■ELECTRONIC CONTROL SYSTEM

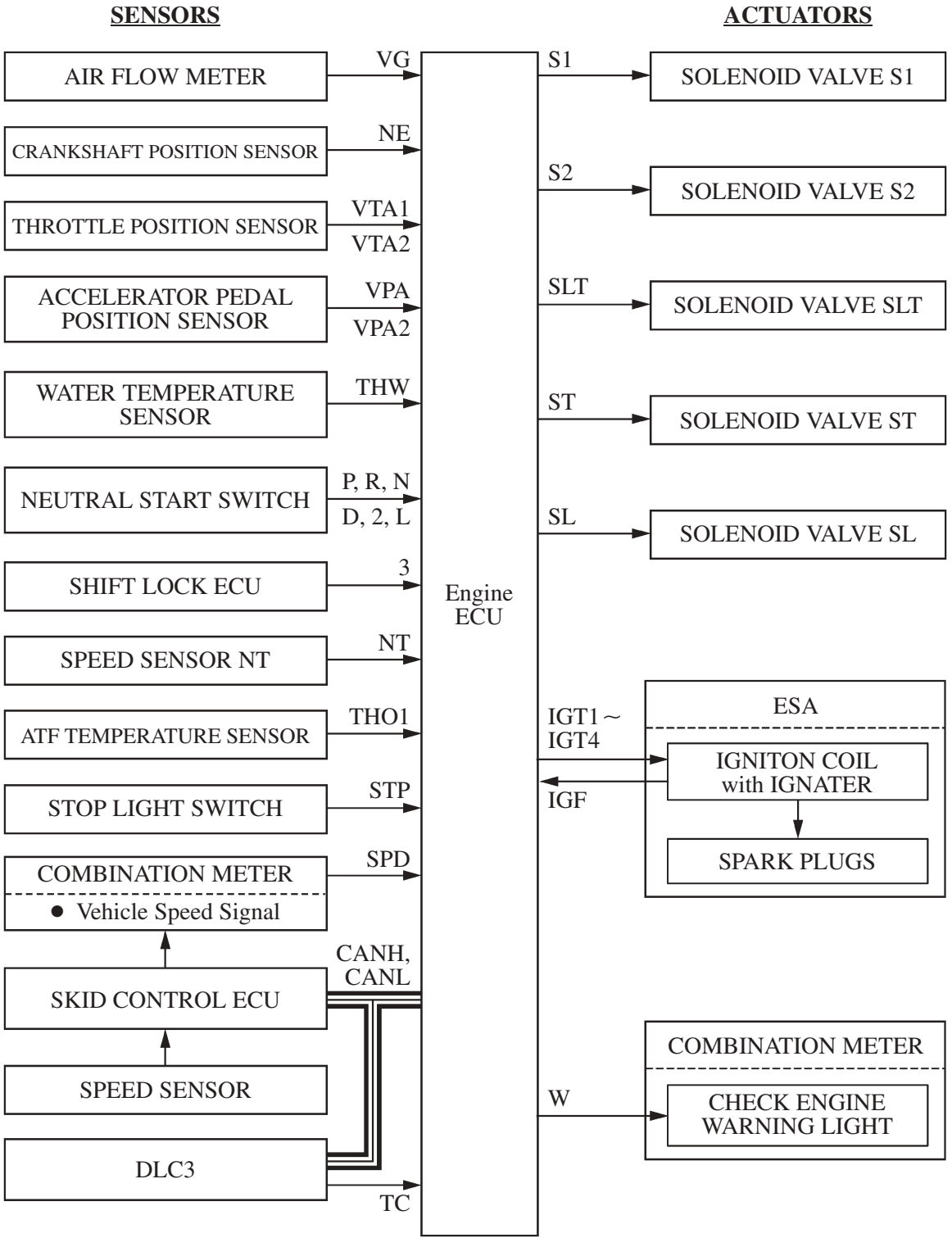
1. General

The electronic control system of the U340E and U441E automatic transaxles consists of the controls listed below.

