

6. System Control

General

The control of the dynamic radar cruise control system varies by mode (A: constant speed control mode; B: vehicle-to-vehicle distance control mode).

Control	Outline						
Constant Speed Control [See page 32]	The engine ECU compares the actual vehicle speed and the set speed and if the vehicle speed is lower than the set speed, it activates the throttle motor in the throttle opening direction.						
Deceleration Control* [See page 33]	Effects throttle control and brake control in order to decelerate the vehicle so that the vehicle-to-vehicle distance between this vehicle and the vehicle ahead equals the set distance.						
Follow-up Control* [See page 34]	After effecting deceleration control, the vehicle follows the vehicle ahead in order to maintain the proper vehicle-to-vehicle distance in accordance with the vehicle speed.						
Acceleration Control* [See page 35]	Accelerates the vehicle in order to attain the set vehicle speed if the vehicle ahead or this vehicle has changed lanes.						
Set Control	<p>While this system fulfils the following conditions, and the cruise control switch is pressed to the SET/COAST side and released with the MAIN switch turned on, the engine ECU stores the vehicle speed and controls it constantly at that speed.</p> <ul style="list-style-type: none"> While the shift lever is in D position, it is engaged in the S mode, and shift range is 4th, 5th or 6th. The vehicle is running within a vehicle speed range. <table border="1"> <thead> <tr> <th>Mode</th> <th>Vehicle Range</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>About 43 km/h or 30 mph or more</td> </tr> <tr> <td>B</td> <td>About 43 – 180 km/h or 30 – 114 mph</td> </tr> </tbody> </table>	Mode	Vehicle Range	A	About 43 km/h or 30 mph or more	B	About 43 – 180 km/h or 30 – 114 mph
Mode	Vehicle Range						
A	About 43 km/h or 30 mph or more						
B	About 43 – 180 km/h or 30 – 114 mph						
Low Speed Limit Control	<p>The low speed limit is the lowest speed that cruise control can be set and is designed as approx. “40 km/h (25 mph)”. The cruise control cannot be set below that speed. If the vehicle speed drops below that speed while running in the cruise control, the cruise control is cancelled automatically.</p> <table border="1"> <thead> <tr> <th>Mode</th> <th>Control</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>The setting vehicle speed in the memory is cleared.</td> </tr> <tr> <td>B</td> <td>The setting vehicle speed in the memory is kept.</td> </tr> </tbody> </table>	Mode	Control	A	The setting vehicle speed in the memory is cleared.	B	The setting vehicle speed in the memory is kept.
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COAST Switch Control	<p>While the cruise control switch is kept to push to the SET/COAST side, the vehicle speed and the set vehicle speed change as follows, according to the mode:</p> <table border="1"> <thead> <tr> <th>Mode</th> <th>Control</th> </tr> </thead> <tbody> <tr> <td>A</td> <td> <ul style="list-style-type: none"> The vehicle decelerates constantly. The setting vehicle speed changes to the speed at which the switch is turned OFF. </td> </tr> <tr> <td>B</td> <td> <ul style="list-style-type: none"> The setting vehicle speed decreases in increments 5 km/h or 5 mph. [Example: 103 → 100 → 95 km/h (mph)] The vehicle decelerates rapidly by ETCS-i and brake control to the speed that is set at the time the switch is turned OFF. </td> </tr> </tbody> </table>	Mode	Control	A	<ul style="list-style-type: none"> The vehicle decelerates constantly. The setting vehicle speed changes to the speed at which the switch is turned OFF. 	B	<ul style="list-style-type: none"> The setting vehicle speed decreases in increments 5 km/h or 5 mph. [Example: 103 → 100 → 95 km/h (mph)] The vehicle decelerates rapidly by ETCS-i and brake control to the speed that is set at the time the switch is turned OFF.
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*: Only for Vehicle-to-Vehicle Distance Control Mode

(Continued)

