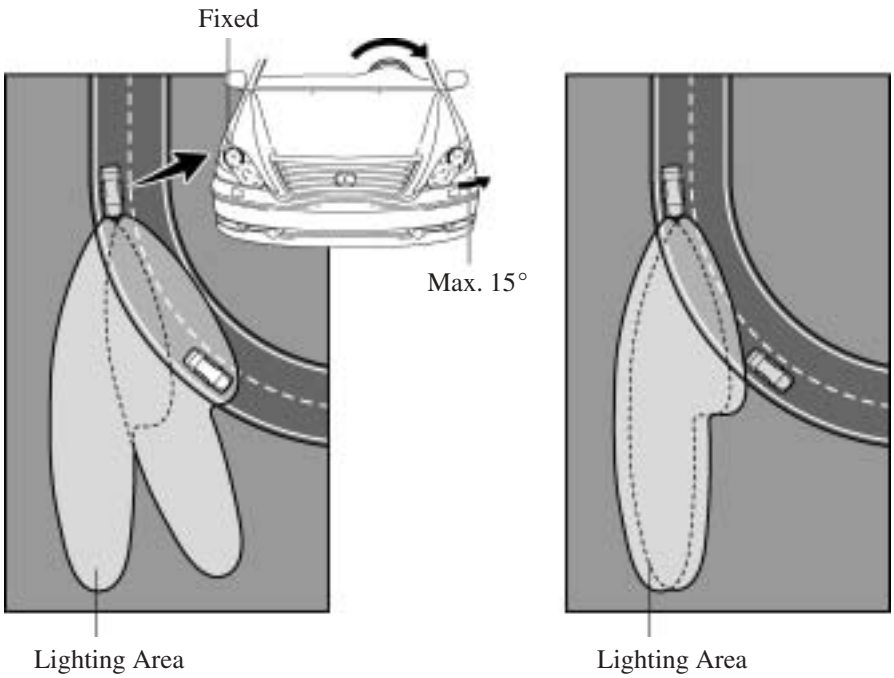
4. Intelligent AFS (Adaptive Front-Lighting System)

General

An intelligent AFS (Adaptive Front-lighting System) has been adopted in order to ensure a wide range LO beam lighting area and realize excellent visibility during turning by swinging the projector headlight (for LO beam) to the inner side of the cornering direction.



with intelligent AFS **without intelligent AFS**

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▶ Swivel Angle Range ◀

Driving Condition	Headlight Unit			
	LHD Model		RHD Model	
	Left	Right	Left	Right
Right Turn	0° Fixed	0 ~ 5° to Right	0° Fixed	0 ~ 15° to Right
Left Turn	0 ~ 15° to Left	0° Fixed	0 ~ 5° to Left	0° Fixed

