

ADAPTIVE LED HEADLIGHTS

id15100002400

Outline

- The adaptive LED headlights improve visibility by changing the headlight illumination range depending on the vehicle driving conditions and the surrounding conditions without switching the headlights between HI/LO.
- Depending on on-coming vehicles, vehicles ahead, driving around curves and the vehicle speed, the headlights automatically increase or decrease the brightness to illuminate farther and wider when the light switch is in the AUTO position and the dimmer switch is in the HI position.

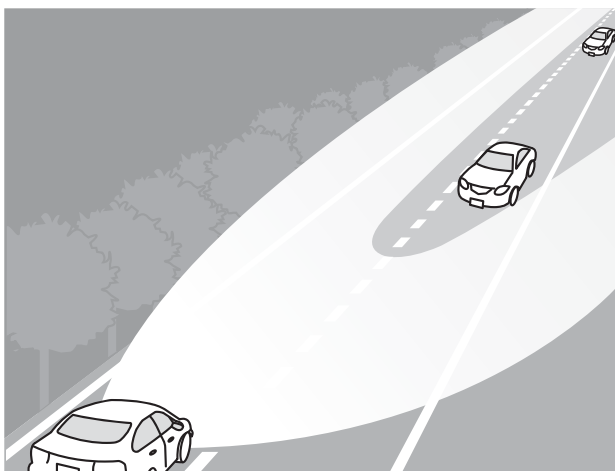
Function

- The adaptive LED headlights determine the surrounding conditions and vehicle conditions based on the signals from the related modules, and based on the determined results, the adaptive LED headlights changes the headlight brightness. For surrounding condition and vehicle condition determination, refer to the [ADAPTIVE LED HEADLIGHTS CONTROL MODULE]. (See ADAPTIVE LED HEADLIGHTS CONTROL MODULE.)
- The adaptive LED headlights has the following functions.

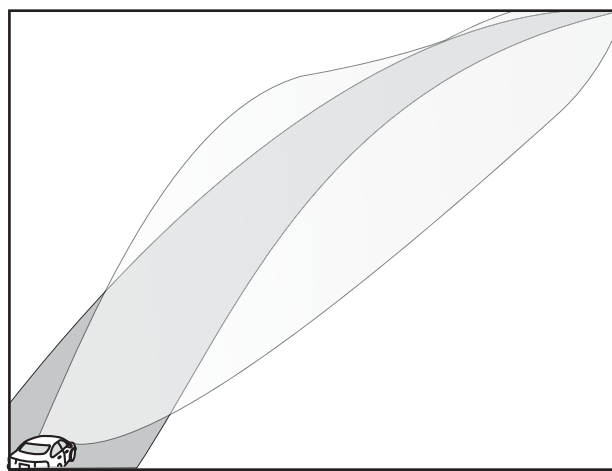
Glare-free high beam

- Depending on the presence of vehicles ahead, driving around curves, traveling through towns and cities, or vehicle speed, the glare-free high beam helps prevent the drivers of other vehicles from being dazzled while the maintaining headlight high beam light distribution.

EXAMPLE IMAGE OF LIGHT DISTRIBUTION
WHEN ON-COMING VEHICLES EXIST



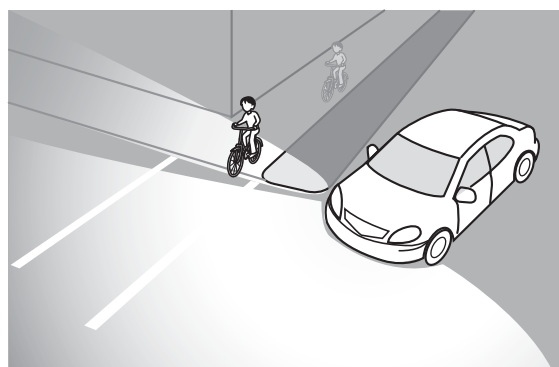
EXAMPLE IMAGE OF LIGHT DISTRIBUTION
WHEN DRIVING ON CURVE



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Wide-range low beam

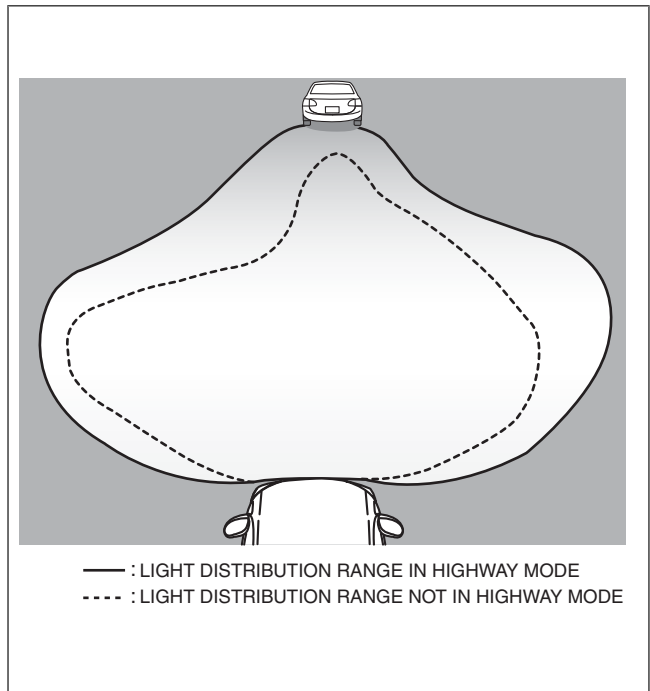
- The wide-range low beam enhances the visibility at intersections during the night by illuminating the side-illuminating LEDs of the front combination light while traveling at low speeds.



