■U341E AUTOMATIC TRANSAXLE

1. General

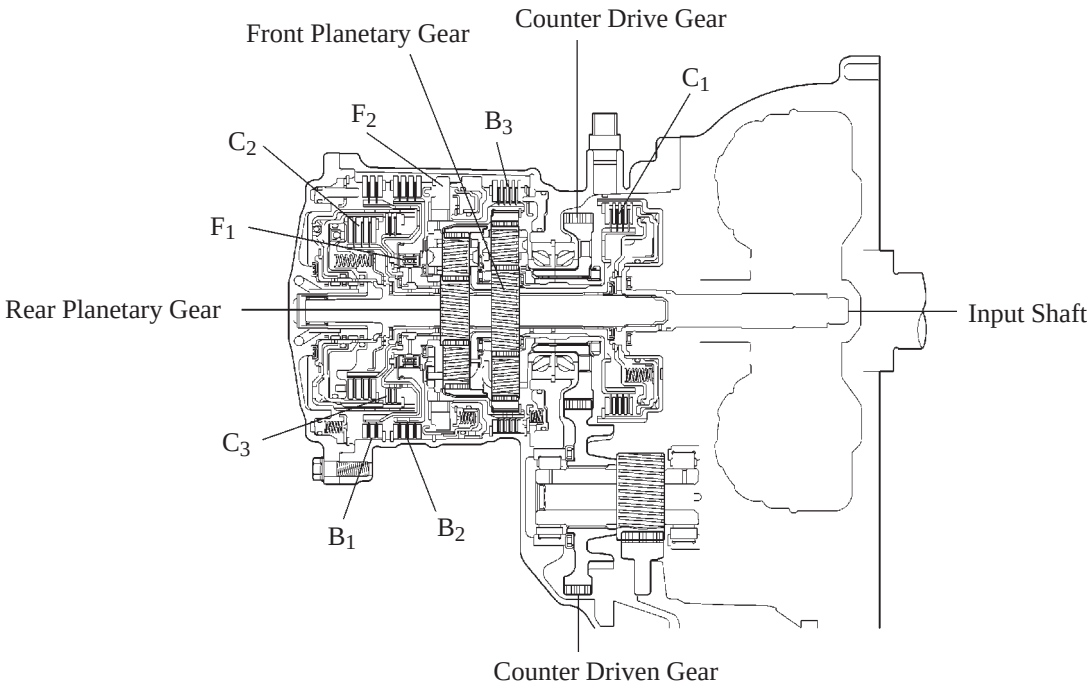
The compact and high-capacity 4-speed U341E automatic transaxle [Super ECT (Electronic Controlled Transaxle)] is used.
The following chart describes the changes from the previous model.

Destination	New Model	Previous Model	Change (from previous model)
Europe	U341E	A246E	Adopted newly. ● Multi-mode automatic transmission has been adopted. ● The shift lever with multi-mode automatic transmission has been adopted. ● DTC (Diagnostic Trouble Codes) changed

▶ Specification ◀

Model		New	Previous
Transaxle		U341E	A246E
Engine		1ZZ-FE	1ZZ-FE
Gear Ratio*1	1st	2.847	4.005
	2nd	1.552	2.208
	3rd	1.000	1.425
	4th	0.700	0.981
	Reverse	2.343	3.272
Differential Gear Ratio		4.237	2.962
Fluid Capacity*2 Liters (US qts, Imp.qts)		6.9 (7.3, 6.1)	7.6 (8.0, 6.7)
Fluid Type		ATF Type T-IV	ATF Type D-II
Weight (Reference)*3 kg (lb)		70 (31.8)	80.2 (36.4)

*1: Counter Gear Ratio Included
*2: Differential Included
*3: Weight shows the figure with the fluid fully filled



▶ Specification ◀

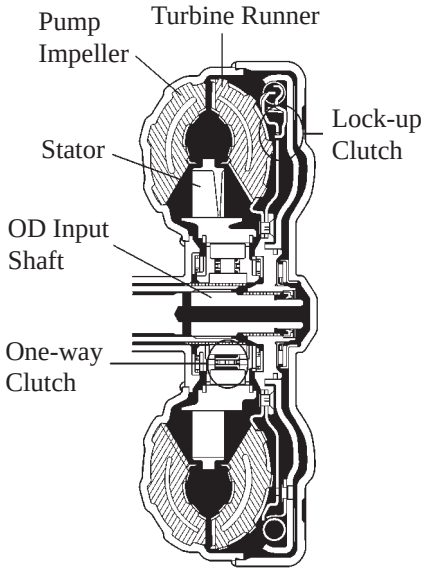
C_1	Forward Clutch	The No. of Discs	4
C_2	Direct Clutch		3
C_3	Reverse Clutch		3
B_1	OD & 2nd Brake		2
B_2	2nd Brake		4
B_3	1st & Reverse Brake		4
F_1	No.1 One-Way Clutch	The No. of Sprags	16
F_2	No.2 One-Way Clutch	The No. of Rollers	15
Front Planetary Gear		The No. of Sun Gear Teeth	46
		The No. of Pinion Gear Teeth	21
		The No. of Ring Gear Teeth	85
Rear Planetary Gear		The No. of Sun Gear Teeth	32
		The No. of Pinion Gear Teeth	21
		The No. of Ring Gear Teeth	75
Counter Gear		The No. of Drive Gear Teeth	52
		The No. of Driven Gear Teeth	53

2. Torque Converter

- This torque converter has optimally designed fluid passages and impeller configuration resulting in substantially enhanced transmission efficiency to ensure better starting, acceleration and fuel economy.
- Furthermore, a hydraulically operated lock-up mechanism which cuts power transmission losses due to slippage at medium and high speeds is used.

▶ Specification ◀

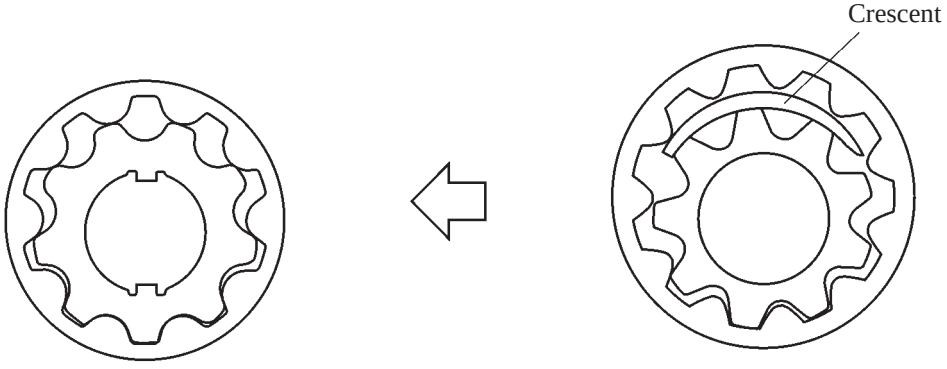
Torque Converter Type	3-Element, 1-Step, 2-Phase (with Lock-up Mechanism)
Stall Torque Ratio	1.8



240CH102

3. Oil Pump

The shape of the teeth in the oil pump have been changed and the crescent has been discontinued, has been adopted.
As a result, the oil pump has been made more compact, and the driving torque has been reduced, thus attaining excellent volumetric efficiency during low-speed operation.