Tap Down Control	<p>When the cruise control switch is pushed momentarily (approx. 0.5 sec) to the SET/COAST side, the vehicle speed and the set vehicle speed change as follows, according to the mode:</p> <table border="1" data-bbox="464 279 1365 630"> <thead> <tr> <th data-bbox="464 279 570 321">Mode</th> <th data-bbox="574 279 1365 321">Control</th> </tr> </thead> <tbody> <tr> <td data-bbox="464 327 570 548">A</td> <td data-bbox="574 327 1365 548"> <ul style="list-style-type: none"> ● The vehicle decelerates in increments of approximately 1.6 km/h (1 mph). ● However, if the difference between the actual vehicle speed and the set vehicle speed is greater than 5 km/h or 5 mph, the set vehicle speed changes to the speed at which the vehicle was being driven at the time the switch was operated. </td> </tr> <tr> <td data-bbox="464 554 570 630">B</td> <td data-bbox="574 554 1365 630"> <ul style="list-style-type: none"> ● The setting vehicle speed decreases in increments 5 km/h or 5 mph. ● The vehicle decelerates to the setting vehicle speed. </td> </tr> </tbody> </table>	Mode	Control	A	<ul style="list-style-type: none"> ● The vehicle decelerates in increments of approximately 1.6 km/h (1 mph). ● However, if the difference between the actual vehicle speed and the set vehicle speed is greater than 5 km/h or 5 mph, the set vehicle speed changes to the speed at which the vehicle was being driven at the time the switch was operated. 	B	<ul style="list-style-type: none"> ● The setting vehicle speed decreases in increments 5 km/h or 5 mph. ● The vehicle decelerates to the setting vehicle speed.
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A	<ul style="list-style-type: none"> ● The vehicle decelerates in increments of approximately 1.6 km/h (1 mph). ● However, if the difference between the actual vehicle speed and the set vehicle speed is greater than 5 km/h or 5 mph, the set vehicle speed changes to the speed at which the vehicle was being driven at the time the switch was operated. 						
B	<ul style="list-style-type: none"> ● The setting vehicle speed decreases in increments 5 km/h or 5 mph. ● The vehicle decelerates to the setting vehicle speed. 						
ACC Switch Control	<p>When the cruise control switch is kept to push to the RES/ACC side, the vehicle speed and the set vehicle speed change as follows, according to the mode:</p> <table border="1" data-bbox="464 743 1365 1134"> <thead> <tr> <th data-bbox="464 743 570 785">Mode</th> <th data-bbox="574 743 1365 785">Control</th> </tr> </thead> <tbody> <tr> <td data-bbox="464 791 570 907">A</td> <td data-bbox="574 791 1365 907"> <ul style="list-style-type: none"> ● The vehicle accelerates constantly. ● The setting vehicle speed changes to the speed at which the switch is turned OFF. </td> </tr> <tr> <td data-bbox="464 913 570 1134">B</td> <td data-bbox="574 913 1365 1134"> <ul style="list-style-type: none"> ● The setting vehicle speed increases in increments 5 km/h or 5 mph. [Example: 98 → 100 → 105 km/h (mph)] ● The vehicle accelerates to the speed that is set at the time the switch is turned OFF. However, only the setting vehicle speed changes during follow-up control. </td> </tr> </tbody> </table>	Mode	Control	A	<ul style="list-style-type: none"> ● The vehicle accelerates constantly. ● The setting vehicle speed changes to the speed at which the switch is turned OFF. 	B	<ul style="list-style-type: none"> ● The setting vehicle speed increases in increments 5 km/h or 5 mph. [Example: 98 → 100 → 105 km/h (mph)] ● The vehicle accelerates to the speed that is set at the time the switch is turned OFF. However, only the setting vehicle speed changes during follow-up control.
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Tap Up Control	<p>When the cruise control switch is pushed momentarily (approx. 0.5 sec) to the RES/ACC side, the vehicle speed and the setting vehicle speed change as follows, according to the mode:</p> <table border="1" data-bbox="464 1287 1365 1820"> <thead> <tr> <th data-bbox="464 1287 570 1329">Mode</th> <th data-bbox="574 1287 1365 1329">Control</th> </tr> </thead> <tbody> <tr> <td data-bbox="464 1335 570 1667">A</td> <td data-bbox="574 1335 1365 1667"> <ul style="list-style-type: none"> ● The vehicle accelerates in increments of approximately 1.6 km/h (1 mph). ● However, if the difference between the actual vehicle speed and the setting vehicle speed is greater than 5 km/h or 5 mph, the setting vehicle speed changes to the speed at which the vehicle was being driven at the time the switch was operated. ● If the driver presses the accelerator pedal to accelerate and pushes the cruise control switch to the RES/ACC side, the vehicle speed changes to the setting vehicle speed. </td> </tr> <tr> <td data-bbox="464 1673 570 1820">B</td> <td data-bbox="574 1673 1365 1820"> <ul style="list-style-type: none"> ● The setting vehicle speed increases in increments 5 km/h or 5 mph. ● The vehicle decelerates to the setting vehicle speed. However, only the setting vehicle speed changes during follow-up control. </td> </tr> </tbody> </table>	Mode	Control	A	<ul style="list-style-type: none"> ● The vehicle accelerates in increments of approximately 1.6 km/h (1 mph). ● However, if the difference between the actual vehicle speed and the setting vehicle speed is greater than 5 km/h or 5 mph, the setting vehicle speed changes to the speed at which the vehicle was being driven at the time the switch was operated. ● If the driver presses the accelerator pedal to accelerate and pushes the cruise control switch to the RES/ACC side, the vehicle speed changes to the setting vehicle speed. 	B	<ul style="list-style-type: none"> ● The setting vehicle speed increases in increments 5 km/h or 5 mph. ● The vehicle decelerates to the setting vehicle speed. However, only the setting vehicle speed changes during follow-up control.
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B	<ul style="list-style-type: none"> ● The setting vehicle speed increases in increments 5 km/h or 5 mph. ● The vehicle decelerates to the setting vehicle speed. However, only the setting vehicle speed changes during follow-up control. 						