System	Function
Clutch to Clutch Pressure Control (See page CH-60)	● Controls the pressure that is applied directly to B_1 brake and C_1 clutch by actuating the solenoid valves (ST, SLT) in accordance with engine ECU signals. ● The solenoid valves minutely control the clutch pressure in accordance with the engine output and driving conditions.
Clutch Pressure Optimal Control (See page CH-60)	The solenoid valve SLT minutely controls the clutch pressure in accordance with the engine output and driving conditions.
Line Pressure Control (See page CH-61)	Actuates the solenoid valve SLT to control the line pressure in accordance with information from the engine ECU and the operating conditions of the transaxle.
Shift Control in Uphill/Downhill Traveling (See page CH-62)	Controls to restrict the 4th upshift or to provide appropriate engine braking by using the engine ECU to determine whether the vehicle is traveling uphill or downhill.
High Response Shift Control (See page CH-61)	The shift time lag has been reduced to half by the centrifugal fluid pressure canceling mechanism and clutch pressure optimal control.
Shift Timing Control	The engine ECU sends current to the solenoid valve S1 and/or S2 based on the signals from each sensor and shifts the gear.
Lock-up Timing Control	The engine ECU sends current to the solenoid valve SL based on signals from each sensor and engages or disengages the lock-up clutch.
Engine Torque Control	Temporarily retards the engine ignition timing to restrict the output torque, thus ensuring the shift feel during up or down shifting.
“N” to “D” Squat Control	When the shift lever is shifted from the “N” to “D” position, the gear is temporarily shifted to the 3rd and then to the 1st to reduce vehicle squat.
Diagnosis (See page CH-63)	When the engine ECU detects a malfunction, the engine ECU makes a diagnosis and memorizes the failed section.
Fail-safe (See page CH-63)	Even if a malfunction is detected in the sensors or solenoids, the engine ECU effects fail-safe control to prevent the vehicle’s drivability from being affected significantly.

2. Construction

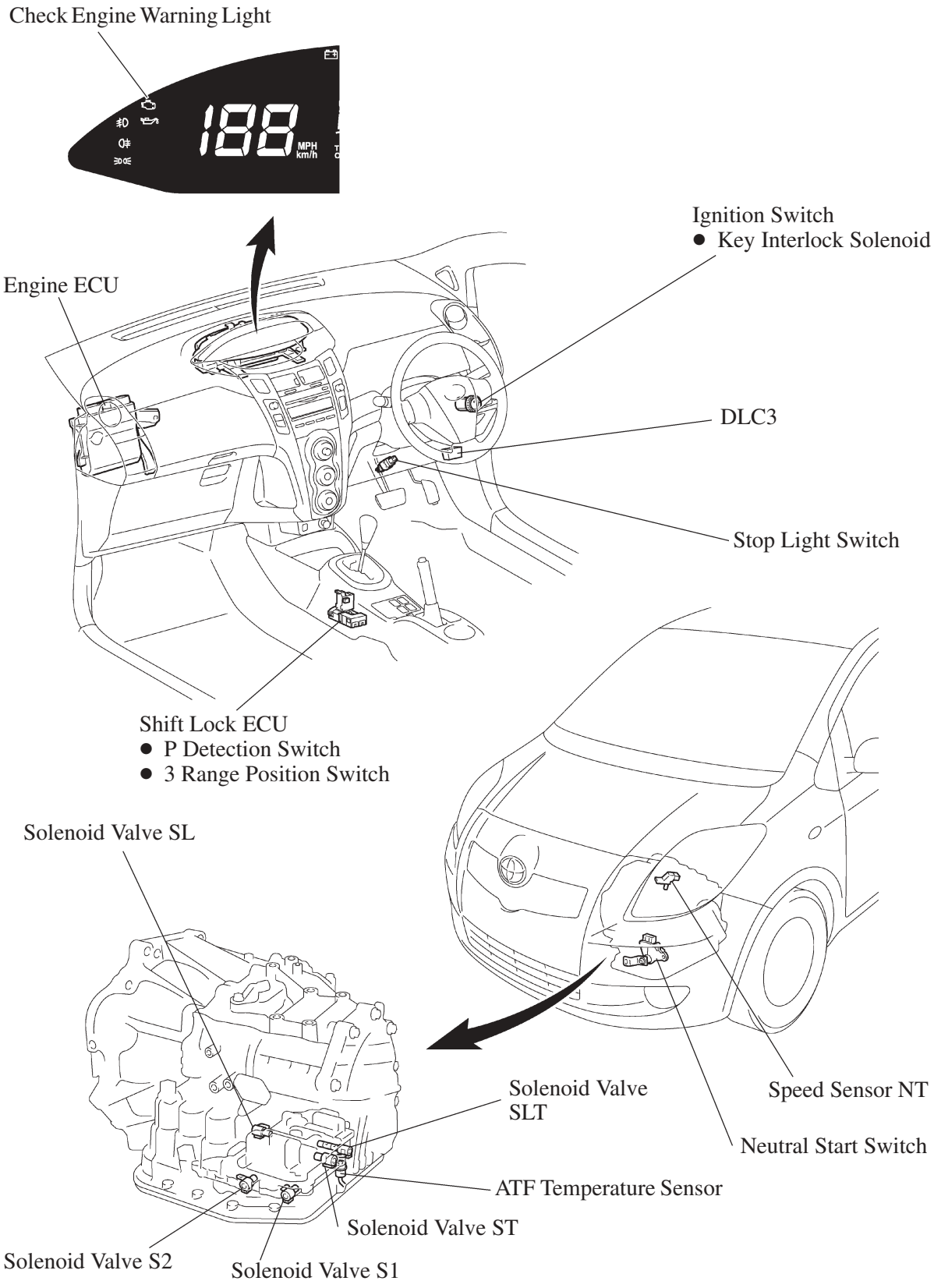
The configuration of the electronic control system in the U340E and U441E automatic transaxles is as shown in the following chart.



