05H0P–01

SYSTEM DESCRIPTION

1. GENERAL

(a) The dynamic radar cruise control system has 2 cruise control modes: the constant speed control mode and vehicle–to–vehicle distance control mode.
- The vehicle–to–vehicle distance control mode is always selected when starting up the dynamic radar cruise control system.
- Operation of the constant speed control mode is the same as a conventional cruise control system.

(b) This system maintains the vehicle speed that the driver has set, as long as there are no vehicles ahead in the same lane. Then, the system maintains the vehicle distance that has been set by the driver. If the system detects a vehicle in front moving at a slower speed while the driver is driving at a constant speed, it closes the throttle valve to decelerate. If further deceleration is required, the system controls the brake actuator in order to apply the brakes. Thereafter, if there are no vehicles ahead within the set vehicle–to–vehicle distance because either the vehicle ahead or the driver has changed lanes, the system accelerates slowly to reach the set vehicle speed and resumes driving at the constant speed.

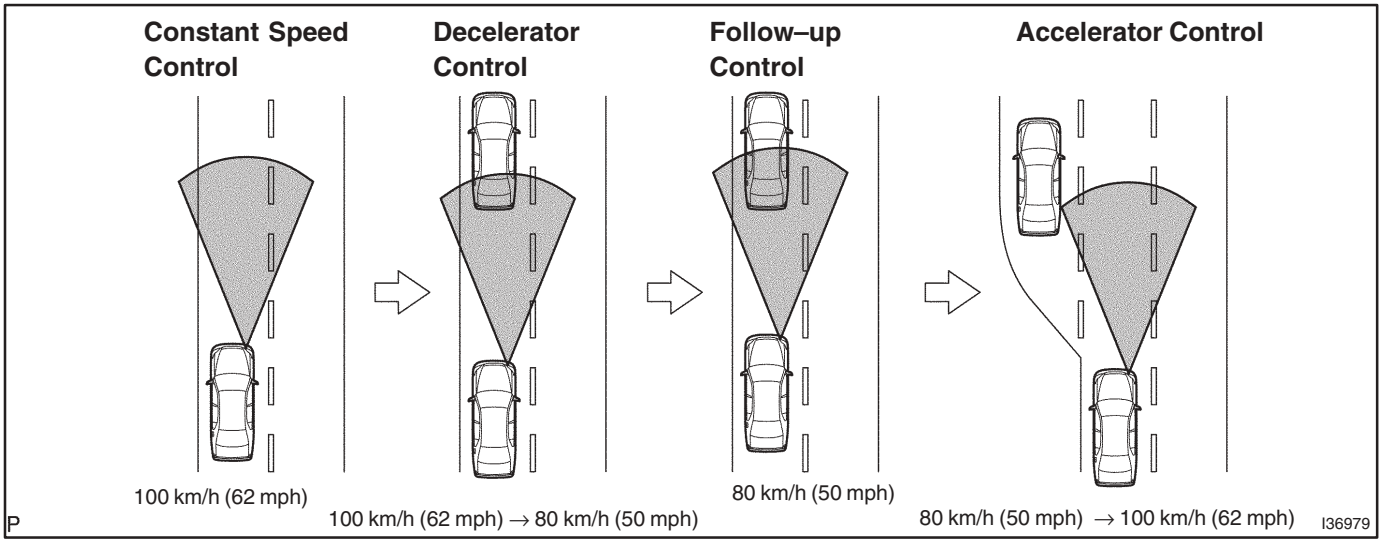
(c) The constant speed control mode is designed to maintain a constant cruising speed. The vehicle–to–vehicle distance control mode is designed to control cruising at a constant speed function, deceleration cruising function, follow–up cruising function and acceleration cruising function.

(d) The millimeter wave radar sensor and the cruise control ECU (distance control ECU) control the system while the vehicle–to–vehicle distance control mode is in operation, and send signals to each actuator and ECU.

(e) In vehicle–to–vehicle distance control mode, the dynamic radar cruise control system receives signals from the yaw rate sensor (deceleration sensor) and the steering angle sensor. Based on these signals, it then estimates curve radius and compensates for information on the preceding vehicle while turning. It can also compensate for the brake control when approaching another vehicle.

(f) This system judges the existence of a vehicle in front and the distance to it based on the signals from the millimeter wave radar sensor while the vehicle–to–vehicle distance control mode is in operation. Using this information, the system informs the driver of any danger with the warning buzzer, performs brake control, and turns on the stop lamp when approaching the vehicle in front.

(g) The following illustration shows a control example under the following conditions: own vehicle speed is 100 km/h (62 mph) and the speed of the vehicle in front is 80 km/h (50 mph).



The distance from your own vehicle to the vehicle in front can be maintained by the system. 3 settings (long,middle and short) are available on the steering pad switch modulator (distance control switch) (DISP2 button). When the vehicle speed is 80 km/h (50 mph), the approximate vehicle–to–vehicle distance for each setting is: long, 50 m (165 ft); middle, 40 m (132 ft); and short 30 m (100 ft).

HINT:

- Vehicle distance increases and decreases in accordance with vehicle speed.
- Controlling condition is indicated on the combination meter multi–information display.

2. FUNCTION OF MAIN COMPONENTS

Item	Outline
Combination Meter (CRUISE Main Indicator Lamp)	• Turns on when MAIN switch is ON • If cruise control ECU (distance control ECU) detects malfunction, this lamp flashes to warn driver
Combination Meter (Master Warning Lamp)	If ECM or cruise control ECU (distance control ECU) detects automatic cancel signal while vehicle is operating under cruise control, this lamp turns on to inform driver
Combination Meter (Buzzer)	If ECM or cruise control ECU (distance control ECU) detects an automatic cancel signal while vehicle is operating under cruise control, this buzzer sounds only once to inform driver
Combination Meter (Multi–information Display)	• While system is in vehicle–to–vehicle distance control mode, multi–information display receives signals from cruise control ECU (distance control ECU), in order to display system conditions in graphic area • If ECM or cruise control ECU (distance control ECU) detects malfunction signal while vehicle is operating under cruise control, warning message will be dis–played in warning area to inform driver • While system is in millimeter wave radar sensor adjustment mode, adjustment angle detected by cruise control ECU (distance control ECU) will be displayed in warning area to inform driver
Cruise Control Main Switch (Main Switch)	Turns cruise control system ON/OFF
Cruise Control Main Switch (Control Switch)	• Vehicle speed setting, deceleration setting, preset speed resumption, acceleration setting, and canceling signals are output to ECM through operation of this switch • Changes control mode: constant speed control mode and vehicle–to–vehicle distance mode
Steering Pad Switch Modulator (Distance Control Switch) (DISP2)	While system is in vehicle–to–vehicle distance control mode, driver can operate steering pad switch (DISP2) to select vehicle–to–vehicle distance: long, middle, and short
Stop Lamp Switch	Detects pressing of brake pedal and transmits its signal to ECM

Item	Outline
Wiper Switch	Transmits wiper switch information to cruise control ECU (distance control ECU)
Tail Lamp Control Switch	Switches to beam axis adjustment mode for millimeter wave radar sensor
Millimeter Wave Radar Sensor	Radiates radar rays forward, uses reflected rays for detecting presence of vehicle in front, vehicle–to–vehicle distance, and relative speed, and transmits this information to cruise control ECU (distance control ECU)
Steering Angle Sensor	Detects angle and direction of steering and transmits its signal to cruise control ECU (distance control ECU)
Vehicle Speed Sensor (SP1)	Vehicle speed signal which is output from skid control ECU is sent to ECM via combination meter
Yaw Rate Sensor (Deceleration Sensor)	Detects yaw rate of vehicle and transmits its signal to cruise control ECU (distance control ECU)
Rain Sensor	This sensor detects raindrops, and when wiper operates at LO or HI, it requests distance control ECU to transmit cruise control cancel signal
ABS & Traction Actuator (Skid Control ECU)	• Actuates brakes in accordance with signals from skid control ECU • While system is in vehicle–to–vehicle distance control mode, skid control ECU actuates brake actuator in accordance with brake request signal received from cruise control ECU (distance control ECU) • Upon receiving signal from cruise control ECU (distance control ECU), skid control ECU sounds skid control buzzer
Skid Control Buzzer	This buzzer sounds upon receiving signal from skid control ECU
ECM	• Controls cruise control system in accordance with signals from switches, sensors, and cruise control ECU (distance control ECU) • If ECM detects malfunction in cruise control system, it will output DTCs
Throttle Control Motor	Upon receiving signal from ECM throttle control motor actuates throttle valve
Cruise Control ECU (Distance Control ECU)	While system is in vehicle–to–vehicle distance control mode, cruise control ECU (distance control ECU) detects vehicle in front based on signal from tmillimeter wave radar sensor. Then, cruise control ECU (distance control ECU) calculates acceleration or deceleration rate in order to attain target vehicle–to–vehicle distance, and outputs request signal to ECM and skid control ECU

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3. LIMIT CONTROL

(a) Low speed limit

The lowest possible limit of the speed setting range is set at approximately 40 km/h (25 mph). The cruise control system cannot be set when the vehicle speed is below the low speed limit. Cruise control operation will be automatically canceled and the stored vehicle speed will be erased when the vehicle speed decreases below the low speed limit while the cruise control is in operation.

(b) High speed limit (constant speed control mode)

The highest possible limit of the speed setting range is set at approximately 200 km/h (125 mph). The cruise control system cannot be set when the vehicle speed is over the high speed limit. Also, RESUME/ACCEL cannot be used to increase speed beyond the high speed limit.

(c) Upper speed limit (vehicle–to–vehicle distance control mode)

This set vehicle speed can be increased up to approximately 180 km/h (114 mph).

4. CRUISE CONTROL OPERATION

The cruise control main switch operates 8 functions: SET, COAST, TAP–DOWN, RESUME, ACCEL, TAP–UP, CANCEL, and MODE. The SET, TAP–DOWN and COAST functions, and the RESUME, TAP–UP and ACCEL functions are operated with the same switch. The cruise control main switch is an automatic return type switch which turns on only while pressing it in each arrow direction and turns off after releasing it.

The dynamic radar cruise control system has 2 cruise control modes: the constant speed control mode and vehicle–to–vehicle distance control mode.

- The vehicle–to–vehicle distance control mode is always selected when starting up the dynamic radar cruise control system.
- Operation of the constant speed control mode is the same as a conventional cruise control system.

(a) MODE CONTROL
Setting the switch to MODE for more than 1 second while driving with the cruise control main switch ON (RADAR READY is on) changes the mode to the constant speed control mode.

(b) SET CONTROL (constant speed control mode)
Vehicle speed is stored and constant speed control is maintained when setting the switch to SET/COAST while driving with the vehicle speed within the set speed range (between the low and high speed limits) after turning the cruise control main switch ON (RADAR READY is on), and entering the constant speed control mode.

(c) SET CONTROL (vehicle–to–vehicle distance control mode)
Vehicle speed is stored and vehicle–to–vehicle control is maintained when setting the switch to SET/COAST while driving with the cruise control main switch ON (RADAR READY is on), and vehicle speed is within the set speed range (between the low and high speed limits).

(d) COAST CONTROL (constant speed control mode)
While the constant speed control mode is operating, the ECM changes the cruise control demanding throttle opening angle to 0 degrees and decelerates the vehicle (the throttle valve is not fully closed due to the idle speed control, etc.) when SET/COAST on the cruise control main switch is pressed and held. When the cruise control main switch is released from SET/COAST, the vehicle speed is stored and constant speed control is maintained.

(e) COAST CONTROL (vehicle–to–vehicle distance control mode)
When SET/COAST on the cruise control main switch is pressed and held while the vehicle–to–vehicle distance control mode is operating, the stored vehicle speed decreases by approximately 5 km/h (5 mph) per second.

