CONTENTS

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

ETACS INPUT & OUTPUT Diagram

**Inputs**
- Battery (Back-up Voltage)
- Ignition 1 & 2 (Power Voltage)
- Alternator “L” Terminal
- Washer Switch
- Wiper INT. Switch
- Wiper INT. Volume Resistor
- Rear Defogger Switch
- Seat Belt Switch
- Keyless Switch
- DRV/PASS Door Switch
- All Door Switch (each door S/W)
- Main Door Switch (Door Lock/Unlock)
- TNS Switch
- Vehicle Speed Signal
- Tail Gate Switch
- Tail Gate Glass Switch
- ETC

**Controller**

**Actuator**
- Wiper Motor Relay
- Defogger Relay
- Seat Belt Warning Lamp
- Chime Bell
- Power Window Relay
- Central Door Lock Relay
- Key Illumination Lamp
- TNS Relay
- Room Lamp
- T/gate Glass Actuator
- Hazard Relay
- ETC
E T A C S
FUNCTION
Detail
Washer Related Wiper Control

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.

IGN. S/W

Washer S/W

Wiper MOTOR

* T1 : 0.6±0.1 sec.  * T2 : 2.5~3.8 sec.  * T4 : 0.7±0.1 sec.  * T3 : 0.2~0.6 sec.(MAX)  T4 : MIST FUNCTION
Washer & Wiper Circuit

- **ST**: IGN. Key S/W
- **IG1**: IGN. Key S/W
- **IG2**: IGN. Key S/W
- **BATT 12V**: Battery 12V
- **Tr1**: Wiper Relay
- **M**: Wiper Motor
- **ETACSCM**: Wiper Motor
- **M/Function S/W**: M/Function Switch
- **INT**: Internal
- **OFF**: Off
- **HI**: High
- **LO**: Low
- **W**: Wiper

The diagram shows the connections between these components, indicating how they interact to control the washer and wiper functions.
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. Incase 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”.

T1 : 20±1 minutes
Defogger System Circuit

- **ETACS** -- FUNCTION

- **Defogger Relay**
- **BATT 12V**
- **IGN. S/W**
- **ALT “L” terminal**
- **ETACSCM**
- **Defogger S/W**
- **RR. Window Glass**

- **IG1**, **IG2**, **ST**
- **IGN. Key S/W**
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.

**Diagram**

IGN. S/W
- ON
- OFF

SEAT BELT S/W(N.C)
- Not fasten
- Fasten
- T2

CHIME BELL
- ON
- OFF
- T1

SEAT BELT WARNING LAMP
- ON
- OFF

* T1 : 6 ± 1.5 sec.  * T2 : 0.5 ± 0.1 sec.
Seat Belt Warning Timer Circuit

ETACSC -- FUNCTION

Seat Belt Warning Lamp

IGN. Key S/W

ST
IG1
IG2

IGN. Key

BATT 12V

5V

ETACSCM

Seat Belt S/W
Key Hole Illumination

IGN. S/W

ON

OFF

DRV or PASS DR S/W

OPEN

CLOSE

KEY HOLE ILL. LAMP

ON

OFF

* T1 : 10 ± 1 sec. * T2 : 0 ~ 10 sec

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”.

KIA MOTORS
Key Hole Illumination Circuit

ETACSM -- FUNCTION

ETACSM

IGN. Key S/W

KEY HOLE ILLUMINATION

IGN. Key S/W

Driver's DR S/W

BATT 12V

5V
**Room Lamp Delay Out**

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 - 6 seconds 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.

* T1 : 5 ~ 6 sec.  * T2 : 30 ± 3 esc.
**Room Lamp Delay Out**

- **ETACSM**
- **T/Gate SW, T/gate glass SW**
- **Remote Controller**
- **BATT 12V**
- **IGN. Key S/W**
- **Lamp**
- **IG1**
- **IG2**
- **5V**
- **4Door SW**
### Panic Function

| Keyless SW | ON | OFF |
| TX panic | ON | OFF |
| HORN | ON | OFF |
| HAZARD LAMP | OFF | Lock |
| D/Lock UNIT | OFF |

![Waveform diagram]

**T1**: 27±2sec, **T2**: 2.0±0.5sec, **T3**: 0.5±0.1sec

### Description

When ETACSCCM 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 ETACSCCM 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.

