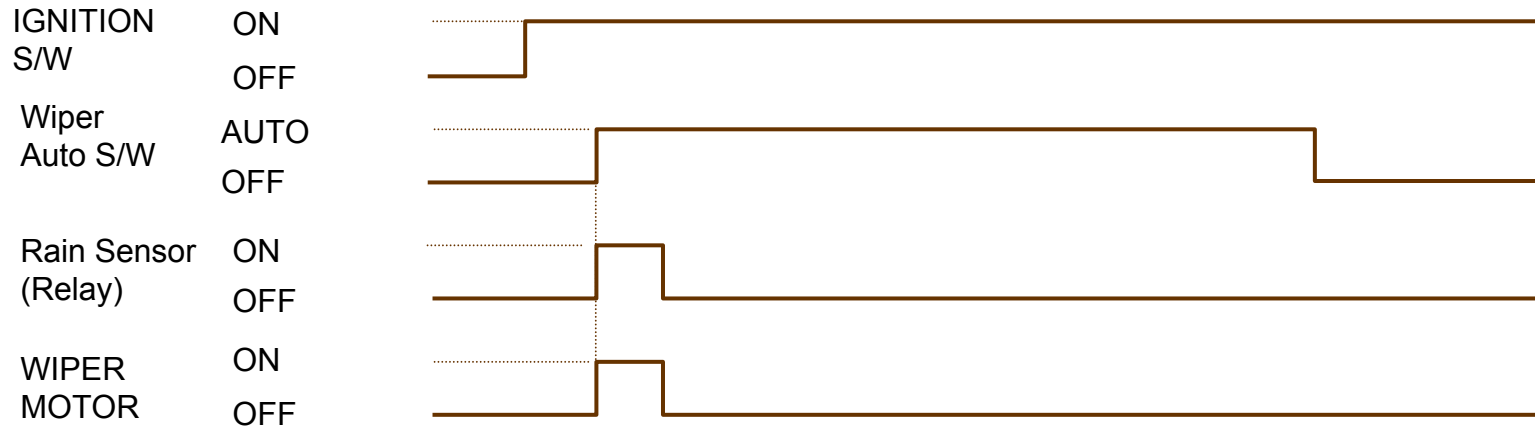
## Components



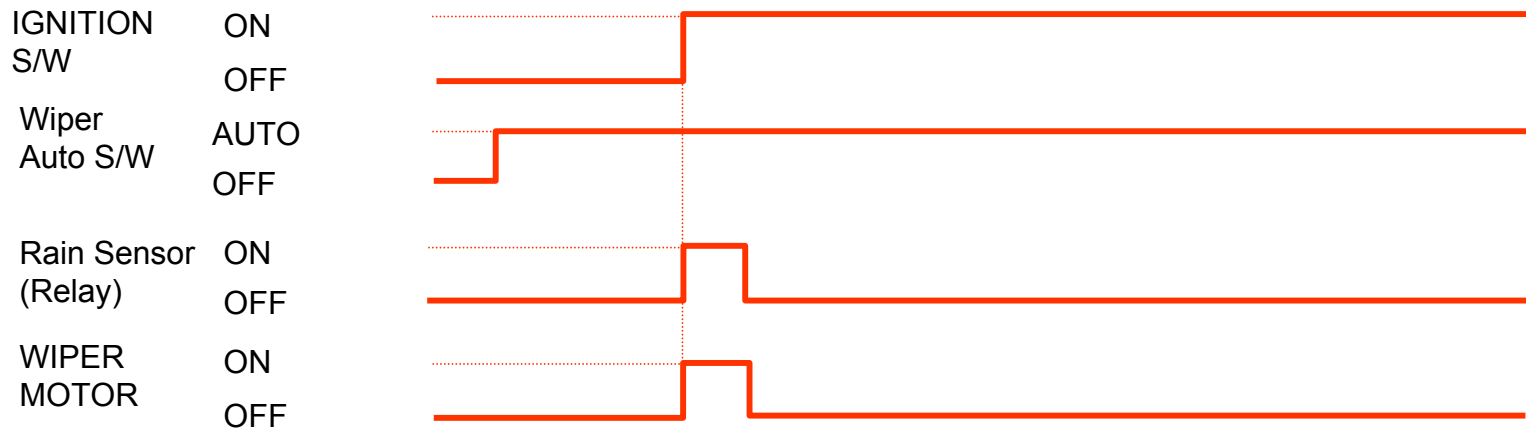
# RAIN SENSOR

## Wiper Motor Operating Chart

1. Condition "1" : Wiper S/W Auto Position after IGN. Key "ON".



2. Condition "2" : Wiper S/W Auto Position Before IGN. Key "OFF".



## Detection of Amount of rain by Rain Sensor

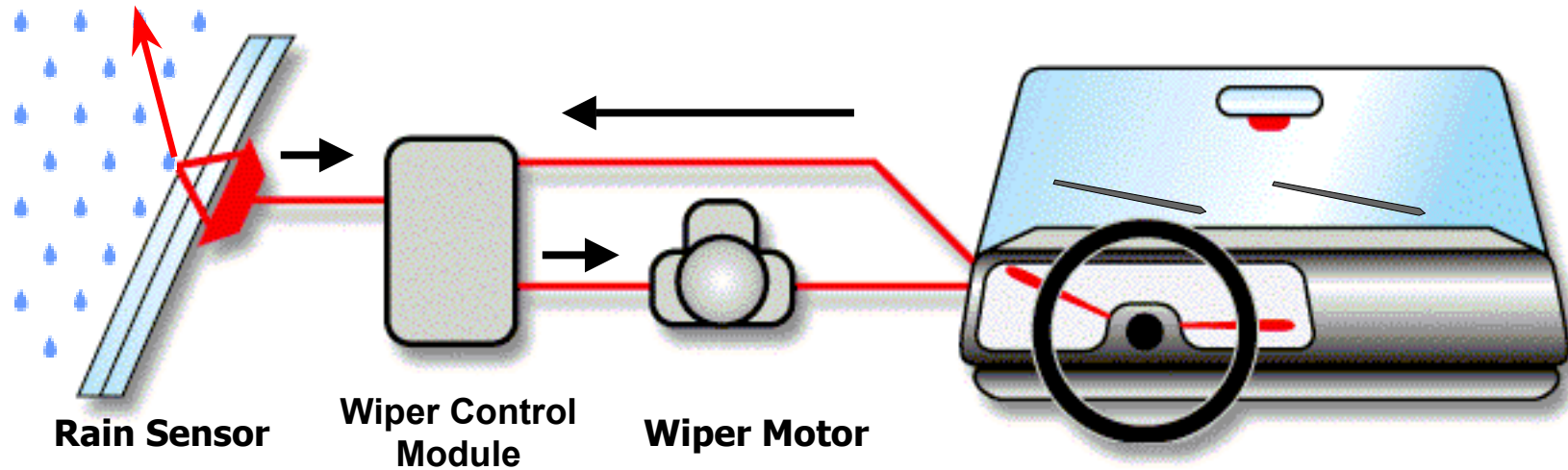
**By the Refract Ratio**

**By the Rain drop times**

**By the Rain drop distance**

# RAIN SENSOR

## Principle



- Infrared signal is changed according to amount of rain.

