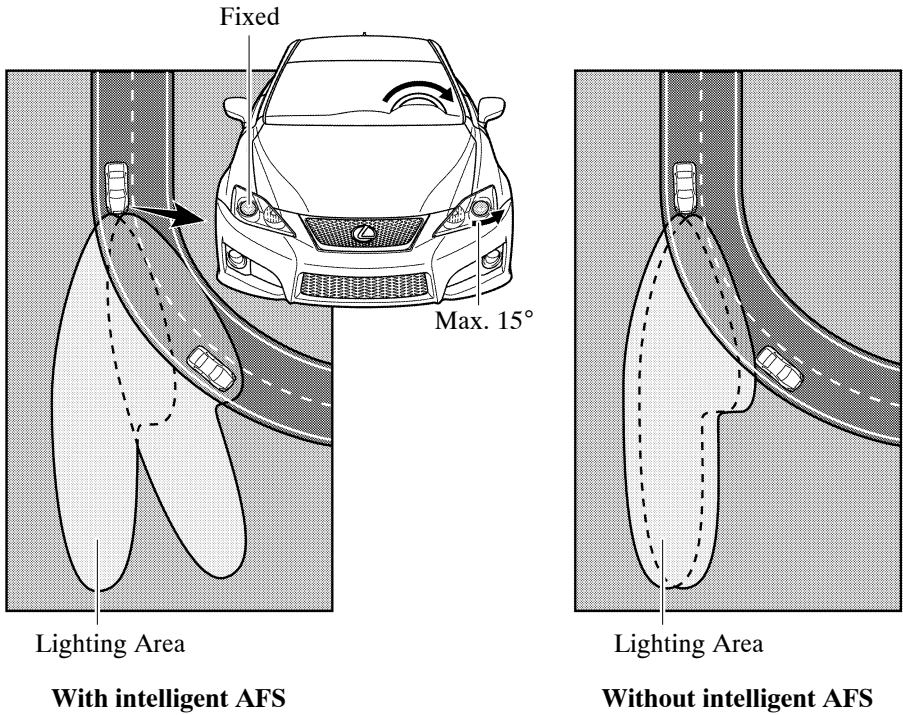


■ INTELLIGENT AFS

1. General

An intelligent AFS (Adaptive Front-lighting System) is used in order to ensure a wide range of Lo/Hi beam (discharge bulb) lighting area and realize excellent visibility during turning by moving the Lo/Hi beam to the inside of the cornering direction.



