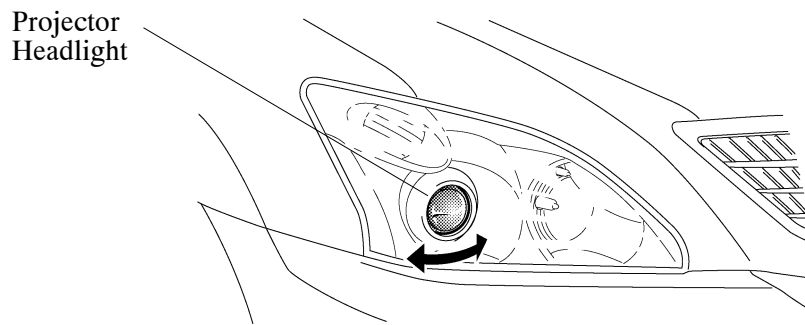


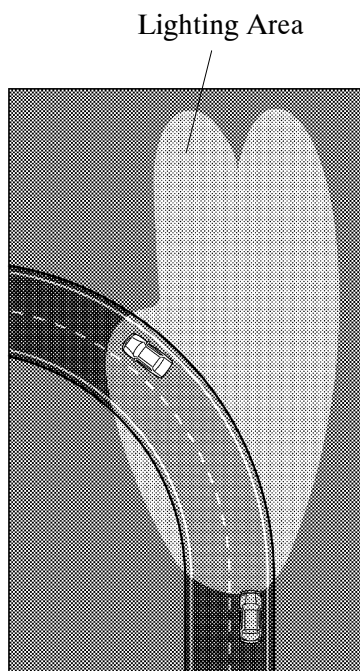
## ■ INTELLIGENT AFS (Adaptive Front-lighting System)

### 1. General

- An Intelligent AFS (Adaptive Front-lighting System) is available as optional equipment in order to ensure a wide range of the Lo beam lighted area and increase visibility during turning by swinging the projector headlight (for Lo beam) to the inner side of the cornering direction.
- This system is mainly comprised of 2 projector headlights (for Lo beam), the AFS ECU, 2 headlight swivel ECU, 2 headlight swivel actuators, steering angle sensor and rear wheel speed sensors.
- This system is controlled by the AFS ECU. The AFS ECU also controls the automatic headlight beam level control system. For details of the automatic headlight beam level control system, [see page BE-38](#).
- AFS ECU maintains communication with other ECUs through the BEAN (Body Electronics Area Network)