- Current rain is detected by rain sensor and calculated.

- Rain sensor communicates with the Wiper Control Module to control a wiper motor speed.

- According to this signal, Wiper Control Module perform the wiper motor speed.

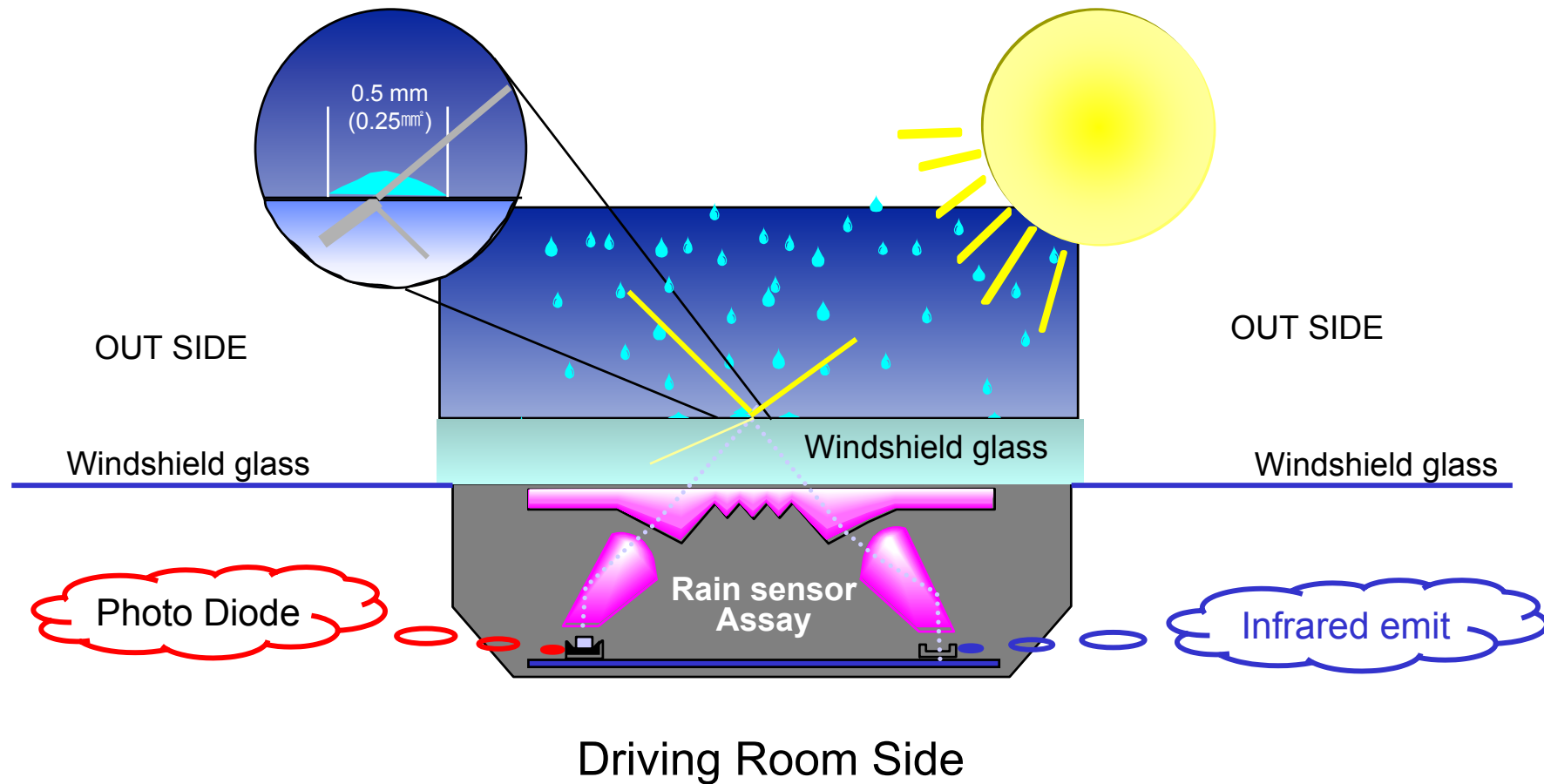
Driver Control(Multi Function Wiper Switch)

