■ELECTRONIC CONTROL SYSTEM

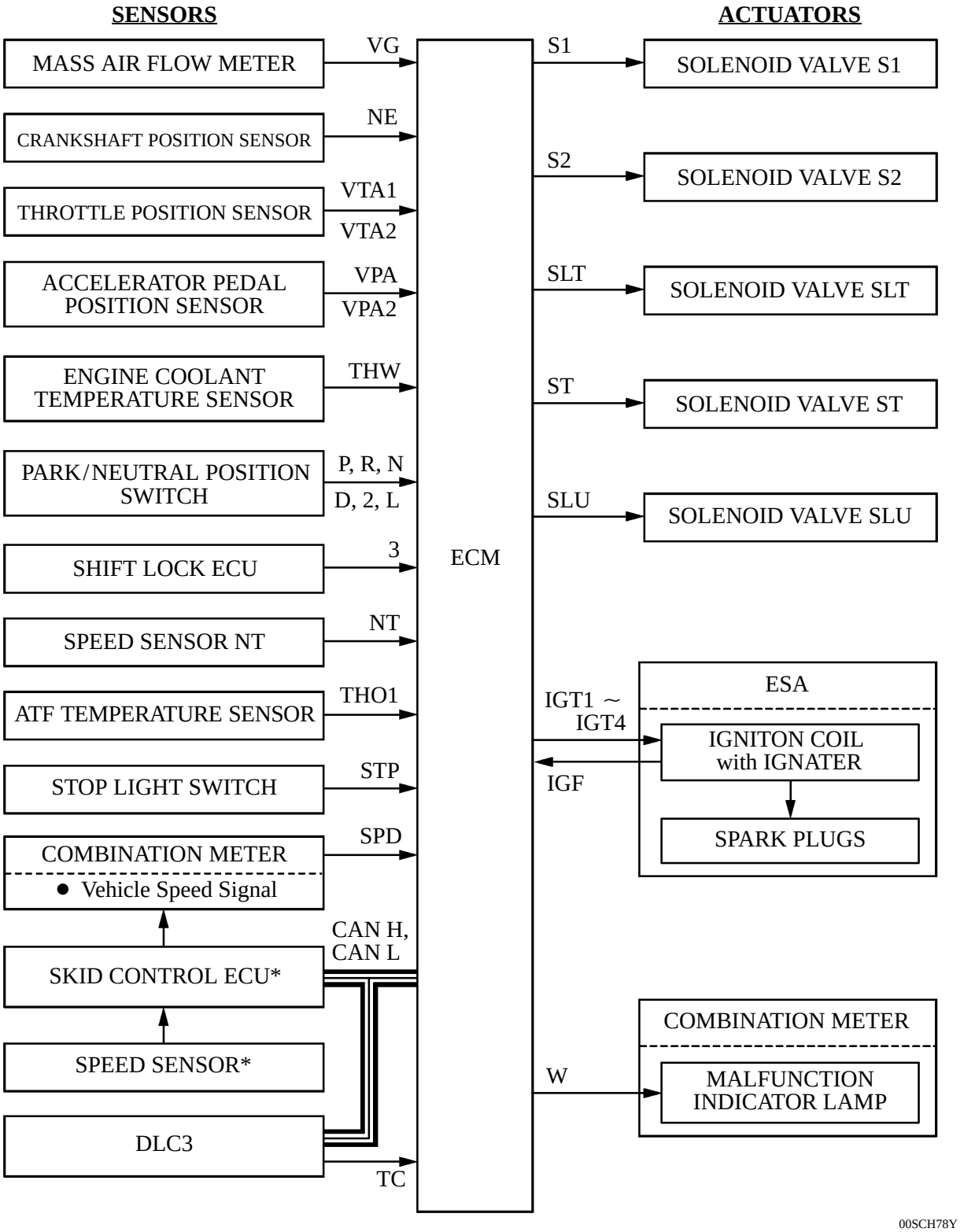
1. General

The electronic control system of the U340E automatic transaxle consists of the controls listed below.