U341E **Conventional**

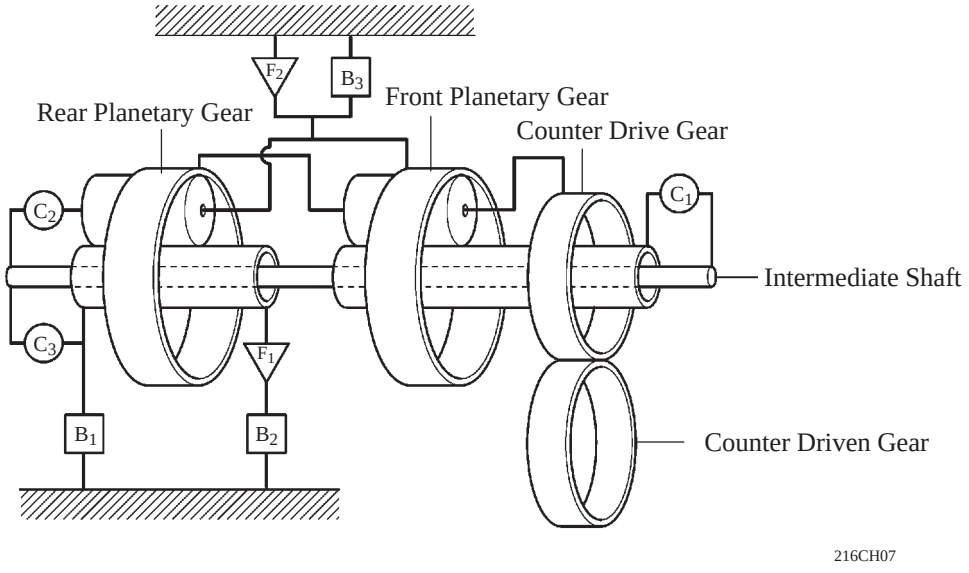
165CH10

4. Planetary Gear Unit

Construction

▶A CR-CR type planetary gear has been adopted in the planetary gear unit, which is located on the input shaft. This planetary gear is a type of planetary gear unit that joins the front and rear planetary carriers to the ring gear. As a result, the unit has been made significantly more simple and compact.

▶A centrifugal fluid pressure canceling mechanism has been adopted in the C_1 clutch, which is applied when the gears are shifted from 3rd to 4th.



Function of Component

Component		Function
C_1	Forward Clutch	Connect input shaft and front planetary sun gear.
C_2	Direct Clutch	Connect intermediate shaft and rear planetary carrier.
C_3	Reverse Clutch	Connect intermediate shaft and rear planetary sun gear.
B_1	OD & 2nd Brake	Lock the rear planetary sun gear.
B_2	2nd Brake	Prevents rear planetary sun gear from turning counterclockwise.
B_3	1st & Reverse Brake	Lock the front planetary ring gear and rear planetary carrier.
F_1	No.1 One-Way Clutch	Prevents rear planetary sun gear from turning counterclockwise.
F_2	No.2 One-Way Clutch	Prevents front planetary ring gear and rear planetary carrier from turning counterclockwise.
Planetary Gears		These gears change the route through which driving force is transmitted, in accordance with the operation of each clutch and brake, in order to increase or reduce the input and output speed.

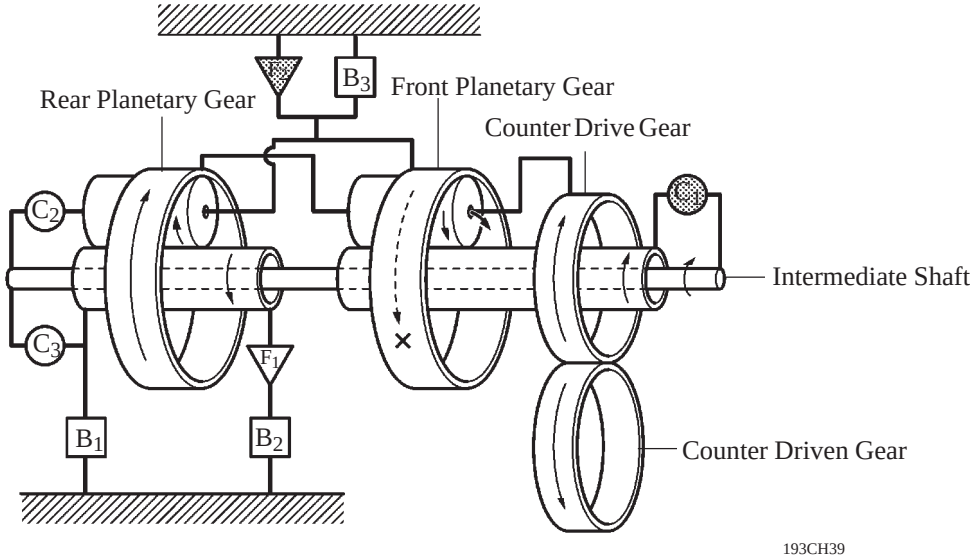
Transaxle Power Flow

Shift Lever Position	Gear	Solenoid Valve		Clutch			Brake			One-way Clutch	
		S_1	S_2	C_1	C_2	C_3	B_1	B_2	B_3	F_1	F_2
P	Park										
R	Reverse										
N	Neutral										
D, S (4)*	1st										
	2nd										
	3rd										
	4th										
S (3)*	1st										
	2nd										
	3rd										
S(2)*	1st										
	2nd										
S (1)*	1st										

: Operation

* : When the shift lever position is “S” and the range position indicator shows “4”, “3”, “2” or “1”

1st Gear (D or S mode 2, 3, 4 Position)



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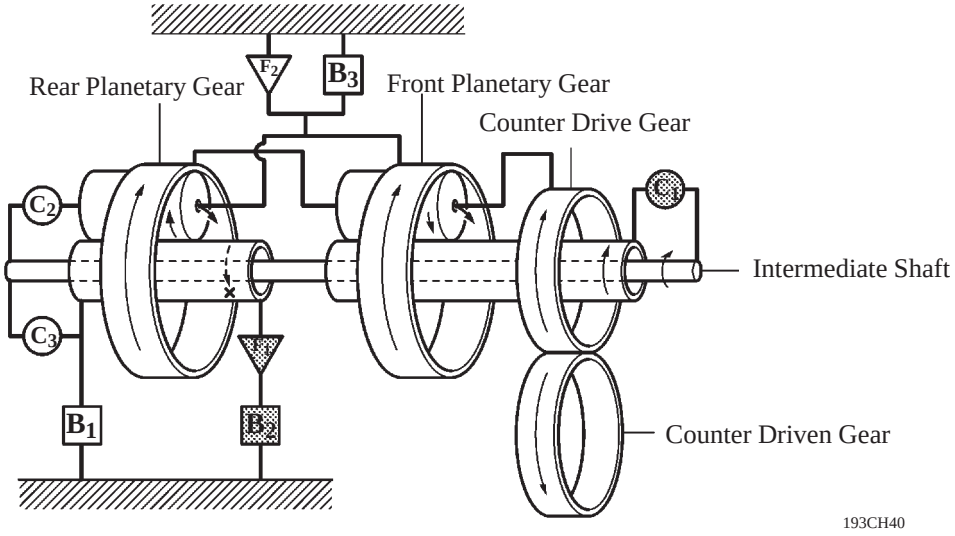
2nd Gear (D or S mode 3, 4 Position)