Intermittent → Automatic

Delay Time → Driver's tendency

# RAIN SENSOR

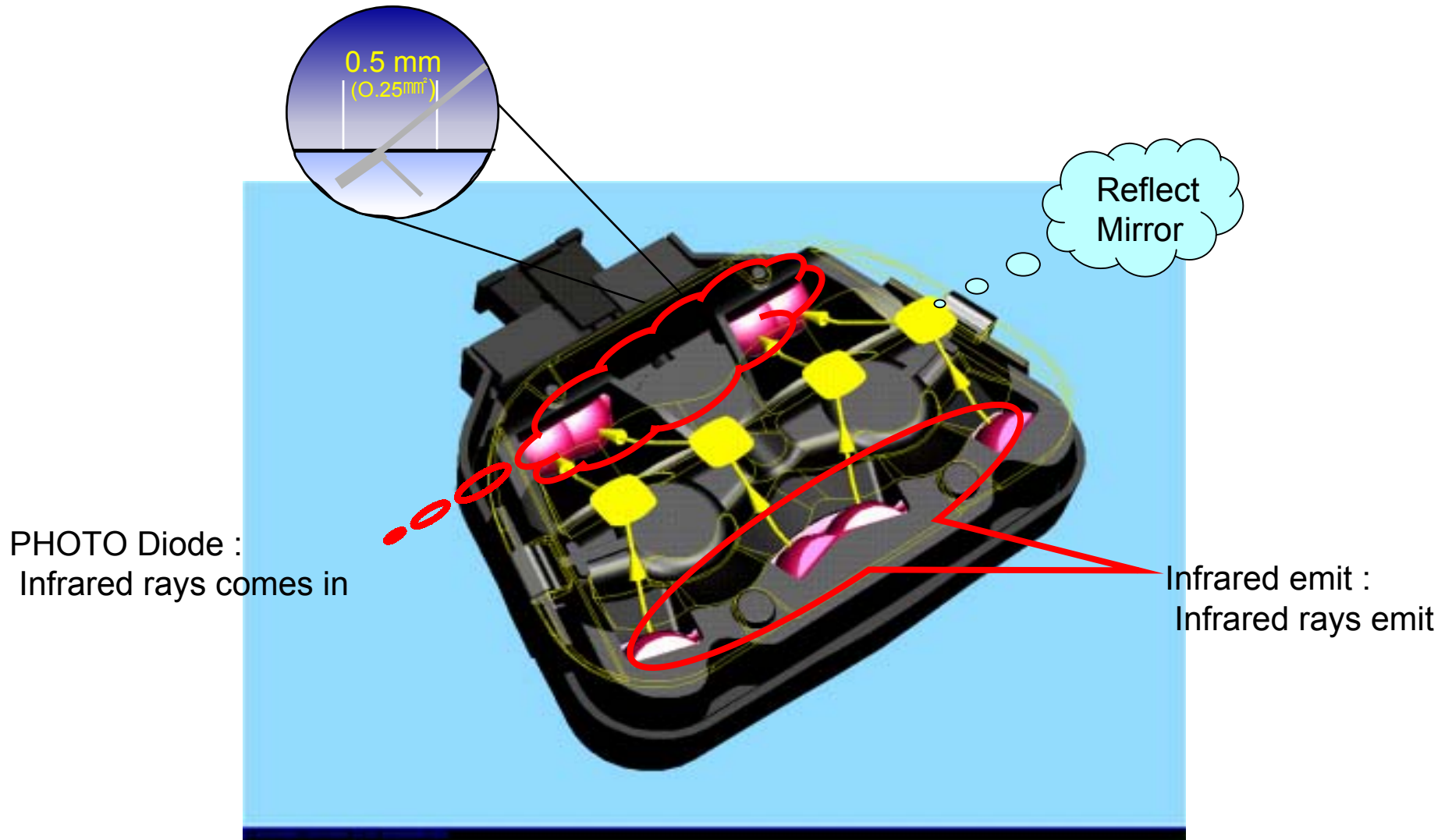
## Principle





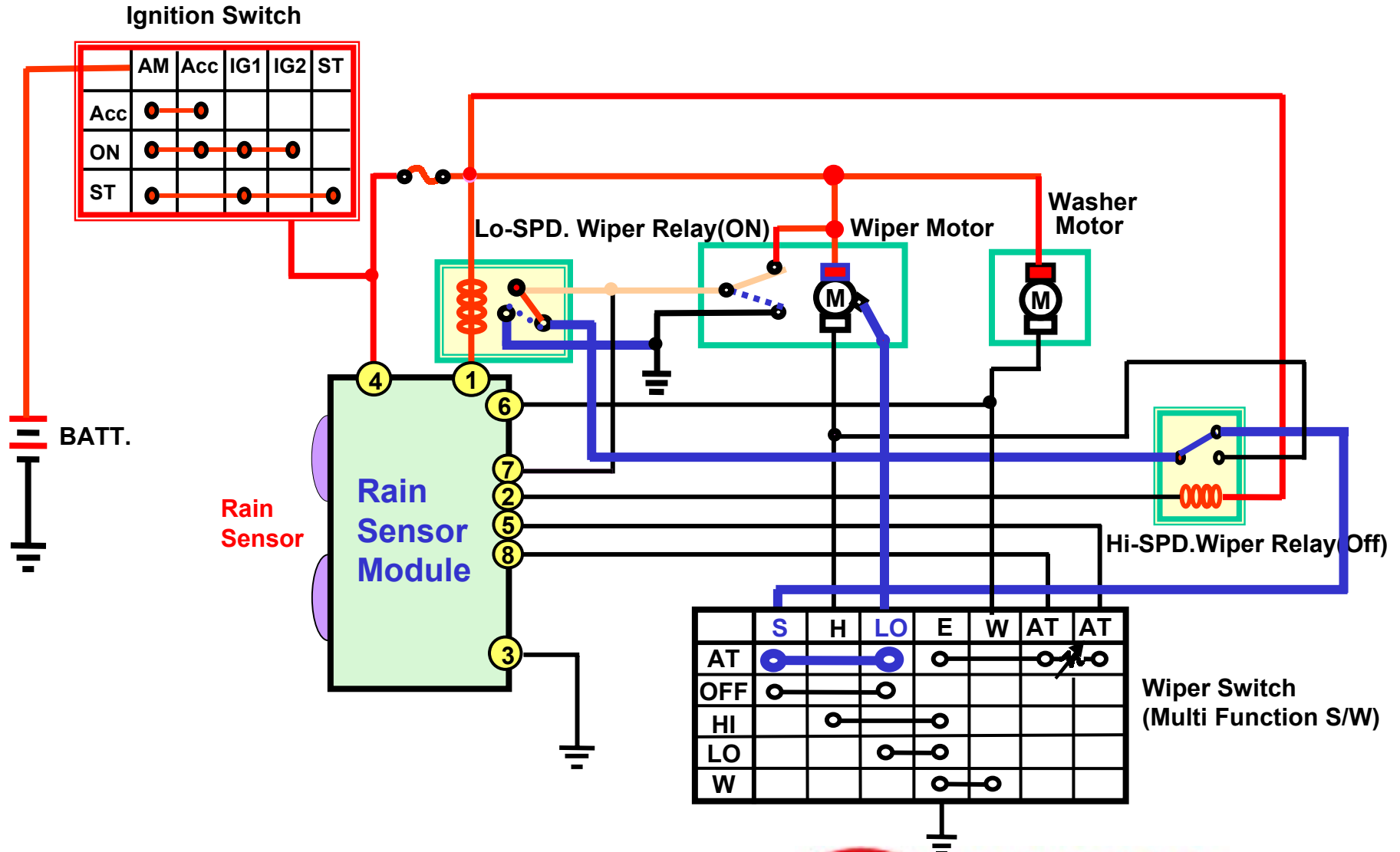
# RAIN SENSOR

## Rain Sensor



# RAIN SENSOR

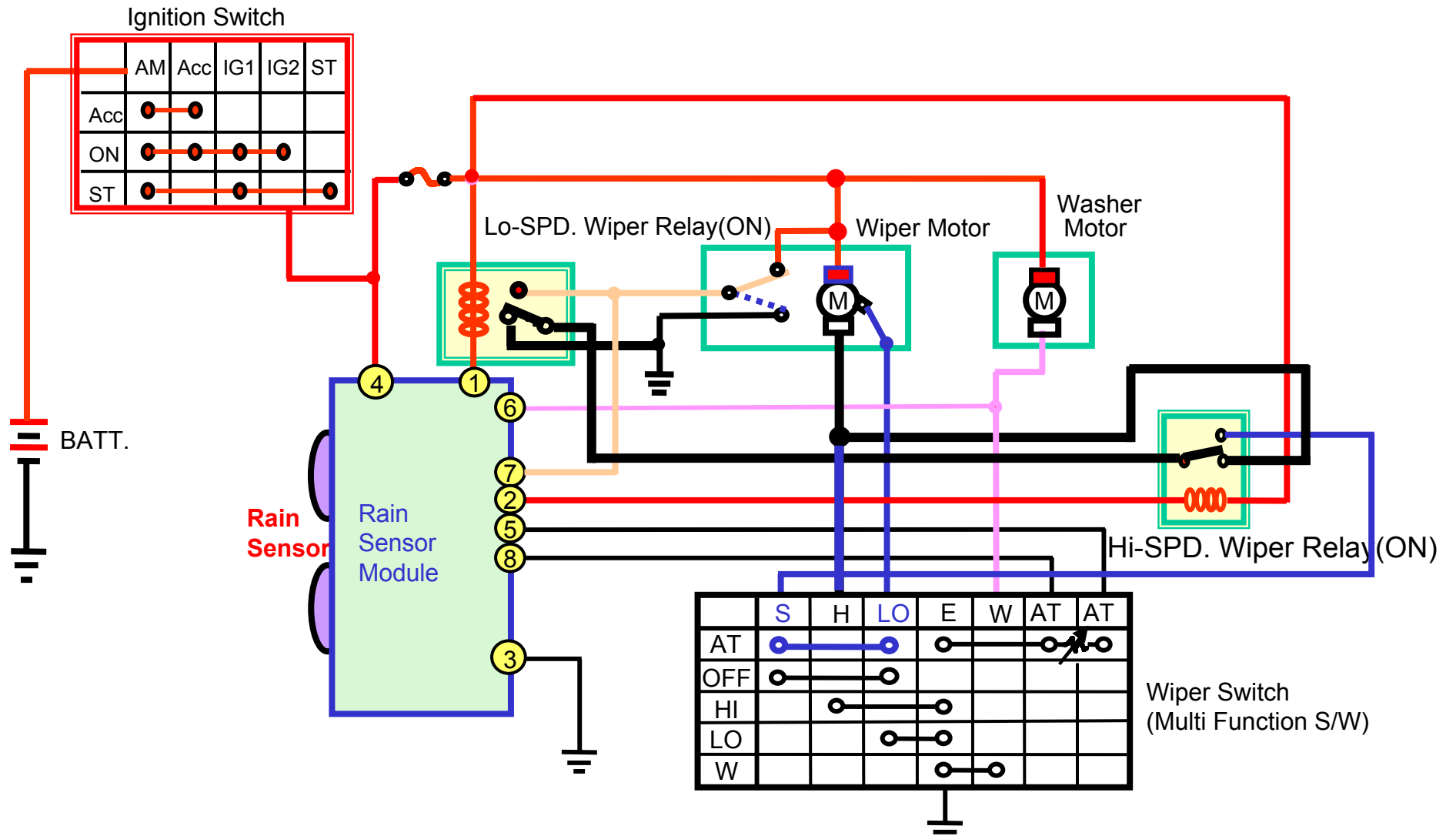
## Circuit (Low Speed Mode)





# RAIN SENSOR

## Circuit (High Speed Mode)



## QUESTIONS

Q1 Rain 센서 회로도 에서 Pin No7번의 신호는 Dwell신호로써 와이퍼 작동을 센서가 모니터링을 하게 되는데 이 신호가 Fail시에 일어 날수 있는 현상은?