(Continued)

RES Switch Control	<p>When the driver cancels cruise control (except by turning the MAIN switch OFF), and subsequently pushes the cruise control switch to the RES/ACC side, the cruise control resumes its operation according to the mode, as follows:</p> <table border="1" data-bbox="545 275 1435 737"> <thead> <tr> <th data-bbox="545 275 651 317">Mode</th> <th data-bbox="651 275 1435 317">Control</th> </tr> </thead> <tbody> <tr> <td data-bbox="545 317 651 506">A</td> <td data-bbox="651 317 1435 506"> <p>If the vehicle is operating above the low speed limit, the cruise control resumes operation to reach the vehicle speed that was set at the time the driver canceled cruise control.</p> <ul style="list-style-type: none"> ● In the A mode, if the vehicle speed decreases by the low speed limit or less even once, resume cannot be performed. </td> </tr> <tr> <td data-bbox="545 506 651 737">B</td> <td data-bbox="651 506 1435 737"> <p>If the vehicle speed is above the low speed limit, the cruise control resumes operation to reach the vehicle speed that was set at the time the driver canceled cruise control.</p> <ul style="list-style-type: none"> ● In the B mode, even if the vehicle speed decreases by the low speed limit or less, resume can be performed when the vehicle speed increases to the low speed limit or more. </td> </tr> </tbody> </table>	Mode	Control	A	<p>If the vehicle is operating above the low speed limit, the cruise control resumes operation to reach the vehicle speed that was set at the time the driver canceled cruise control.</p> <ul style="list-style-type: none"> ● In the A mode, if the vehicle speed decreases by the low speed limit or less even once, resume cannot be performed. 	B	<p>If the vehicle speed is above the low speed limit, the cruise control resumes operation to reach the vehicle speed that was set at the time the driver canceled cruise control.</p> <ul style="list-style-type: none"> ● In the B mode, even if the vehicle speed decreases by the low speed limit or less, resume can be performed when the vehicle speed increases to the low speed limit or more.
Mode	Control						
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B	<p>If the vehicle speed is above the low speed limit, the cruise control resumes operation to reach the vehicle speed that was set at the time the driver canceled cruise control.</p> <ul style="list-style-type: none"> ● In the B mode, even if the vehicle speed decreases by the low speed limit or less, resume can be performed when the vehicle speed increases to the low speed limit or more. 						