System	Function
Clutch Pressure Control (See page CH-20)	● 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 the ECM signals. ● The solenoid valve SLT minutely controls the clutch pressure in accordance with the engine output and driving conditions.
Line Pressure Control (See page CH-21)	Actuates the solenoid valve SLT to control the line pressure in accordance with information from the ECM and the operating conditions of the transaxle.
Shift Control in Uphill/Downhill Traveling (See page CH-22)	Controls to restrict the 4th upshift or to provide appropriate engine braking by using the ECM to determine whether the vehicle is traveling on uphill or downhill.
Shift Timing Control	The ECM sends current to the solenoid valve S1 and/or S2 based on signals from each sensor and shifts the gear.
Flex Lock-up Clutch Control (See page CH-23)	Controls the solenoid valve SLU, provides an intermediate mode between the ON/OFF operation of the lock-up clutch, and increases the operating range of the lock-up clutch to ensure fuel economy.
Lock-up Timing Control	The ECM sends current to the solenoid valve SLU based on the 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-24)	When the ECM detects a malfunction, the ECM makes a diagnosis and memorizes the failed section.
Fail-Safe (See page CH-24)	Even if a malfunction is detected in the sensors or solenoids, the ECM effects fail-safe control to prevent the vehicle’s drivability from being affected significantly.