Q2 센서가 장착된 부위에 이 물질(때)가 끼었다면 와이퍼 작동과는 어떤 관계가 있는가?

Q3 센서 내부에 있는 비를 감지하는 Photo Diode중 한 개가 inoperative 할 때 일어날수 있는 현상은?

Q4 wiper switch 의 위치가 Auto 위치에 있을 때는 미의 양에 따라서 wiper intermittent interval speed 가 달라진다. 이때 최저 interval time 과 max interval time 는 각각 몇 초인가?

Q5 Rain sensor가 장착된 windshield glass 표면에 얼음이 얼었다면 어떤 현상이 일어 날까?

# MULTI METER

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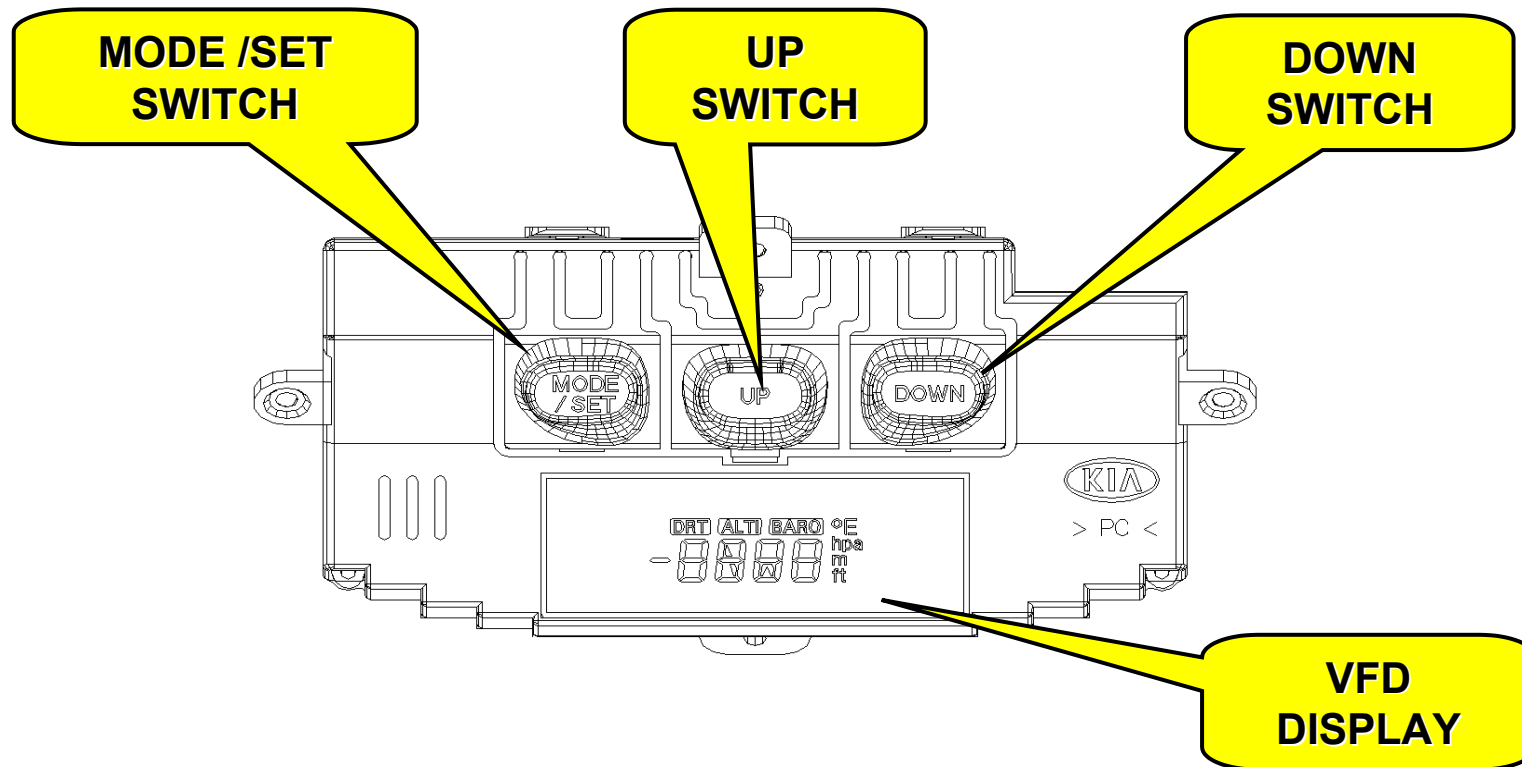
59



