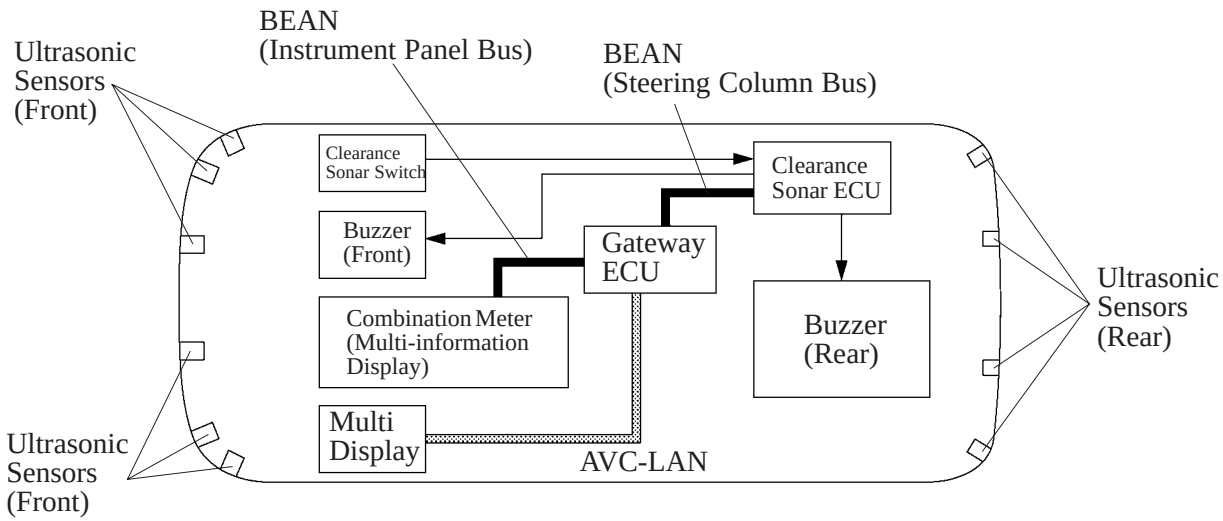
■LEXUS PARK ASSIST SYSTEM

1. General

- The LEXUS park assist system is optional equipment on the Europe model and standard equipment on the except Europe model.
- This system uses ultrasonic sensors to detect any obstacles at the corners or the front or the rear of the vehicle. The system then informs the driver of the distance between the sensors and the obstacles as well as their positions by displaying them on the multi-information display in the combination meter and by sounding a buzzer. This information also appears on the Multi display on the models equipped with a Multi display.