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Highway mode



- The highway mode raises the optical axis of the headlight low beams to improve long distance visibility while traveling at high speeds.



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System conditions display function

- The forward sensing camera (FSC) displays the system status using the adaptive LED headlights indicator light (green), adaptive LED headlights warning light (amber), multi-information display (with multi-information display) in the instrument cluster, and the warning display on the center display (with center display).

Condition	Adaptive LED headlights indicator light (green)	Adaptive LED headlights warning light (amber)	Multi-information display	Center display
Light switch is in AUTO and dimmer switch is in position other than HI	Off	Off	No display	No display
Headlights off				
While vehicle is stopped				
System set to off by personalization				
Light switch is in AUTO and dimmer switch is in HI and headlights turned on	On			
Forward sensing camera (FSC) detects camera/windshield fogging	Off	On	 Front camera blocked Defog windshield completely	Warning display*1
Forward sensing camera (FSC) detects that the camera/windshield is dirty			 Clear outside of windshield completely	
Adaptive LED headlights has a malfunction			Front camera sensor system malfunction	
Forward sensing camera (FSC) has a malfunction				

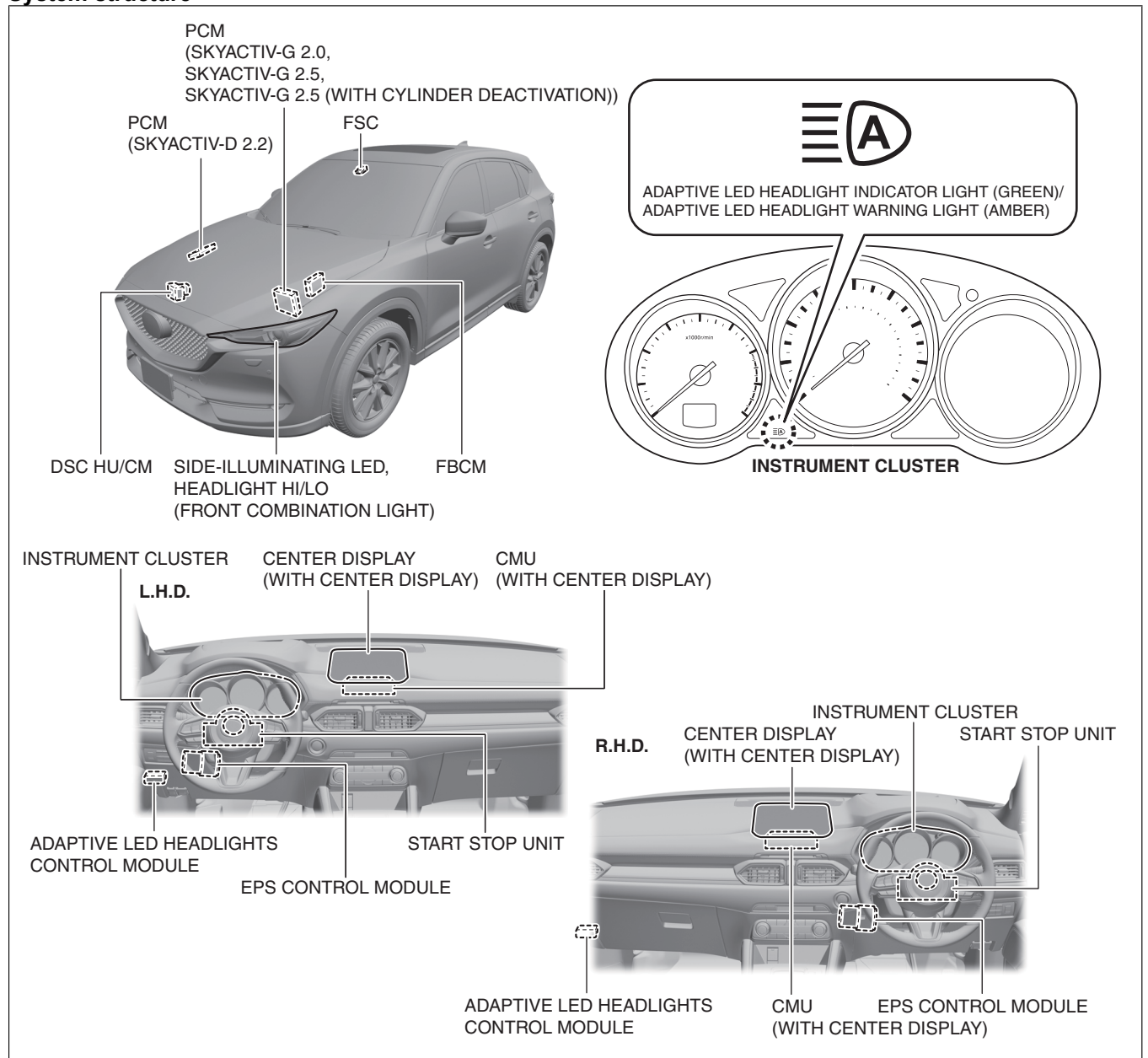
*1 : For the warning display content on the center display, refer to the [CENTER DISPLAY]. (See CENTER DISPLAY [WITH CENTER DISPLAY].)

Personalization feature

- The adaptive LED headlights can be set to On (operational)/Off (non-operational) (initial setting is [On (operational)]). For details on the personalization features, refer to the [i-ACTIVSENSE PERSONALIZATION]. (See i-ACTIVSENSE PERSONALIZATION.)