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3. Layout of Main Components



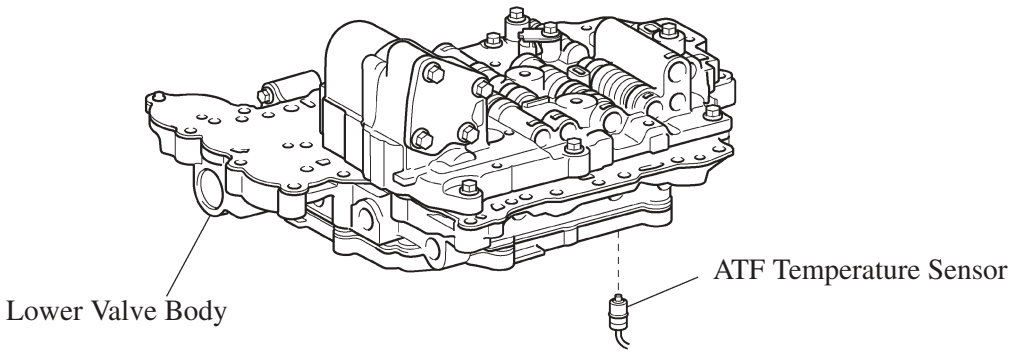
U340E Automatic Transaxle (Hatchback Model)

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4. Construction and Operation of Main Components

ATF Temperature Sensor

- The ATF temperature sensor is installed in the lower valve body for direct detection of the fluid temperature.
- The ATF temperature sensor is used for correction of clutch and brake pressures to keep smooth shift quality every time.

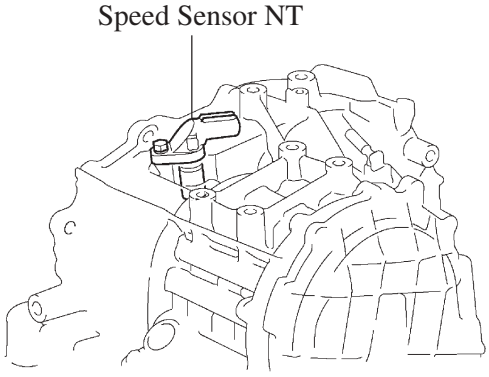


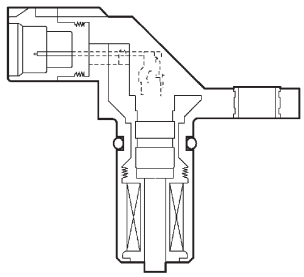
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U340E Automatic Transaxle

Speed Sensor NT

The speed sensor NT detects the input speed of the transaxle. The forward clutch (C_1) drum is used as the timing rotor for this sensor.
Thus, the engine ECU can detect shift timing of the gears and appropriately control the engine torque and hydraulic pressure in response to the various conditions.





