

2002 ACCESSORIES & EQUIPMENT

Back Up Warning System - Sedona

GENERAL

When reversing, the driver is not easy to find objects in the blind spots and to determine the distance from the object. In order to provide the driver safety and convenience, back warning system will operate upon shifting to "R". Ultrasonic sensor will emit ultrasonic wave rearward and detect the reflected wave. Control unit will calculate distance to the object using the sensor signal input and output buzzer alarm in three steps (first, second and third alarm).

SPECIFICATION

Item		Specification
CONTROL UNIT	Voltage rating	DC 12V
	Operation voltage	DC 9 ~ 16 V
	Operation temperature	-30°C ~ +80°C
	Storage temperature	-40°C ~ +90°C
	Operation current	MAX 600mA
	Operation frequency	40 ± 5 KHz
	Detective method	Direct or indirect detection
ULTRASONIC SENSOR	Voltage rating	DC 8V
	Detecting range	25cm ~ 120 cm
	Operation voltage	DC 9~16
	Operation current	20 mA
	Operation temperature	-40°C ~ +90°C
	Beam width	Horizontal : 110cm, / Vertical : 50cm
	Number of sensors	4
PIEZO BUZZER	Voltage rating	DC 12V
	Operation voltage	DC 9 ~ 16 V
	Operation temperature	-30°C ~ +80°C
	Storage temperature	-40°C ~ +85°C
	Operation current	MAX 60 mA
	Sound, tone	Oscillation frequency : 2.2 ± 0.5 KHz
		Sound level : 70 dB (DC 13V, /m)

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Fig. 1: Warning System Specifications
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BACK WARNING CONTROL MODULE

DESCRIPTION

Control unit is installed in the rear washer compartment, located in the left side storage in the cargo area.

Control unit will control the ultrasonic transmission and reception timing, determine the presence of objects, and detect a broken circuit.

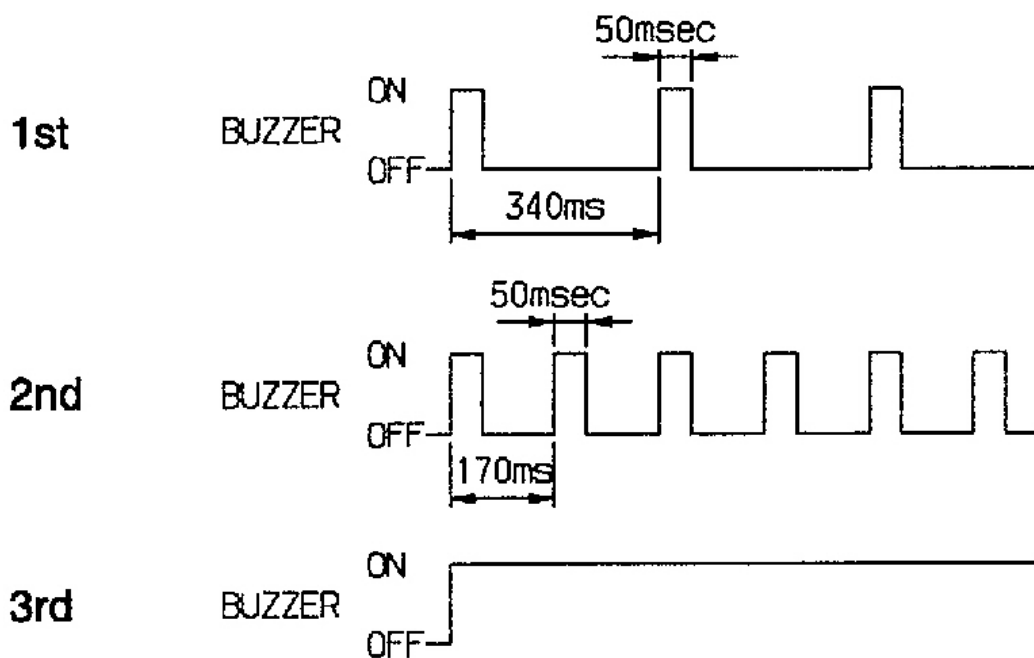
ALARM RANGE

Upon detecting an object at each range out of 3 ranges as stated below within the operation range, it will generate alarm.