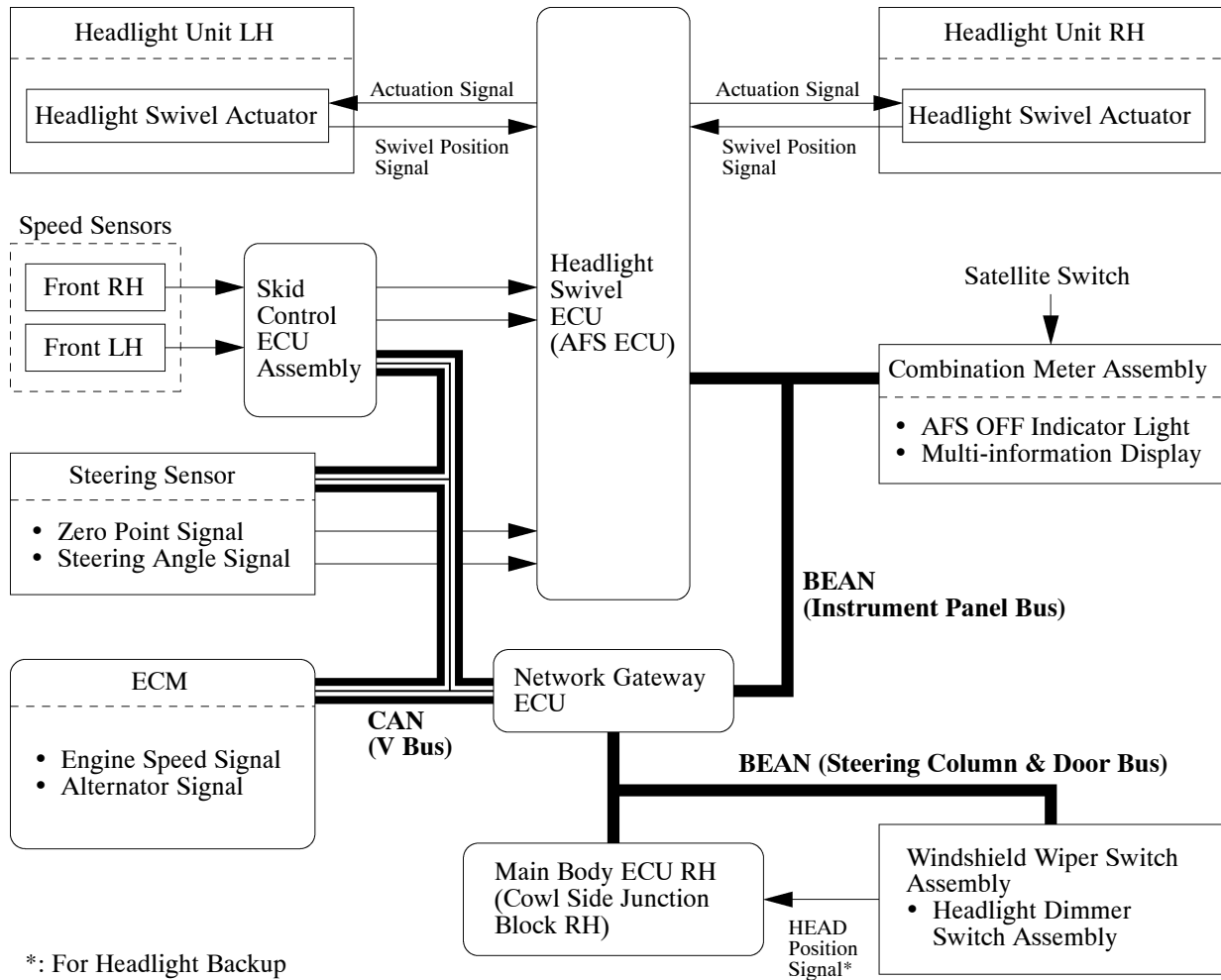
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► Swivel Angle Range ◀