Structure/Construction

System structure

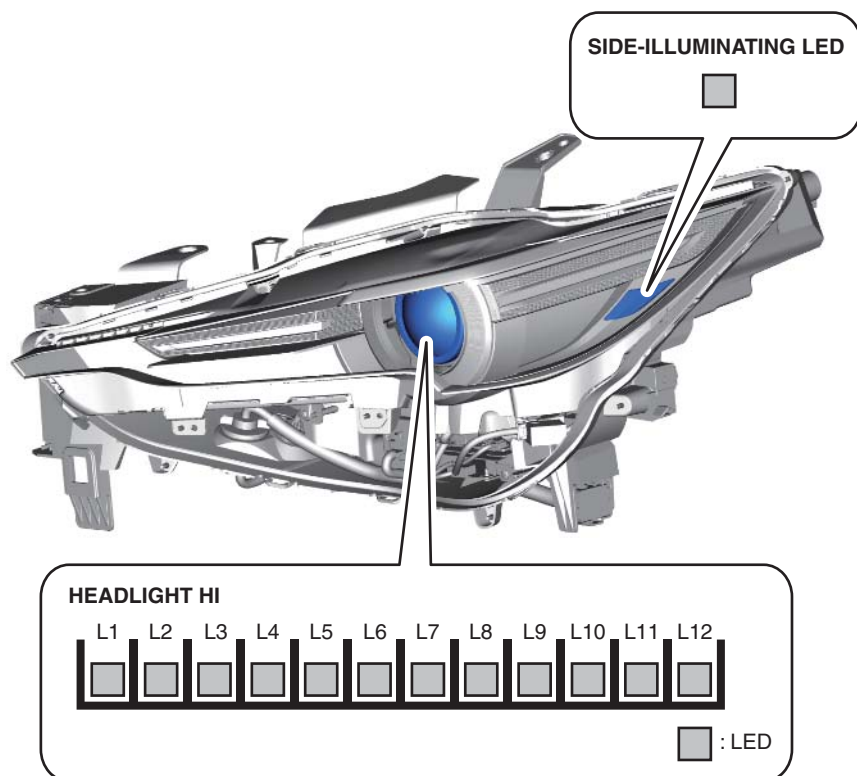


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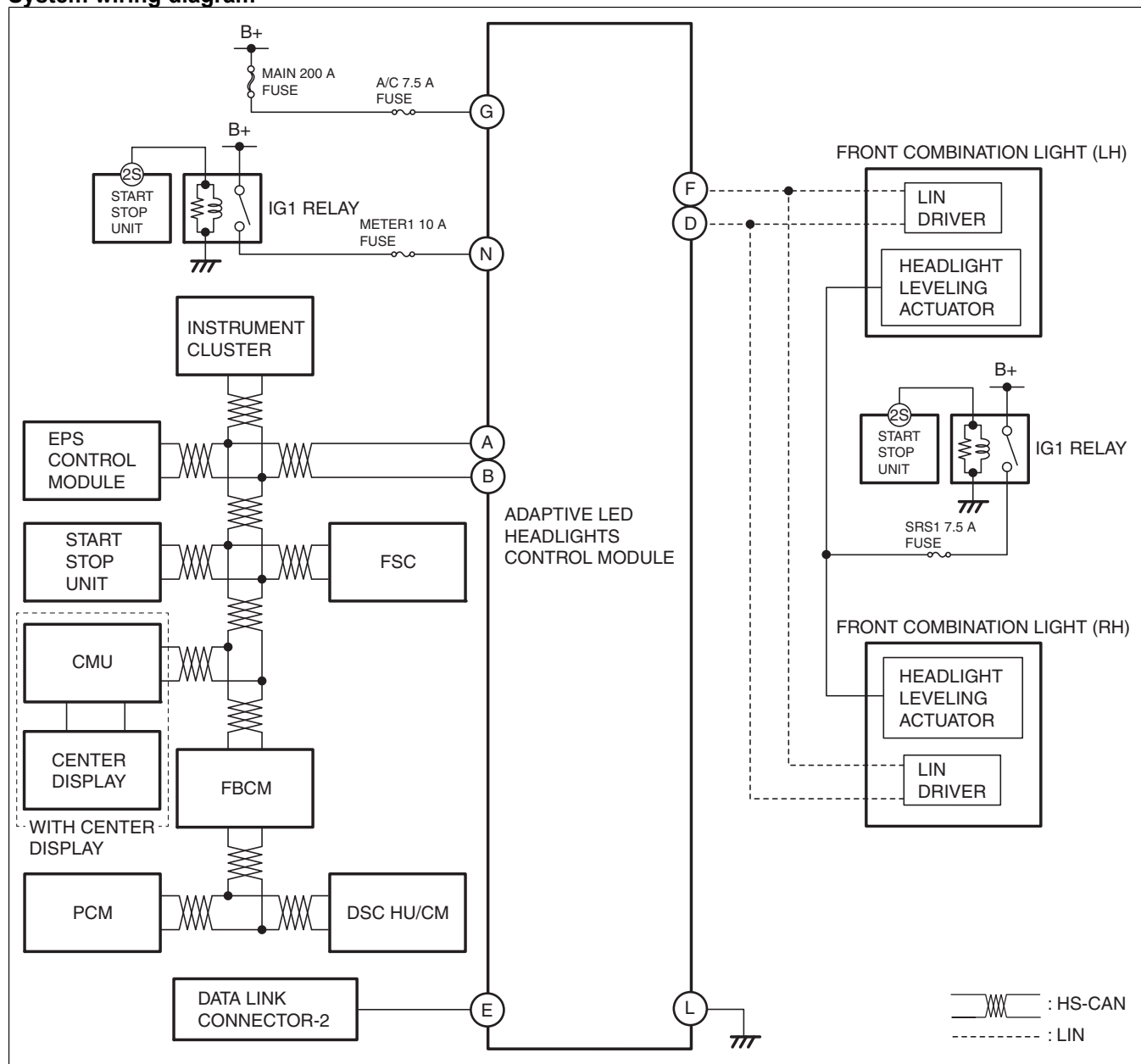
- 24 LEDs (12 on each side) are located in the headlight high beams.