First alarm: Object comes near to the sensor located at the rear of vehicle, within 81-120 cm

Second alarm: Object comes near to the sensor located at the rear of vehicle, within 41-80 cm

Third alarm: Object comes near to the sensor located at the rear of vehicle, within 40 cm



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Fig. 2: Buzzer Operational Time Chart
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NOTE: 1. Time tolerance of the above waveform: Time +/- 10%

2. At nearer distance than 25 cm, detection may not occur.
3. Alarm will be generated with vehicle reversing speed 5km/h or less.

For moving target, maximum operation speed shall be target approach speed of 5km/h.

4. When the vehicle or the target is moving, sequential alarm generation or effective alarm may be failed.
5. Misalarm may occur in the following conditions.
 - Irregular road surface, gravel road, reversing toward grass.
 - Horn, motor cycle engine noise, large vehicle air brake, or other object generating ultrasonic wave is near.
 - When a wireless transmitter is used near to the sensor.
 - Dirt on the sensor.
6. Sequential alarm may not occur due to the reversing speed or the target shape.

DIAGNOSIS AND INDICATION

1. Operate with ignition switch on and shift the lever to position "R".
2. Then it checks the system condition.

If no trouble, it generates buzzer alarm sound for 0.065 seconds. In case of system failure, buzzer alarm is generated 3 times continuously with the interval of 0.05 seconds or it does not generate.

3. Effective operation range is 5km/h or less for the vehicle speed.
 - Diagnosis: Ignition switch on and shift the lever to position "R" MICOM checks the sensor condition, and generates buzzer sound for 0.3 seconds if it is O.K.

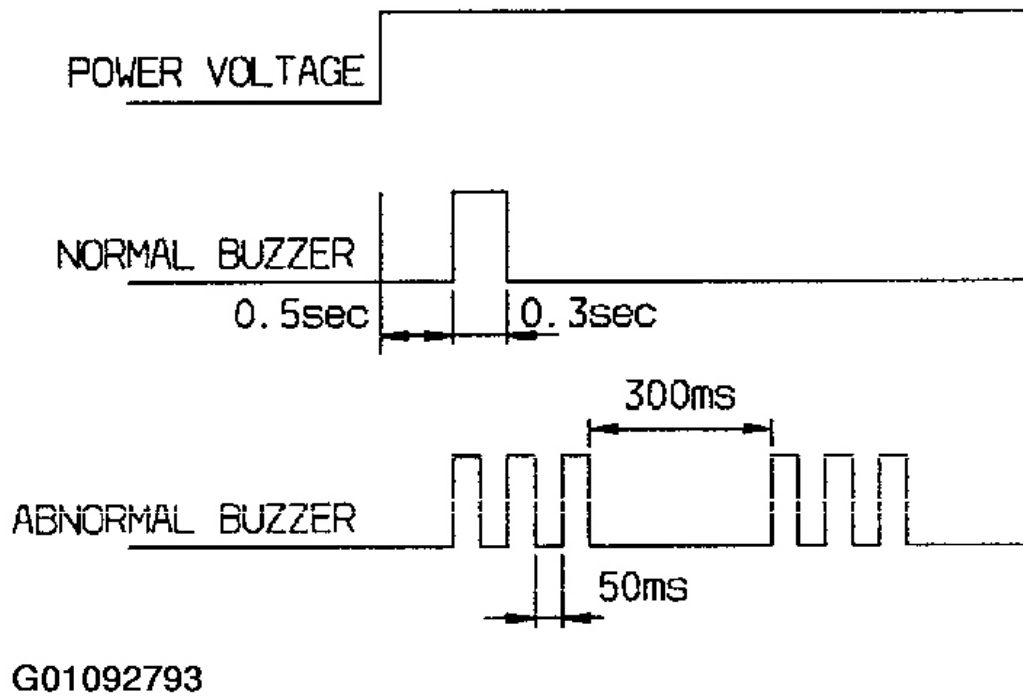
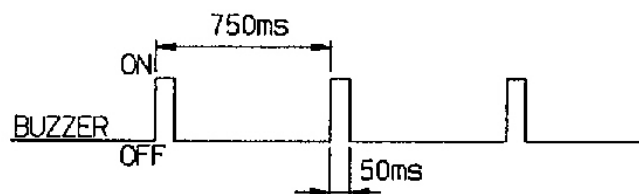


Fig. 3: Diagnostic Buzzer Indicator
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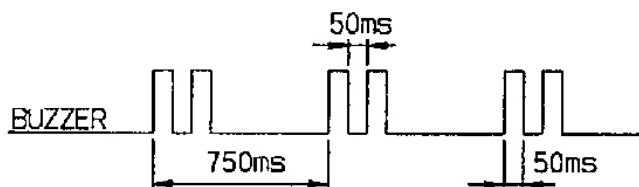
- Diagnosis mode: In case of system failure, turns on the repair switch that is installed at the back warning unit then it indicates the failed point as follows.
 - a. Side left sensor failure: beep-beep
 - b. Rear left sensor failure: beep beep-beep beep-beep beep-
 - c. Rear right sensor failure: beep beep beep-beep beep beep-beep beep beep-
 - d. Side right sensor failure: beep beep beep beep-beep beep beep beep

NOTE: Upon failure of two or more sensors, it generates alarm in the order of SL-RL-RR-SR sensor.

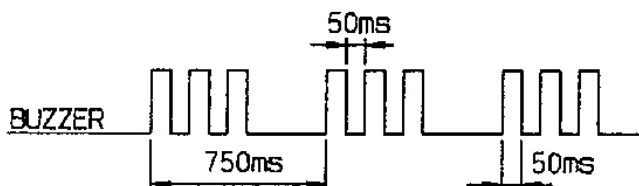
(1) When the 'Side Left Sensor' is out of order (- - -)



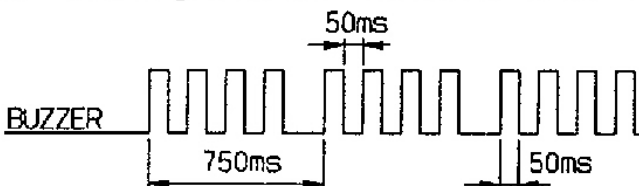
(2) When the 'Rear Left Sensor' is out of order (--- -- --)



(3) When the 'Rear Right Sensor' is out of order (---- ---- ----)



(4) When the 'Side Right Sensor' is out of order (----- -----)

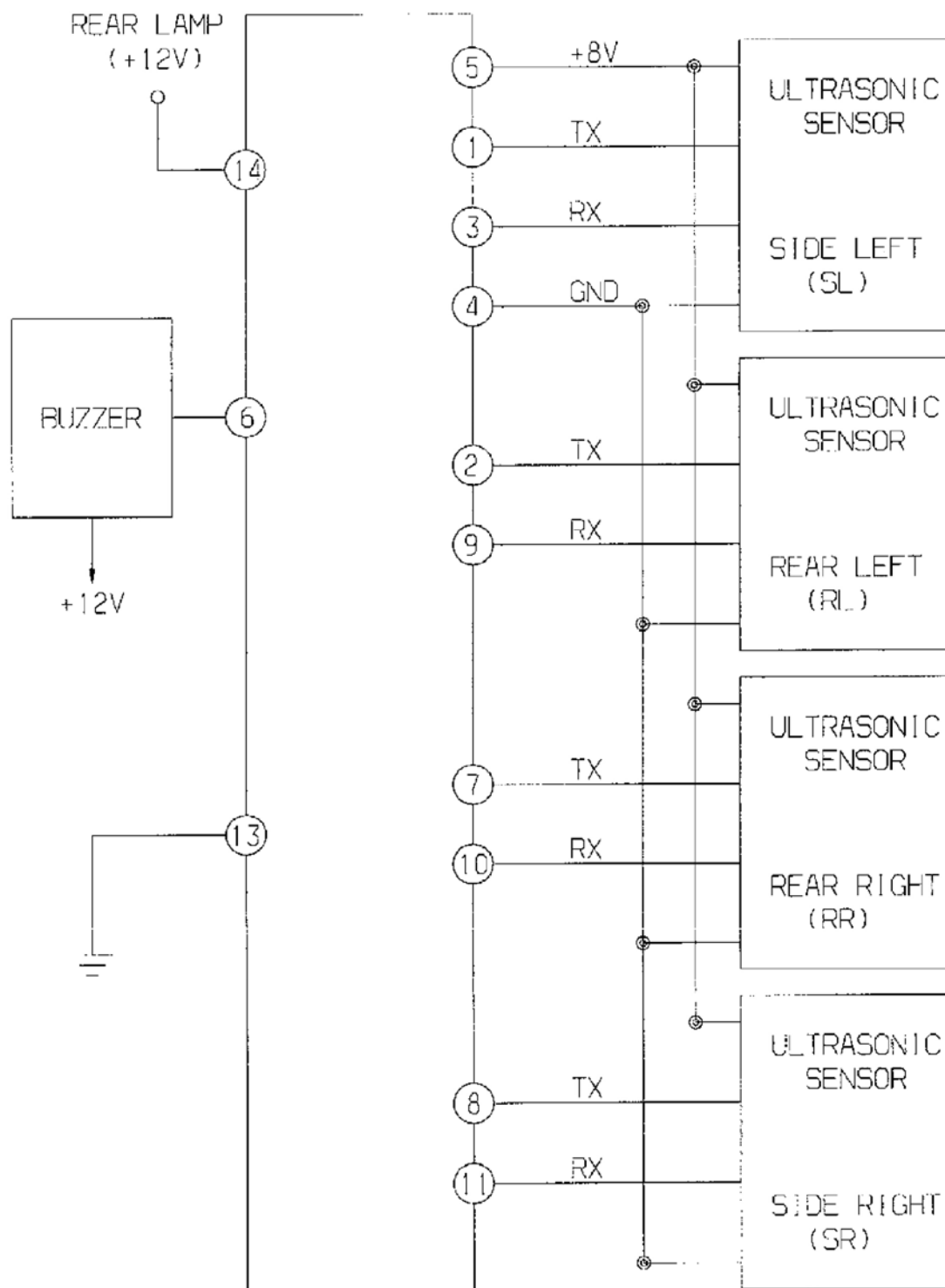


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Fig. 4: Diagnostic Buzzer Codes

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CONTROL UNIT OUTSIDE CIRCUIT DIAGRAM

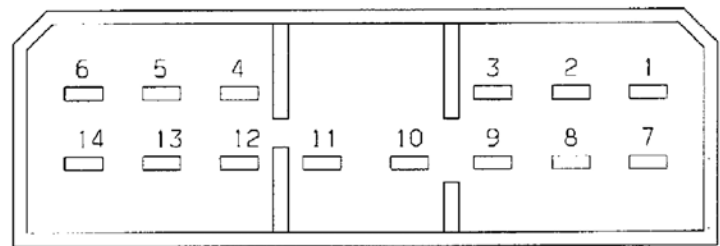


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Fig. 5: Control Unit Outside Circuit Diagram
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CONTROL UNIT & SENSOR TERMINAL ALIGNMENT

Back warning unit



PIN	FUNCTION	PIN	FUNCTION
1	TX, SL SENSOR	8	TX, SR SENSOR
2	TX, RL SENSOR	9	RX, RL SENSOR
3	RX, SL SENSOR	10	RX, RR SENSOR
4	GND SENSOR	11	RX, SR SENSOR
5	+8V, SENSOR	12	N.C
6	BUZZER	13	GND
7	TX, RR SENSOR	14	REAR LAMP (+12V)

Back warning sensor

	PIN NO	SIGNAL
	1	TX
	2	RX
	3	8V
	4	GND

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Fig. 6: Control Unit & Sensor Terminal Alignment

ULTRASONIC SENSOR

OPERATION PRINCIPLE

The sensor emits ultrasonic wave to the objects, and it measures the time until reflected wave returns, and calculates the distance to the object.

DISTANCE DETECTION TYPE

Direct detection type and indirect detection type are used together for improving effectiveness of the detection.

1. Direct detection type: One sensor transmits and receives signals to measure the distance.

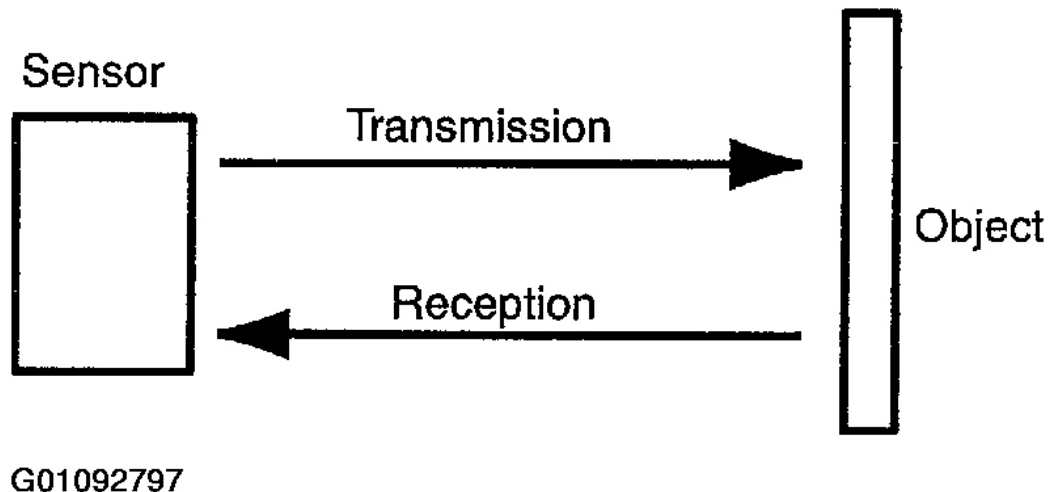


Fig. 7: Illustrating Direct Detection Type
Courtesy of KIA MOTORS AMERICA, INC.

2. Indirect detection type: One sensor transmits signals and the other sensor receives the signals to measure the distance.

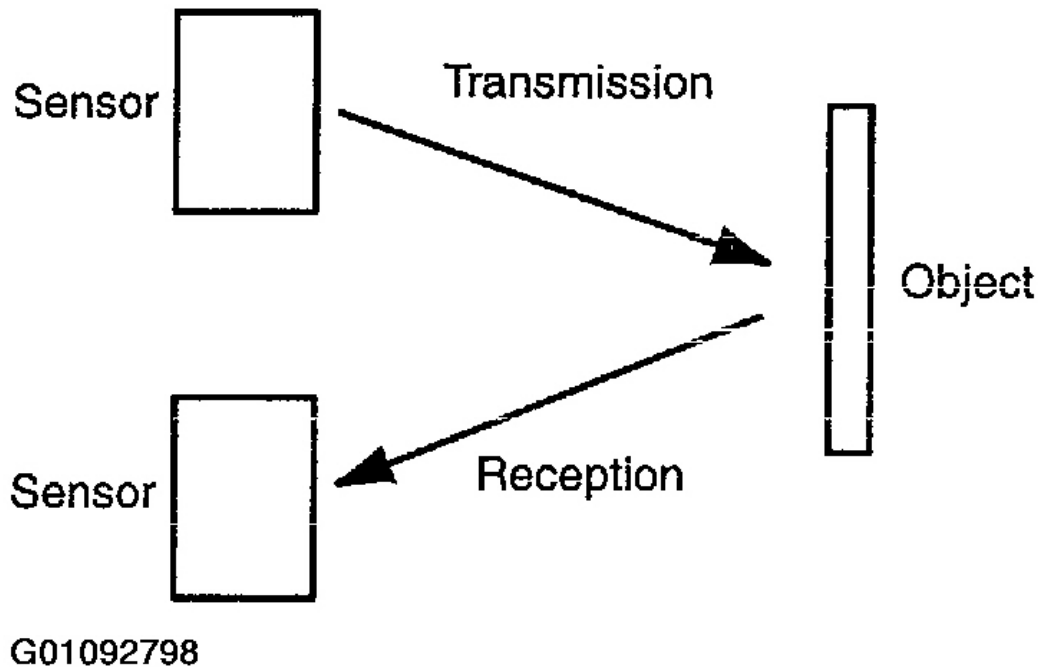


Fig. 8: Illustrating Indirect Detection Type
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MEASUREMENT PRINCIPLE

Back warning system (BWS) is a complementary device for reversing. BWS detects objects behind vehicle and provides the driver with buzzer alarm finding objects in a certain area, using ultrasonic wave propagation speed and time.