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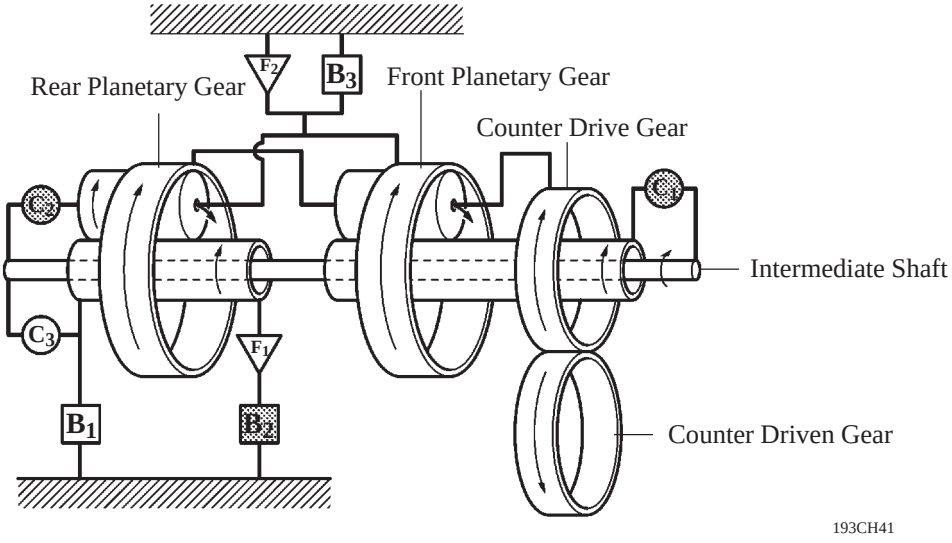
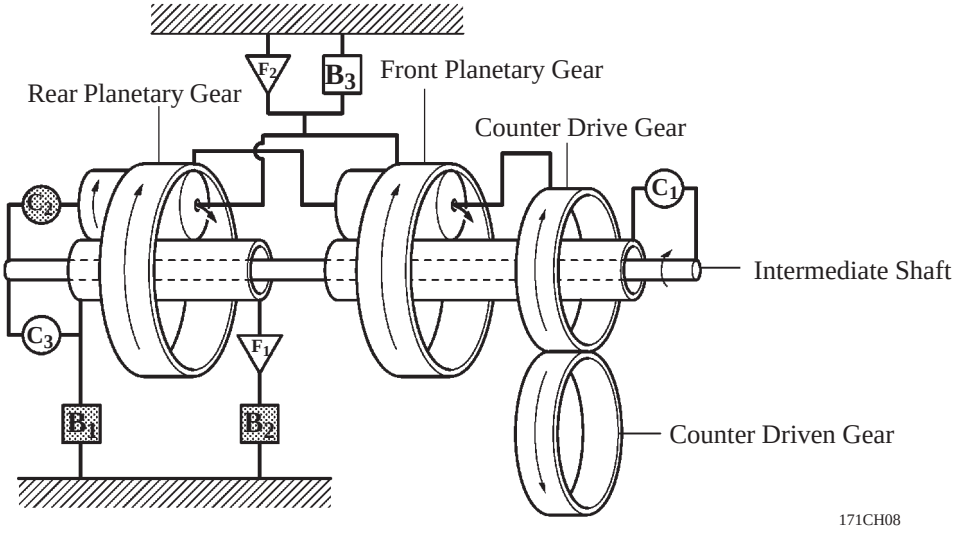
3rd Gear (D or S mode 3, 4 Position)



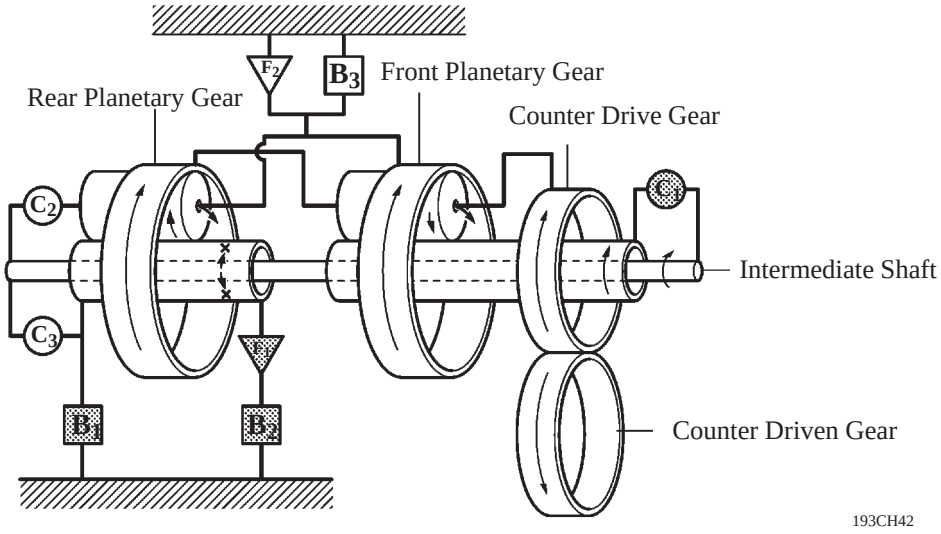
193CH41

4th Gear (D or S mode 4 Position)

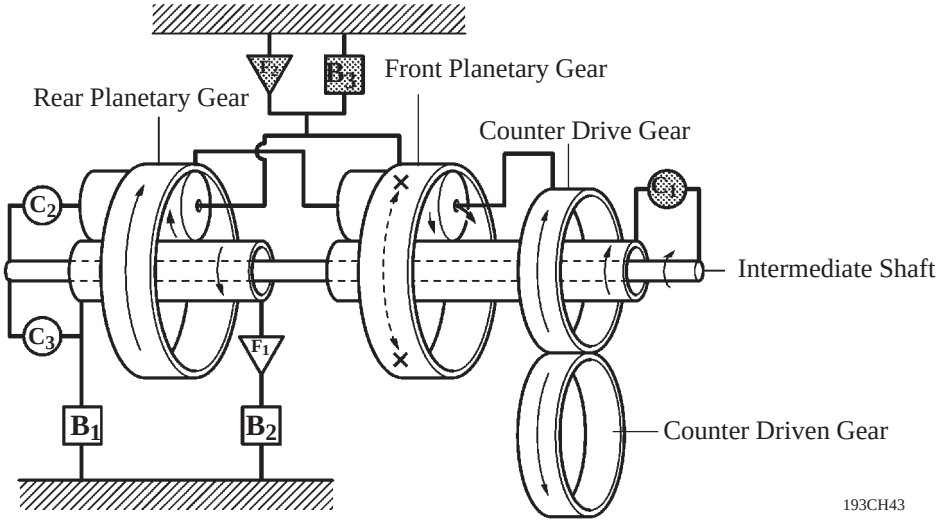


171CH08

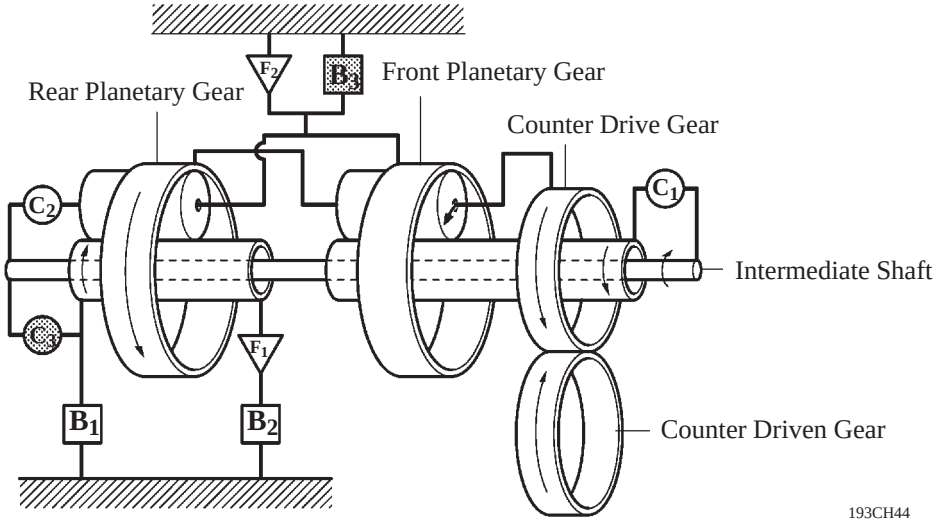
2nd Gear (S mode 2 Position)