# MULTI METER

## MULTI METER DESIGN

DISPLAY COMPASS, ALTITUDE, BAROMETRIC PRESSURE & TEMPERATURE

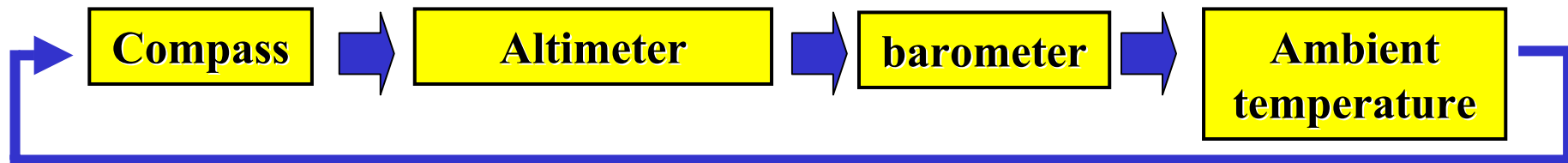


# MULTI METER

## SWITCH FUNCTION

PRESS MODE/SET SW MORE THAN 0.1SEC.

### 1. Ambient Temperature Switch Type



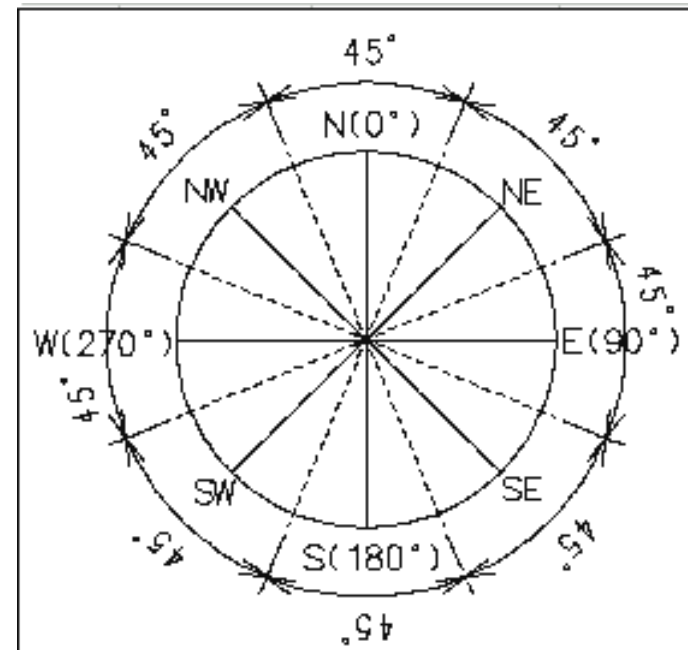
### 2. Without Ambient temperature switch type



# MULTI METER

## Reading compass

NO	Vehicle direction	Vehicle angle ( $\pm 22.5^\circ$ )	1st Row	2nd Row
1	N	0°	N	
2	NE	45°	N	E
3	E	90°		E
4	SE	135°	S	E
5	S	180°	S	
6	SW	225°	S	W
7	W	270°		W
8	NW	315°	N	W

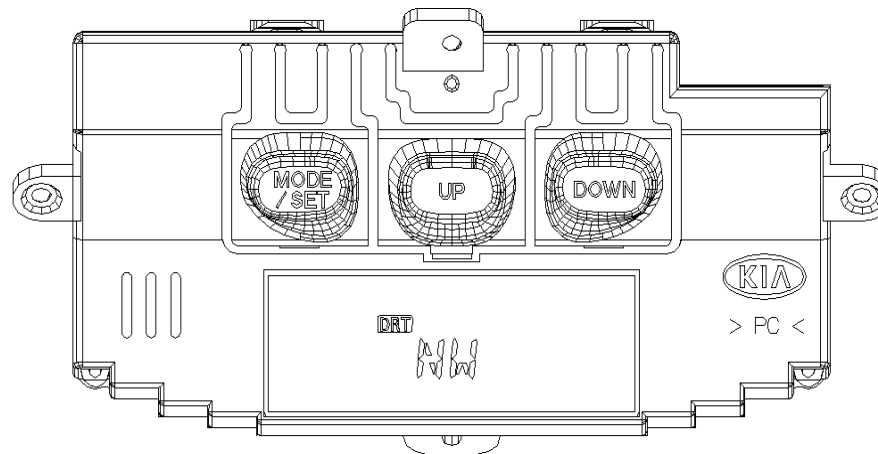


## Declination Correction

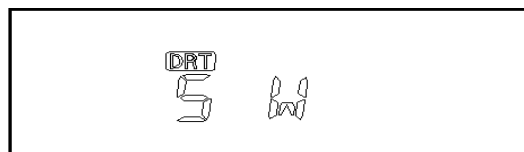
Declination of each region(or nations) should be memorized to correspond north of vehicle with north of map

1.setting:

- If MODE/SET switch press for 4.5sec or more, [DRT] display is setting after 4 times ON/OFF



- display features after 4 times ON/OFF



Setting Value: West 5°  
(Like Korea Declination Value )

---

## Declination Correction

### 2. Correction method

- Declination sets using UP or DOWN switch which press for 0.1sec or more under the declination setting

- and confirm the declination correction with MODE/SET switch (press 1sec or more)

※ UP switch: move to the east every 5°, DOWN switch :move to the west every 5°

( correction range: West 30° ~East 30 °)