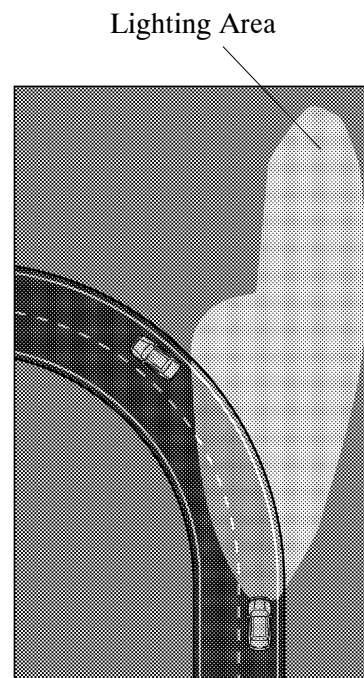


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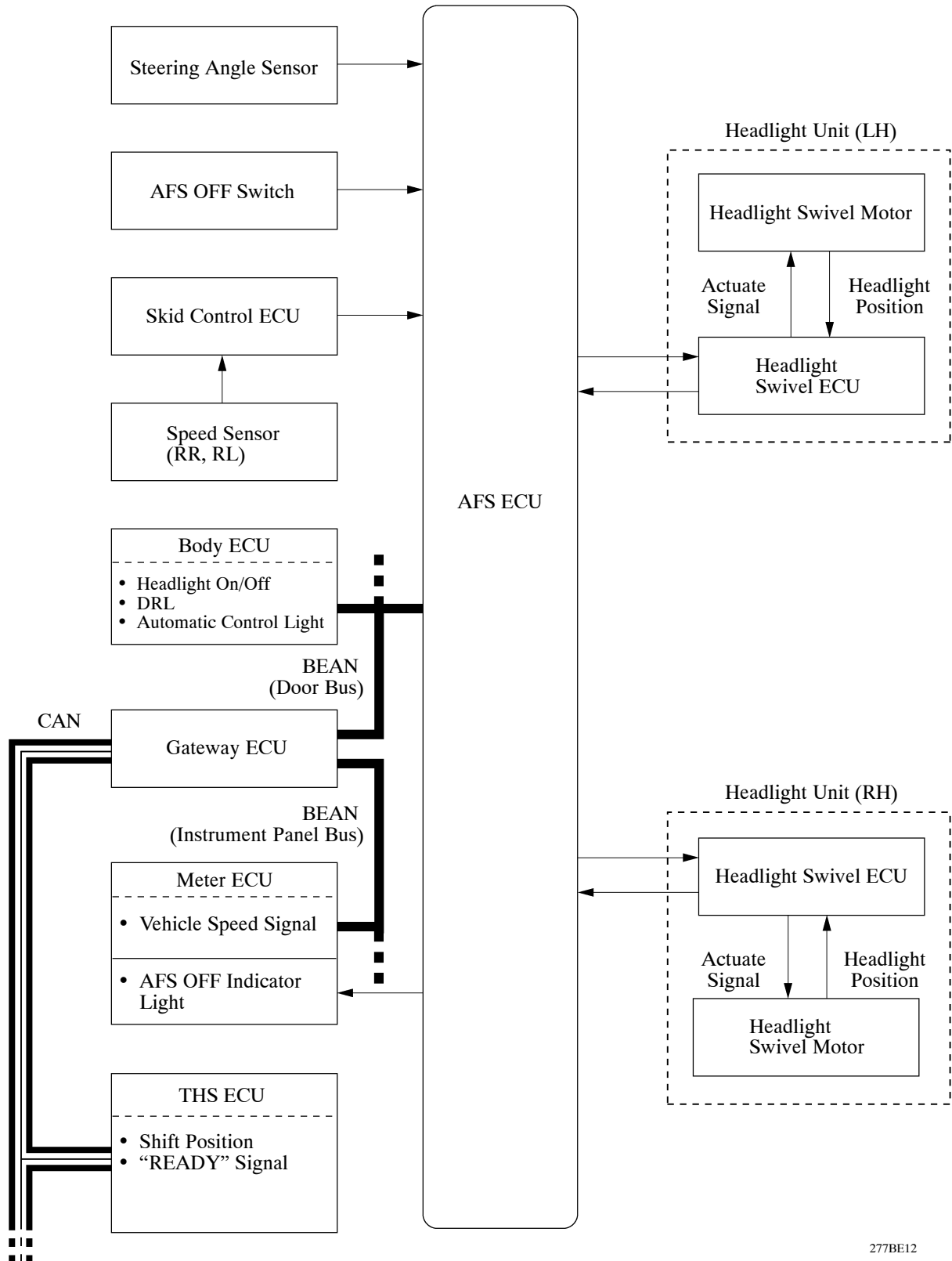
**LHD Models with  
Intelligent AFS**