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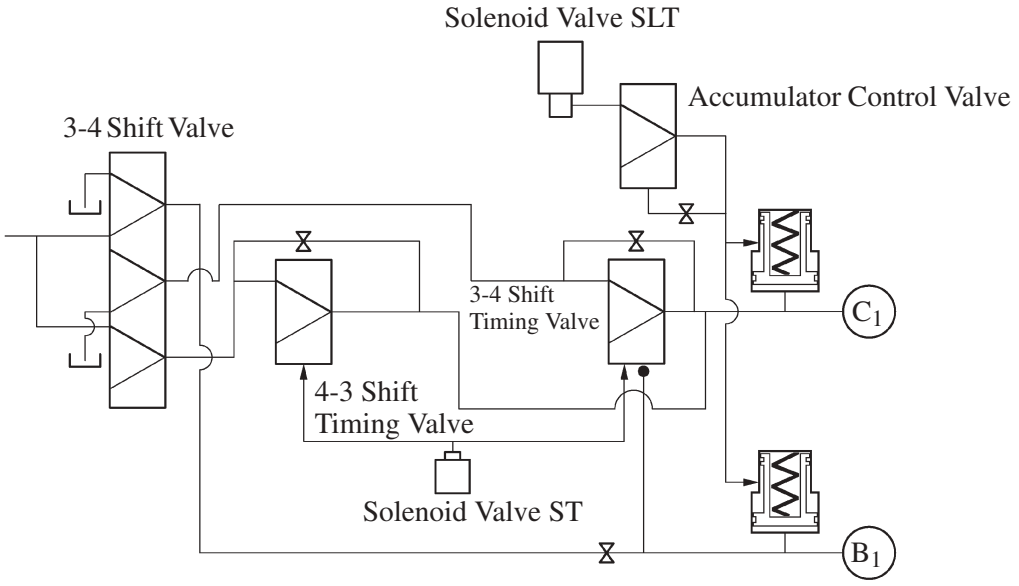
U340E Automatic Transaxle **Speed Sensor NT**

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5. Clutch Pressure Control

Clutch to Clutch Pressure Control

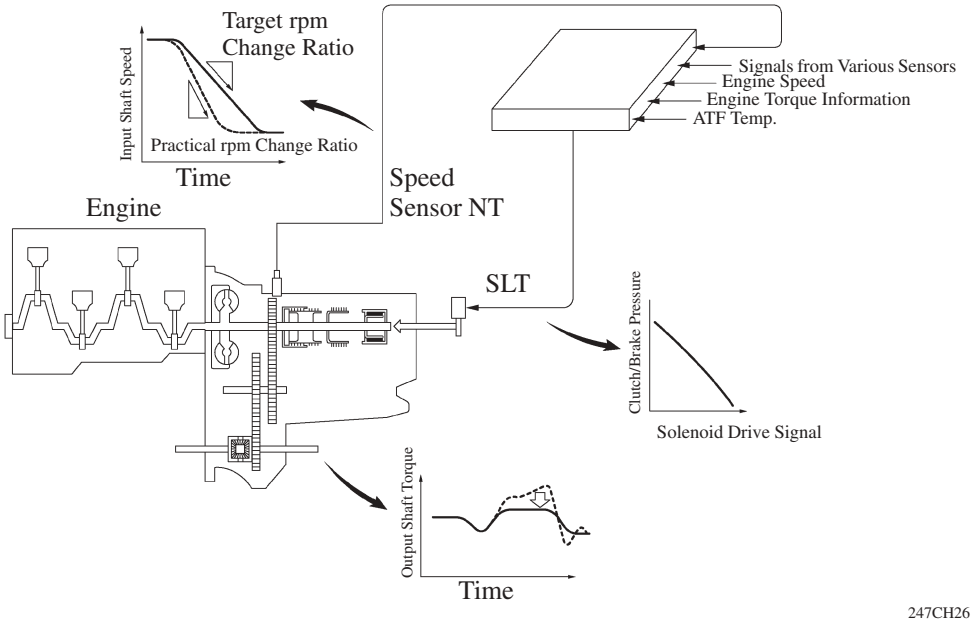
This control is used for shifting from the 3rd to 4th gear, and from the 4th to 3rd gear. It actuates solenoid valves ST and SLT in accordance with the signals from the engine ECU, and guides this output pressure directly to 4-3 shift timing valve and 3-4 shift timing valve in order to regulate the line pressure that acts on the B_1 brake and C_1 clutch.
As a result, compact B_1 and C_1 accumulators without a back pressure chamber have been realized.



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Clutch Pressure Optimal Control

The engine ECU monitors the signals from various types of sensors such as the speed sensor NT, allowing solenoid valve SLT to minutely control the clutch pressure in accordance with engine output and driving conditions. As a result, smooth shift characteristics have been realized.

