05H0P–01

DESCRIPTION

1. GENERAL

(a) The dynamic laser cruise control system has two 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 laser cruise control system.
- Operation of the constant speed control mode is the same as that for the conventional type cruise control system.

(b) This system maintains the vehicle running at the 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 moving at a slower speed ahead 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.

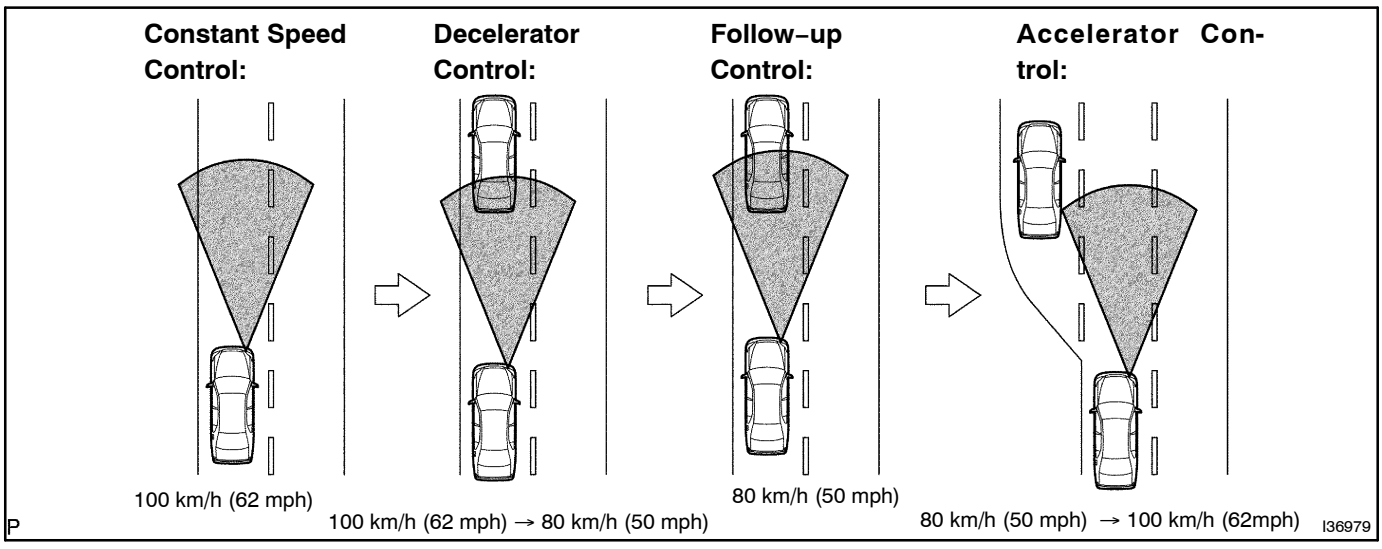
(c) The constant speed control mode is designed to maintain a constant cruising speed. The vehicle–to–vehicle distance control mode is designed to control cruising at a constant speed function, deceleration cruising function, follow–up cruising function and acceleration cruising function.

(d) The laser sensor and the distance control ECU (cruise 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 laser cruise control system receives signals from the yaw rate & 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 laser 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).



Setting of the vehicle distance can be changed to 3 distances by operating the distance control switch (DISP2 button): long (approximately 75 m (246 ft)), middle (approximately 50 m (164 ft)), and short (approximately 30 m (98 ft)) when vehicle speed is approximately 90 km/h (55 mph).