* T1 : 3 ±0.5sec.  * T2 : 0.5sec
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 opens 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.
**ETACS -- FUNCTION**

**Power Window Time Lag**

- **IGN. S/W**
  - ON
  - OFF

- **Driver’s or Assist DR S/W**
  - OPEN
  - CLOSE

- **Power Window Relay**
  - ON
  - OFF

* T1 : 30 ± 3 sec.

- **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 Switch**

<table>
<thead>
<tr>
<th>AM</th>
<th>Acc</th>
<th>G1</th>
<th>G2</th>
<th>ST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acc</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ON</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ST</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- To Drive Door Switch
- To Passenger Door Switch
- To RR LH & RH Door Switch

- **BATT.**
- **Fusible Link**
- **Power Window Relay**
- **ETACS Control Module**
- **Driver’s DR S/W**
Ignition Key Reminder Control

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

Description

This function is to prevent vehicle from Door Lock remaining the key in the key cylinder.
Ignition Key Reminder Control Circuit

ETACS Control Module

Central Door Lock Relay

Lock RLY.

Unlock RLY

143Ω

Dash Fuse Box

Door Warning Switch

Fusible Link

BATT.

Ignition Switch

<table>
<thead>
<tr>
<th>AM</th>
<th>Acc</th>
<th>IG1</th>
<th>IG2</th>
<th>ST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acc</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ON</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ST</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Dash Fuse Box

Battery

Lock

Unlock

Each Door Lock Actuator

Unlock RLY

143Ω

Driver side DR. Actuator Lock/Unlock S/W operated by Key or Knob

Door Lock Knob

Unlock

KIA MOTORS
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

Ignition Switch

Vehicle Speed Sensor

ETACS Control Module

Central Door Lock Relay

Each Door Lock Actuator

Driver side DR. Actuator Lock/Unlock S/W operated by Key or Knob

Dash Fuse Box

Fusible Link

Battery

Unlock RLY

Lock RLY.

Unlock

143Ω

143Ω
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

**ETACS -- FUNCTION**

<table>
<thead>
<tr>
<th>AM</th>
<th>Acc</th>
<th>IG1</th>
<th>IG2</th>
<th>ST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acc ON</td>
<td></td>
<td></td>
<td></td>
<td>ST</td>
</tr>
</tbody>
</table>

- **Ignition Switch**
- **Fusible Link**
- **Dash Fuse Box**
- **ETACS Control Module**
- **Monitor Line**
- **Battery**
- **Lock RLY.**
- **Unlock RLY.**
- **Central Door Lock Relay**
- **Each Door Lock Actuator**
- **Driver side DR. Actuator Lock/Unlock S/W operated by Key or Knob**

**Notes:**
- Driver side DR. Actuator Lock/Unlock S/W operated by Key or Knob.
- Each Door Lock Actuator.
**Description**

1. If a driver opens 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.
Battery Saver Circuit

ALTERNATOR

IGN SW

DIMMER SW

LIGHT SW

100A Fusible Link

100A Fusible Link

BATT.

TNS Relay

H/Lamp RLY

Driver's DR S/W

ETACSCM

Door Warning S/W

Tail Lamp

Head Lamp

BATT.
## Transmitter Specification

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

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**

- **IGN. KEY**
  - ON
  - OFF

- **RKE SET connector**
  - ON
  - OFF

- **T/SIGNAL LAMP**
  - ON
  - OFF

- **TX LOCK**
  - ON
  - OFF

For more than 3sec until T/Signal is turned “OFF”

**1±0.5sec**

**2-nd CODE**

**Two TX cording procedure**

- **TX1 LOCK**
  - ON
  - OFF

- **TX2 LOCK**
  - ON
  - OFF

**1±0.5sec**

**1±0.5sec**
**QUESITION**

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 문제인가?

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 있다
REAR WIPER
SORENTO
REAR WIPER

1. Circuit

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

※ **Wiper Motor rotate direction**

KIA KIA MOTORS
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 (counterclockwise). 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±50 ms. T2 retardation Time : 1200±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.

T3 : 0.6 ± 0.1 sec.
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 stops 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.
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)

<table>
<thead>
<tr>
<th>Switch Position</th>
<th>Lamp operation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Manual</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Tail Lamp       | Tail Lamp ON   | ◆ According to the position of tail lamp Switch, the tail lamp is turned ON or OFF.  
|                 |                | ◆ 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) |
| Head Lamp       | Head Lamp OFF  | ◆ According to the position of head lamp switch, the head lamp is turned ON and OFF.  
|                 |                | ◆ If ignition Key is turned OFF remaining the head lamp ON. The head lamp is turned OFF. |
| **Auto**        | Head Lamp & Tail Lamp ON/OFF automatically | ◆ The Tail lamp & Head lamp is ON/OFF automatically regardless of a driver's intention according to the surroundings brightness.  
|                 |                | ◆ The auto ON and OFF of lamp is controlled by Auto Light Sensor. |
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.