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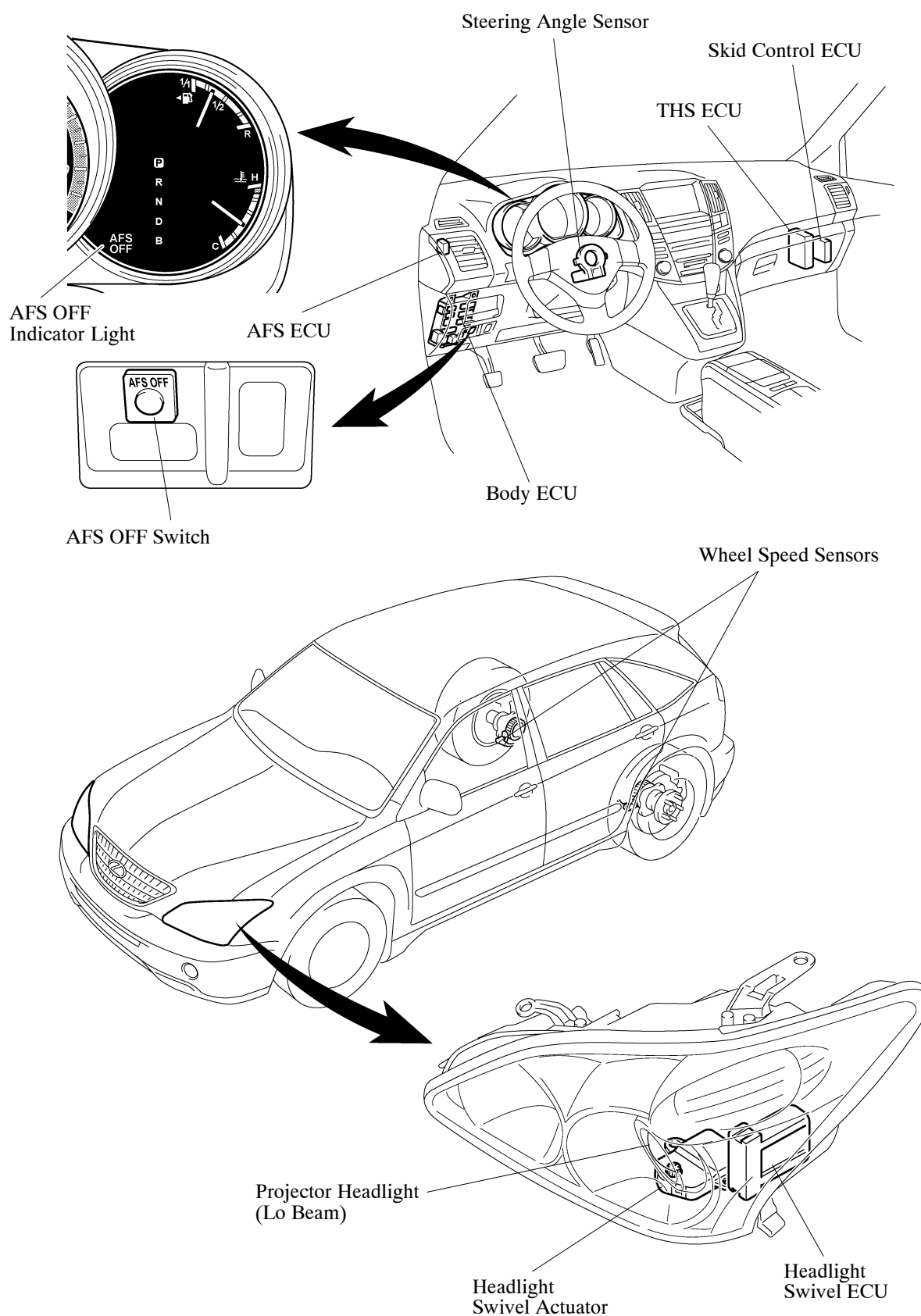
**LHD Models without  
Intelligent AFS**

## 2. System Diagram



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### 3. Layout of Main Components



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LHD Model

#### 4. Function of Main Components

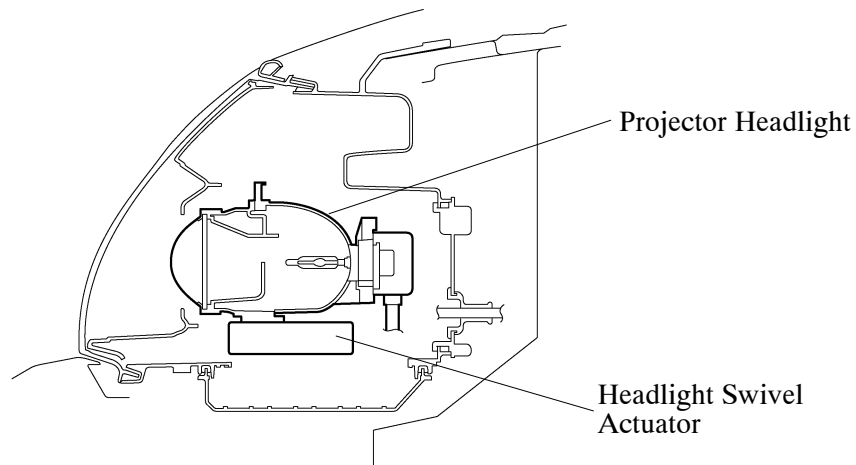
| Item                    |                           | Outline                                                                                                                                                                                                                                                    |
|-------------------------|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Headlight Unit          | Headlight Swivel Actuator | Driven by the headlight swivel ECU, the actuator moves the projector headlight (low beam) to the angle calculated by the AFS ECU.                                                                                                                          |
|                         | Headlight Swivel ECU      | Drives the headlight swivel actuator according to control signals from the AFS ECU.                                                                                                                                                                        |
| AFS ECU                 |                           | The AFS ECU effects the control of the system.                                                                                                                                                                                                             |
| Steering Angle Sensor   |                           | The AFS ECU receives the steering angle sensor signal and uses this information to calculate the headlight operation angle.                                                                                                                                |
| Wheel Speed Sensor      |                           | The AFS ECU receives the speed sensor signal from the skid control ECU and uses this information to calculate the headlight operation angle.                                                                                                               |
| AFS OFF Switch          |                           | Pressing this switch, it enables to cut off the operation of the AFS.                                                                                                                                                                                      |
| AFS Off Indicator Light |                           | <ul style="list-style-type: none"> <li>• When AFS control is stopped by the AFS OFF Switch, it is indicated by the AFS Off Indicator Light lighting up.</li> <li>• When the AFS ECU detects a malfunction, the AFS Off Indicator Light flashes.</li> </ul> |