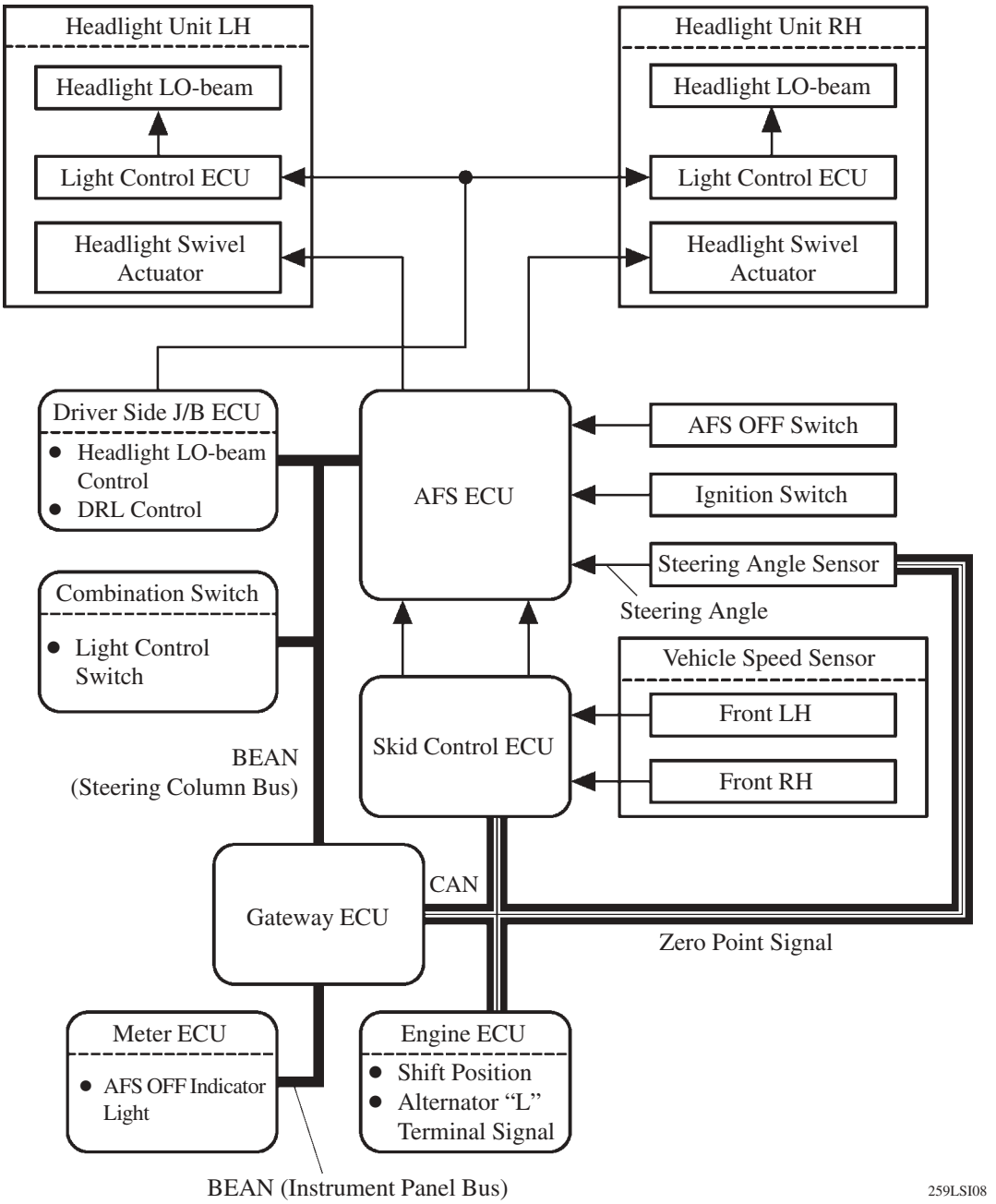
- This system consists of two projector headlights (for LO beam), the AFS ECU, two headlight swivel actuators, steering angle sensor and front speed sensors. The AFS ECU controls this system.
- The AFS ECU also controls the automatic headlight beam level control system.

Major Difference (from RX330/300)