Automatic Transmission Control	<p>When the vehicle is cruising uphill, there is a case where the overdrive turns off depending on the ECT (Electronic Control Transmission) control. After that, when the engine ECU judges the end of cruising up from the throttle valve opening angle, the overdrive function will turn on again. There is a case where the overdrive turns off during ACC or RES switch control.</p>						
Manual Cancel Control	<p>If any of the following signals is sent to the engine ECU, the cruise control is cancelled accordingly.</p> <ul style="list-style-type: none"> ● Stop light switch ON signal (Depress the brake pedal) ● D position circuit in neutral start switch OFF signal (Shift the shift lever from D to N) ● When 1st, 2nd, or 3rd range is selected in S mode position. ● CANCEL switch ON signal ● MAIN switch OFF signal ● VSC operation signal 						
Automatic Cancel Control [See page 36]	<p>When the automatic cancel signal is sent to the engine ECU, the cruise control is canceled. At this time, the style of the warning to the driver and the control resumption condition varies according to the cancel signal.</p>						
Mode Switching Control	<p>The following operations switch the modes:</p> <ol style="list-style-type: none"> 1) MAIN switch is ON. (Starts in the vehicle-to-vehicle distance control mode) 2) Cruise control switch is kept to push to the MODE side. (Approx. one second or more) <p>If the switch is pushed to the other side before switching the modes, first turn the MAIN switch OFF; then, perform steps 1) and 2) again.</p>						
Diagnosis [See page 37]	<p>If a malfunction occurs in the dynamic radar cruise control system during cruise control, the engine ECU cancels cruise control and diagnoses and memorizes the failed section.</p>						

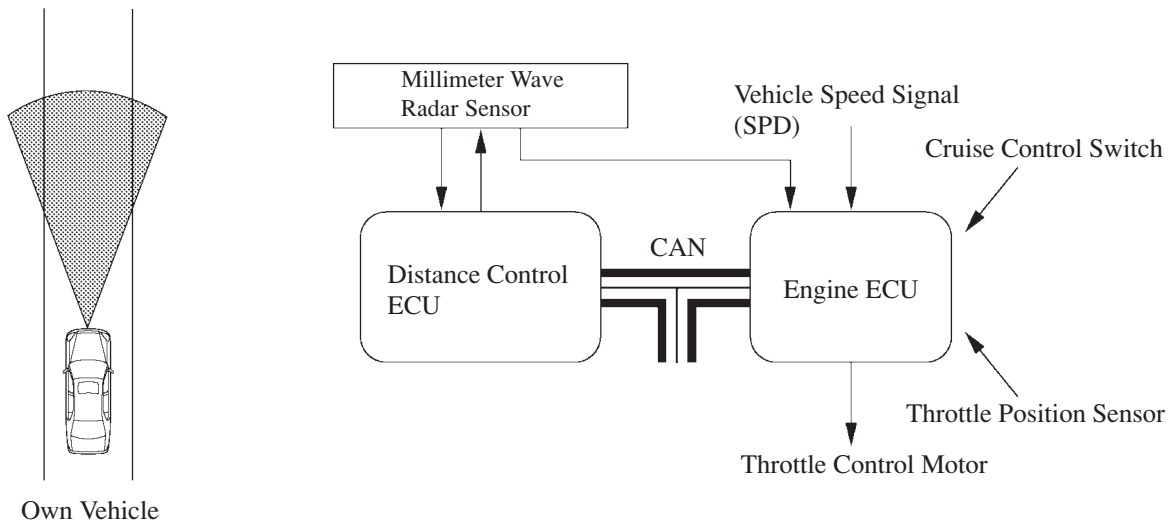
Constant Speed Control

1) General

- In the constant speed control mode, the constant speed control is effected by the engine ECU in the same way as the conventional cruise control.
- In the vehicle-to-vehicle distance control mode, the constant speed control is effected by the millimeter wave radar sensor and distance control ECU.