<table>
<thead>
<tr>
<th>Switch Type</th>
<th>ON Condition</th>
<th>OFF Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>IG switch</td>
<td>T1: 3 ± 1.0 sec</td>
<td>T2: 100 ms</td>
</tr>
<tr>
<td>Auto Light switch</td>
<td>23.8 ± 3 Lux(0.8 ± 0.04 volt)</td>
<td>46.7 ± 3 Lux(1.38 ± 0.04 Volt)</td>
</tr>
<tr>
<td>Illumination switch</td>
<td>46.7 ± 3 Lux(1.38 ± 0.04 Volt)</td>
<td>12.2 ± 4 Lux(0.51 ± 0.04 volt)</td>
</tr>
<tr>
<td>Head Light switch</td>
<td>5.7 ± 4 Lux(0.36 ± 0.04 volt)</td>
<td>12.2 ± 4 Lux(0.51 ± 0.04 volt)</td>
</tr>
</tbody>
</table>
Auto Light Operation Characteristics 1
- Tail Lamp Auto Cut Function (IG S/W ON and Off and Door Open)

<table>
<thead>
<tr>
<th>IGN. KEY</th>
<th>ON</th>
<th>OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tail Lamp Switch</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>Tail Lamp</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>Door SW</td>
<td>ON(open)</td>
<td>OFF(close)</td>
</tr>
</tbody>
</table>
Auto Light Operation Characteristics 2
- Tail Lamp Auto Cut (IG. ON with Door Open)

<table>
<thead>
<tr>
<th></th>
<th>ON</th>
<th>OFF</th>
<th>ON</th>
<th>OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>IGN. KEY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OFF</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tail Lamp Switch</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ON</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>OFF</td>
<td></td>
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</tr>
<tr>
<td>Tail Lamp</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ON</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>OFF</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Door SW</td>
<td>ON(open)</td>
<td>OFF(close)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Auto Light Operation Characteristics 3
- Tail Lamp Auto Cut (Auto S/W “ON” and Door Open)

<table>
<thead>
<tr>
<th></th>
<th>ON</th>
<th>OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>IGN. KEY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tail Lamp Switch Auto</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tail Lamp ON Condition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tail Lamp</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Door SW</td>
<td>ON(open)</td>
<td>OFF(close)</td>
</tr>
</tbody>
</table>
Auto Lighting Circuit

- **Ignition Switch**
  - AM, Acc, IG1, IG2, ST
  - ACC ON

- **Dimmer Passing SW**
  - EB, HL, HU, HS2
  - Lo, Hi, P

- **Light SW**
  - TS, HS, EL, Auto
    - Off, Tail, H/L, Auto

- **Components**
  - BATT.
  - Fusible Link
  - Dash Fuse Box
  - Tail Lamp RLY
  - Head Lamp RLY
  - ETACS
  - Auto Light Sensor
Auto Light Photo Diode Sensor Inspection

- 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
RAIN SENSOR
Components

Optic Coupler & Attachment
Sensor & Interface
Styling Cover
RAIN SENSOR

Wiper Motor Operating Chart

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

<table>
<thead>
<tr>
<th></th>
<th>IGNITION S/W</th>
<th>Wiper Auto S/W</th>
<th>Rain Sensor (Relay)</th>
<th>WIPER MOTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ON</strong></td>
<td>ON</td>
<td>AUTO</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td><strong>OFF</strong></td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th>IGNITION S/W</th>
<th>Wiper Auto S/W</th>
<th>Rain Sensor (Relay)</th>
<th>WIPER MOTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ON</strong></td>
<td>ON</td>
<td>AUTO</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td><strong>OFF</strong></td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
</tbody>
</table>
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
Principle

RAIN SENSOR

Driving Room Side

OUT SIDE

Windshield glass

Photo Diode

0.5 mm (0.25 mm²)