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 Light)	• Comes on when the MAIN switch is ON. • If the distance control ECU detects a malfunction, this light flashes to warn the driver.
Combination Meter (Master Warning Light)	If the ECM or the distance control ECU detects an automatic cancel signal while the vehicle is operating under cruise control, this light comes on to inform the driver.
Combination Meter (Buzzer)	If the ECM or the distance control ECU detects an automatic cancel signal while the vehicle is operating under cruise control, this buzzer sounds only once to inform the driver.
Combination Meter (Multi–information Display)	• While the system is in the vehicle–to–vehicle distance control mode, the multi–information display receives signals from the distance control ECU, in order to display the system conditions in the graphic area. • If the ECM or the distance control ECU detects a malfunction signal while the vehicle is operating under cruise control, a warning message will be displayed in the warning area to inform the driver. • While the system is in the laser sensor adjustment mode, the adjustment angle detected by the distance control ECU will be displayed in the warning area to inform the driver.
Cruise Control Switch (Main Switch)	Turns the power to the cruise control system ON/OFF.
Cruise Control Switch (Control Switch)	• The vehicle speed setting, deceleration setting, preset speed resumption, acceleration setting, and canceling signals are output to the ECM through the operation of this switch. • Switches the control mode: the constant speed control mode and vehicle–to–vehicle distance mode.
Steering Pad Switch (DISP2)	While the system is in the vehicle–to–vehicle distance control mode, the driver can operate the steering pad switch (DISP2) to select the vehicle–to–vehicle distance in three stages: long, middle, and short.
Stop Light Switch	Detects the pressing of the brake pedal and transmits its signal to the ECM.
Wiper Control Switch	Transmits the wiper control switch information to the distance control ECU.
Taillight Control Switch	Switches to the beam axis adjustment mode for the laser sensor.
Laser Sensor	Radiates laser rays forward, uses the reflected rays for detecting the presence of a vehicle in front, the vehicle–to–vehicle distance, and the relative speed, and transmits this information to the distance control ECU.
Steering Angle Sensor	Detects the angle and direction of steering and transmits its signal to the distance control ECU.
Output Speed Sensor (SP1)	A vehicle speed signal which is output from the skid control ECU is sent to the ECM via the meter.
Yaw Rate & Deceleration Sensor	Detects the yaw rate of the vehicle and transmits its signal to the distance control ECU.
Rain Sensor	This sensor detects raindrops, and when the wiper operates at LO or HI, it requests the distance control ECU to transmit a cruise control cancel signal.
Brake Actuator (Skid Control ECU)	• Actuates the brakes in accordance with the signals from the skid control ECU. • While the system is in the vehicle–to–vehicle distance control mode, the skid control ECU actuates the brake actuator in accordance with the brake request signal received from the distance control ECU. • Upon receiving a signal from the distance control ECU, the skid control ECU sounds a VSC warning buzzer.
VSC Warning Buzzer	This buzzer sounds upon receiving a signal from the skid control ECU.
ECM	• Controls the cruise control system in accordance with the signals from the switches, sensors, and distance control ECU. • If the ECM detects a malfunction in the cruise control system, it will output DTCs (Diagnostic Trouble Codes).

Item	Outline
Throttle Control Motor	Upon receiving a signal from the ECM the throttle control motor actuates the throttle valve.
Distance Control ECU	While the system is in the vehicle–to–vehicle distance control mode, the distance control ECU detects a vehicle in front based on a signal from the laser sensor. Then, the distance control ECU calculates the acceleration or deceleration rate in order to attain the target vehicle–to–vehicle distance, and outputs a request signal to the ECM and the skid control ECU.

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 driving 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 goes 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 driving vehicle speed is over the high speed limit. Speed up using RESUME/ACCEL with the cruise control main switch assy also cannot be set 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 135 km/h (84 mph).

4. CRUISE CONTROL OPERATION

The cruise control main switch operates eight 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 assy is an automatic return type switch which turns on only while operating it in each arrow direction and turns off after releasing it.

The dynamic laser cruise control system has two 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 laser cruise control system.
- Operation of the constant speed control mode is the same as that for the conventional type cruise control system.

(a) MODE CONTROL
Pushing the switch to MODE for more than 1 second while driving with the cruise control main switch ON–OFF button on (RADAR READY is on) switches 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 pushing the switch to SET/COAST while driving with the vehicle speed within the set speed range (between the low and high speed limits) after pushing the cruise control main switch ON–OFF button 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 pushing the switch to SET/COAST while driving with the cruise control main switch ON–OFF button 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)
The ECM makes the cruise control demanding throttle opening angle zero 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 while the constant speed control mode is in operation. Vehicle speed, when the cruise control main switch is released from SET/COAST, 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 in operation, the stored vehicle speed decreases by approximately 5 km/h (3 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 second) while the constant speed control mode is in operation, the stored vehicle speed decreases 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 (3 mph), the vehicle speed, when the cruise control main switch is released from SET/COAST, 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 second) while the vehicle–to–vehicle distance control mode is in operation, the stored vehicle speed decreases each time by approximately 5 km/h (3 mph).

(h) ACCELERATOR CONTROL (Constant speed control mode)
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 while the constant speed control mode is in operation. Vehicle speed, when the cruise control main switch is released from RESUME/ACCEL, 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 in operation, the stored vehicle speed increases by approximately 5 km/h (3 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 second) while the constant speeds control mode is in operation, 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 (3 mph) during this operation, the stored vehicle speed will not be changed.

(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 second) while the vehicle–to–vehicle distance control mode is in operation, the stored vehicle speed increases each time by approximately 5 km/h (3 mph).

(l) MANUAL CANCEL CONTROL
Doing any of the following cancels the cruise control system while in operation. (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)
- Pushing the cruise control main switch to CANCEL
- Pushing the cruise control main switch ON–OFF button 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, pushing the cruise control main switch to RESUME/ACCEL restores vehicle speed memorized at the time of cancellation, and maintains constant speed control.
In constant speed mode, once vehicle speed goes below the low speed limit, RESUME operation is not possible even if accelerating up to the low speed limit, or more, again.

5. LASER BEAM AXIS ADJUSTMENT

The dynamic laser cruise control system has an automatic adjustment function of the optical axis. Perform the adjustment of the laser sensor optical axis with the intelligent tester II (see page 82–4 for the optical axis adjustment).

6. BRAKE CONTROL

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

7. DOWNSHIFT CONTROL

While the cruise control system is in operation, 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) (for details, see page 05–3647).