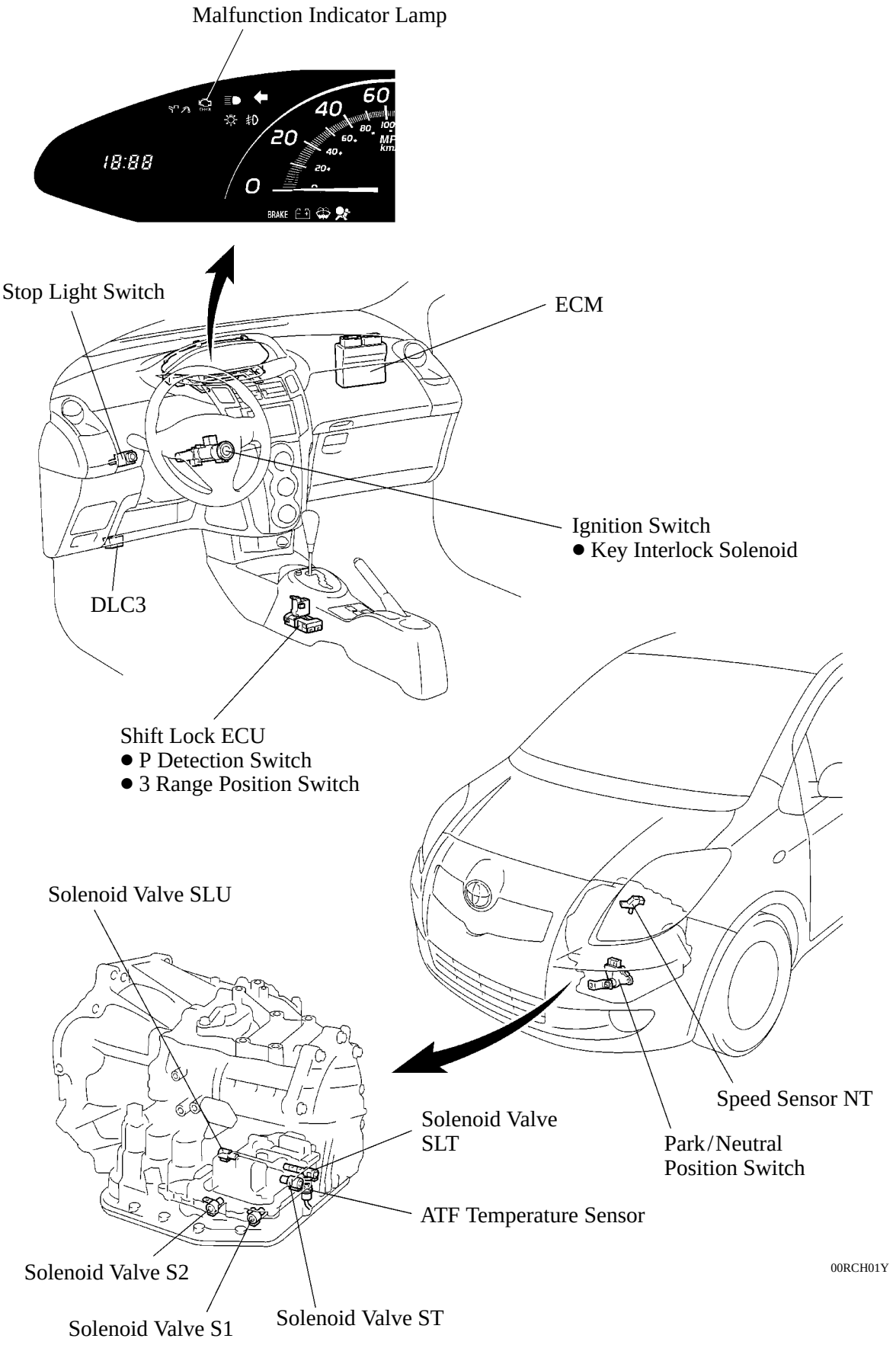
2. Construction

The configuration of the electronic control system in the U340E automatic transaxle is as show in the following chart.



*: Models with ABS System

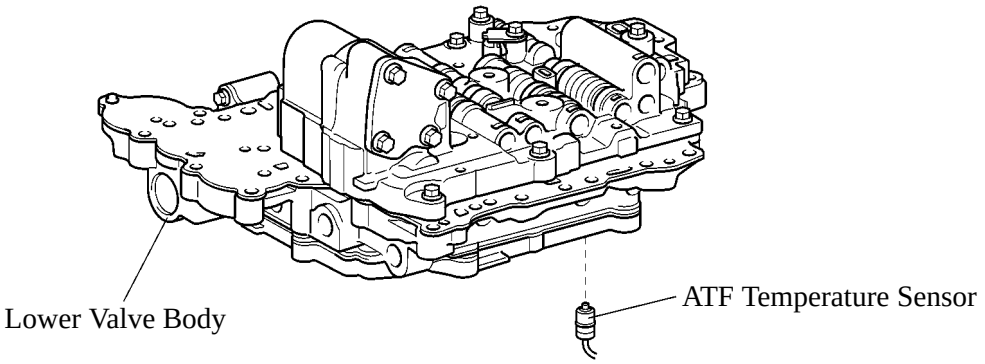
3. Layout of Main Components



4. Construction and Operation of Main Components

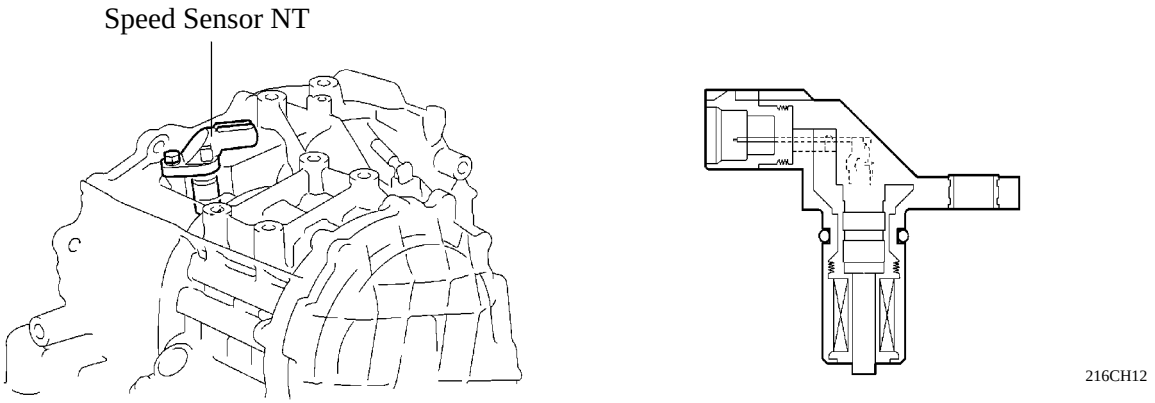
ATF Temperature Sensor

- 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.