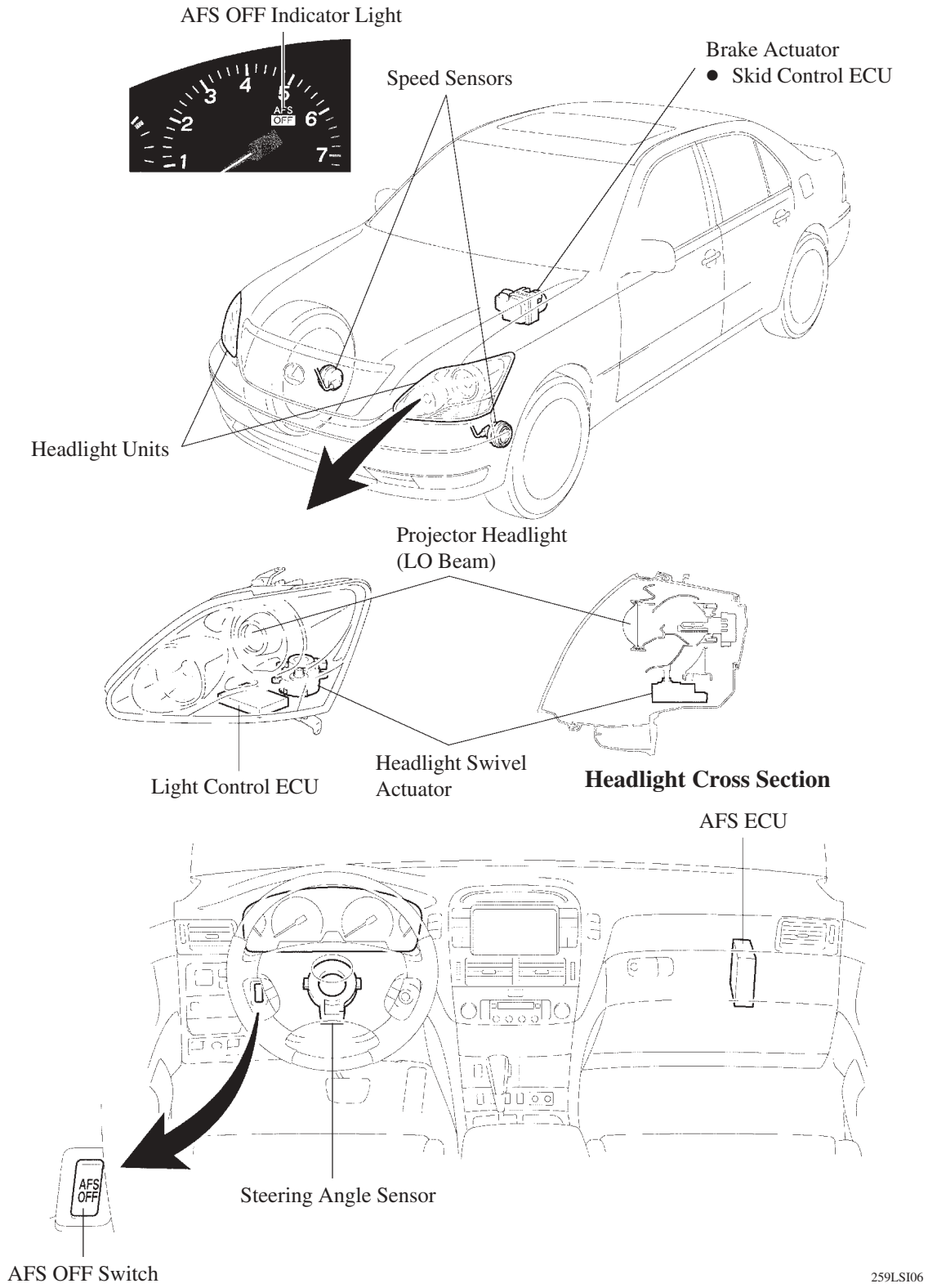
This system and the intelligent AFS system used on the RX330/300 differ as follows:

- The headlight swivel ECU is enclosed in the headlight swivel actuator.
- The headlight swivel actuator uses a step motor.
- Because the zero point of the steering angle sensor is being input from the skid control ECU, it is not necessary to initialize the steering position.