Infrared emit

Windshield glass

Driving Room Side

OUT SIDE

Windshield glass

Rain sensor Assay

Photo Diode

Infrared emit
Rain Sensor

PHOTO Diode:
Infrared rays comes in

Reflect Mirror

Infrared emit:
Infrared rays emit

0.5 mm
(0.25"
㎟)
RAIN SENSOR

Circuit (Low Speed Mode)

Ignition Switch

<table>
<thead>
<tr>
<th>AM</th>
<th>Acc</th>
<th>IG1</th>
<th>IG2</th>
<th>ST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acc</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ON</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ST</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Rain Sensor Module

Wiper Switch (Multi Function S/W)

Wiper Motor

Washer Motor

Lo-SPD. Wiper Relay(ON)

Hi-SPD. Wiper Relay(Off)

BATT.
RAIN SENSOR

Circuit (High Speed Mode)

Ignition Switch

<table>
<thead>
<tr>
<th>AM</th>
<th>Acc</th>
<th>IG1</th>
<th>IG2</th>
<th>ST</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acc</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ON</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>ST</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Rain Sensor Module

Lo-SPD. Wiper Relay(ON)

Wiper Motor

Washer Motor

BATT.

Wiper Switch
(Multi Function S/W)

Hi-SPD. Wiper Relay(ON)
QUESTIONS

Q1 Rain 센서 회로도에서 Pin No7번의 신호는 Dwell 신호로써 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 Diode 중 한 개가 inoperative 할 때 일어날수 있는 현상은?

Q4 wiper switch의 위치가 Auto 위치에 있을 때는 미의 양에 따라서 wiper intermittent interval speed가 달라진다. 이때 최저 interval time과 max interval time는 각각 몇 초인가?

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

DISPLAY COMPASS, ALTITUDE, BAROMETRIC PRESSURE & TEMPERATURE

- MODE /SET SWITCH
- UP SWITCH
- DOWN SWITCH
- VFD DISPLAY
SWITCH FUNCTION

PRESS MODE/SET SW MORE THAN 0.1SEC.

1. Ambient Temperature Switch Type

2. Without Ambient temperature switch type
### Reading compass

<table>
<thead>
<tr>
<th>NO</th>
<th>Vehicle direction</th>
<th>Vehicle angle (±22.5°)</th>
<th>1st Row</th>
<th>2nd Row</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N</td>
<td>0°</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>NE</td>
<td>45°</td>
<td>N</td>
<td>E</td>
</tr>
<tr>
<td>3</td>
<td>E</td>
<td>90°</td>
<td></td>
<td>E</td>
</tr>
<tr>
<td>4</td>
<td>SE</td>
<td>135°</td>
<td>S</td>
<td>E</td>
</tr>
<tr>
<td>5</td>
<td>S</td>
<td>180°</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>SW</td>
<td>225°</td>
<td>S</td>
<td>W</td>
</tr>
<tr>
<td>7</td>
<td>W</td>
<td>270°</td>
<td></td>
<td>W</td>
</tr>
<tr>
<td>8</td>
<td>NW</td>
<td>315°</td>
<td>N</td>
<td>W</td>
</tr>
</tbody>
</table>
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 4.5 sec 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**

1. **MODE/SET SW**
   - ON: ↑4.5sec

2. **UP or DOWN SW**
   - ON: ↑0.1sec

3. **MODE/SET SW**
   - ON: ↑1sec

**[DRT] display 4times ON/OFF setting**

When Declination correction cancel:
- Mode/Set SW ON : ↓ 0.1sec

**Declination movement**

When Declination correction cancel:
- Mode/Set SW ON : ↓ 0.1sec

**Declination confirmation**
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
**Procedure**

Mode/Set SW ON: ↓ 1~4.5sec → Entry Mode

Vehicle 360° Turning

When B/Position correction cancel: Mode/Set SW ON: ↑ 0.1sec → While Bearing Correction

B/Position completion

Vehicle Direction Bearing Display (Normal Bearing)

When Bearing Correction Cancel: Mode/Set SW ON: ↑ 0.1sec
Bearing Position Correction Procedure

1. Setting: Press the Mode / Set switch for 1 to 4.5 sec. 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 128 sec, bearing correction fails.
   - Recommended turning speed is 20 km/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 0.1 sec or more
   - After vehicle enter the correction mode, vehicle turning is not performed within 128 sec.
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 0.25 second.

And whenever the right data input into multi meter, bearing display comes to normal.
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: $\pm 3000m (\pm 9800ft)$

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”

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.
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: