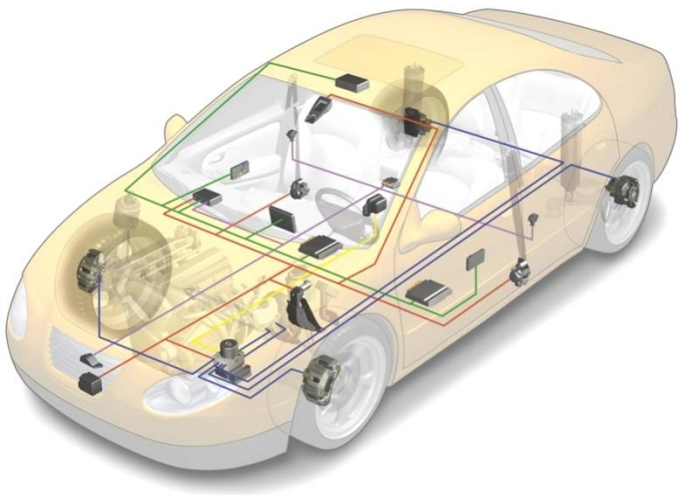
Advanced Smart Cruise Control System



I. System Information

1. Introduction

- The ASCC system operates the convenience feature automatically maintaining the distance by measuring the distance and speed of the lead vehicle with the radar in front of the car. Also, if the lead vehicle is stopped along the rear of the lead vehicle stops, and re-start feature provides at the start with Stop & Go function.

2. System Operation

operation principle

Absence of a lead vehicle

Existing of a lead vehicle

Stopping a lead vehicle

Blinding a lead vehicle

Cluster display state

Cruise control at the driver's setting speed

Driving the lead vehicle traveling speed maintaining a set following distance

When auto stop and starting the lead vehicle within 3 seconds, automatically start.

Accelerate to the target speed and then cruise control.

1) Normal Mode Control

- All of the speed/distance control can perform from 30 to 180 km/h speed range.
- The minimum target speed is 30km/h.
- If the lead vehicle's speed is from 0 to 30km/h, the proper distance can be expected(or calculated/measured).

2) Stop mode Control

- When the lead vehicle is stopped, and then the vehicle would stop at a certain distance.
- If the stop duration is within 3 second, the vehicle automatically start, or not manually the resume/set switch turn on or the accelerator pedal is pressed. If the stopping maintain more than 5 minutes, the ASCC control will be released.

3) Overdrive Control

- Driver's accelerator pedal is pressed, the system will give acceleration priority to the judgment of the driver than the system decision. Then, the driver releasing the accelerator pedal, the target speed gradually slows down.

4) Overtaking Support Control

- The driver turn on the left blinker, the system internally set as the target distance one-step regardless of the display condition. Therefore, a slight acceleration can help to occur soft overtaking.

II. Specific System Structure

1. SCC

1) Function

- Monitoring front road condition(sensing function)
- Driver riding/getting off and monitoring car condition(ECU function)
- Calculating and output of the Required acceleration(ECU function)

2. Switch

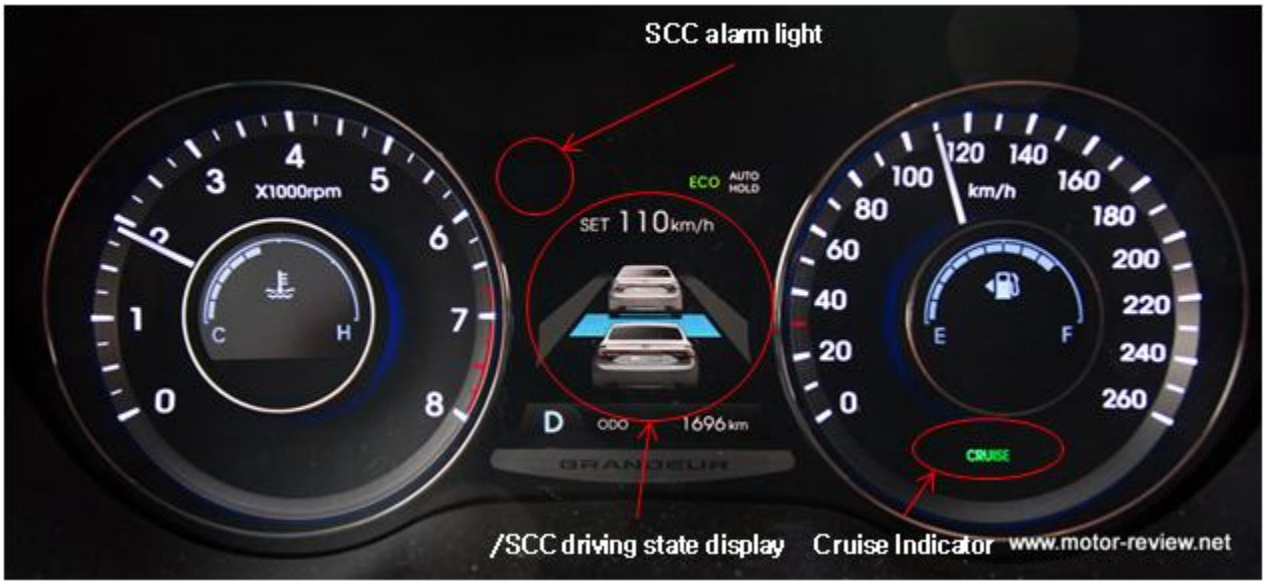
1) Function

- ACSS system On/Off
- Target speed control
- Target distance control
- Operation ON/OFF
- ASCC-CC switching operation