▶ System Diagram ◀



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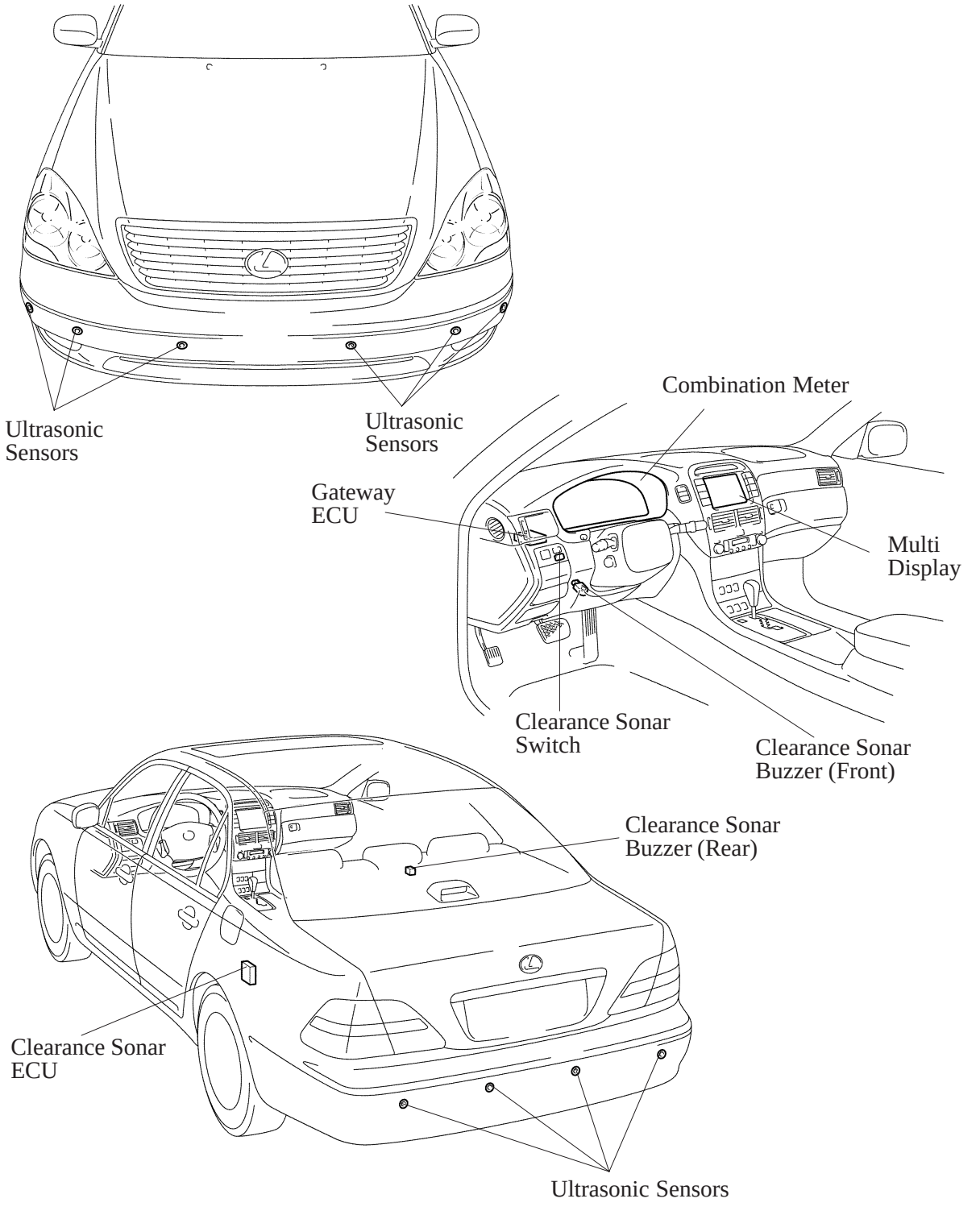
2. Layout of Components



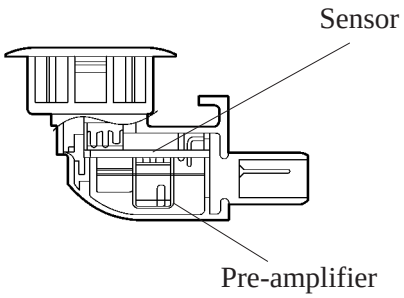
3. Function of Components

Components	Function
Ultrasonic Sensor	Detects the distance between the vehicle and the obstacle.
Clearance Sonar Switch	Turns the LEXUS park assist system operative.
Buzzer (Front & Rear)	Emits an intermittent sound to inform the driver that the ECU has detected an obstacle within a prescribed range.
Clearance Sonar ECU	Judges the approximate distance between the vehicle and the obstacle based on the signals from the ultrasonic sensors and sends the display signal to the display panel and buzzer signal to the buzzer.
Gateway ECU	Sends the display signal of the clearance sonar ECU to the combination meter and the Multi display. The signal for the multi display is output by converting it to an AVC-LAN signal.
Combination Meter (Multi-information Display) & Multi Display	Displays the location of the obstacle and the approximate distance between the vehicle and the obstacle. On the Multi display, the sound volume, buzzer sounding distance, and display requirement distance can be set on the setup screen for this system.