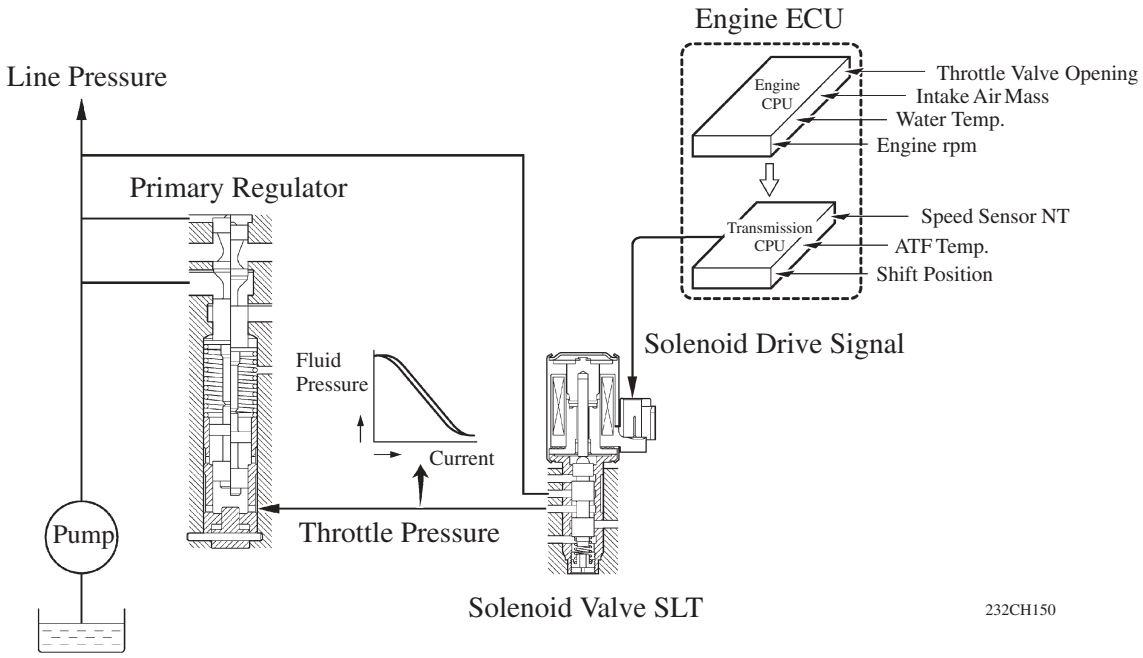


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6. Line Pressure Control

Through the use of the solenoid valve SLT, the line pressure is optimally controlled in accordance with the engine torque information, as well as with the internal operating conditions of the torque converter and the transaxle.

Accordingly, the line pressure can be controlled minutely in accordance with the engine output, traveling condition, and the ATF temperature, thus realizing smooth shift characteristics and optimizing the workload in the oil pump.



7. High Response Shift Control

Due to the use of the previously mentioned centrifugal fluid pressure canceling mechanism and the clutch pressure optimal control, not only smooth shifting has been achieved, but the shift time lag has been halved to realize excellent response.

8. Shift Control in Uphill/Downhill Traveling

General

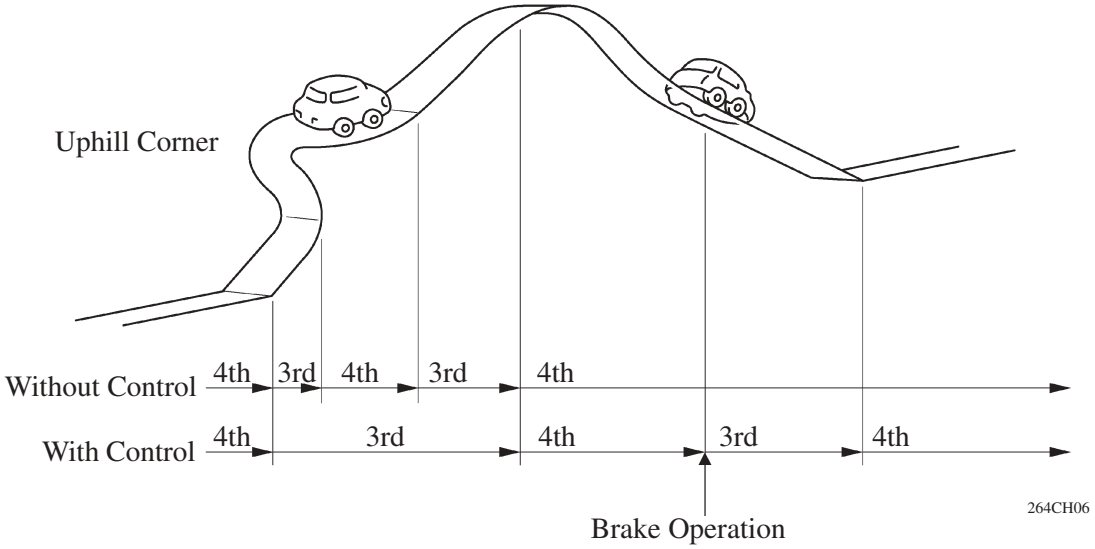
This control helps minimize the gear shifting when the driver operates the accelerator pedal while driving on a winding uphill or downhill road in order to ensure a smooth drive.

