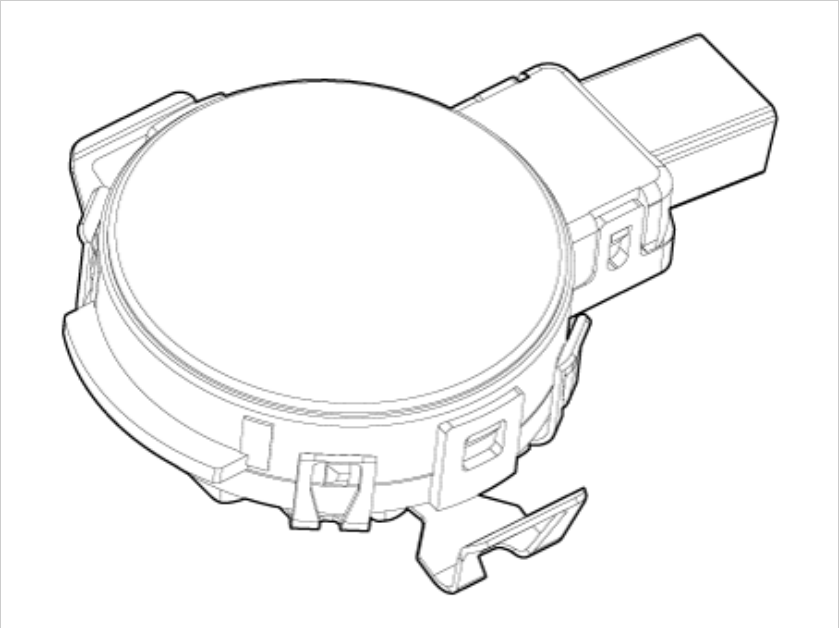
Description

Integrated Rain Sensor

Integrated rain sensor (A) controls three systems: front wiper, auto-light, and central air conditioner.

1. Wiper Control System
   When "AUTO" switch signal is received from the multi-function switch on the right, the integrated rain sensor detects the amount of rainfall. The sensor is installed inside the upper part of the front window for wiper motor control.
   This system automatically controls the operation duration and speed of the wiper depending on the measured amount of rainfall even if the driver does not operate the wiper switch.
2. Auto Light Control System
   When "AUTO" signal is received from the multi-function switch on the left, the integrated rain sensor installed on the front window detects the brightness of the light and controls the operation of the head lamp and screen brightness of the internal multimedia.
   This system automatically controls the brightness of the head lamp and the internal multimedia screen depending on the measured brightness even if the driver does not operate the lamp switch.
3. Central Air Conditioning System
   When "AUTO" signal is received from the central air conditioner switch, the integrated rain sensor detects the amount of sunshine depending on the direction of the sunlight.
   This system automatically controls the cooling system depending on the measured amount of sunshine even if the driver does not operate the air conditioner switch.



Functions and Operating Principles

Basic Principle

1. Detecting the amount of rainfall
   The light (beam) emitted from light emitting diodes (LED) is totally reflected on the external surface of the windshield and comes back to the photo diodes. When there is water on the external surface of the windshield, the light is optically separated and reflected partially and the remaining brightness is measured by the photo diodes. Water remaining on the windshield results in the light being not totally reflected. The loss of brightness due to this indicates how much the glass surface is wet.
2. Detecting light
   Brightness of light is measured by the diodes using the infrared light. The brightness of the outside of the vehicle is measured in two directions: (a) the upper direction and (b) the front direction. The measured amount of light is used to determine whether it is day or night.
3. Detecting the amount of sunshine
   The system measures the amount of sunshine from the left and right sides and operates the air conditioner on the driver side or the passenger side.

NOTICE

Integrated rain sensor is composed of 2 LEDs and 2 photo diodes to detect rainfall, 2 photo diodes to detect light, 1 photo diode to detect the amount of sunshine, and bracket.

Operation Control

1. When "AUTO" signal is received from the multi-function switch on the right, the integrated rain sensor detects the rainfall and controls the wiper motor.
2. When “AUTO” signal is received from the multi-function switch on the left, the integrated rain sensor detects the brightness and controls the head lamp and internal multimedia brightness.
3. When “AUTO” signal is received from the central air conditioner switch, the integrated rain sensor detects the amount of sunshine and controls the air conditioning system.