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 ECM can detect shift timing of the gears and appropriately control the engine torque and hydraulic pressure in response to the various conditions.

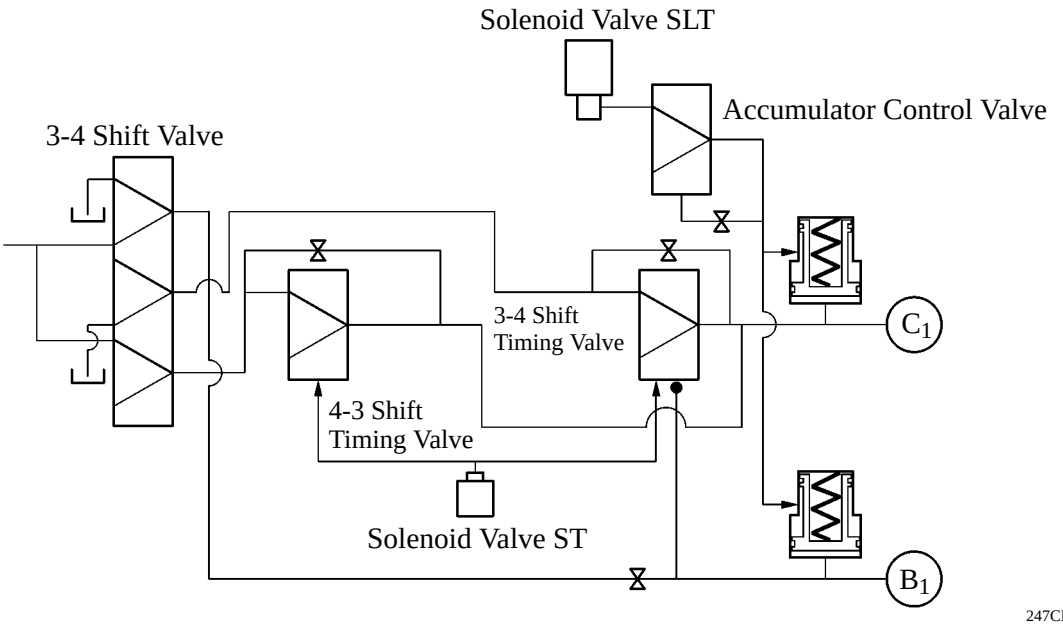


Speed Sensor NT

5. Clutch Pressure Control

Clutch to Clutch Pressure Control

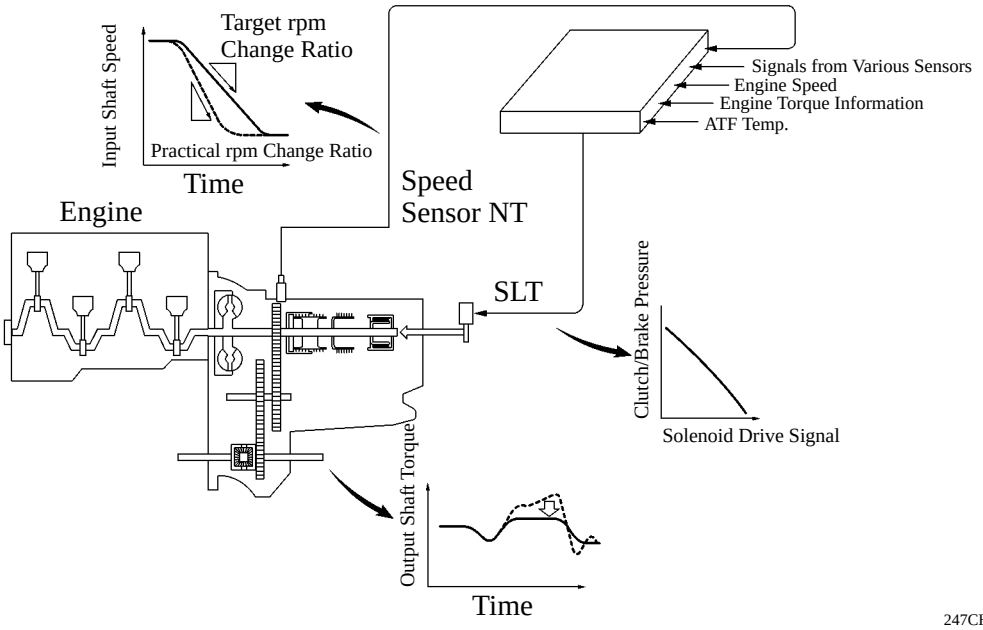
This control is used for shifting from the 3rd to 4th gear, and from the 4th to 3rd gear. It actuates solenoid valves ST and SLT in accordance with the signals from the ECM, and guides this output pressure directly to 4-3 shift timing valve and 3-4 shift timing valve in order to regulate the line pressure 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 ECM 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.