## 5. Construction and Operation

### Headlight Unit

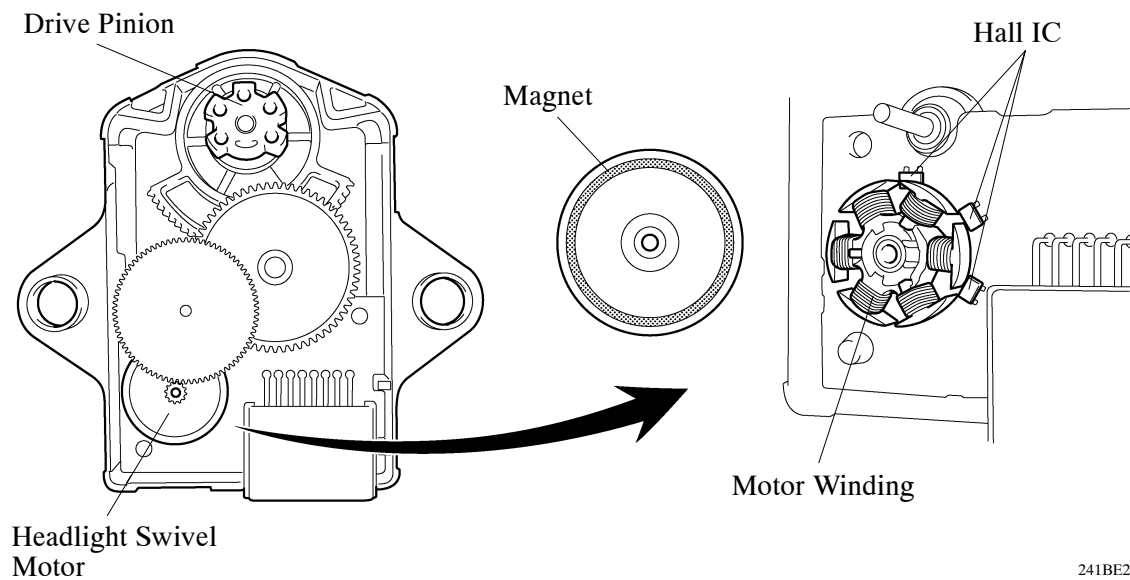
#### 1) Headlight Swivel Actuator

- The headlight swivel actuator is located under the projector headlight (for Lo beam) of the headlight unit, and it is comprised of the headlight swivel motor that moves the projector headlight (for Lo beam) to the left and right, and the 3 Hall ICs that detect the headlight swivel motor position. This actuator cannot be disassembled.
- The 3 Hall ICs detect changes in the magnetic flux density accompanying turning of the headlight swivel motor, and output to the headlight swivel ECU.