Interference

Integrated rain sensor might malfunction due to the interferences listed below.

1. Dust on the measuring surface and other surfaces on the light path (surface of light emitting diodes and photo diodes, fiber optics, bracket, and glass surface of windshield joint area) weakens the received light.
2. Movement of windshield and bracket
3. Movement of bracket due to vibration
4. Damaged wiper blade
5. Damaged head lamp
6. Damaged multimedia device
7. Damaged air conditioning system

NOTICE

When the integrated rain sensor does not operate or malfunctions, the driver should operate the wiper switch manually.
When the integrated rain sensor does not operate or malfunctions, the driver should operate the head lamp switch manually.
When the integrated rain sensor does not operate or malfunctions, the driver should operate the air conditioner switch manually.

Automatic Operation

1. Operational status of rain sensor

Operation Mode	Operation
Direct Mode	It is the normal operational status of the integrated rain sensor when the wiper switch is in "Auto" and the sensor detected dry windshield. Based on this state, integrated rain sensor determines the operation mode of wiper depending on the rainfall and its duration.
Intermittent Mode	Integrated rain sensor activates the intermittent mode when wiper operation is done successively more than twice with a pause of 0.5 - 5 seconds.
Low Speed	The wiper operates continuously in low speed
High Speed	The wiper operates continuously in high speed

2. Operational status of light sensor

Operation Mode	Operation
Auto Mode	It is the normal operational status of the integrated rain sensor when the head lamp switch is in "Auto" and the sensor detected the brightness of the light. Based on this state, the Integrated rain sensor determines the operation mode of head lamp and internal multimedia depending on the amount of light measured.
Low beam ON	The lamp and multimedia turn on at medium brightness.
High beam ON	The lamp and multimedia turn on at maximum brightness.

3. Operational status of solar load sensor

Operation Mode	Operation
Auto Mode	It is the normal operational status of the integrated rain sensor when the air conditioner switch is in "Auto" and the sensor detected the amount of sunshine. Based on this state, the integrated rain sensor determines the operation mode of air conditioning system depending on the amount of sunshine measured.
Manual Mode	The cooling intensity is controlled manually.

Safety Function High

1. When there is ice or foreign substance in the detecting area, integrated rain sensor cannot recognize the condition for operation correctly.

Detecting Special Conditions

1. Rain sensor

Special Condition	Operation based on special conditions detecting
Splash	When integrated rain sensor detects a high level of water (splash) in Direct or Intermittent mode, the system switches from Park to High speed. Then, wiping is done once in High speed and once more in Low speed. If the condition of rainfall does not change after wiping, it returns to the original condition (Direct or Intermittent).
Smearing	Smearing is a thin oil film that has dried fast and occurs when a small amount of raindrops is wiped by a dirty or worn-out wiper blade. Operational signal should not be issued when smearing occurs in Direct or Intermittent mode.
Dirt	When no change is detected after wiping, integrated rain sensor determines that the windshield is dirty. In this state, operational signal should not be issued. If the windshield becomes clean (for example, by washer fluid), the integrated rain sensor returns to the normal condition.
Automatic change of sensitivity between day and night	Integrated rain sensor automatically adjusts the sensitivity between day and night using a day & night sensor.
Compensating for the level of illumination in the surrounding area	The system operates normally by compensating for the interference due to illumination in the surrounding area.
Washer fluid	Integrated rain sensor does not respond to the washer fluid during the Washer mode. In other words, wiping speed does not change even if the washer fluid is sprayed (automatic operation of the washer pump is not reflected in the functioning of integrated rain sensor).

2. Light sensor

Special Condition	Operation based on special conditions
Pedestrian overpasses / high rise buildings / street trees	Integrated rain sensor prevents the head lamp from blinking when it detects lightness while passing by the pedestrian overpasses, high rise buildings, or street trees during the day. However, head lamp might turn on when the sensor determines it as night time while passing by the places mentioned above.
Tunnels	Integrated rain sensor recognizes a tunnel when the vehicle passes by it during the day. When entering the tunnel, the integrated rain sensor recognizes the tunnel and turns on the head lamp immediately and turns off the head lamp several seconds after escaping the tunnel.