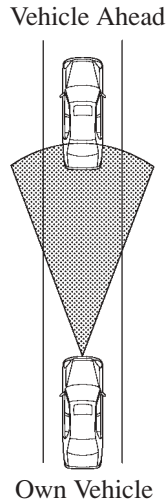
2) Constant Speed Control in Vehicle-to-Vehicle Distance Control Mode

The millimeter wave radar sensor transmits the information on the vehicle ahead to the distance control ECU and the operation signal of the millimeter wave radar sensor to the engine ECU. The distance control ECU transmits this signal to the engine ECU. The engine ECU compares the set vehicle speed and the actual vehicle speed, and effects constant speed control by regulating the throttle control in order to attain the setting vehicle speed.

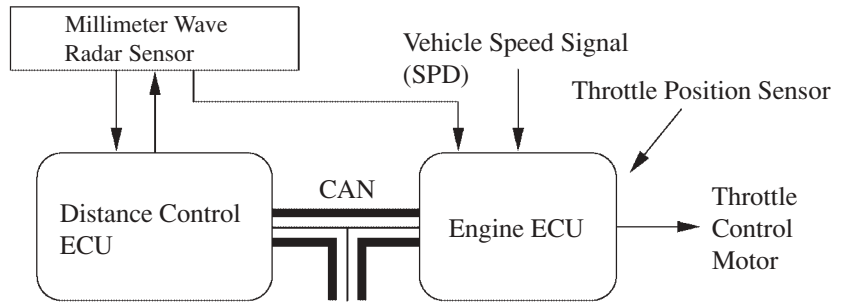


Deceleration Control

- The distance control ECU calculates the target deceleration rate in accordance with the signal from the millimeter wave radar sensor, and transmits a deceleration request signal to the engine ECU. Upon receiving this signal, the engine ECU closes the throttle valve in order to decelerate.
- This control is not effected in the presence of a parked vehicle or object, or below the settable vehicle speed range.

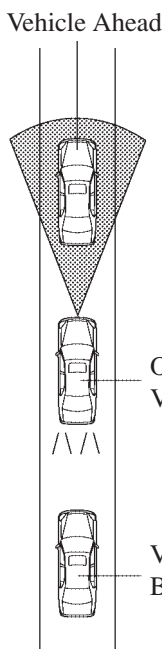


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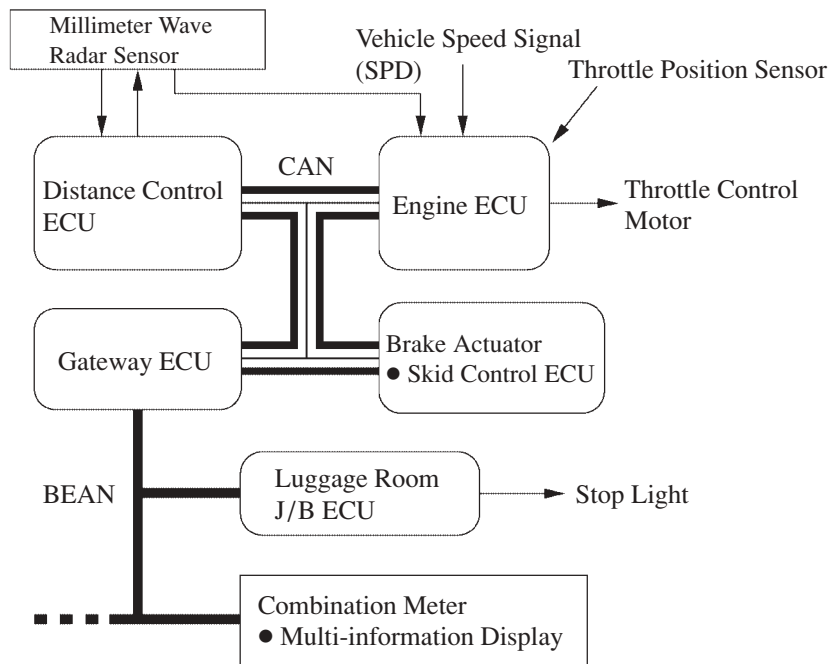