4. Construction and Operation

Ultrasonic Sensor

The following number of ultrasonic sensors are provided: 4 along the front corners, 2 along the rear corners, and 2 each in the front and rear centers. Each ultrasonic sensor consists of a sensor portion that transmits and receives ultrasonic waves and a pre-amplifier that amplifies them. The ultrasonic sensor outputs the ultrasonic transmission and reception signals to the clearance sonar ECU.



Center Sensor

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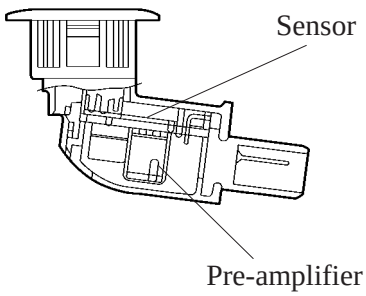

Corner Sensor

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Front and Rear Buzzer

The ON/OFF times of the front and rear buzzer vary in accordance with the distance to the obstacle as given in the following table:

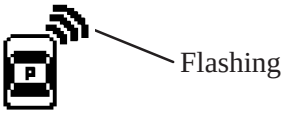
Item	Obstacle Distance (cm)	ON Time (ms)	OFF Time (ms)
Corner Area	Approx. 50 ~ 37.5	50	300
	Approx. 37.5 ~ 25.0	50	100
	Approx. 25.0 or less	Continuous	0
Front Center & Rear Center	Approx. 100 ~ 50	50	500
	Approx. 50 ~ 37.5	50	300
	Approx. 37.5 ~ 25.0	50	100
	Approx. 25.0 or less	Continuous	0

Multi-information Display and Multi Display

If an obstacle is detected, the LEXUS park assist system appears on the multi-information display in the combination meter and the Multi display. When one of the sensors detects an obstacle nearby, bars appear on the display on the side of the vehicle near the obstacle. The obstacle distance for the front and rear center appears in 4 ways, and for the corners in 3 ways. If a sensor malfunction is detected, the position of the affected sensor flashes to inform the driver.
On the Multi display, the following settings can be made on the system setup screen.

- Sound Volume (5 stages)
- Buzzer sounding distance for the front and rear center (approx. 100cm ↔ 50cm)
- Display requirement distance for the front and rear center (approx. 100cm ↔ 50cm)
- No Display

▶ Obstacle Distance and Display Image ◀

Obstacle Distance (cm)		Approx. 100 ~ 50	Approx. 50 ~ 37.5	Approx. 37.5 ~ 25.0	Approx. 25.0 or less
Display Image	Front/Rear Center Display	 189BE140	 189BE140	 189BE141	 189BE142
	Corner Display	—	 189BE143	 189BE144	 189BE145
	Sensor Malfunction Detection Display	 189BE143			

Clearance Sonar ECU

The clearance sonar ECU switches the transmission and reception of the ultrasonic signals, processes the received waves, determines and displays the presence of obstacles, controls the sounding of the buzzer, detects an open circuit in the sensor, detects other malfunctions, and displays the data on the multi-information display.

5. System Operation

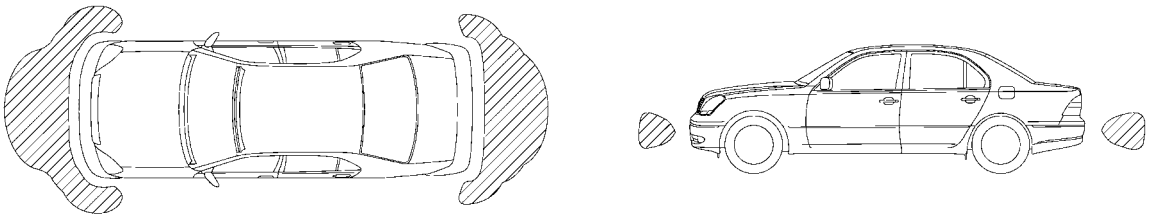
Detection Activation

This system activates with the ignition switch turned ON, the clearance sonar switch turned ON, and when the conditions given below have been met.