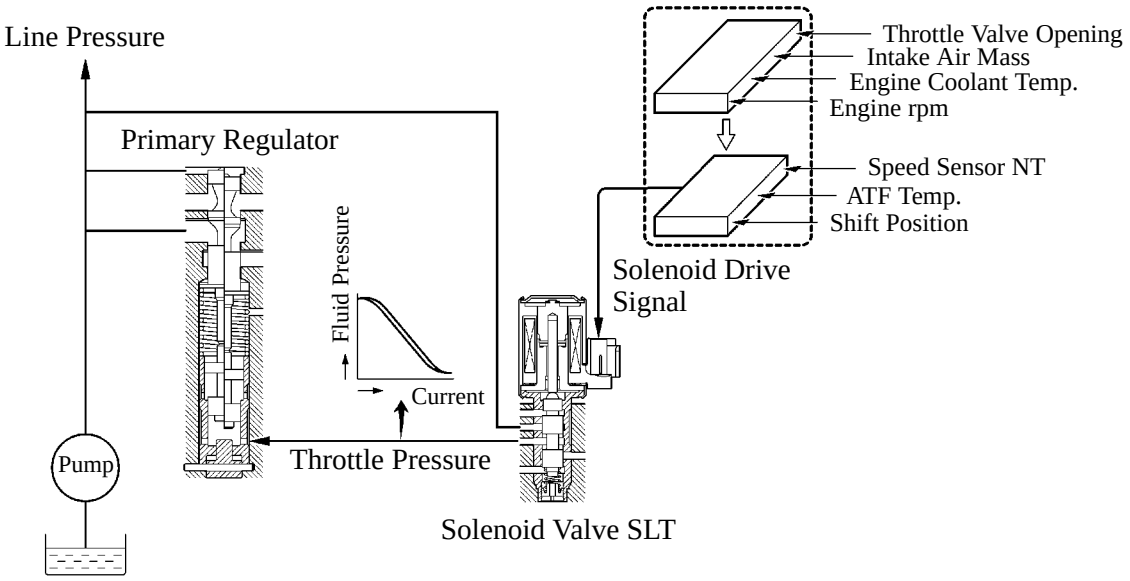


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6. Line Pressure Control

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. Shift Control in Uphill/Downhill Traveling