Shift Control in Uphill Traveling

When the engine ECU detects uphill travel, it prohibits upshifting to the 4th after downshifting to the 3rd.

Shift Control in Downhill Traveling

If a signal indicating that the driver has operated the brake pedal is input while the engine ECU detects downhill travel, it downshifts from the 4th to 3rd.

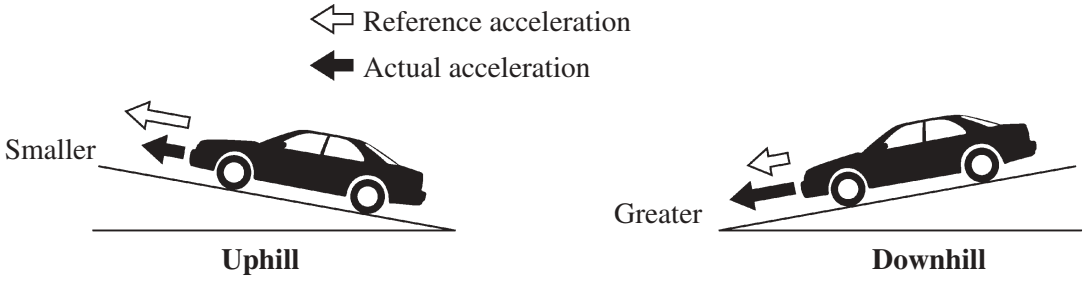


Uphill/Downhill Judgment

The actual acceleration calculated from the speed sensor signal is compared with the reference acceleration (based on level road travel) stored in the engine ECU to determine uphill or downhill travel.

Actual Acceleration < Reference Acceleration

Actual Acceleration > Reference Acceleration



9. Diagnosis

- When the engine ECU detects a malfunction, the engine ECU makes a diagnosis and memorizes the failed section. Furthermore, the check engine warning light in the combination meter illuminates or blinks to inform the driver.
- At the same time, the DTCs (Diagnosis Trouble Codes) are stored in memory. The DTCs can be read by connecting an intelligent tester II. For details, see the Yaris Repair Manual (Pub. No. RM00S1E).

10. Fail-safe

This function minimizes the loss of operability when any abnormality occurs in each sensor or solenoid.

▶ Fail-safe Control List ◀

Malfunction Part	Function
Vehicle Speed Signal	During a vehicle speed signal malfunction, the 4th upshift is prohibited.
Speed Sensor NT	During a speed sensor NT signal malfunction, the 4th upshift is prohibited.
ATF Temperature Sensor	During an ATF temperature sensor malfunction, the 4th upshift is prohibited.
Solenoid Valve SLT or SL	During a solenoid valves SLT or SL malfunction, the 4th upshift is prohibited.
Water Temperature Sensor, Knock Sensor, or Throttle Position Sensor	During a water temperature sensor, knock sensor, or throttle position sensor malfunction, the 4th upshift is prohibited.
Solenoid Valve S1 or S2	During a malfunction in the solenoid valve S1 or S2, the current to the faulty solenoid valve is cut off and control is effected by operating the normal solenoid valves. Shift control is effected as described in the table below, depending on the failed solenoid valve.

When all solenoid Valves are normal			When solenoid valve S1 is abnormal			When solenoid valve S2 is abnormal			When solenoid valves S1 and S2 are abnormal		
Solenoid valve		Gear	Solenoid valve		Gear	Solenoid valve		Gear	Solenoid valve		Gear
S1	S2		S1	S2		S1	S2		S1	S2	
ON	ON	1st	x	ON ↓ OFF	3rd	ON	x	2nd	x	x	3rd
ON	OFF	2nd	x	OFF	3rd	ON	x	2nd	x	x	3rd
OFF	OFF	3rd	x	OFF	3rd	OFF	x	3rd	x	x	3rd
OFF	ON	4th	x	ON	4th	OFF	x	3rd	x	x	3rd

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