### 3. Declination correction mode cancellation

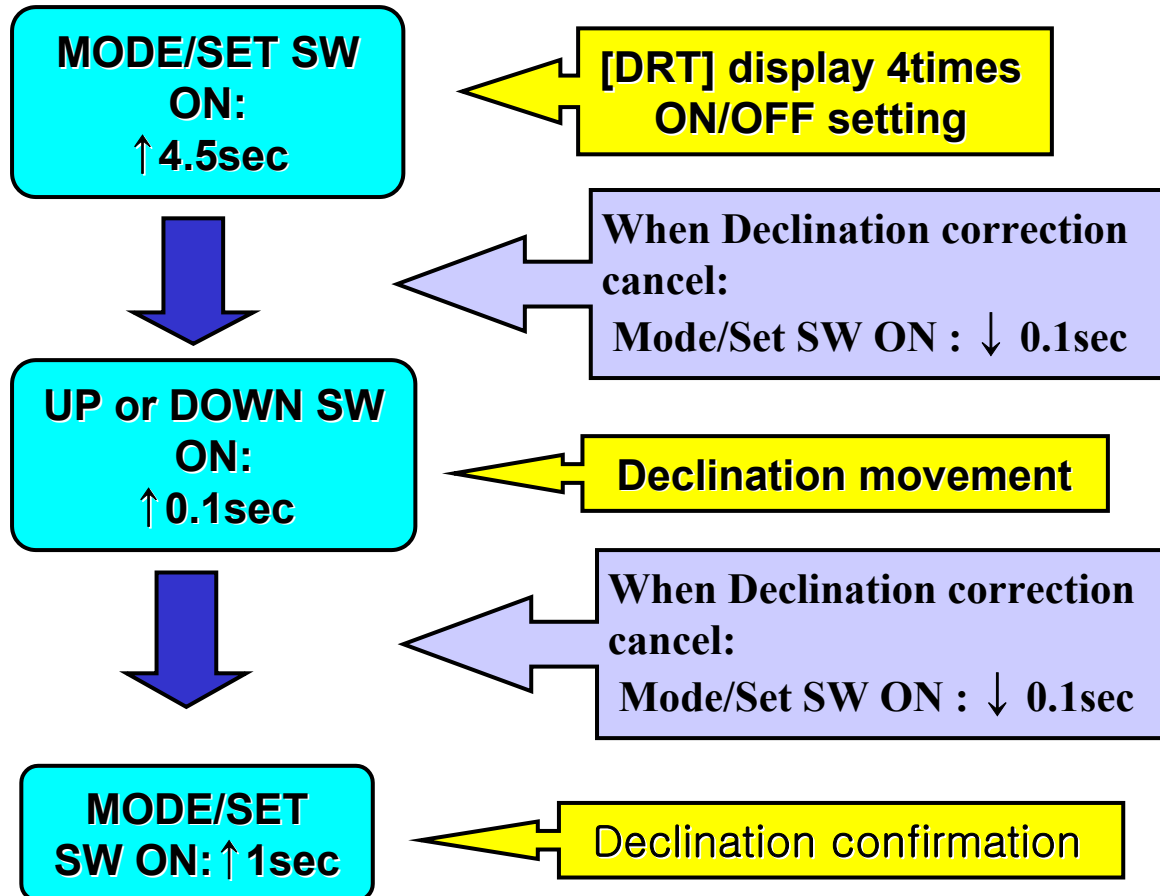
- MODE/SET switch is depressed less than 0.1~1sec.

- there is no operation of correction within 30sec after correction setting.

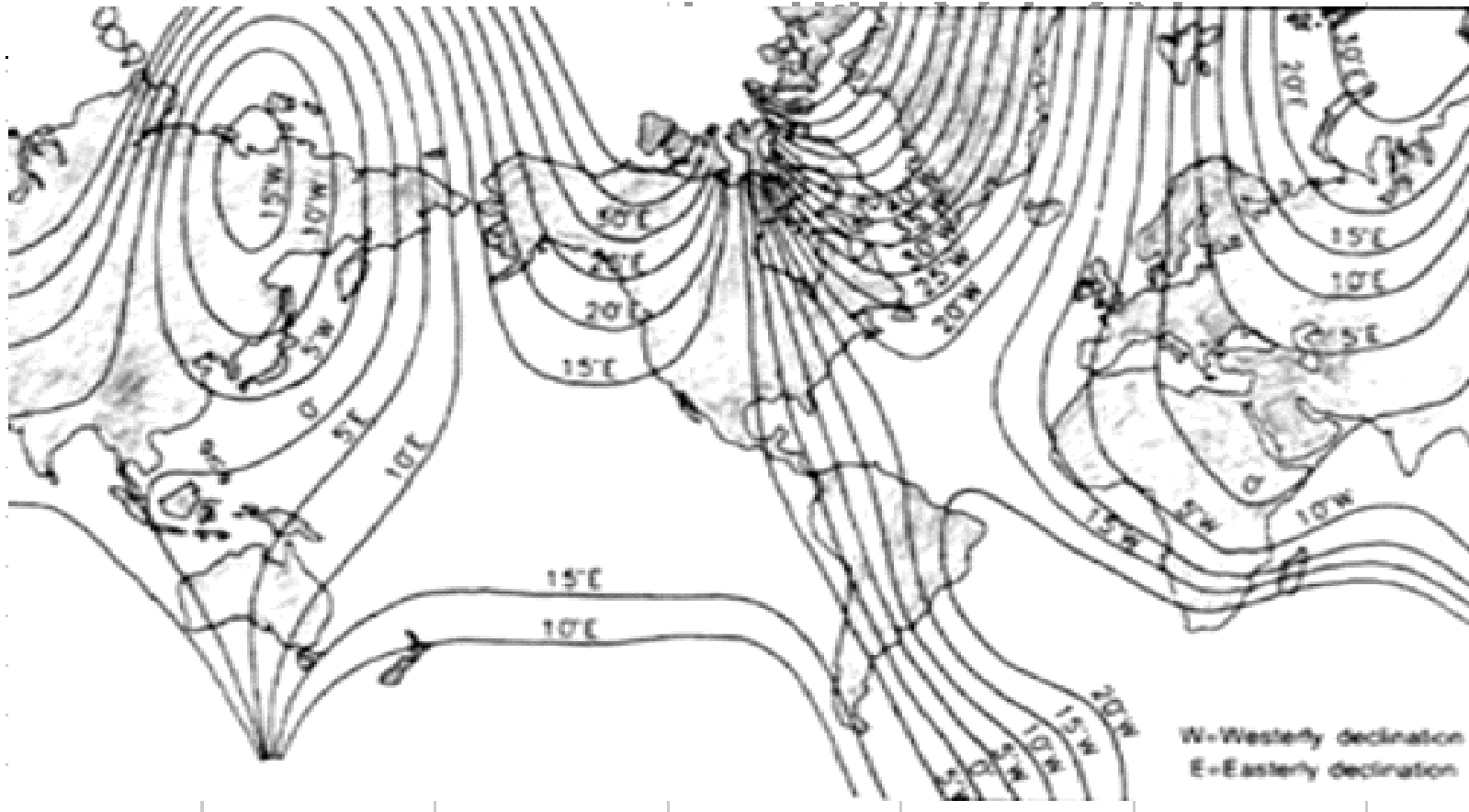


## Bearing Declination Correction

### Procedure



## Declination Map

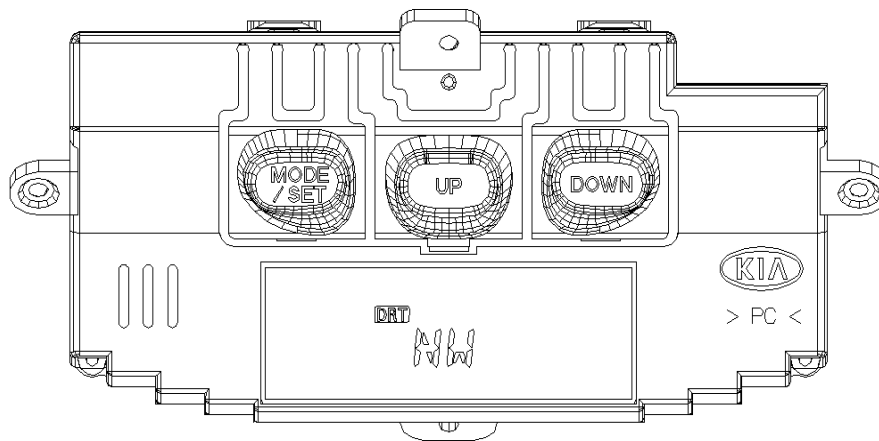


The number of nearest contour line is decided as a value of declination correction