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- If the distance control ECU determines that further deceleration is necessary, it transmits a brake request signal to the engine ECU. Upon receiving this signal, the engine ECU transmits a brake request signal to the skid control ECU. The skid control ECU then controls the brake actuator to apply the brakes.
- At this time, if the deceleration rate is higher than a predetermined value, the skid control ECU outputs a stop light illumination request signal to the luggage room J/B ECU and the combination meter, in order to inform the driver of the vehicle being driven behind. Upon receiving this signal, the luggage room J/B ECU illuminates the stop light, and the combination meter changes the display of the multi-information display in order to inform the driver that the stop light is illuminating.

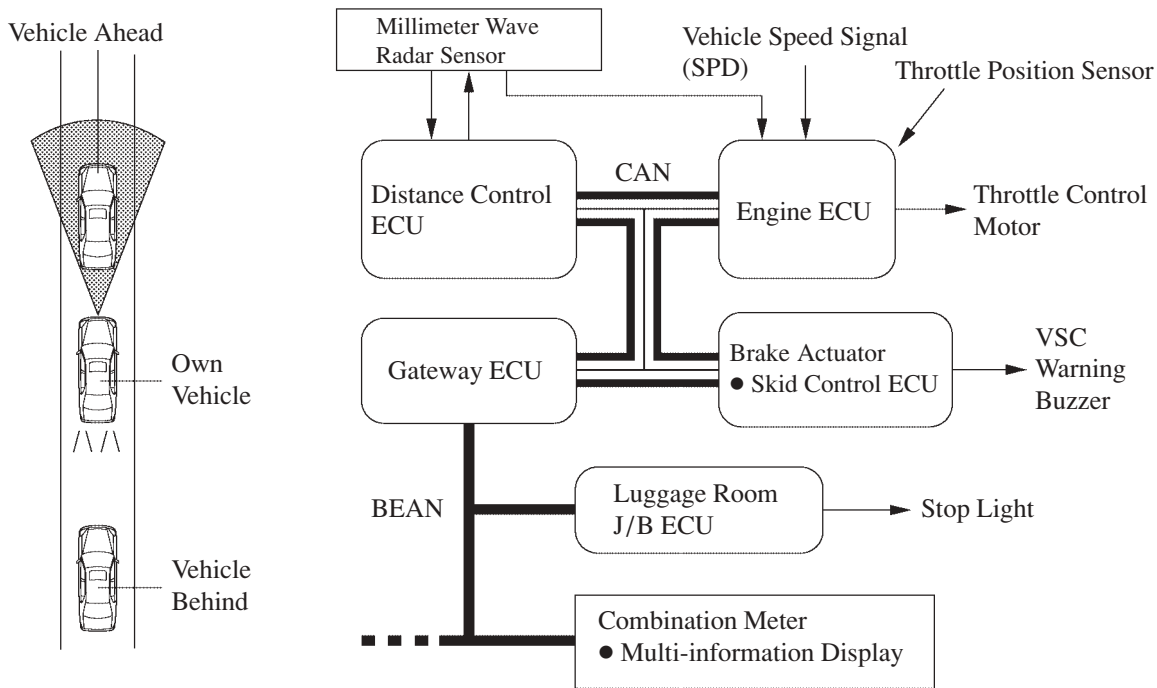


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- If the vehicle is not decelerating adequately, the distance control ECU sounds a VSC warning buzzer to prompt the driver to apply the brakes.