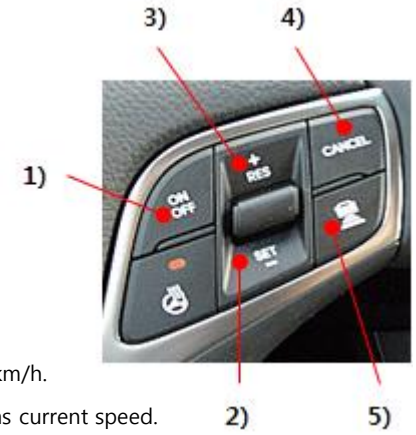
3. Cluster

1) Function

- System On/Off
- System Alarm
- ASCC Operation State (lead vehicle, Break, Overtake, Stop modes) Display
- ASCC Driver Setting State (Target Speed/Distance) Display
- ASCC Auto-unlock/ Usage Condition Un-satisfaction
- ASCC Hazardous situation (lead vehicle breaking, Stop vehicle alert) Display



4. Instruction of the ASCC control using switch



1) ON/OFF Main Switch

- ON/OFF function
- In case of the Standby mode, "CRUISE" Ramp turn ON

2) 『SET/– 』Switch

- At the Stand by mode, Press SET Switch and then Control start.
  - » The target speed set 30 km/h when the car speed is from 0 to 30 km/h.
  - » When the car speed is over 30 km/h, the target speed is the same as current speed.
- If the SET switch is pressed under control, the target speed will be decreased.
  - » Press short period, the speed decrease 1km/h step. ex) 81→80→79→78
  - » Press long period, the speed decrease at first 1km/h step then 10km/h step. ex) 77→76→70→60

3) 『RES/+』Switch

- At Standby mode, Press RES+ switch and then control start.
  - » After the OFF mode changed to Standby mode, the ASCC usage history have to be existed at least once.
- If the RES+ switch is pressed under control, the target speed will be increased.
  - » Press short period, the speed increase 1km/h step. ex) 77→78→79→80→81
  - » Press long period, the speed increase at first 1km/h step then 10km/h step. ex) 66→67→70→80

4) 『CANCEL』Switch

- Released from the control condition

5) 『 Distance setting 』switch

- Set the target headway distance(Initial value is level.4)
- Press the switch, the target headway distance value changed in the following order.
  - » level.4->level.3->level.2->level.1->level.4
  - » In case of the car speed is 90km/h
  - » At level 1 (1sec.), Headway distance is 25m.
  - » At level 2 (1.3sec.), Headway distance is 32.5m
  - » At level 3 (1.6sec.), Headway distance is 40m
  - » At level 4 (2.1sec.), Headway distance is 52.5m
- If press the switch over 2 sec, the ASCC mode is switched the CC mode each other.

◈ Equipment Specification

Product name	LRR-20
Kind of product	Automotive Radar
Operating frequency range	76.125 GHz ~ 76.95 GHz
Bandwidth	825 MHz
Type(s) of Modulation (e.g. BPSK, FSK, ASK, …)	FMCW
Number / Type of Antenna(s)	10(Tx :2 EA, Rx: 8 EA) / patch ANT
Antenna Gain	Tx1: 21 dBi, Tx2: 14 dBi, LRx: 18 dBi, SRx: 14 dBi
Intended area of use	Automobile
Test sample information	production unit
Wired Interfaces	CAN/LIN Cable Length: 2 m
Power supply:	Battery
Voltages	Vnom : 12 V Vmax : 16 V Vmin : 9 V
Current consumption	500 ~ 600 mA
Dimensions (in cm):	101.5 x 77 x 21.5
Weight:	240 g

Notice:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) this device may not cause harmful interference, and

(2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

—Reorient or relocate the receiving antenna.

—Increase the separation between the equipment and receiver.

—Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

—Consult the dealer or an experienced radio/TV technician for help.

Any changes or modifications not expressly approved by the party responsible for compliance could void the authority to operate equipment.

FCC RF Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.

This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

This device complies with Industry Canada's licence-exempt RSSs. Operation is subject to the following two conditions:

(1) This device may not cause interference; and

(2) This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

IC Radiation Exposure Statement:

This equipment complies with IC RSS-102 radiation exposure limits set forth for an uncontrolled environment.

This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

Equipment Operating Information

- Minimum operating temperature : -40 ℃
- Maximum operating temperature : + 85 ℃

MANDO corp. hereby declares that this Vehicle Radar equipment is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.

Full doc can be obtained: suhan.kim@halla.com