Note

- The illumination off or increase/decrease in brightness of the LEDs is performed on each LED separately.
- 2 LEDs (1 on each side) are located in the side illumination front combination lights.



System wiring diagram

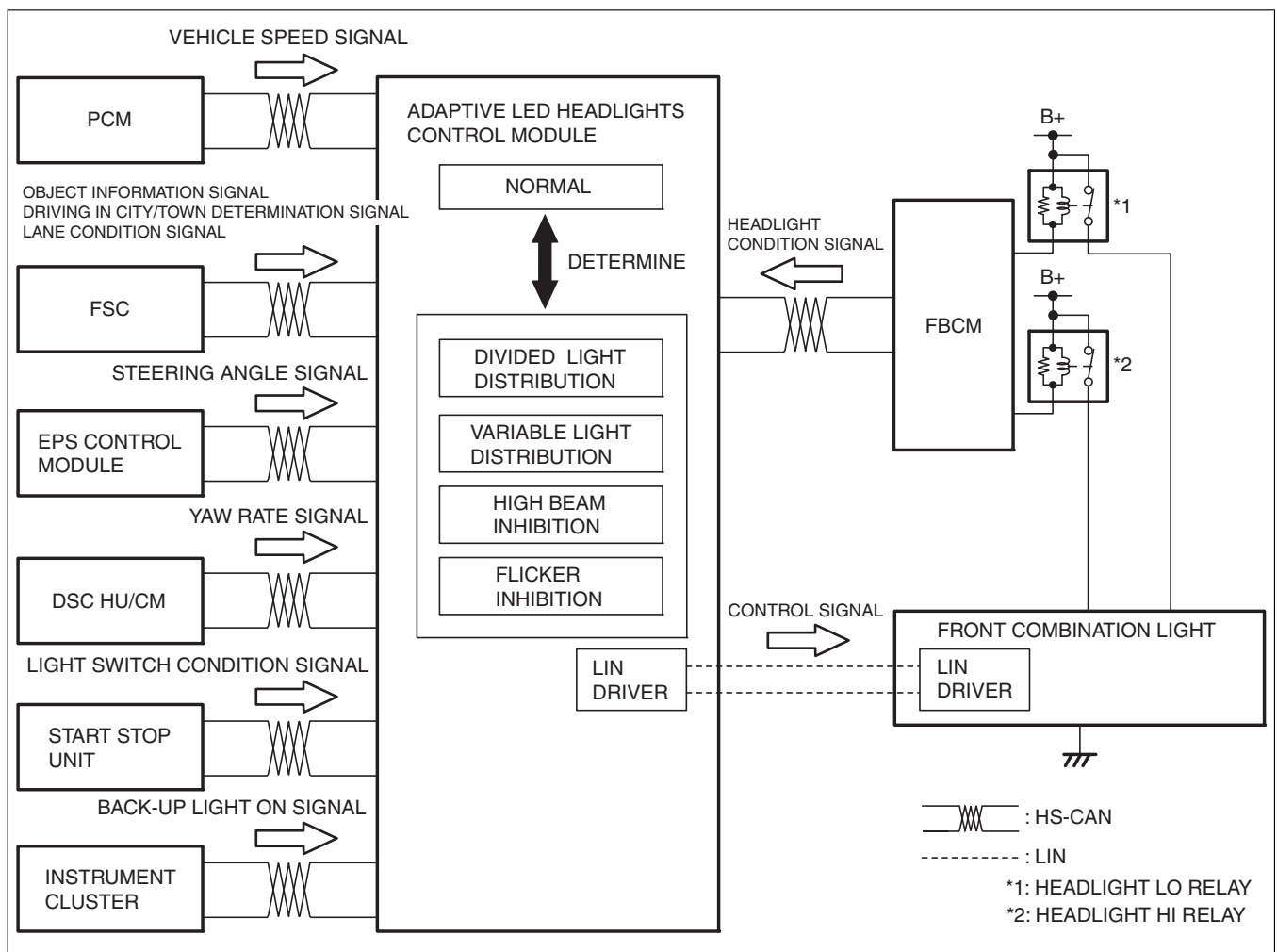


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Operation

Glare-free high beam

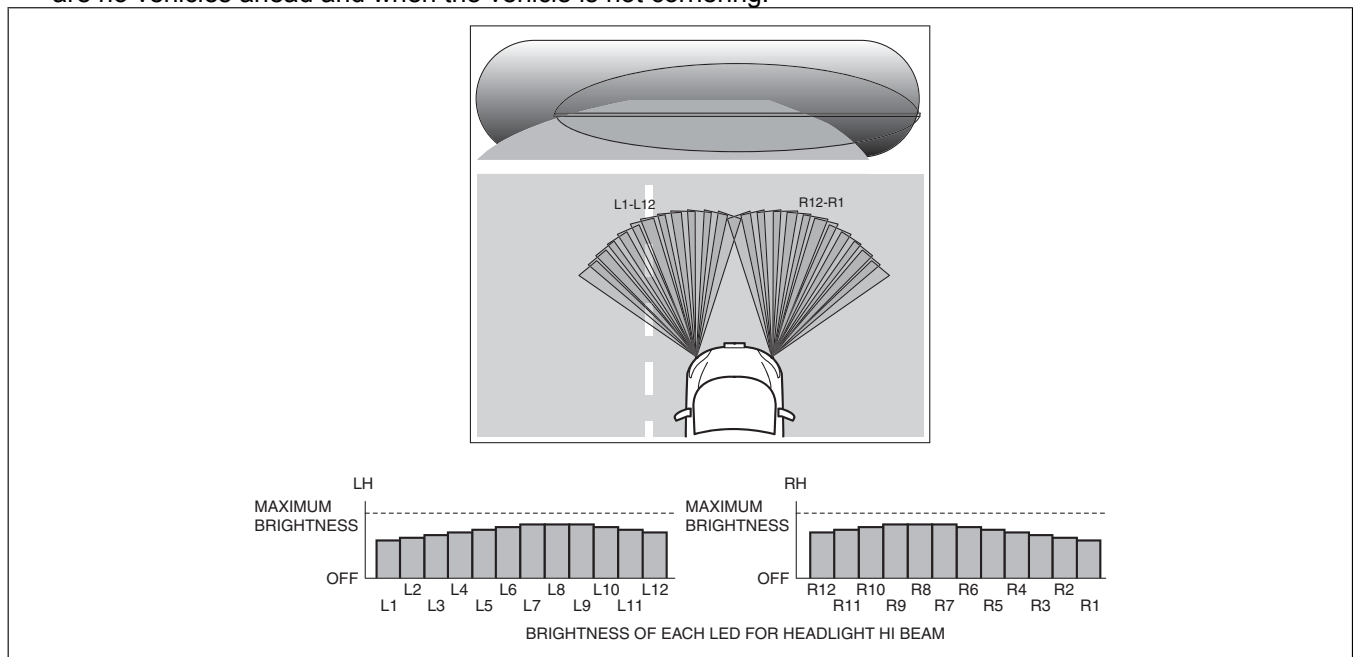
- The adaptive LED headlights control module determines the vehicle driving status and surrounding conditions based on the signals from the related modules, and based on the determined result, the glare-free high beam controls the on/off/increase and decrease of brightness for the LEDs installed on the headlight high beams.
- When the glare-free high beam operates with all the following conditions met.