1st Gear (S mode 1 Position)



Reverse Gear (R Position)



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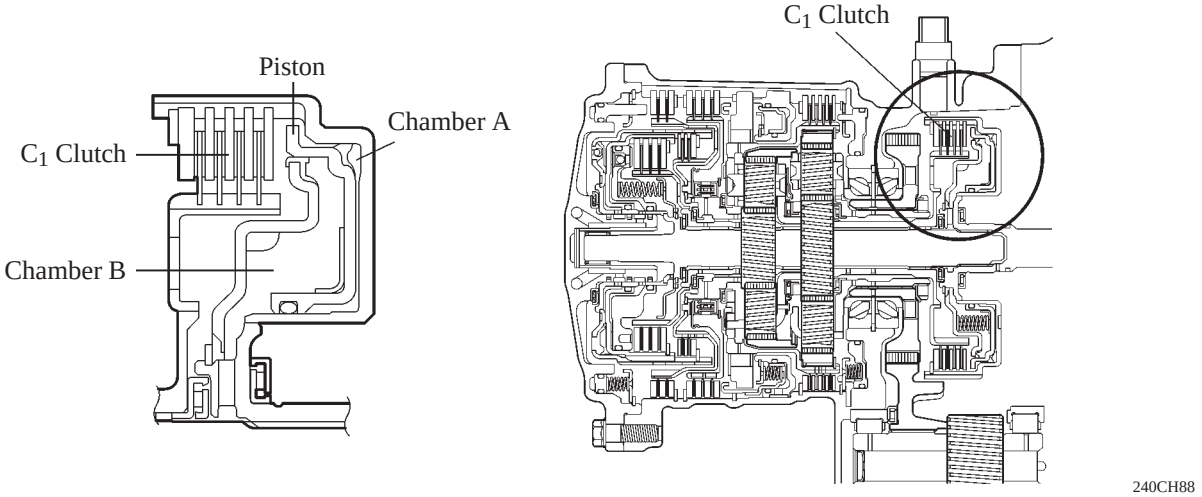
Centrifugal Fluid Pressure Canceling Mechanism

▶A centrifugal fluid pressure canceling mechanism has been adopted in the C_1 clutch. There are two reasons for improving the conventional clutch mechanism:

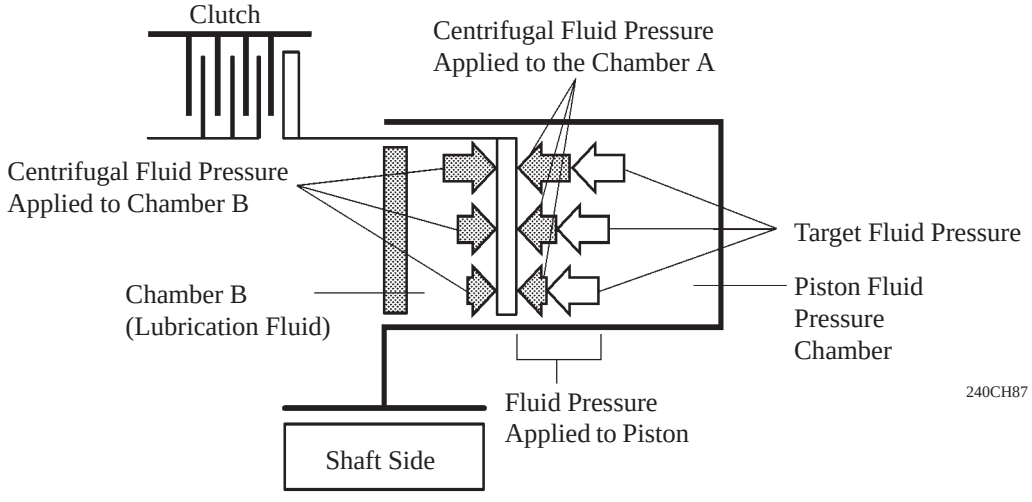
▶To prevent the generation of pressure by centrifugal force applied to the fluid in the piston fluid pressure chamber (hereafter referred to as "chamber A") when the clutch is released, a check ball was provided. Therefore, before the clutch could be subsequently applied, it took time to fill chamber A.

▶During shifting, in addition to the original clutch pressure that is controlled by the valve body, centrifugal pressure acts on the fluid in the chamber A exerting increased pressure depending on RPM.

▶To address these two needs for improvement, a canceling fluid pressure chamber (hereafter referred to as "chamber B") has been provided opposite chamber A.



By utilizing the lubrication fluid such as that of the shaft, the same amount of centrifugal force is applied, thus canceling the centrifugal force that is applied to the piston itself. Accordingly, it is not necessary to discharge the fluid through the use of a check ball, and a highly responsive and smooth shifting characteristic has been achieved.

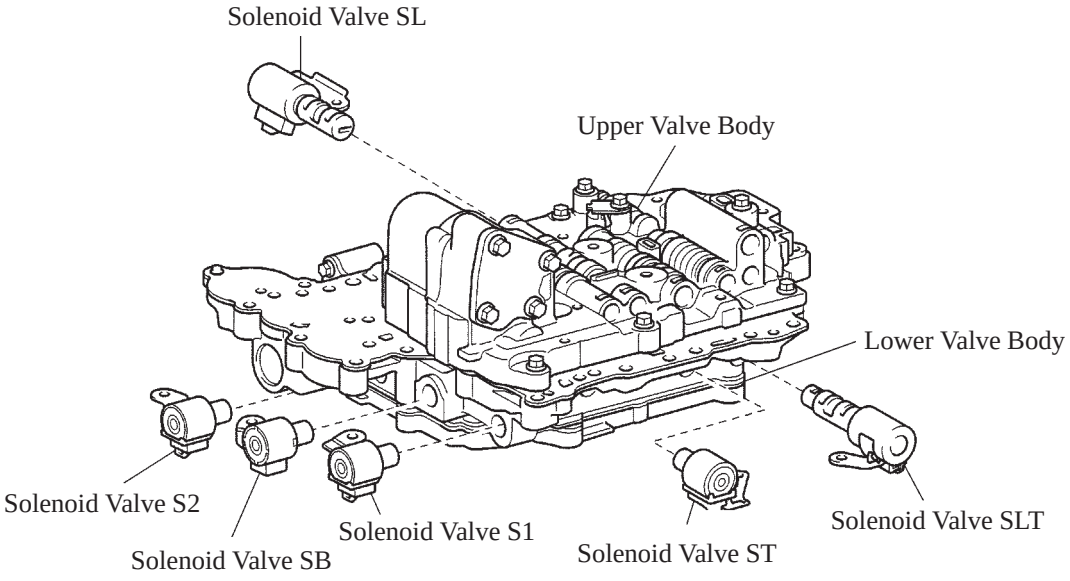


Centrifugal fluid pressure applied to chamber A	=	Centrifugal fluid pressure applied to chamber B				
Target fluid pressure (original clutch pressure)	=	Fluid pressure applied to piston	–	Centrifugal fluid pressure applied to chamber B		

5. Valve Body Unit

General

- The valve body consists of the upper and lower valve bodies and 6 solenoid valves.
- The 6 solenoid valves are installed in the lower valve body for serviceability.