(f) TAP–DOWN CONTROL (constant speed control mode)
When tapping down on the cruise control main switch to SET/COAST (for approximately 0.5 seconds) while the constant speed control mode is operating, the stored vehicle speed decreases each time by approximately 1.6 km/h (1 mph). However, when the cruise control main switch is released from SET/COAST and the difference between the driving and the stored vehicle speeds is more than 5 km/h (5 mph), the vehicle speed, will be stored and constant speed control is maintained.

(g) TAP–DOWN CONTROL (vehicle–to–vehicle distance control mode)
When tapping down on the cruise control main switch to SET/COAST (for approximately 0.5 seconds) while the vehicle–to–vehicle distance control mode is operating, the stored vehicle speed decreases each time by approximately 5 km/h (5 mph).

(h) ACCELERATION CONTROL (constant speed control mode)
While the constant speed control mode is operating, the throttle valve motor of the throttle position sensor and motor is instructed by the ECM to open the valve when RESUME/ACCEL on the cruise control main switch is pressed and held. When the cruise control main switch is released from RESUME/ACCEL, the vehicle speed is stored and constant speed control is maintained.

(i) ACCELERATION CONTROL (vehicle–to–vehicle distance control mode)
When RESUME/ACCEL on the cruise control main switch is pressed and held while the vehicle–to–vehicle distance control mode is operating, the stored vehicle speed increases by approximately 5 km/h (5 mph) per second.
Pushing the cruise control main switch to RESUME/ACCEL while following the vehicle in front with the vehicle–to–vehicle distance control mode does not increase the actual vehicle speed, but changes only the set vehicle speed.

(j) TAP–UP CONTROL (constant speed control mode)
When tapping up on the cruise control main switch to RESUME/ACCEL (for approximately 0.5 seconds) while the constant speeds control mode is operating, the stored vehicle speed increases each time by approximately 1.6 km/h (1 mph). However, when the difference between the driving and the stored vehicle speeds is more than 5 km/h (5 mph) during this operation, the stored vehicle speed will not change.

(k) TAP–UP CONTROL (vehicle–to–vehicle distance control mode)
When tapping up on the cruise control main switch to RESUME/ACCEL (for approximately 0.5 seconds) while the vehicle–to–vehicle distance control mode is operating, the stored vehicle speed increases each time by approximately 5 km/h (5 mph).

(l) MANUAL CANCEL CONTROL
Performing any of the following cancels the cruise control system (the stored vehicle speed in the ECM is maintained).
- Depressing the brake pedal
- Moving the shift lever to any position except D (6th, 5th, and 4th gears)
- Setting the cruise control main switch to CANCEL
- Turning the cruise control main switch OFF (the stored vehicle speed in the ECM is not maintained)

(m) RESUME CONTROL
If the cruise control operation was cancelled with the stop lamp switch or the CANCEL switch, and if driving speed is within the limit range, setting the cruise control main switch to RESUME/ACCEL restores vehicle speed memorized at the time of cancellation, and maintains constant speed control.

5. RADAR BEAM AXIS ADJUSTMENT

The dynamic radar cruise control system has an automatic beam axis adjustment function. Perform the adjustment of the millimeter wave radar sensor beam axis with the intelligent tester II (see page 82–2).

6. BRAKE CONTROL

The cruise control ECU (distance control ECU) determines the distance to a vehicle in front, relative speed, target decreasing speed and deceleration rate. Based on the data, the ECU may transmit a brake demand signal to the skid control ECU via the ECM.

7. DOWNSHIFT CONTROL

While the cruise control system is operating, the gear may downshift from overdrive (6th) to 5th on an uphill road. After the gear is shifted down to 5th, if the system determines that the uphill inclination has become smaller based on throttle opening, the gear automatically returns to overdrive (6th).

8. AUTO CANCEL (FAIL–SAFE)

This system has an automatic cancellation function (fail–safe) (see page 05–30).