 - Adaptive LED headlights personalization is [ON (operational)]
 - Headlight auto leveling system initial setting is complete
 - Selector lever is in position other than R position (ATX)
 - Shift lever is in position other than reverse position (MTX)
 - Light switch in AUTO position and dimmer switch in HI position
 - Vehicle speed is **40 km/h {25 mph} or more**
 - Driving in city/town signal is not received from forward sensing camera (FSC)



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No vehicle ahead and not driving on a curve (normal)

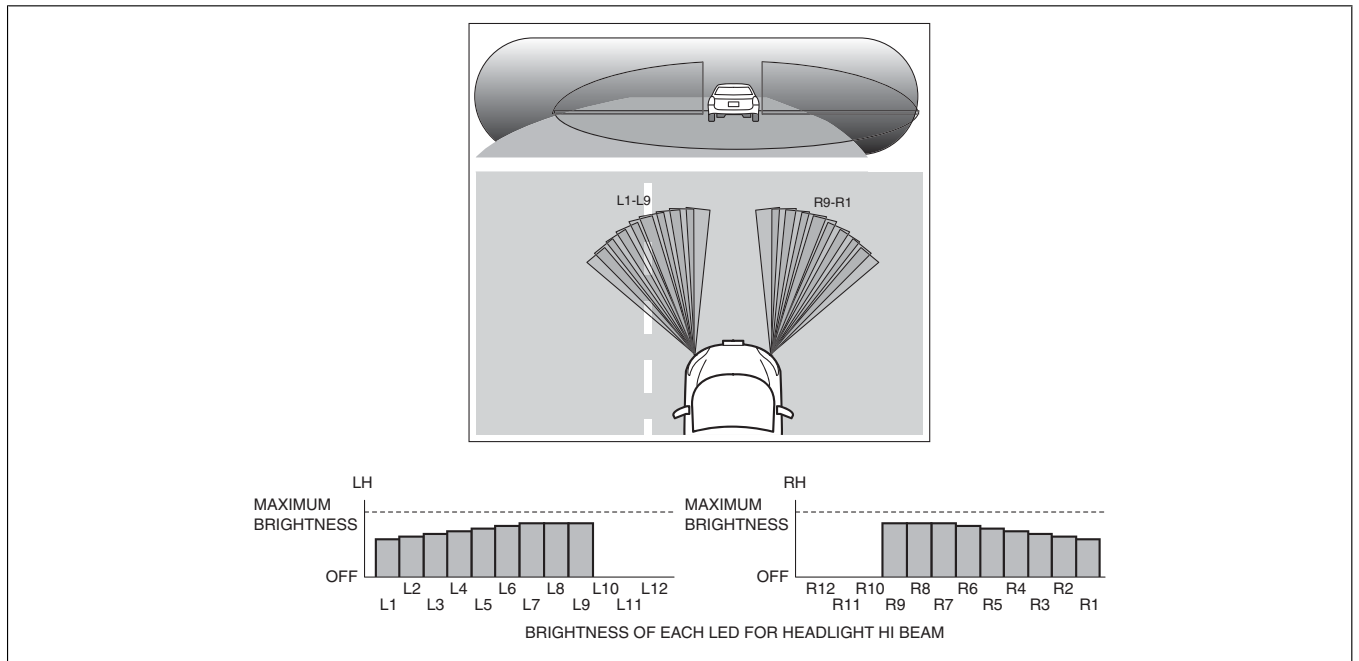
- The adaptive LED headlights control module turns on the LEDs installed to the headlight high beams when there are no vehicles ahead and when the vehicle is not cornering.