General

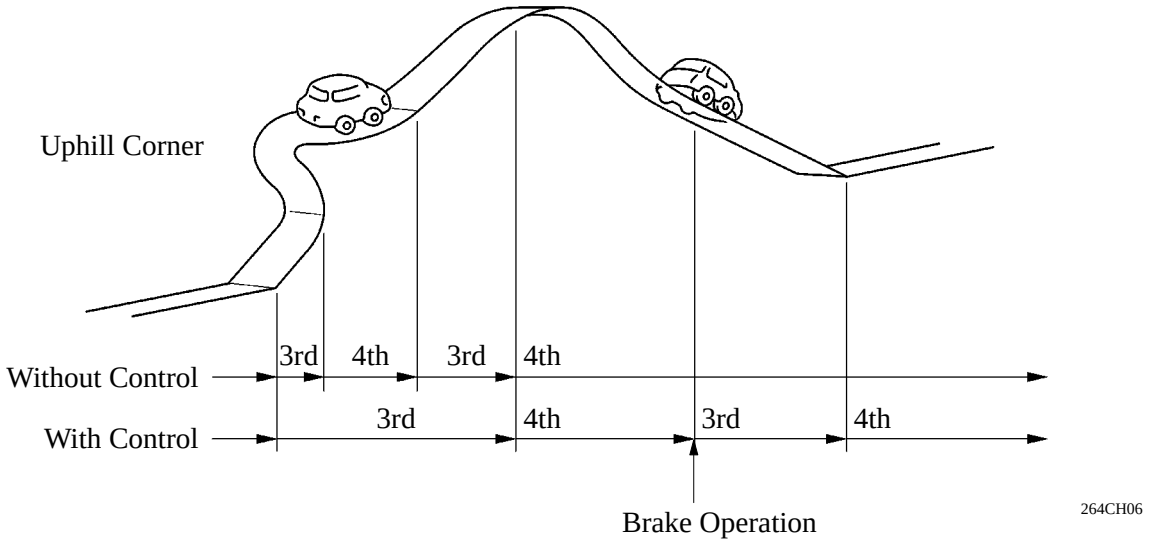
This control helps minimize the gear shifting when the driver operates the accelerator pedal while driving on a winding uphill or downhill road in order to ensure a smooth drive.

Shift Control in Uphill Traveling

When the ECM 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 ECM detects downhill travel, it downshifts from the 4th to 3rd.