▶ System Diagram ◀



Layout of Main Component

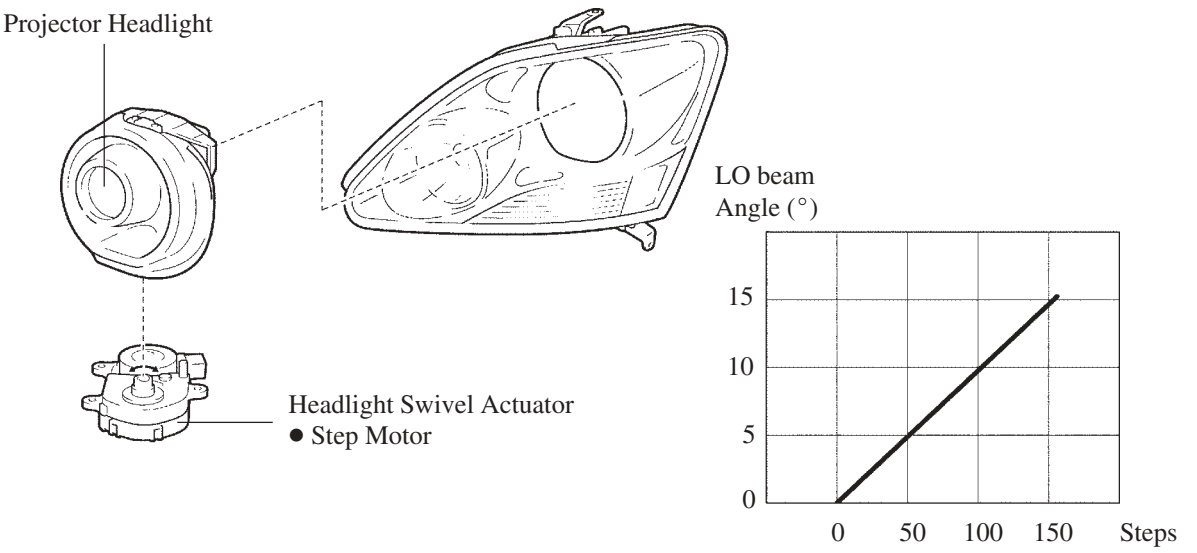


Function of Main Component

Item		Outline
Combination Meter	AFS OFF Indicator Light	● When AFS control is stopped by the AFS OFF Switch, it is indicated by the AFS OFF Indicator Light lighting up. ● When the AFS ECU detects a malfunction, the AFS OFF Indicator Light flashes.
AFS OFF Switch		Pressing this switch, enables or disenables the operation of AFS.
Steering Angle Sensor		● Detects the steering angle signal and direction and outputs this signal to the AFS ECU and the skid control ECU. ● Outputs a zero point signal to the skid control ECU.
Speed Sensor (Front RH, LH)		Detects the wheel speed signal and outputs this signal.
Headlight Unit	Projector Headlight (LO Beam)	Is moved by the headlight swivel actuator.
	Headlight Swivel Actuator	Driven by the AFS ECU, the actuator moves the projector headlight (low beam) to the angle calculated by the AFS ECU.
Brake Actuator	Skid Control ECU	● Transmits the signals of the front vehicle speed sensors to the AFS ECU. ● Receives the zero point signal from the steering angle sensor and transmits it to the AFS ECU via BEAN.
AFS ECU		● The AFS ECU receives various signals, calculates the target lighting angle, and actuates the headlight swivel actuator. ● When the AFS ECU detects a malfunction, the AFS ECU flashes the AFS OFF indicator light.

Headlight Swivel Actuator

A step motor is used for the headlight swivel motor. The AFS ECU determines the projector headlight (LO beam) angle based on the steps (position) of the step motor.



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System Control

1) General

The system control consists of the initial set control, basic control, fail-safe, and diagnosis. The AFS ECU performs intelligent AFS control when all the following conditions are fulfilled.

Operation Condition	● Engine is running. ● Shift lever is not R and N range. ● Vehicle speed* is 12 mph (20 km/h) or more. ● Steering angle* is 9° or more. ● Headlight LO beam operates (except when the daytime running light system is operating). ● AFS OFF switch is turned OFF.

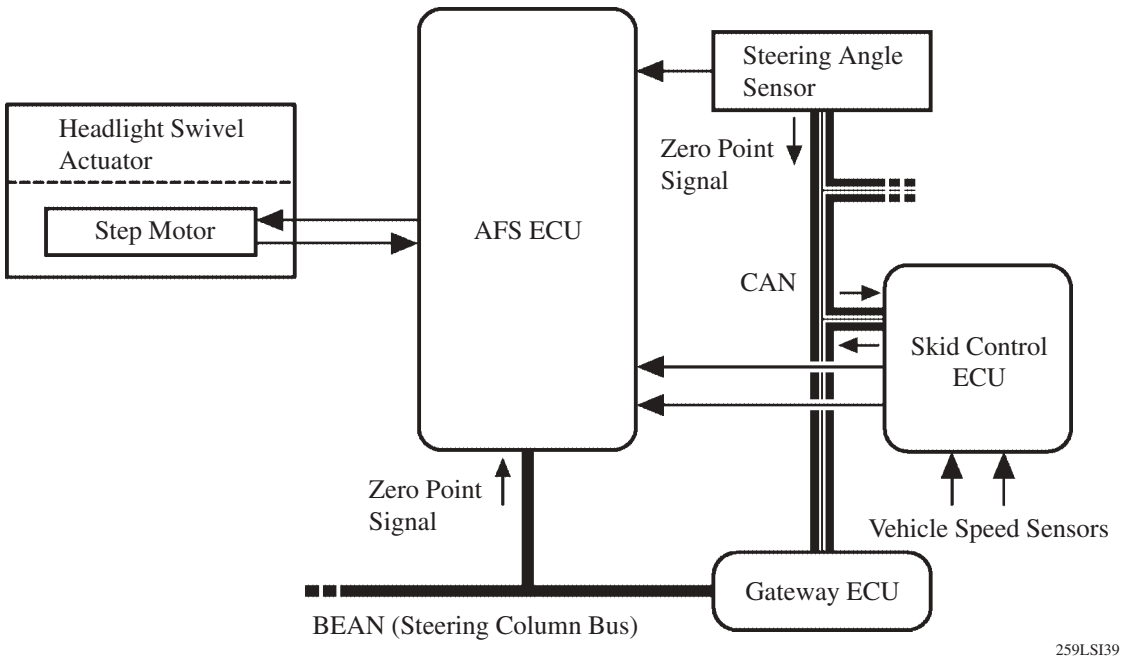
*: A swivel angle changes is accordance with the vehicle speed and steering angle. The minimum steering angle to change the swivel is 9° if the vehicle speed is high. While the minimum vehicle speed the change the swivel is 12 mph (20 km/h) if the steering angle is large.