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When there is a vehicle ahead (divided light distribution)

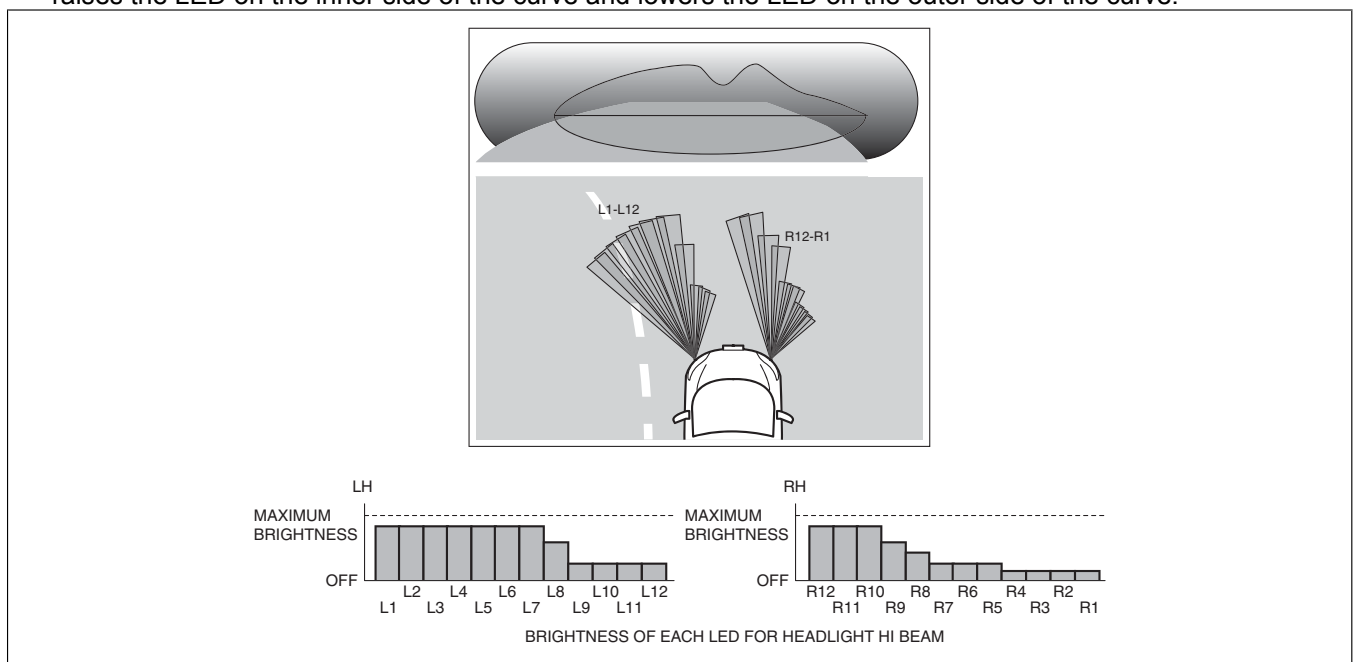
- The adaptive LED headlights control module turns off the LEDs located on the headlight high beams that are emitting light on a vehicle ahead, based on the vehicle detection signal from the forward sensing camera (FSC).



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Driving on a curve (variable light distribution)

- The adaptive LED headlights control module determines the lanes curve direction and curve length based on the lane condition signal or vehicle signal from related modules from the forward sensing camera (FSC), it then raises the LED on the inner side of the curve and lowers the LED on the outer side of the curve.



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High beam inhibition

- When the adaptive LED headlights control module receives a driving in city/town signal from the forward sensing camera (FSC), it turns off the high beams and inhibits unnecessary brightness.