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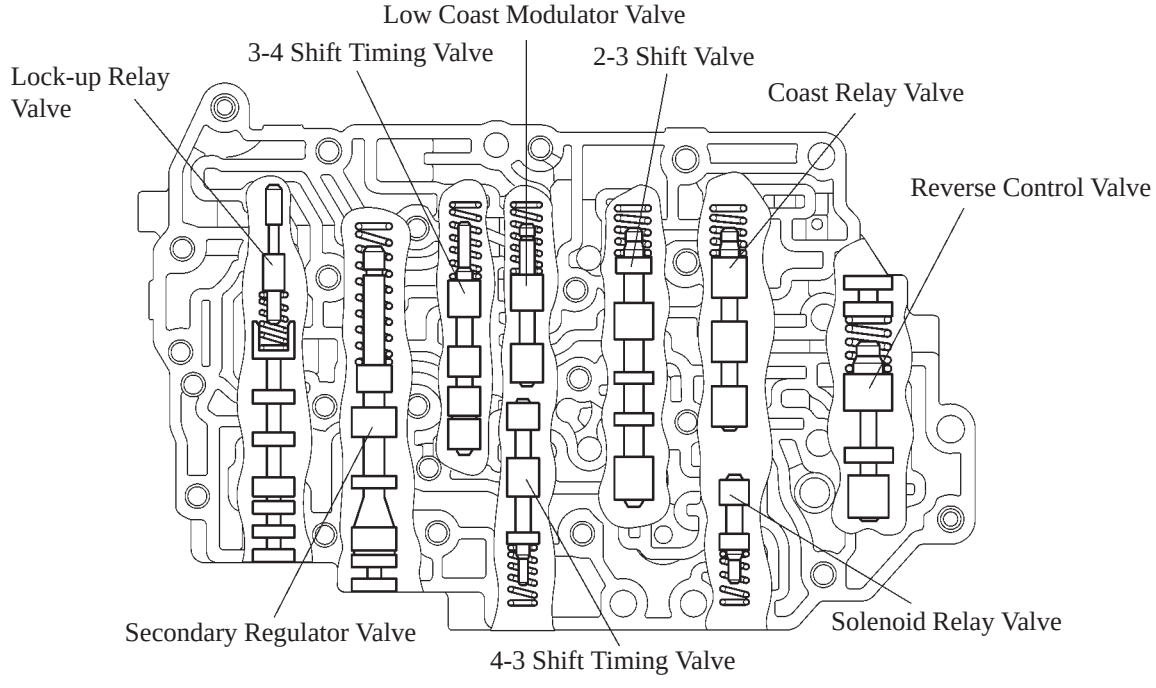
▶ Upper Valve Body ◀



240CH103

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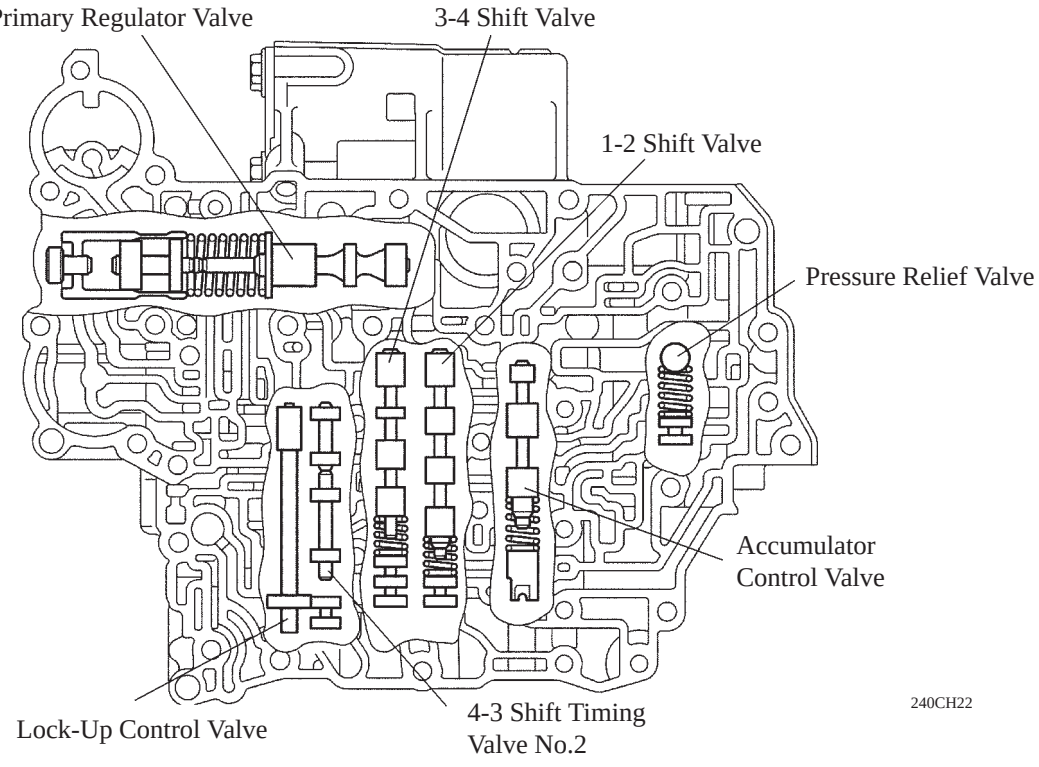
▶ Lower Valve Body ◀



Function of Solenoid Valve

Solenoid Valve	Action	Function
S1	For 2-3 shift valve control	Shift gears by switching the 2-3 shift valve and controlling the C_2 clutch.
S2	For 1-2 and 3-4 shift valve control	Shift gears by switching the 1-2 and 3-4 shift valves and controlling 2 clutches (C_1 and C_2) and 2 brakes (B_1 and B_2).
ST	For clutch to clutch pressure control	Switches 3-4 and 4-3 shift valves.
SL	For clutch engagement pressure control	Controls the lock-up clutch.
SLT	For line pressure control	Controls the line pressure, secondary pressure, and accumulator back pressure.
SB	For engine brake control	Controls the 2nd brake (B_1) and 1st and reverse brake (B_3) pressures and performs the 1st and 2nd engine brake control.

