■ FUNCTION OF MAIN COMPONENTS

Component		Function
Ultrasonic Sensors		Detect the distance between the vehicle and the obstacle.
Accessory Meter	Sonar On/Off Indicator Light	The sonar on/off condition can be displayed.
	Indicator Light	● Show the location of the obstacle and the approximate distance between the vehicle and the obstacle. ● Show to inform the driver of a malfunctioning or frozen ultrasonic sensor.
	Buzzer	● Sounds to inform the driver according to the distance to the obstacle. ● Sounds an indication of a malfunctioning or frozen ultrasonic sensor to inform the driver.
Clearance Warning ECU		Judges the approximate distance between the vehicle and an obstacle based on signals from the ultrasonic sensors. Output signals are sent to the accessory meter.
SONAR Switch		Operating this switch allows the operation of the TOYOTA parking assist-sensor system to be enabled or disabled.
Combination Meter		Transmits a vehicle speed signal to the clearance warning ECU.
Neutral Start Switch		Transmits the shift position signal to the clearance warning ECU.

■ CONSTRUCTION AND OPERATION

1. Ultrasonic Sensor

Each ultrasonic sensor transmits ultrasonic waves, receives the reflected waves from an obstacle, and transmits a signal to the clearance warning ECU regarding the distance to the obstacle.

- The frequency used by the ultrasonic sensors varies as shown below, depending on the installation position of the ultrasonic sensors:

Ultrasonic Sensor	Frequency
Front & Rear Corner	45.7 kHz
Back	58.8 kHz

2. Buzzer

- The on/off times of the buzzer vary in accordance with the distance to the obstacle as shown in the following table:

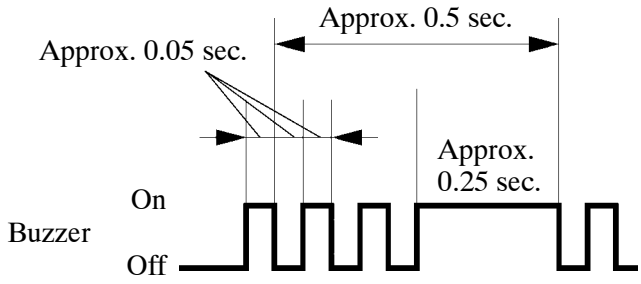
Detection Area	Detection Distance	mm (in.)	On Time (ms)	Off Time (ms)
Front Corner	Long	600 ± 60 to 400 ± 40 (23.6 ± 2.4 to 15.7 ± 1.6)	150 ± 15	150 ± 15
	Middle	400 ± 40 to 250 ± 30 (15.7 ± 1.6 to 9.8 ± 1.1)	75 ± 7.5	75 ± 7.5
	Short	250 ± 30 or less (9.8 ± 1.1 or less)	Continuous	0
Rear Corner	Long	850 ± 90 to 520 ± 60 (33.5 ± 3.4 to 20.5 ± 2.4)	150 ± 15	150 ± 15
	Middle	520 ± 60 to 400 ± 40 (20.5 ± 2.4 to 15.7 ± 1.6)	75 ± 7.5	75 ± 7.5
	Short	400 ± 40 or less (15.7 ± 1.6 or less)	Continuous	0
Back	Long	1800 ± 180 to 1150 ± 120 (70.9 ± 7.1 to 45.7 ± 4.6)	150 ± 15	150 ± 15
	Middle	1150 ± 120 to 850 ± 90 (45.7 ± 4.6 to 33.5 ± 3.4)	75 ± 7.5	75 ± 7.5
	Short	850 ± 90 or less (33.5 ± 3.4 or less)	Continuous	0

- The following table indicates the changes in buzzer beeping patterns depending on obstacle detection. It also shows the pattern changes in regard to detection by both front ultrasonic sensors and rear ultrasonic sensors.

Buzzer Frequency (sec.)

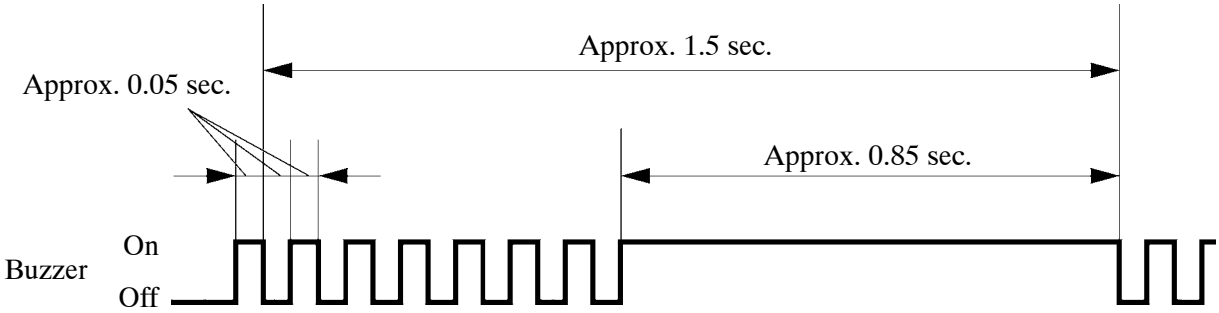
Front / Rear	Short	Middle	Long	Not detected
Short	Timing 1	Timing 2	Timing 2	Continuous Beep
Middle	Timing 2	0.15	0.15	0.15
Long	Timing 2	0.15	0.3	0.3
Not Detected	Continuous Beep	0.15	0.3	No Beep

▶ **Timing 1** ◀



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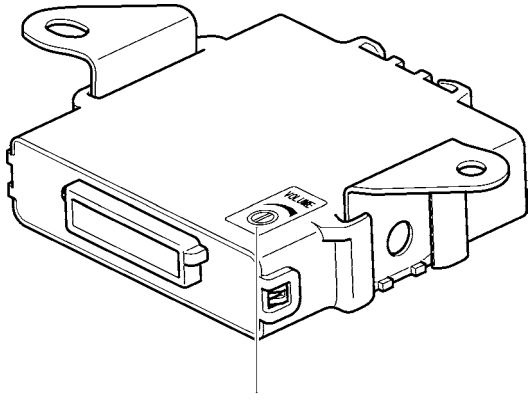
▶ **Timing 2** ◀



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3. Clearance Warning ECU

- The clearance warning ECU effects overall control of the system, including the switching of the transmitting and reception of the ultrasonic sensor signals, processing the received wave signals, determining the presence of obstacles, actuating the buzzer, and determining the presence of a malfunction in the sensors.
- The sound volume of the buzzer in the accessory meter can be adjusted at the clearance warning ECU.



Buzzer Sound Volume Adjustment Screw

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■ DIAGNOSIS

If the clearance warning ECU detects a malfunction in an ultrasonic sensor, the ECU blinks the indicator light in the accessory meter 5 times and also sounds the buzzer 5 times to inform the driver of the malfunction.