**Headlight Unit Cross Section**

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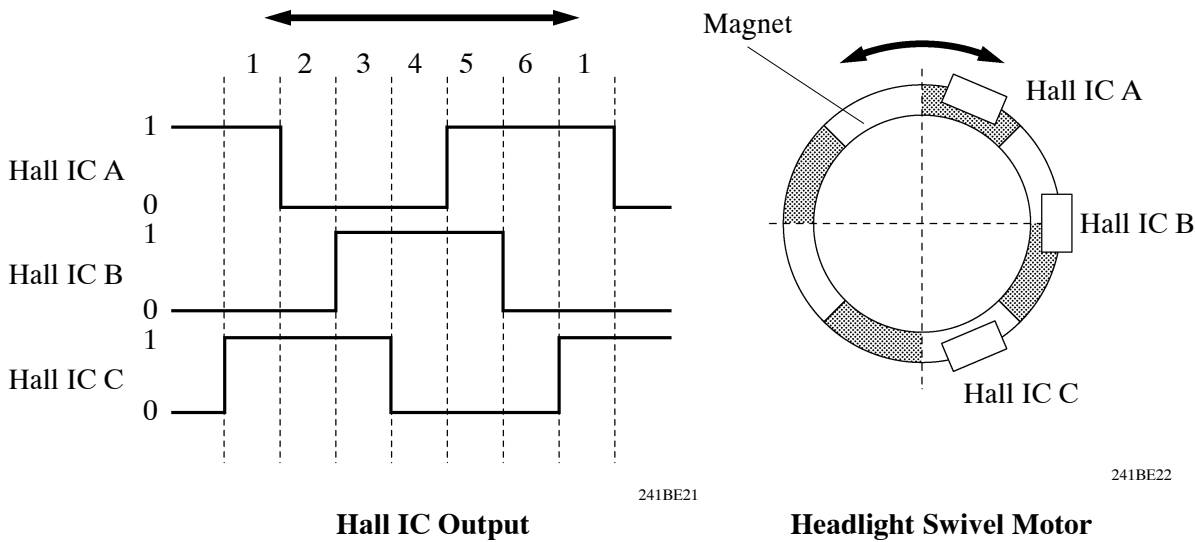


**Headlight Swivel Actuator**

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2) Headlight Swivel ECU

- The headlight swivel ECU performs drive control of the headlight swivel motor by control signals from the AFS ECU, and it judges the position and turning direction of the headlight swivel motor, then outputs to the AFS ECU.
- The headlight swivel ECU judges the position and turning direction of the headlight swivel motor from the combination of the 3 Hall IC signals from the headlight swivel actuator.



|                |                                   |   |   |   |   |   |   |   |   |                |   |   |   |   |   |   |   |   |   |   |   |
|----------------|-----------------------------------|---|---|---|---|---|---|---|---|----------------|---|---|---|---|---|---|---|---|---|---|---|
| Direction      | <div><div></div><div></div></div> |   |   |   |   |   |   |   |   |                |   |   |   |   |   |   |   |   |   |   |   |
| No.            | 1                                 |   |   | 2 |   |   | 3 |   |   | 4<br>(Neutral) |   |   | 5 |   |   | 6 |   |   | 1 |   |   |
| Hall IC Output | A                                 | B | C | A | B | C | A | B | C | A              | B | C | A | B | C | A | B | C | A | B | C |
|                | 1                                 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0              | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 1 |

## AFS ECU

### 1) General

- The AFS ECU judges the steering angle and steering direction from the steering angle sensor signal, then calculates the lighting angle of the projector headlight (for Lo beam) from the steering angle information, and the vehicle speed and headlight swivel motor position signal from the headlight swivel ECU, then outputs a headlight swivel motor drive signal to each headlight swivel ECU.
- The AFS ECU performs Intelligent AFS control when all the following conditions are fulfilled:
  - Shift lever is not R and N position.
  - The vehicle speed\* is 30 km/h (19 mph) or more.
  - The steering angle\* is 12° or more.
  - The headlight Lo beam operates (but the DRL system is not operating)
  - AFS OFF switch is turned OFF.

\*: A swivel angle changes in accordance with the vehicle speed and steering angle. The minimum steering angle to change the swivel is 12° if the vehicle speed is high. While the minimum vehicle speed to change the swivel is 30 km/h (19 mph) if the steering angle is large.