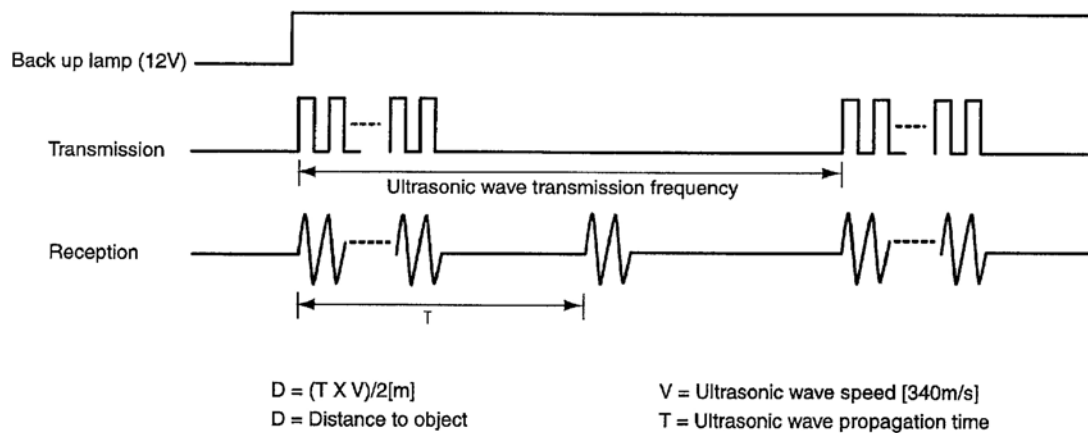
The propagation speed formula of ultrasonic wave in air is following:

$$v=331.5 + 0.6t \text{ (m/s)}$$

v=ultrasonic wave propagation speed

t=ambient temperature

The basic principle of distance measurement using ultrasonic wave is:



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Fig. 9: Illustrating Distance Measurement Principle
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- 14cm (dia.) plastic rod is used for the test target.
- The test result may differ by a different target object.
- Detection range may be reduced by dirt accumulated on sensor, and extremely hot or cold weather.
- The following object may not be detected.:
 - Sharp object or thin object like rope.
 - Cotton sponge, snow or other materials absorbing sonic wave.
 - Smaller objects than 14cm (dia.), 1m length.

WARNING

1. Range detected by back sensors is limited. Watch back before reversing.
2. There is a blind spot below the bumper. Low objects (for example boundary barrier) may be detected from minimum 1.2m away unable to detect at nearer.
3. Besides there are some materials unable to be detected even in detection range as follows.
 - a. Needles, ropes, rods, or other thin objects
 - b. Cotton, snow and other material absorbing ultrasonic wave

(for example, fire extinguisher device covered with snow)