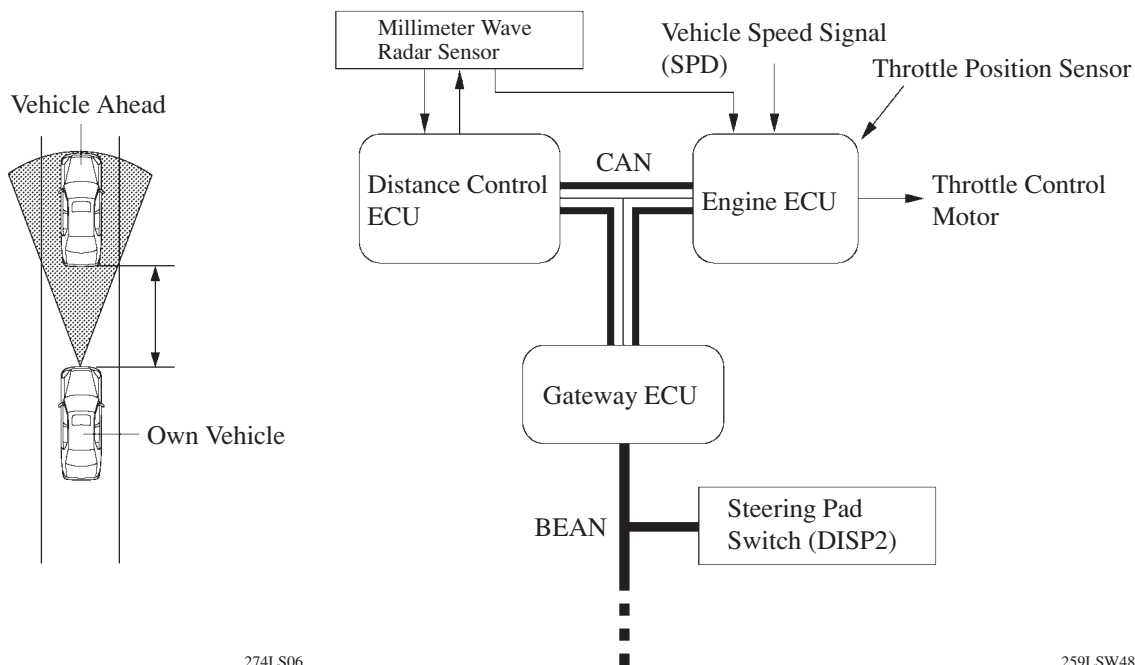


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Follow-up Control

- After effecting deceleration control, the distance control ECU transmits a request signal to the engine ECU so that the vehicle can follow the vehicle ahead while maintaining the proper vehicle-to-vehicle distance according to the vehicle speed. Upon receiving this signal, the engine ECU regulates the throttle in order to effect follow-up control.
- Three stages (long, middle, and short) of vehicle-to-vehicle distance can be selected by operating the steering pad switch (DISP2).

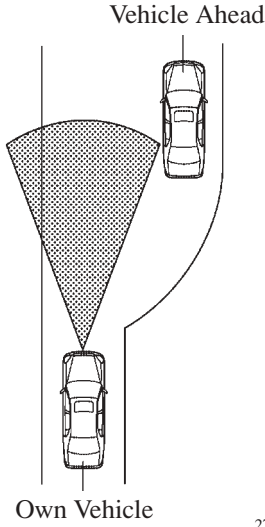


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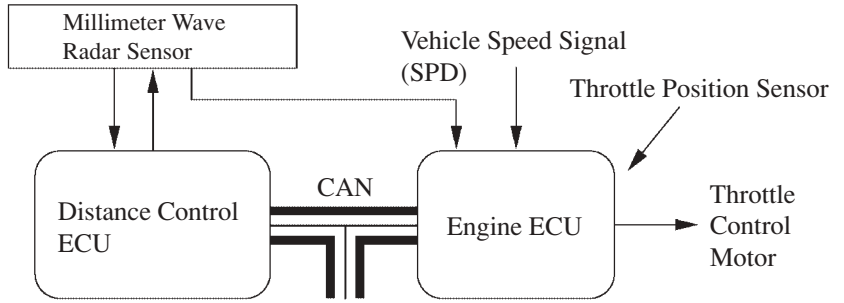
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Acceleration Control

If the distance control ECU detects through millimeter wave radar sensor that either the vehicle ahead or own vehicle has changed lanes, an acceleration request signal is transmitted to the engine ECU in order to attain the setting vehicle speed. Upon receiving this signal, the engine ECU regulates the throttle in order to effect acceleration control.