- The AFS ECU controls the cornering direction projector headlights (for Lo beam) to swing toward the cornering direction inner side as shown in the table below.

| Driving Condition | Swivel Angle Range            |                               |
|-------------------|-------------------------------|-------------------------------|
|                   | Projector Headlight Unit (LH) | Projector Headlight Unit (RH) |
| Right Turn        | 0° Fixed                      | 0° ~ 5° to Right              |
| Left Turn         | 0° ~ 15° to Left              | 0° Fixed                      |

### Service Tip

- If the power to the AFS ECU is interrupted due to the removal of the battery or the AFS ECU, the neutral position data of the steering angle sensor becomes lost from the memory of the AFS ECU, thus stopping the operation of the Intelligent AFS. After the power to the AFS ECU has been restored, drive the vehicle approximately 100 meters at a speed between 20 km/h (12 mph) and 80 km/h (48 mph), in an area where few curves or traffic congestion exists. This enables the AFS ECU to start an automatic correction (AFS ECU initialization) of the steering neutral point, in order to automatically detect the neutral position of the steering angle sensor.
- In addition, after turning the power on to AFS ECU again, performing AFS OFF switch operation while the engine is running and the shift lever is in P position enables to do forced AFS ECU initialization. For details of AFS ECU initialization, refer to the LEXUS RX400h Repair Manual (Pub. No. RM1139E).
- DTC B2421 is output when the AFS ECU has not completed automatic correction of the steering neutral point. The operation of the Intelligent AFS is disabled while this DTC is being output.

## 2) Initial Set Control

When the ignition switch is turned ON, and the AFS ECU receives a “READY” signal from the THS ECU, the AFS ECU drives the headlight swivel motor and moves the projector headlight to the left and right operation limit. Then, it returns to the proper position. Thus, the AFS ECU assesses the position of the light beam that forms the reference for control.

## 3) Fail-Safe

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

| Trouble Area                                     | Headlight Leveling Actuator                                                                                                                                    | Headlight Swivel Actuator                                                                               | AFS OFF Indicator Light |
|--------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|-------------------------|
| Vehicle signal malfunction                       | Controlling continues                                                                                                                                          | Stops operation after returning to initial position                                                     | Blinks                  |
| Vehicle height signal malfunction                | Stops operation after returning to initial position (Fail at higher than initial position)<br>Stops at current condition (Fail at lower than initial position) | Stops operation after returning to initial position                                                     | Blinks                  |
| Leveling actuator Malfunction                    | Stops at current condition                                                                                                                                     | Stops operation after returning to initial position                                                     | Blinks                  |
| Steering sensor Malfunction                      | Lowers by 0.8° than initial position and then re-starts controlling                                                                                            | Stops at current condition and then returning to initial position                                       | Blinks                  |
| Communication signal malfunction                 | Controlling continues                                                                                                                                          | Stops operation after returning to initial position                                                     | Blinks                  |
| Swivel actuator voltage malfunction              | Controlling continues                                                                                                                                          | Stops operation after returning to initial position                                                     | Goes off                |
| Swivel actuator operation malfunction            | Lowers by 0.8° than initial position                                                                                                                           | Stops operation after returning to initial position (Stops at current condition when unable to operate) | Blinks                  |
| Swivel actuator communication signal malfunction | Lowers by 0.8° than initial position                                                                                                                           | Stops operation after returning to initial position (Stops at current condition when unable to operate) | Blinks                  |
| AFS ECU malfunction                              | Stops at current condition                                                                                                                                     | Stops at current condition and then returning to initial position                                       | Goes off                |

## 4) Diagnosis

- If the AFS ECU detects a malfunction in the AFS and automatic headlight beam level control system, the AFS ECU blinks the AFS OFF indicator light (1 Hz) that is provided in the combination meter in order to alert the driver.  
At the same time, the DTC (Diagnostic Trouble Code) are stored in memory.  
The DTC can be accessed the use of the intelligent tester II. For details, see the LEXUS RX400h Repair Manual (Pub. No. RM1139E).
- The table below indicates the DTCs that are associated with this system.

| DTC No. | Detection Item                                    | DTC No. | Detection Item                                            |
|---------|---------------------------------------------------|---------|-----------------------------------------------------------|
| B2410   | Headlight swivel ECU LH communication malfunction | B2416   | Height Control Sensor malfunction                         |
| B2411   | Headlight swivel ECU RH communication malfunction | B2417   | Headlight beam level control motor LH malfunction         |
| B2412   | Headlight swivel motor LH malfunction             | B2418   | Headlight beam level control motor RH malfunction         |
| B2413   | Headlight swivel motor RH malfunction             | B2419   | BEAN communication malfunction                            |
| B2414   | Steering position sensor malfunction              | B2420   | AFS ECU malfunction                                       |
| B2415   | Vehicle speed sensor malfunction                  | B2421   | Steering neutral point automatic correction incomplection |