6. Electronic Control System

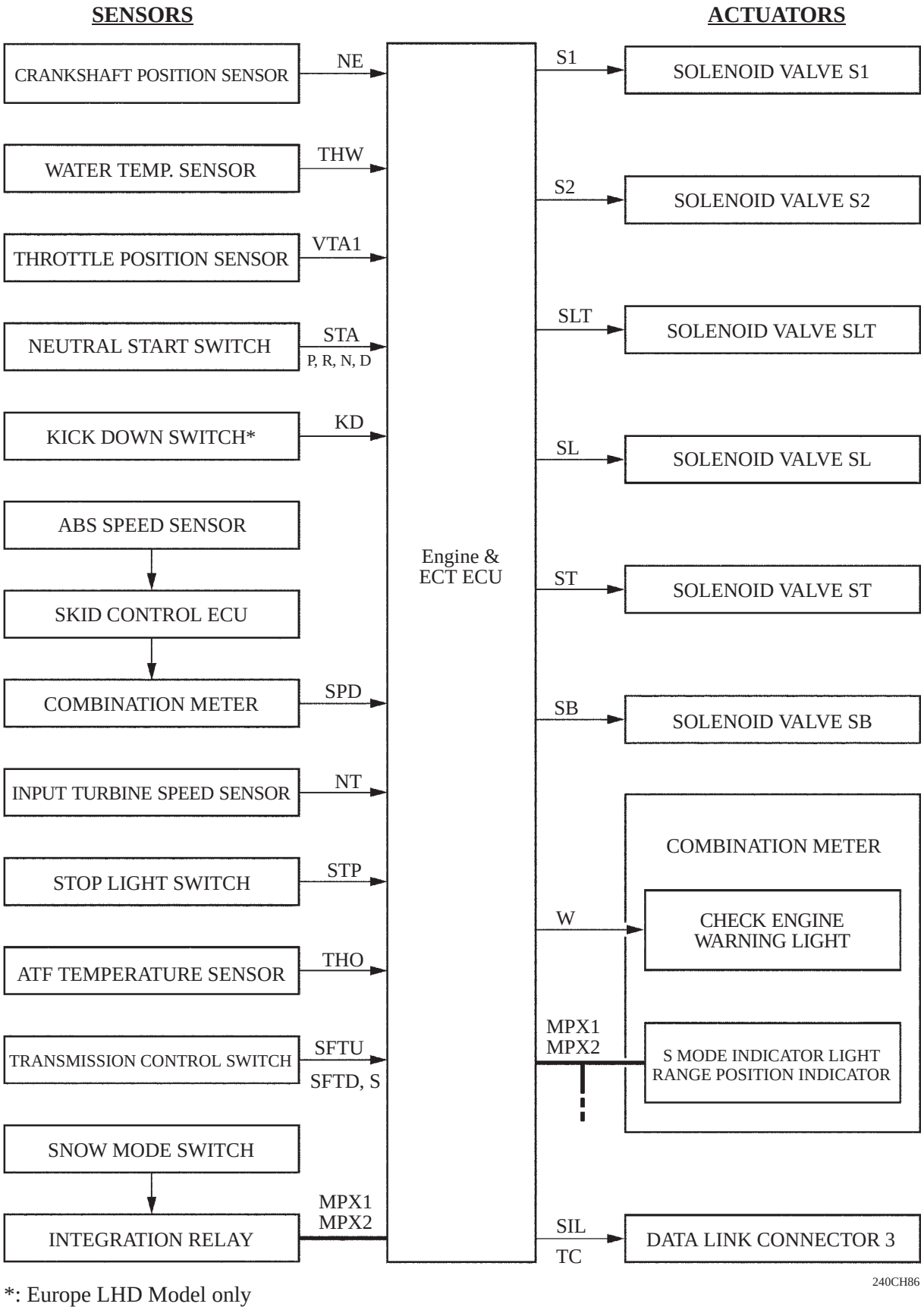
General

The electronic control system of the U341E automatic transaxle consists of the controls listed below.

System	Function
Clutch Pressure Control	The solenoid valve SLT minutely controls the clutch pressure in accordance with the engine output and driving conditions.
Line Pressure Control	Actuates the solenoid valve SLT to control the line pressure in accordance with information from the engine & ECT ECU and the operating conditions of the transaxle.
Engine Torque Control	Retards the engine ignition timing temporarily to improve shift feeling during up or down shifting .
Shift Control in Uphill Traveling	Controls to restrict the 4th upshift or to provide appropriate engine braking by using the engine & ECT ECU to determine whether the vehicle is traveling uphill.
Shift Timing Control	The engine & ECT ECU sends current to the solenoid valve S1 and/or S2 based on signals from each sensor and shifts the gear.
Lock-up Timing Control	The engine & ECT ECU sends current to the shift solenoid valve SL based on signals from each sensor and engages or disengages the lockup clutch.
“N” to “D” Squat Control	When the shift lever is shifted from “N” to “D” position, the gear is temporarily shifted to 2nd and then to 1st to reduce vehicle squat.
2nd Start Control (SNOW Mode)	Enabling the vehicle to take off in the 2nd gear and thus helps to take off on ice or snow.
Multi-Mode Automatic Transmission	The engine and ECT ECU perform shift control upon receiving signals from the transmission control switch (+: up-shift range switch signal and –: down-shift range switch signal). This system is the same as that of the U241E. (See page CH-33)
Diagnosis	When the engine & ECT ECU detects a malfunction, the engine & ECT ECU makes a diagnosis and memorizes the failed section.
	To increase the speed for processing the signals, the 32-bit CPU of the engine & ECT ECU has been adopted.
Fail-safe	Even if a malfunction is detected in the sensors or solenoids, the engine & ECT ECU effects fail-safe control to prevent the vehicle’s drivability from being affected significantly.