2) Initial Set Control

When the ignition switch is turned on and engine is started, the AFS ECU drives the headlight swivel actuator and moves the projector headlight to the left and right operation limit. Then it returns to the proper position. The AFS ECU thus assesses the position of the headlight for reference control.

3) Basic Operation

- The AFS ECU calculates the target lighting angle of the projector headlights (for LO beam) by receiving the steering angle and the vehicle speed. Then, it actuates the headlight swivel actuator in order to attain the target lighting angle.
- The operation angle of the headlights is detected by the steps of the step motor in the headlight swivel actuator.



4) Fail-Safe

If the AFS ECU detects a malfunction in the automatic headlight beam level control system and intelligent AFS, it will take the actions indicated in the table below.

Trouble Area		Automatic Headlight Beam Leveling Control System	Intelligent AFS	AFS OFF Indicator Light
		Control	Control	
AFS ECU Malfunction		Stops at current condition.	Stops the operation at the position when fail-safe is judged.	Turn OFF
Vehicle Speed Sensor Signal Malfunction	One Side	Control continues only at the normal side.	Stops the operation after returning to initial.	Flash
	Both Sides	Control continues only when the vehicle is stopped.	Stops the operation.	Flash
Vehicle Height Signal Malfunction		● Stops the operation after returning to initial position (Fail at higher than initial position). ● Stops the operation at current condition (Fail at lower than initial position).	Stops the operation after returning to initial position.	Flash
Steering Angle Sensor Signal Malfunction		Lowers by 0.8° than current position and then stops the operation.	Stops the operation at the position when fail-safe is judged.	Flash
Steering Angle Sensor Communication Malfunction		Controls 0.8° less than the current position until the swivel actuator returns to the front. Controls normally when the swivel returns to the front.	If a failure is determined, the swivel actuator returns to the front and stops controlling.	Flash
Communication Signal Malfunction ● Headlight Signal ● A/T Reverse Signal		Control is continued.	Stops the operation after returning to initial position.	Flash
Communication Signal Malfunction ● Steering Neutral Signal		Control is continued.	Stops the operation after returning to initial position.	Turn OFF
Communication Signal Malfunction ● Alternator Signal		Continue the operation after returning to initial position.	Continue the operation after returning to initial position.	Flash
Headlight Swivel Actuator Malfunction ● Open, Short and Gear		Continues to control so that the position of 0.8° less than the current position will be maintained.	The normal side swivel actuator comes to the front and the abnormal side swivel actuator stops in the current position.	Flash
Headlight Swivel Actuator Malfunction ● Stop Position		Lowers by 0.8° than current position and then stops the operation.	Re-initializes the swivel actuator after judging the fail-safe.	Flash
Leveling Actuator Malfunction		● Stops the operation after returning to initial position (Fail at higher than initial position). ● Stops at current condition (Fail at lower than initial position).	Stops the operation after returning to initial position.	Flash

5) Diagnosis

If the AFS ECU detects a malfunction in the intelligent AFS, the AFS ECU blinks the AFS OFF indicator light in order to alert the driver. At the same time, the DTC (Diagnostic Trouble Codes) are stored in memory. The DTC can be read by the use of the hand-held tester. For details, see the LEXUS LS430 Repair Manual Supplement (Pub. No. RM1049E).