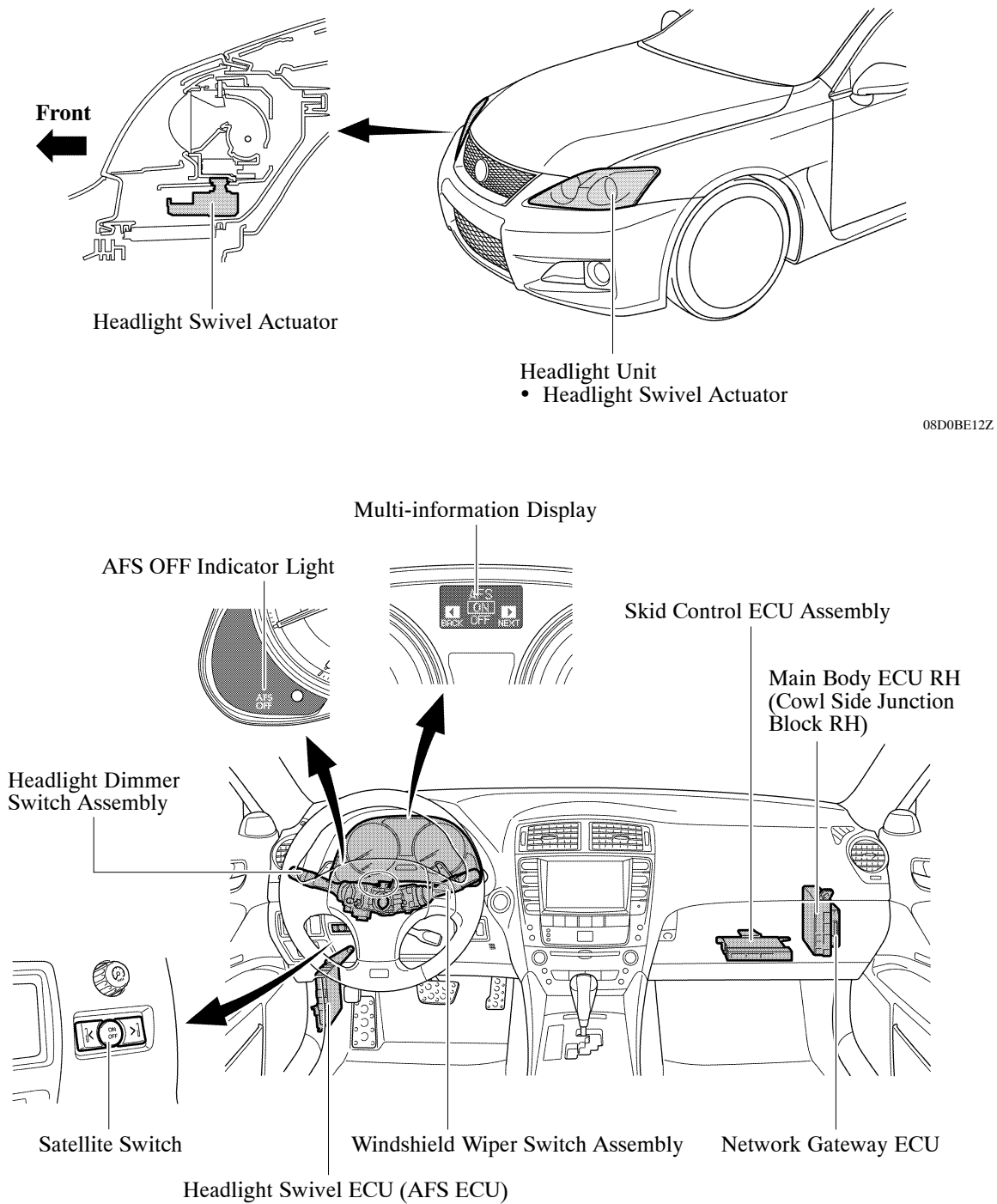
Driving Condition	RHD Models		LHD Models	
	Headlight Unit		Headlight Unit	
	Left	Right	Left	Right
Right Turn	0° Fixed	0 to 15° (to Right)	0° Fixed	0 to 5° (to Right)
Left Turn	0 to 5° (to Left)	0° Fixed	0 to 15° (to Left)	0° Fixed

2. System Diagram

- This system consists of two headlight units (for Lo/Hi beam), the headlight swivel ECU (AFS ECU), two headlight swivel actuators, steering sensor and front speed sensors. The headlight swivel ECU (AFS ECU) controls this system.
- The headlight swivel ECU (AFS ECU) also controls the automatic headlight beam level control system.



3. Layout of Main Components



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4. Function of Main Components

Component		Outline
Combination Meter Assembly		Transmits the vehicle speed signal to the headlight swivel ECU (AFS ECU) for correction.
	AFS OFF Indicator Light	<ul style="list-style-type: none"> When AFS control is stopped by the satellite switch and multi-information display, it is indicated by the AFS OFF indicator light lighting up. When the headlight swivel ECU (AFS ECU) detects a malfunction, the AFS OFF indicator light flashes.
	Multi-information Display	Changes to the multi-switch mode to display the on or off condition of the AFS by operating the satellite switch. For details, see page BE-64 .
Satellite Switch (See page BE-64)		Operating this switch can enable or disables the operation of the AFS.
Steering Sensor		<ul style="list-style-type: none"> Detects the steering angle and direction and outputs this signal to the headlight swivel ECU (AFS ECU) and the skid control ECU assembly. Outputs a zero point signal to the skid control ECU assembly.
Speed Sensors (Front RH and LH)		Detect wheel speed and output signals to the skid control ECU assembly.
Headlight Unit	Lo/Hi Beam	Is moved by the headlight swivel actuator.
	Headlight Swivel Actuator	<p>Driven by the headlight swivel ECU (AFS ECU), the actuator moves the Lo beam left or right to the angle calculated by the headlight swivel ECU (AFS ECU).</p> <ul style="list-style-type: none"> A stepper motor is used for the headlight swivel actuator. The headlight swivel ECU (AFS ECU) determines the Lo/Hi beam angle based on the number of steps (position) of the stepper motor.
Skid Control ECU Assembly		<ul style="list-style-type: none"> Transmits the signals of the front RH and LH speed sensors to the headlight swivel ECU (AFS ECU). Receives the zero point signal from the steering sensor and transmits it to the headlight swivel ECU (AFS ECU) via network gateway ECU.
Windshield Wiper Switch Assembly • Headlight Dimmer Switch Assembly		Transmits the headlight dimmer switch signal to the headlight swivel ECU (AFS ECU).
Headlight Swivel ECU (AFS ECU)		<ul style="list-style-type: none"> The headlight swivel ECU (AFS ECU) receives various signals, calculates the target lighting angle, and actuates the headlight swivel actuator. When the headlight swivel ECU (AFS ECU) detects a malfunction, the headlight swivel ECU (AFS ECU) flashes the AFS OFF indicator light.