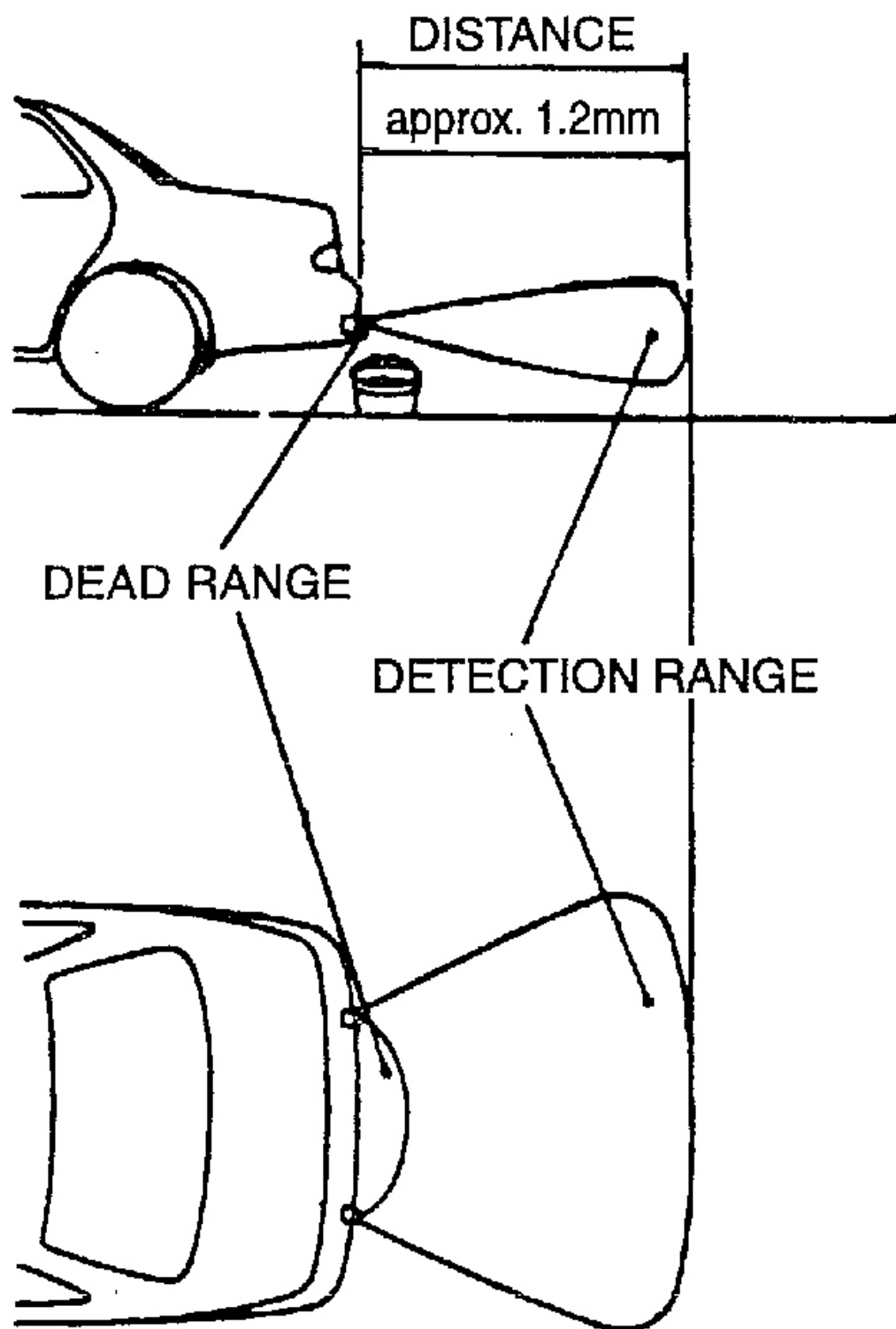
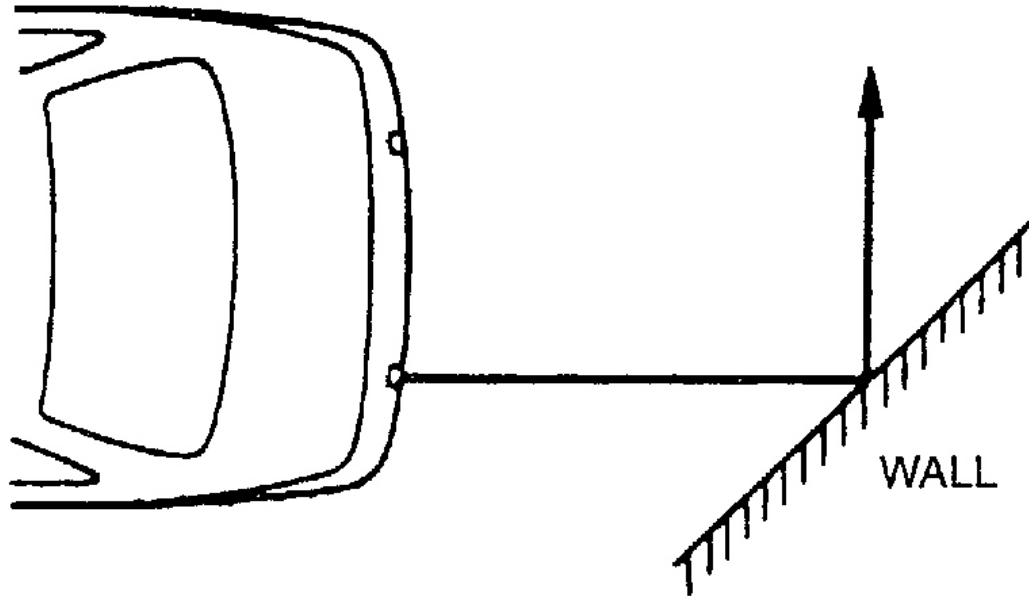