## Bearing Position Correction

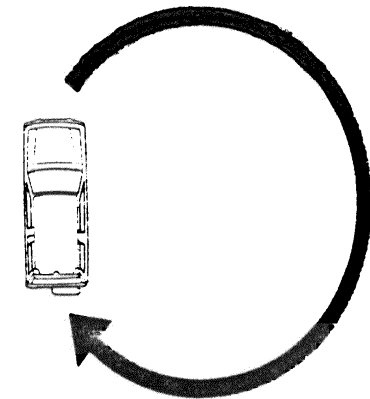
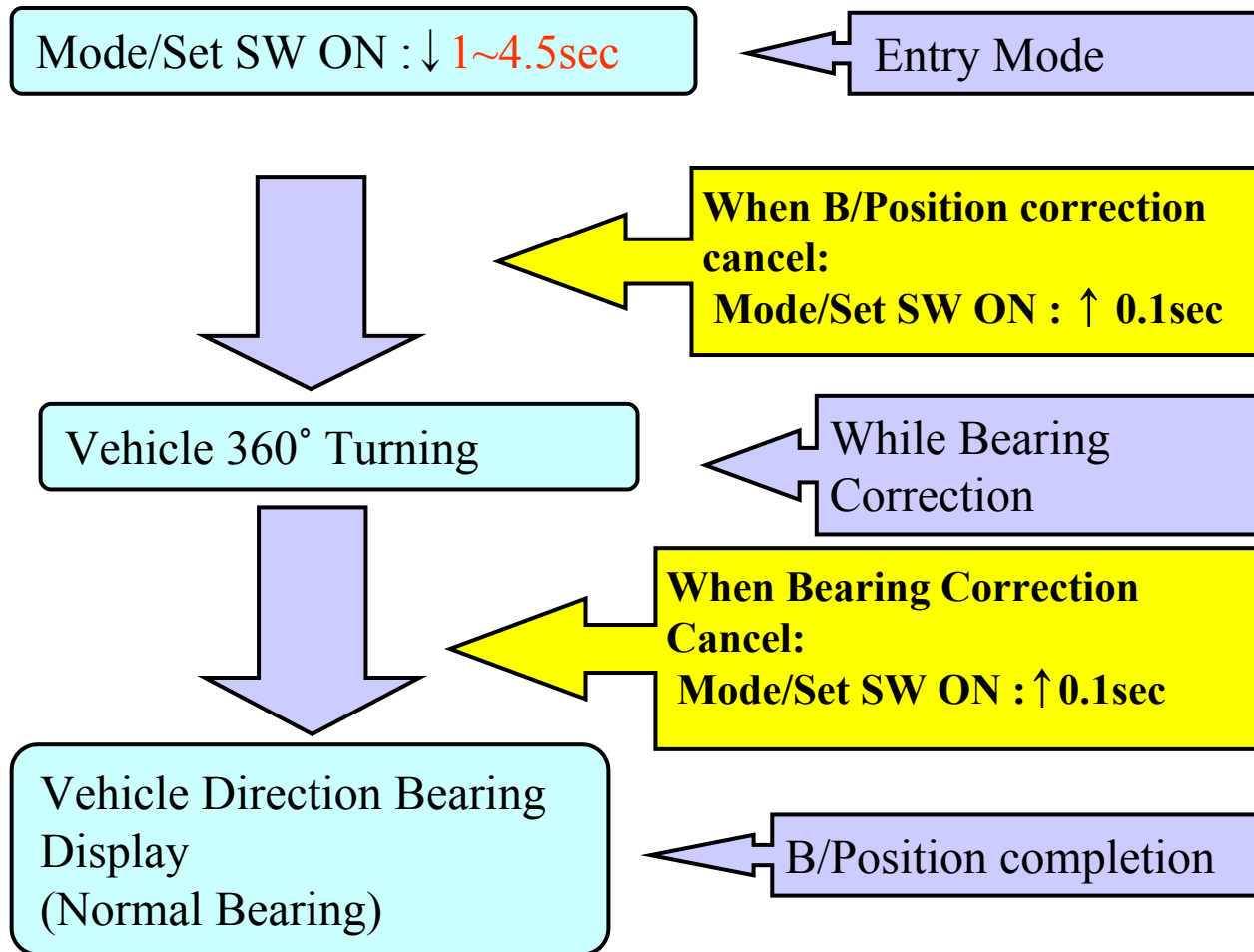
If a displayed bearing is different from the real bearing of the vehicle, bearing should be corrected to compensate the error.

- ※ when the bearing correction should be performed as following:
  - Battery replacement (including battery cable off case)
  - Bearing discrepancy between the real value and displayed value



# MULTI METER

## Procedure



## Bearing Position Correction Procedure

**1.Setting : Press the Mode / Set switch for 1 to 4.5sec. Then bearing display will be flash every 0.5 second**

**2.Bearing Position Correction:**

▶ **Turn the vehicle slowly 360° or more within 128 seconds. Then, bearing correction will be automatically performed and the display flashing will stop**

▶ **if the turning does not finishes within 128sec, bearing correction fails.**

▶ **Recommended turning speed is 20km/h or less, if not, bearing correction may be failed.**

★ **In case that the display flashing still continues, turn the vehicle more until it stops.**