○: Active ×: Not active

Condition			Detection Operation (Initial check included)	Display	Buzzer	
Shift Position	Vehicle Speed or Engine Speed	Obstacle Distance			Front	Rear
P	As desired	Approx. 25 cm or less	○	×	×	×
		Approx. 25 ~ 50 cm	○	×	×	×
		Approx. 50 ~ 100 cm	○	×	×	×
		None	○	×	×	×
N	10 km/h or less and 2500 rpm or less	Approx. 25 cm or less	○	○	○	○
		Approx. 25 ~ 50 cm	○	○	○	○
		Approx. 50 ~ 100 cm (Front & Rear Center)	○	○	×	×
		None	○	×	×	×
Other P, R, or N	2500 rpm or less	Approx. 25 cm or less	○	○	○	○
		Approx. 25 ~ 50 cm	○	○	○	○
		Approx. 50 ~ 100 cm (Front & Rear Center)	○	○	×	×
		None	○	×	×	×
R	10 km/h or less and 2500 rpm or less	Approx. 25 cm or less	○	○	○	○
		Approx. 25 ~ 50 cm	○	○	○	○
		Approx. 50 ~ 100 cm (Front & Rear Center)	○	○	×	×
		None	○	×	×	×

Detection Range



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Initial Check

The clearance sonar ECU performs initial checks (for detecting a sensor open circuit or malfunction) when the conditions listed below have been met. If it detects a malfunction, it informs the driver by way of the display panel.

- Ignition swith ON and clearance sonar switch ON
- Shift lever is in N position and engine speed is 1500 rpm or less
- Shift lever is in a position other than N and engine speed is 2500 rpm or less
- After approximately 2 seconds or longer have elapsed since the ignition switch has been turned ON, and the clearance sonar switch is subsequently turned from OFF to ON, the buzzer sounds for approximately 1.0 second only if the conditions given above have been met.

6. Handling Precautions

The detection function of this system may not activate properly in case of the conditions given below.

- When the sensors are covered with mud, ice, or snow (the function returns to normal after these are removed).
- When the detection portion becomes frozen (the function returns to normal after it is defrosted).
- When the sensors are covered by a hand.
- Particularly at low temperatures when the components are frozen, the display could show a malfunction and the system might not properly detect even if an obstacle is present.
- If the display shows a malfunction, first check the condition of the sensors. If the display shows a malfunction even if the sensors are not covered with mud, ice, or snow, the sensors could be faulty. In this case, the vehicle must be inspected at a LEXUS dealer.

The detection range could be altered in the following conditions:

- When the sensors are covered with foreign matter such as snow or mud.
- When the vehicle is operated under a scorching sun or in a freezing climate.

The system could detect improperly in the following conditions:

- When the vehicle is being driven on a bumpy road, gravel road, or on grass.
- When the sound of horns from other vehicles, the sound of a motorcycle engine, the sound of air brakes of a large truck, or an object that generates ultrasonic waves is in the vicinity.
- When there is a downpour or water is splashing on the vehicle.
- When the vehicle posture tilts significantly.
- When an antenna for a wireless transmitter is mounted on the vehicle.
- When the sensors are covered with mud, ice, or snow.
- When the vehicle travels in the direction of a tall curb or a square curb.

There are cases in which the objects listed below cannot be detected:

- Thin objects such as wire or rope.
- Objects that absorb sound waves such as cotton or snow.
- Objects that have sharp edges.
- Objects that are short in height.
- Objects that are tall and protrude at the top.

Other:

- Objects directly underneath the bumpers cannot be detected. Even if objects that are located lower than the sensors or thin stakes are detected once, they might not be detected after the vehicle comes closer to those objects.
- An object might not be detected if it comes too close to the sensors.
- The sensors might not detect properly if they are exposed to strong shocks such as by striking them or throwing objects at them.