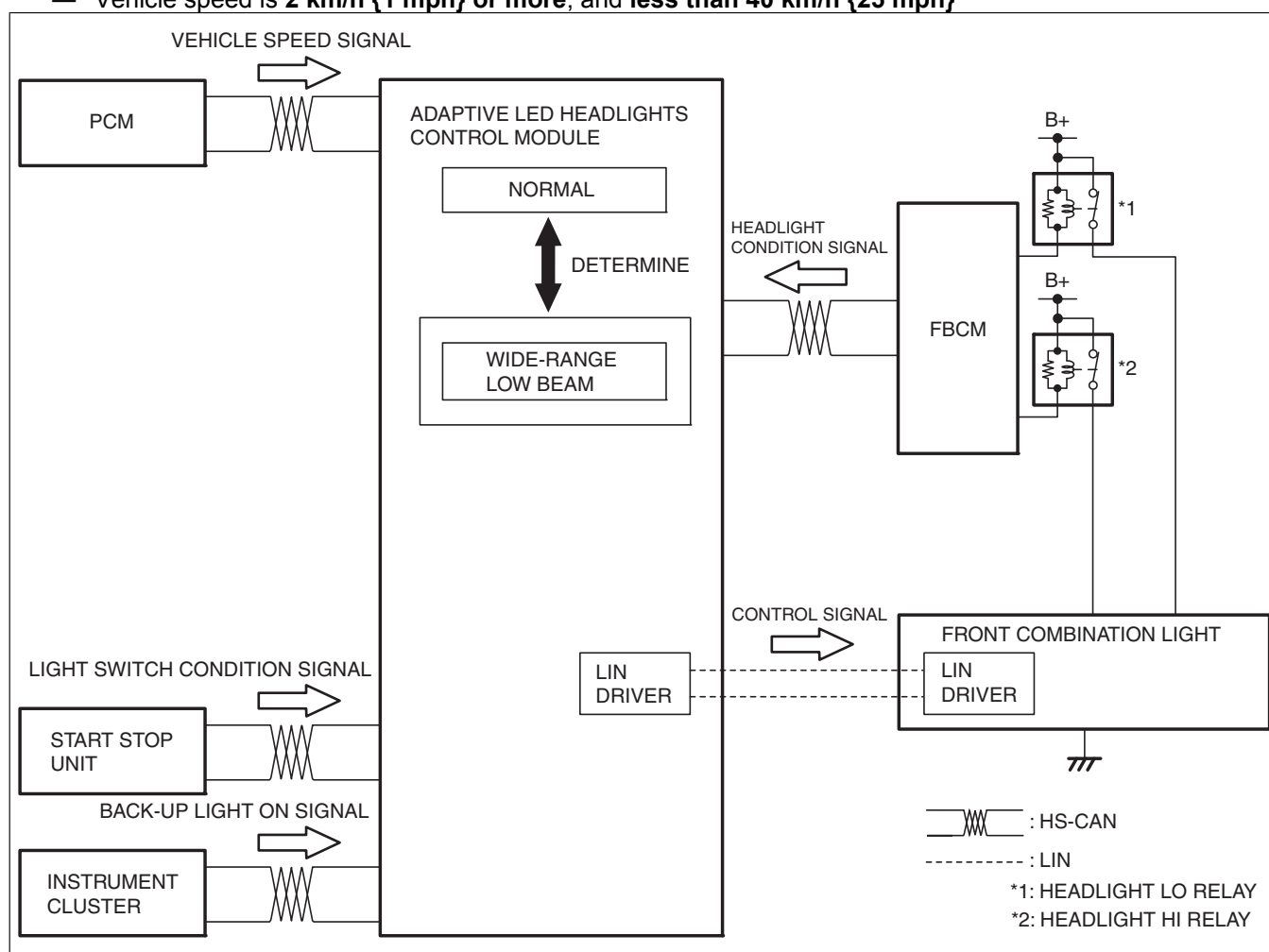
Flicker inhibition

- The adaptive LED headlights control module delays the change in light distribution and inhibits flickering under the following conditions.
 - Losing sight of vehicle ahead due to sloping road conditions
 - Appearance/disappearance of vehicles ahead is due to effect of dividers lining the median strip
 - Light distribution is performed

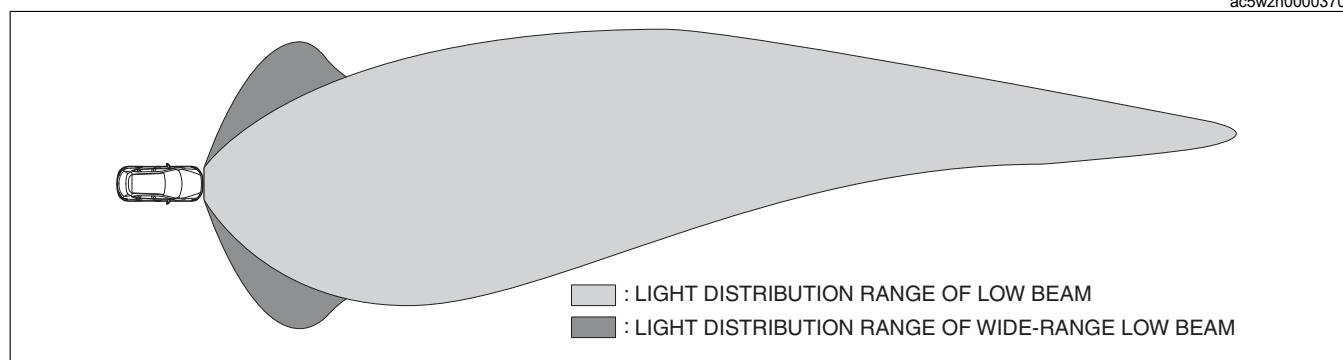
Wide-range low beam

- The adaptive LED headlights control module increases the brightness of the LEDs for side illumination in the front combination light when all the following conditions are met.
 - Adaptive LED headlights personalization feature is [ON (operational)]
 - Light switch in AUTO position and dimmer switch in HI position

- Headlight LO is illuminated
- Vehicle speed is **2 km/h {1 mph} or more, and less than 40 km/h {25 mph}**