**3.Bearing correction mode cancellation**

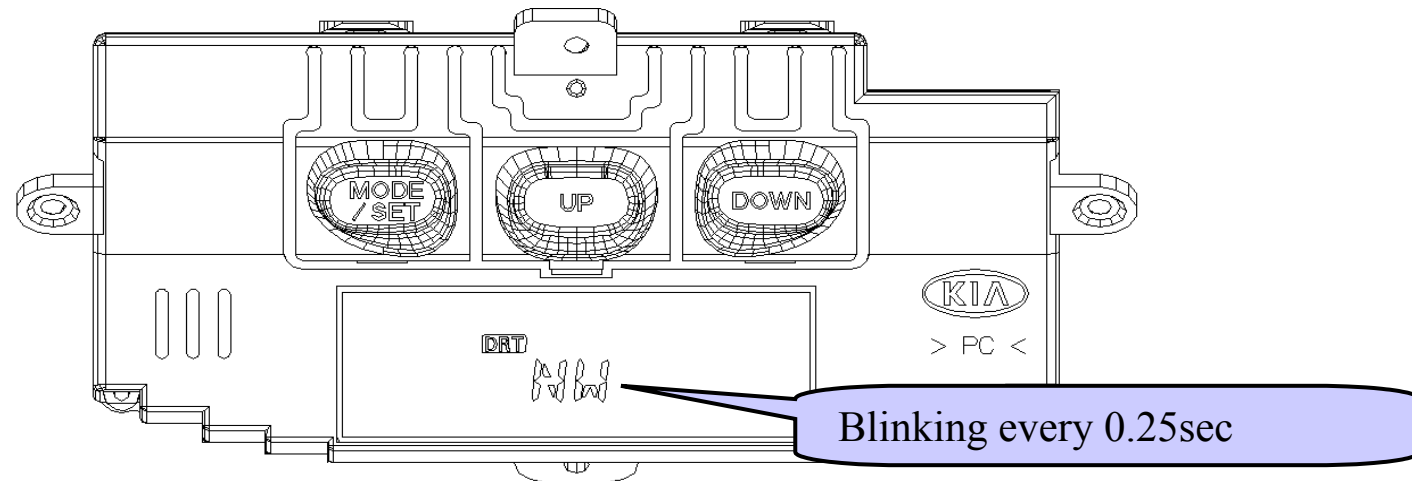
▶ **push the mode/set switch for 0.1sec or more**

▶ **After vehicle enter the correction mode, vehicle turning is not performed within 128sec**

## Bearing Position Correction Procedure

### 4. Bearing Warning Function

- If Bearing position of vehicle is out of specification, displayed bearing on the VFD is flashing(ON/OFF) to alert driver to the abnormal condition now.



If abnormal data is detected for 5 minutes, displayed bearing signal is blinking every 0.25second.

And whenever the right data input into multi meter, bearing display comes to normal.

# MULTI METER

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## RELATIVE ALTIMETER

Atmospheric Pressure is detected by Atmospheric sensor. It displays the altitude which Compared the current setting altitude with specified area on the basis of current altitude.

**Display Range:**  $\pm 3000\text{m}(\pm 9800\text{ft})$

**Hysteresis :** 50m

### Relative Altimeter “0” Clear

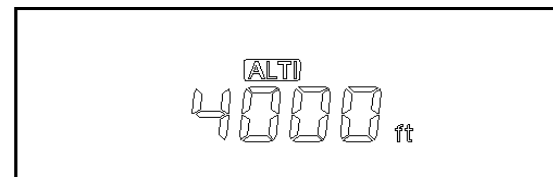
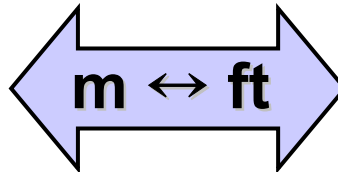
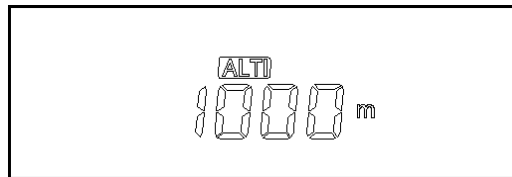
Press the Mode/Set switch for 1sec or more. Then, the current altitude will be reset as “0 m”

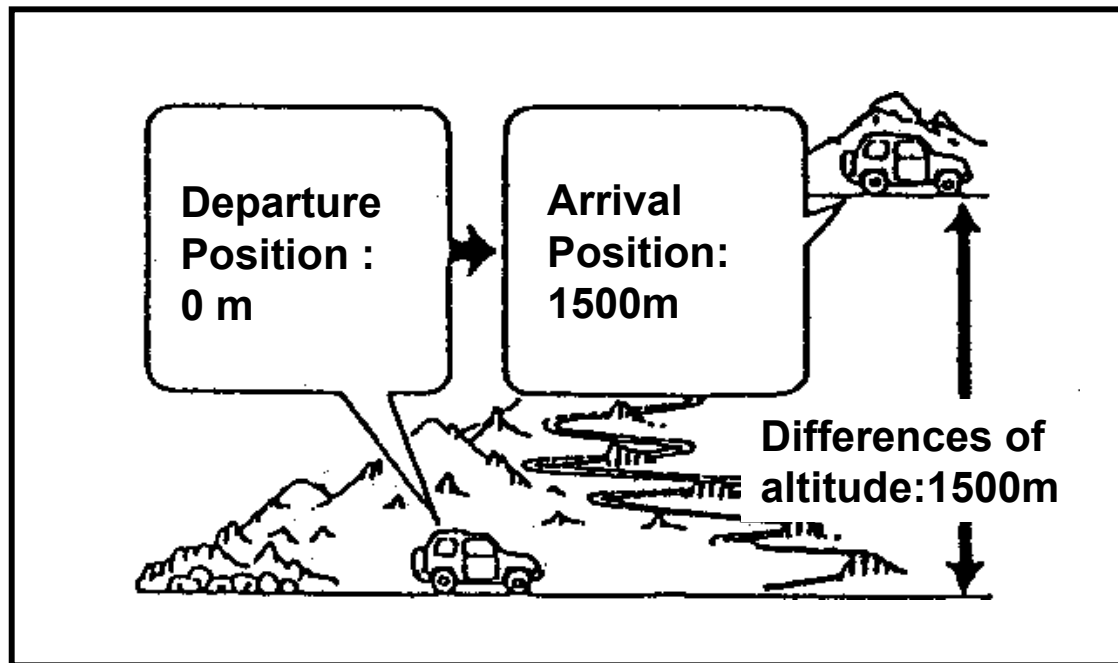
“0” clear



### Altimeter unit change

Unit can be changed by depress Up/Down Switch “ON” for 1sec or more





## MEMORY KEEPING

When IG is on after IG off, the previous data is displayed.  
(Including the amount of atmospheric pressure change)

### ※ ADVICE

Altimeter operates according to the atmospheric pressure variation.  
Therefore, displayed altitude can be different at the same place by the pressure influence.



# MULTI METER

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## BAROMETER

Current Atmospheric Pressure is displayed by unit of 5hpa



**DISPLAY RANGE:**

600 ~ 1100hpa

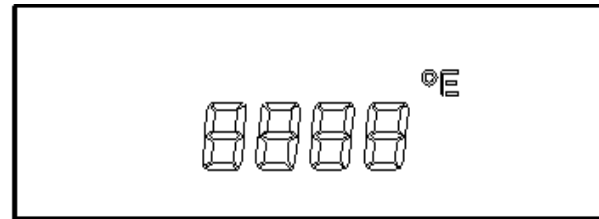
**HYSTERESIS:** 5hpa

\*1atm (Atmospheric) = 1013.25hpa = 1013.25mb = 760mmhg

## OUTER TEMPERATURE

Current Outer Temperature is displayed from the outer temperature sensor of air conditioning system

Display Range : -30~65°C (-30~149°F)



Changing method of Unit : depress Up/Down switch 1sec or more.(default: °C)

Example :