Fig. 10: Illustrating Sensor Blind Spots
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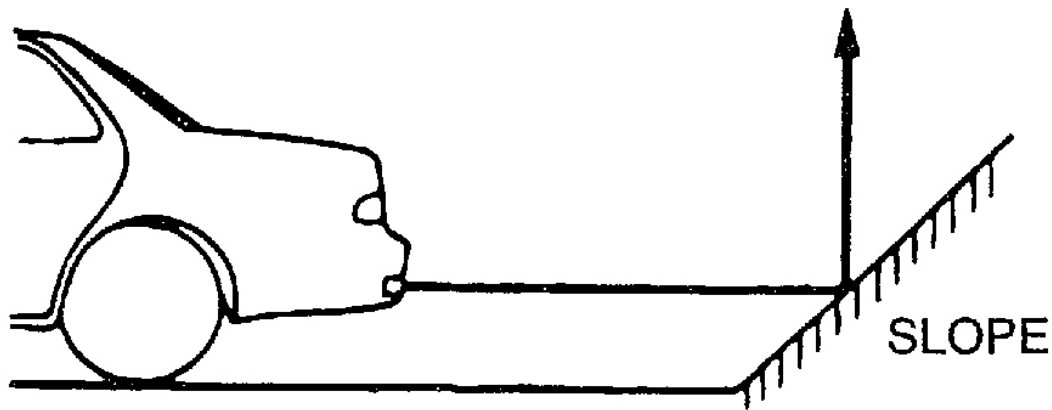
- c. Reversing toward the sloped walls.



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Fig. 11: Illustrating Sloped Wall Blind Spot
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- d. Reversing toward the sloped terrain.



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Fig. 12: Illustrating Sloped Terrain Blind Spot
Courtesy of KIA MOTORS AMERICA, INC.

4. False alarm may operate in the following condition: irregular road surface, gravel road, sloped road, grass. Upon alarm generation by grass the alarm may be generated by rock behind grass. Be sure to check for the safety. Back monitoring sensor cannot discriminate among glass, stake, and rock.
5. Sensors may not operate correctly in the below conditions. Ensure sensors clean from mud or dirt.
 - a. If sensor opening is contaminated with mud, snow, or dirt, detection range will be reduced and alarm may not be generated under the crash condition. Dirt accumulated on the sensor opening shall be removed with water. Do not wipe or scrape sensor with a rod or a hard object.
 - b. If the sensor is frozen, alarm may not operate until sensor thaws.
 - c. If a vehicle stays under extremely hot or cold environment, the detection range may be reduced. It will be restored at the normal temperature.
 - d. When heavy cargo is loaded in trunk, it changes the vehicle balance, which reduces the detection range.
 - e. When other vehicle's horn, motor cycle engine noise, or other ultra-sonic wave sources are near.
 - f. Under heavy rain.
 - g. When reversing towards a vertical wall and the gap between the vehicle and the wall is 15cm. (Alarm may sound despite of no barrier)
 - h. If radio antenna is installed at the rear.
 - i. If the vehicle rear wiring is re-routed or and electrical component is added at the rear part.
 - j. Vehicle balance is changed due to the replacement of the rear spring.
 - k. The unit will operate normally when the vehicle speed is 5km/h or less. Above the speed, the unit may not operate normally.
6. Check the rear bumper for installation condition and deformation. If installed improperly or the sensor orientation is deviated, it may cause malfunction.

7. Be careful not to apply shock during sensor installation on the transmission or reception unit.
8. When adding electrical devices or modifying harness at the rear body of the vehicle, ensure not the change the transmission and reception unit wiring. Tagging the transmission side and reception side, it may cause malfunction.
9. High power radio transmitter (above 10W) may cause malfunction. Do not install it on the vehicle.
10. Be careful that heating or sharp objects shall not touch BWS ultrasonic sensor surface. Besides do not cover the sensor opening or process the sensor.