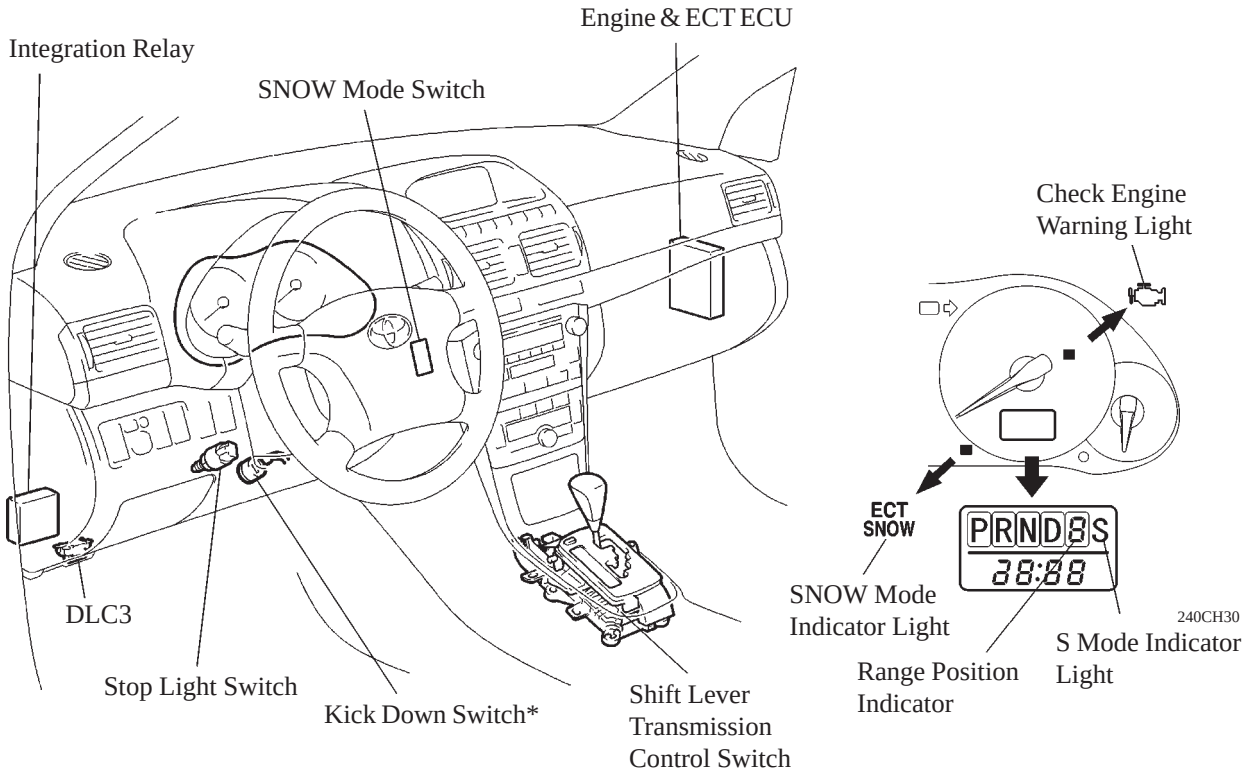
2. Construction

The configuration of the electronic control system in the U341E automatic transaxle is as shown in the following chart.

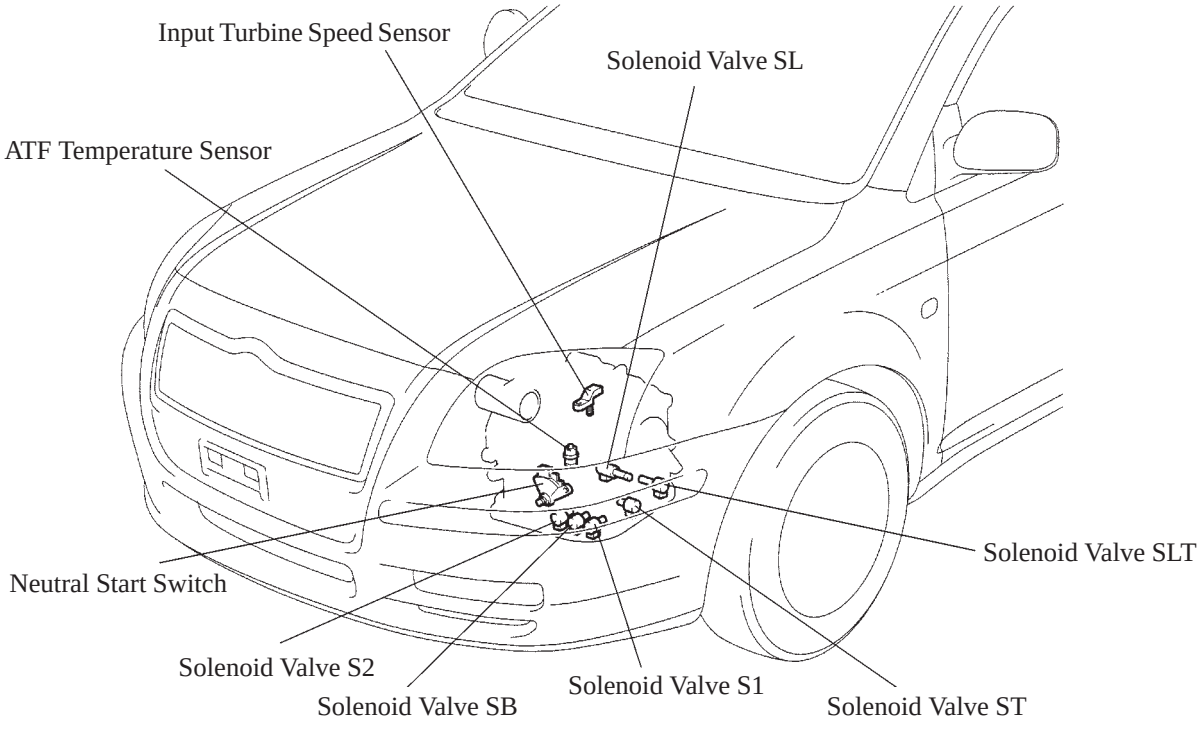


*: Europe LHD Model only

3. Layout of Component



*: Only for the Engine LHD Models



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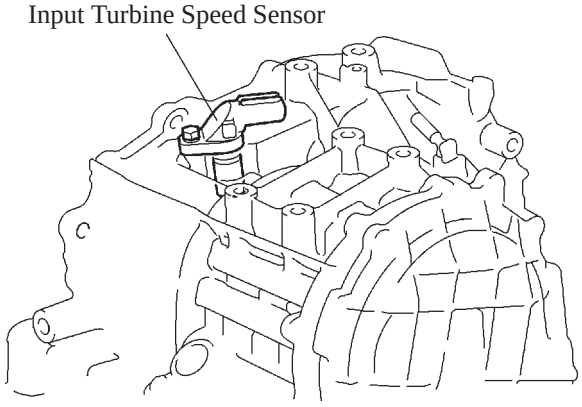
Construction and Operation of Main Component

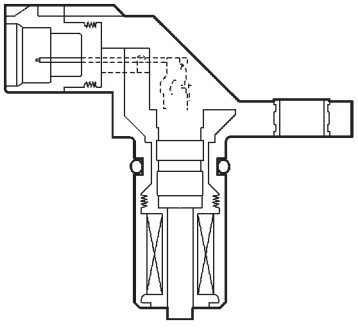
1) Fluid Temperature sensor

A fluid temperature sensor is installed in the valve body for direct detection of the fluid temperature. Fluid temperature sensor is used for adjusting clutch and brake pressures to keep the shift quality smooth.

2) Input Turbine Speed Sensor

This sensor 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 & ECT ECU can detect the timing of the shifting of the gears and appropriately control the engine torque and hydraulic pressure in response to the various conditions.





Cross Section

216CH12

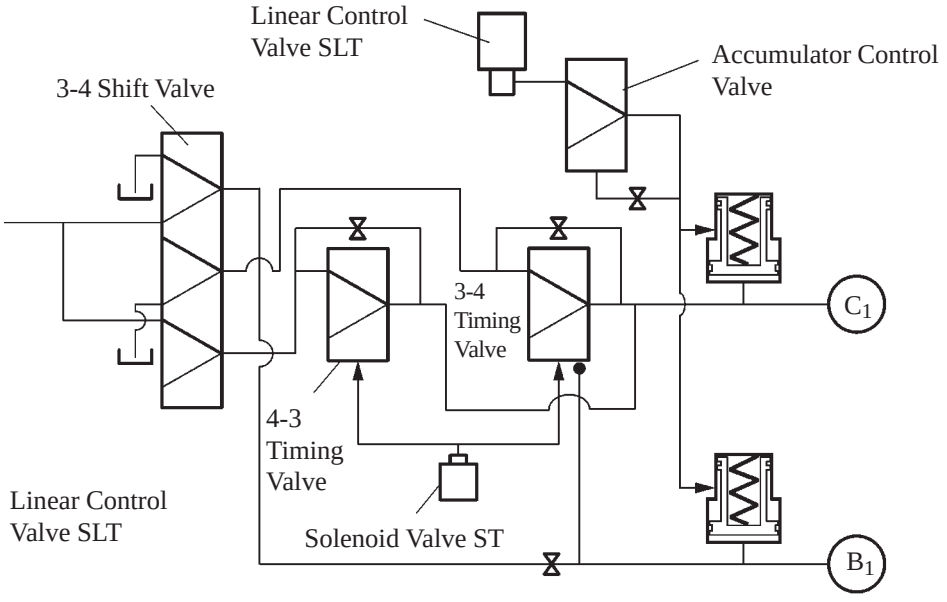
Transmission Control Switch

The structure and operation of the transmission control switch is the same as that of the U241E. (See page CH-29)