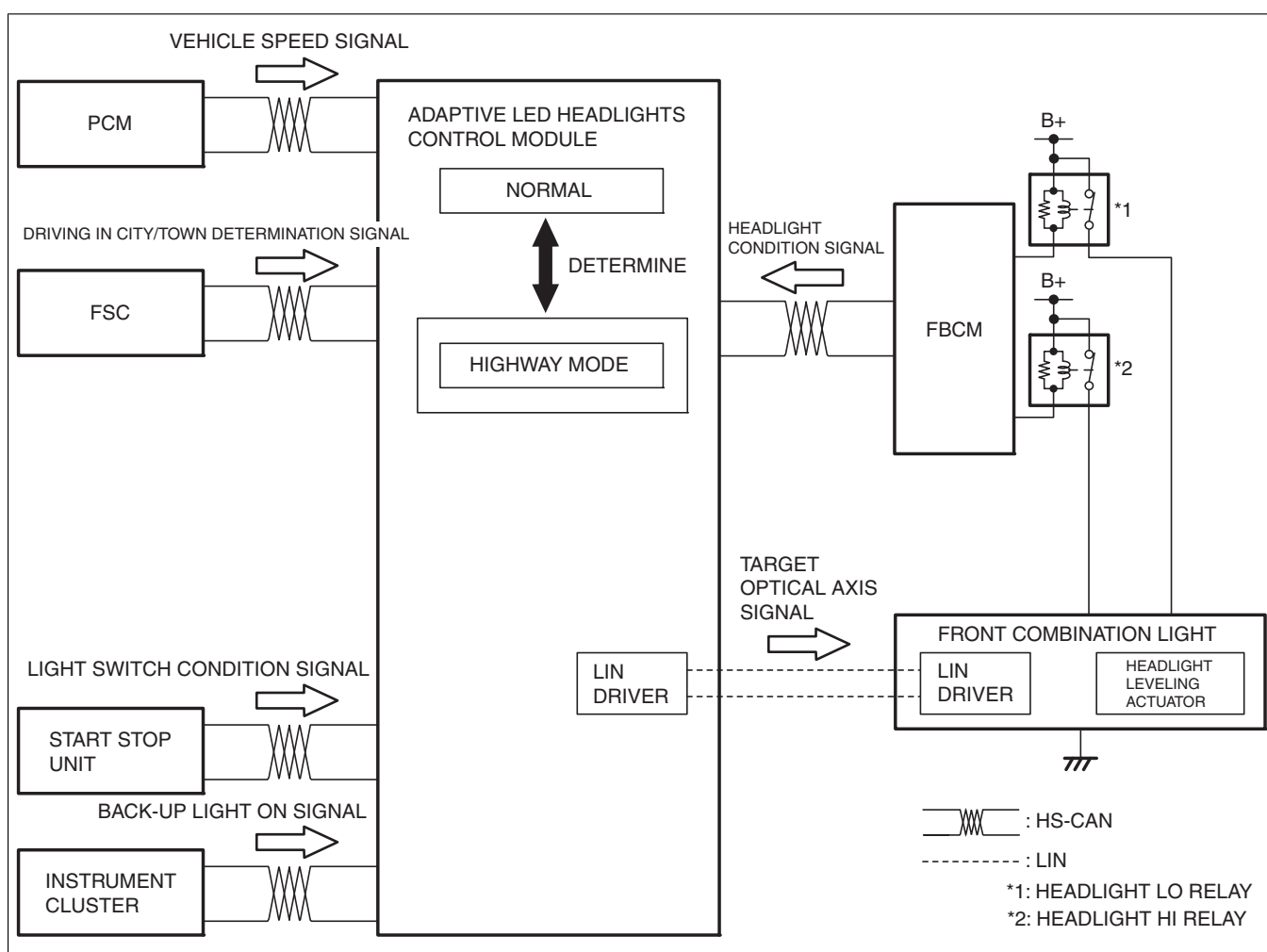
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Highway mode

- The adaptive LED headlights control module operates the highway mode when all of the following conditions are met.
 - Adaptive LED headlights personalization feature is [ON (operational)]
 - Headlight auto leveling system initial setting is completed
 - Selector lever is in position other than R position (ATX)
 - Shift lever is in position other than reverse position (MTX)
 - Light switch in AUTO position and dimmer switch in HI position
 - Headlight LO is illuminated
 - Vehicle speed is **105 km/h {65.2 mph} or more**
 - Driving in city/town signal is not received from forward sensing camera (FSC)

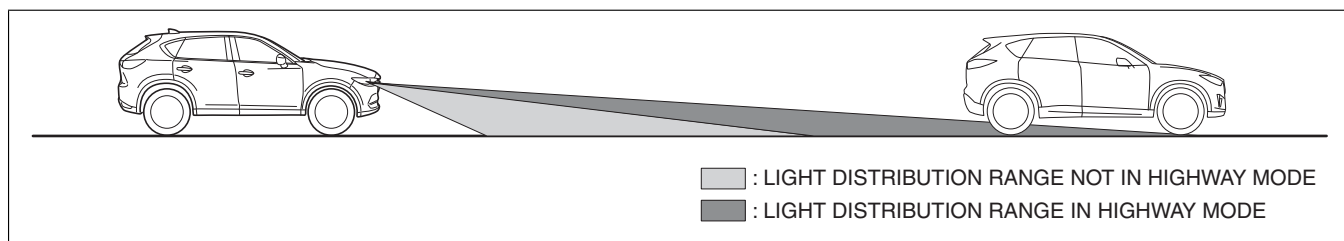


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- The adaptive LED headlights control module raises the headlight low optical axis depending on the vehicle speed. For the headlight low optical axis adjustment, refer to the [HEADLIGHT LEVELING ACTUATOR]. (See HEADLIGHT LEVELING ACTUATOR.)

×: Applicable
—: Not applicable

Vehicle speed	Raise optical axis in 1 step	Raise optical axis in 2 steps
Vehicle speed exceeds 105 km/h {65.2 mph} for 5 s	×	—
Vehicle speed exceeds 110 km/h {68.4 mph}	×	—
Vehicle speed exceeds 115 km/h {71.5 mph} for 5 s	—	×
Vehicle speed exceeds 120 km/h {74.6 mph}	—	×



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List of operations

- The adaptive LED headlights operate as follows depending on the surrounding conditions and vehicle conditions.

×: Applicable

—: Not applicable

Surrounding conditions and vehicle conditions					Operation
Vehicle ahead is recognized	Curve is recognized	Town/city streets recognized	Vehicle speed is 105 km/h {65.2 mph} or more (traveling at high speed)	Vehicle speed is 2 km/h {1 mph} or more and less than 40 km/h {25 mph} (traveling at low speed)	
—	—	—	—	—	Normal
x	—	—	—	—	Divided light distribution
—	x	—	—	—	Variable light distribution
x	x	—	—	—	• Divided light distribution • Variable light distribution
x	x	x	—	—	HI beam inhibition
x	x	—	—	x	Wide-range LO beam
—	—	—	x	—	Highway mode
x	—	—	x	—	• Divided light distribution • Highway mode
—	x	—	x	—	• Variable light distribution • Highway mode
x	x	—	x	—	• Divided light distribution • Variable light distribution • Highway mode
—	—	—	—	x	Wide-range low beam