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Automatic Cancel Control

If any of the conditions listed below occur while the vehicle is in cruise control (A: constant speed control mode; B: vehicle-to-vehicle distance control mode), the cruise control becomes canceled. Then, the following warning items for the driver will appear.

- 1) Warning message is displayed in the multi-information display.
- 2) Master warning light illuminates.
- 3) Buzzer sounds.
- 4) Cruise MAIN indicator light flashes.

Mode	Description of Malfunction	Warning
A and B	<p>If any of the conditions listed below occur, the engine ECU clears the setting vehicle speed and cancels the cruise control.</p> <ul style="list-style-type: none"> ● Malfunction in the vehicle speed signal (SPD). ● Malfunction in the ETCS-i. ● An open or short circuit in the stop light switch. <p>The cruise control is prohibited until the conditions are remedied or the MAIN switch is turned on again.</p>	<ol style="list-style-type: none"> 1) “Check Cruise System” 2) Illuminate 3) Sound 4) Flash
A	<p>If any of the conditions listed below occur, the engine ECU clears the setting vehicle speed and cancels the cruise control.</p> <ul style="list-style-type: none"> ● The vehicle speed drops below low speed limit [approx. 40 km/h (25 mph)]. ● While a speed is being set, the vehicle speed drops below the low speed limit. ● The vehicle speed is more than 16 km/h (10 mph) below the setting vehicle speed. 	<ol style="list-style-type: none"> 1) — 2) — 3) — 4) —
B	<p>If any of the conditions listed below occur, the engine ECU cancels the cruise control while retaining the setting vehicle speed in its memory.</p> <ul style="list-style-type: none"> ● The vehicle speed drops below low speed limit [approx. 40 km/h (25 mph)]. 	<ol style="list-style-type: none"> 1) — 2) — 3) Sound 4) —
	<p>If any of the conditions listed below occur, the engine ECU clears the setting vehicle speed and cancels the cruise control.</p> <ul style="list-style-type: none"> ● Malfunction in the millimeter wave radar sensor. ● Displacement of the axis of the millimeter wave radar sensor. ● Malfunction in the dynamic radar cruise control system other than those given above. <p>The cruise control is prohibited until the conditions are remedied or the MAIN switch is turned on again.</p>	<ol style="list-style-type: none"> 1) “Check Cruise System” 2) Illuminate 3) Sound 4) Flash
	<p>If any of the conditions listed below occur, the engine ECU cancels the cruise control while retaining the setting vehicle speed in its memory.</p> <ul style="list-style-type: none"> ● The millimeter wave radar sensor is dirty. <p>The cruise control is prohibited until the conditions are remedied or the MAIN switch is turned on again.</p>	<ol style="list-style-type: none"> 1) “Clear Radar Sensor” 2) Illuminated 3) Sound 4) Flash
	<p>If any of the conditions listed below occur, the engine ECU cancels the cruise control while retaining the setting vehicle speed in its memory.</p> <ul style="list-style-type: none"> ● The wipers operate at HI speed (including AUTO mode). ● The pattern select switch is SNOW mode. ● A strong light, such as sunlight, laser sensor is received from the front of the vehicle. ● The measurement becomes extremely unstable due to poor weather conditions. <p>The cruise control is prohibited until the conditions are remedied or the MAIN switch is turned on again</p>	<ol style="list-style-type: none"> 1) “Cruise not Available” 2) Illuminate 3) Sound 4) Flash