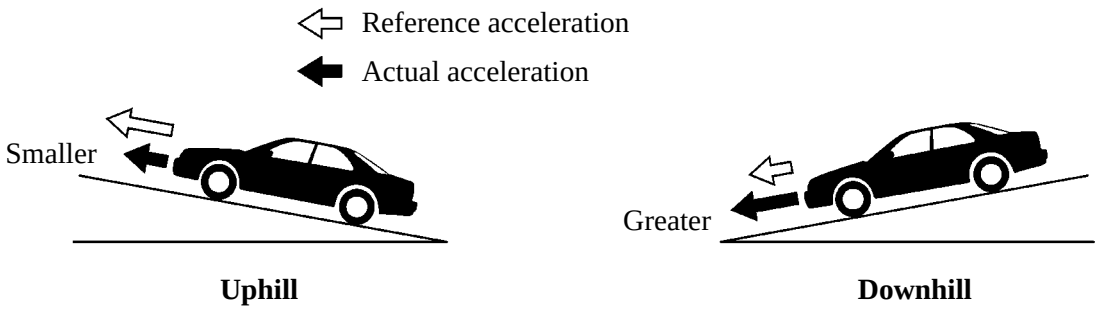


1) Uphill/Downhill Judgment

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

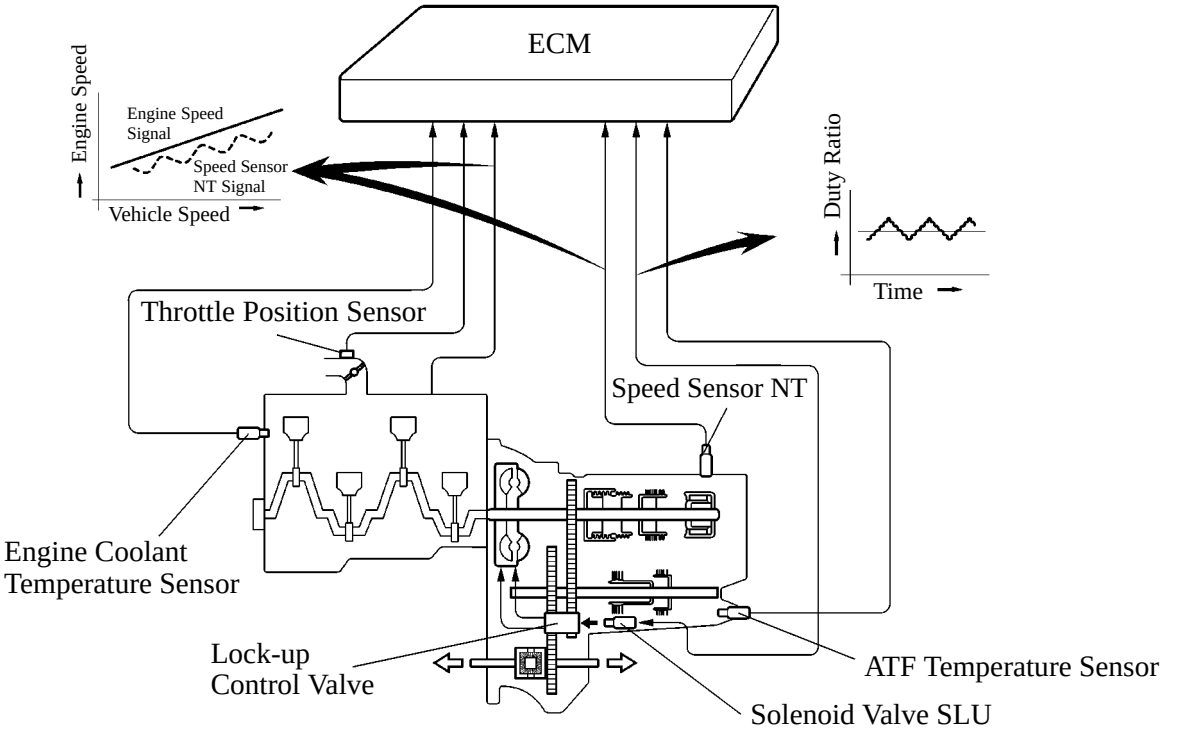
Actual Acceleration < Reference Acceleration

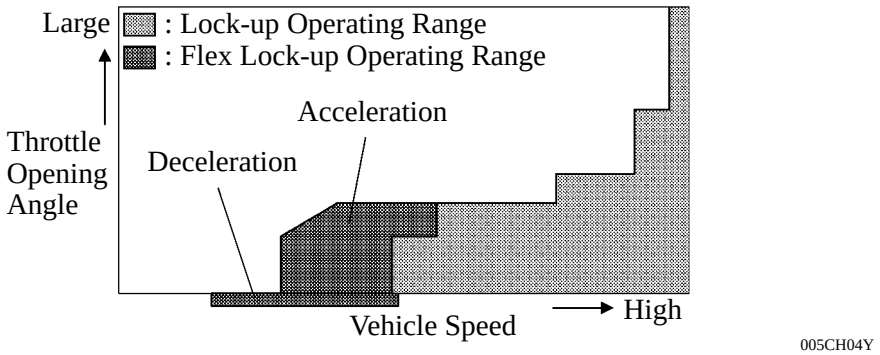
Actual Acceleration > Reference Acceleration



8. Flex Lock-up Clutch Control

In addition to the conventional lock-up timing control, flex lock-up clutch control is used.
This flex lock-up clutch control regulates the solenoid valve SLU as an intermediate mode between the ON/OFF operation of the lock-up clutch.
The flex lock-up clutch control operates during acceleration, in the 3rd and 4th gears in the D range, and during deceleration, in the 3rd and 4th gears in the D range, and in the 3rd gear in the 3 range.





Flex Lock-up Operating Range

▶ Flex Lock-up Operation Gears in D and 3 Range ◀

Range	Gear	Acceleration Flex Lock-up	Deceleration Flex Lock-up
D	1st	x	x
	2nd	x	x
	3rd	○	○
	4th	○	○
3	1st	x	x
	2nd	x	x
	3rd	x	○

9. Diagnosis

- When the ECM detects a malfunction, the ECM makes a diagnosis and memorizes the failed section. Furthermore, the MIL (Malfunction Indicator Lamp) in the combination meter illuminates or blinks to inform the driver.
- At the same time, the DTCs (Diagnosis Trouble Codes) are stored in the memory. The DTCs can be read by connecting the hand-held tester. For details, see the '06 Yaris Repair Manual (Pub. No. RM00R0U).

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 a ATF temperature sensor malfunction, the 4th upshift is prohibited.
Solenoid Valve SLT or SLU	During a solenoid valves SLT or SLU malfunction, the 4th upshift is prohibited.
Engine Coolant 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