5. System Control

General

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

- Engine is running.
- Vehicle speed* is 10 km/h (6 mph) or more.
- Steering angle* is 7.5° or more.
- Headlight Lo/Hi beam operates (except when the daytime running light system is operating).
- AFS ON/OFF condition is ON.

*: Swivel angle change is accordance with the vehicle speed and steering angle.

- The minimum vehicle speed to change the swivel is 10 km/h (6 mph) if the steering angle is large.
- The minimum steering angle to change the swivel is 7.5° if the vehicle speed is high.

Initial Set Control

When the engine is started, the headlight swivel ECU (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 headlight swivel ECU (AFS ECU) thus assesses the position of the headlight for reference control.

Basic Operation

- The headlight swivel ECU (AFS ECU) calculates the target lighting angle of the Lo/Hi 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 position (number of steps) of the stepper motor in the headlight swivel actuator.

Fail-safe

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

Trouble Area	Operation		AFS OFF Indicator Light
	Automatic Headlight Beam Control System	Intelligent AFS	
Headlight Swivel ECU (AFS ECU) Malfunction	Control is continued.	Control is continued.	-
Speed Sensor Signal Malfunction	If a malfunction occurs only at one of the wheels, it doubles the vehicle speed detection value obtained from the normal wheel.	If a malfunction occurs only at one of the wheels, it doubles the vehicle speed detection value obtained from the normal wheel.	Flashes
	If a malfunction occurs at both wheels, it sets the vehicle speed detection value to 0.	Stops operating after returning to the initial position.	
Height Control Sensor Signal Malfunction	<ul style="list-style-type: none"> Stops operating after returning to the initial position (if failure occurs at higher than the initial position). Stops the operation at current condition (if failure occurs at lower than the initial position). 	Stops operating after returning to the initial position.	Flashes
Steering Sensor Signal Malfunction	Continues to control until a position of 0.7° less than the current position is reached, and resumes normal operation after returning to the initial position.	10 seconds after the malfunction occurs, the swivel actuators return to the initial position and operation stops.	Flashes
Headlight Swivel Actuator Malfunction	Continues to control until a position of 0.7° less than the current position is reached.	The normal side swivel actuator comes to the initial position and the abnormal side swivel actuator stops in its current position.	Flashes
Headlight Level Actuator Malfunction	<ul style="list-style-type: none"> Stops operating after returning to the initial position (if failure occurs at higher than the initial position). Stops the operation at current condition (if failure occurs at lower than the initial position). 	Stops operating after returning to the initial position.	Flashes
Communication Signal Malfunction • Vehicle Speed Signal • Generator Signal	Control is continued.	Control is continued.	Flashes
Communication Signal Malfunction • Others Signal	Control is continued.	Stops operating after returning to the initial position.	Flashes

Diagnosis

If the headlight swivel ECU (AFS ECU) detects a malfunction in the intelligent AFS, the headlight swivel ECU (AFS ECU) blinks the AFS OFF indicator light in order to alert the driver. At the same time, the DTCs (Diagnostic Trouble Codes) are stored in memory. The DTC can be read using the intelligent tester. For details, see the LEXUS IS F Repair Manual (Pub. No. RM08E0E).