Clutch Pressure Control

1) Clutch to Clutch Pressure Control

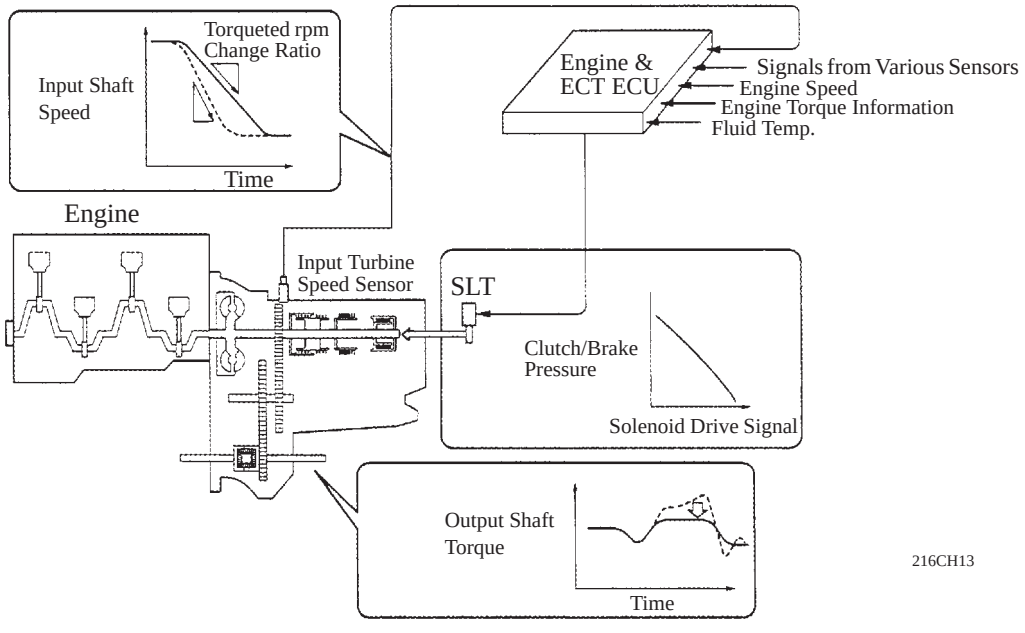
A clutch to clutch pressure control has been adopted for shifting from the 3rd to 4th gear, and from the 4th to 3rd gear. This actuates solenoid valves ST and SLT in accordance with the signals from the engine & ECT ECU, and guides this output pressure directly to the 4-3 timing valve and the 3-4 timing valve in order to regulate the line pressure that acts on the B_1 brake C_1 clutch. As a result, compact B_1 and C_1 accumulators without a back pressure chamber have been realized.
Smooth shifting is achieved by enabling the solenoid valve ST to switch the orifice of the 4-3 timing valve and the 3-4 timing valve.



171CH12

2) Clutch Pressure Optimal Control

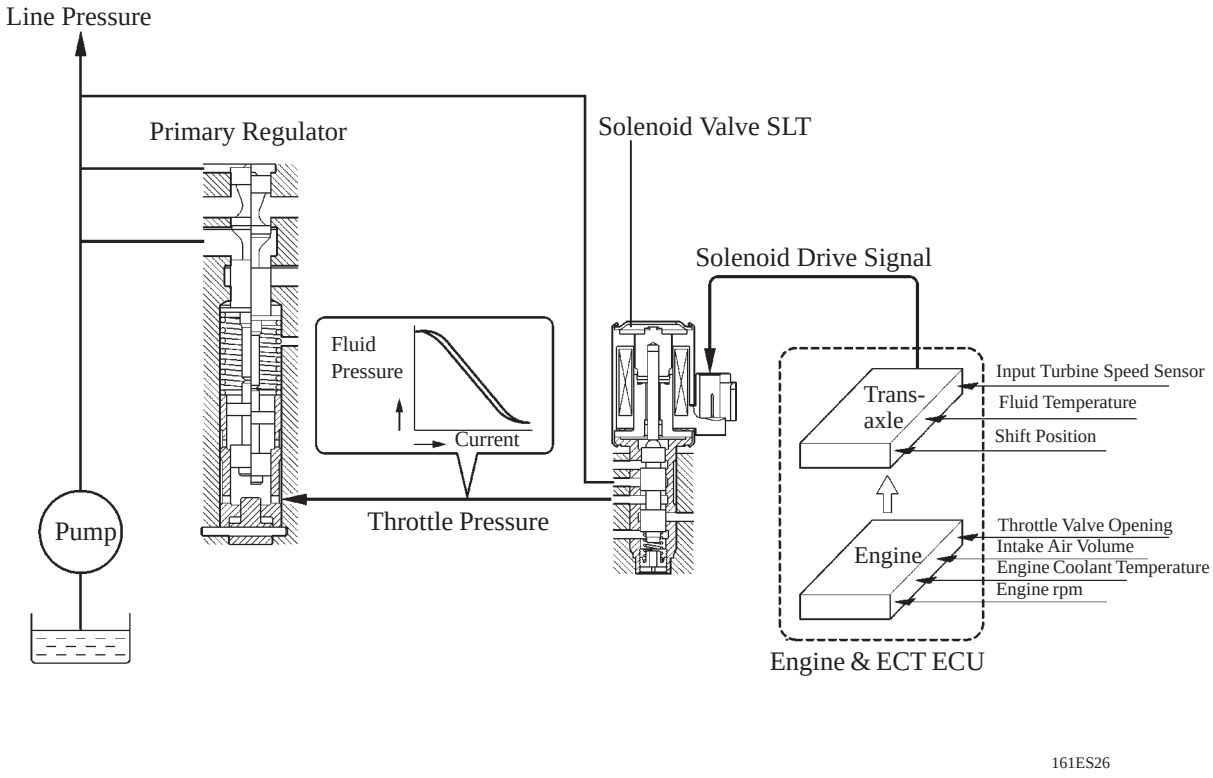
Solenoid valve SLT is used for optimal control of clutch pressure. The engine & ECT ECU monitors the signals from various types of sensors such as the input turbine speed sensor, allowing the solenoid valve SLT to minutely control the clutch pressure in accordance with engine output and driving conditions. Smooth shift characteristics are the result.



216CH13

Line Pressure Optimal 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 toque converter and the transaxle.
Accordingly, the line pressure can be controlled minutely in accordance with the engine output, driving conditions, and the ATF temperature, thus achieving smooth shifts and optimizing the workload in the oil pump.



161ES26

2nd start Control

- This control enables the driver to use a snow mode (momentary type) switch to select the snow mode which allows the vehicle to start in 2nd gear, thus is used to help starting on ice or snow.
- When the snow mode is selected while the shift position is in the “D”, “S mode 4”, “S mode 3” or “S mode 2” position, the vehicle can start in the 2nd gear. After a start, if the shift position is in the “D”, “S mode 4”, or “S mode 3” position, transmission will shift up automatically into 3rd and 4th gears, as usual. If the shift position is in the “S mode 2” position, the transmission will continue to operate in the 2nd gear.

▶ Shift Program ◀

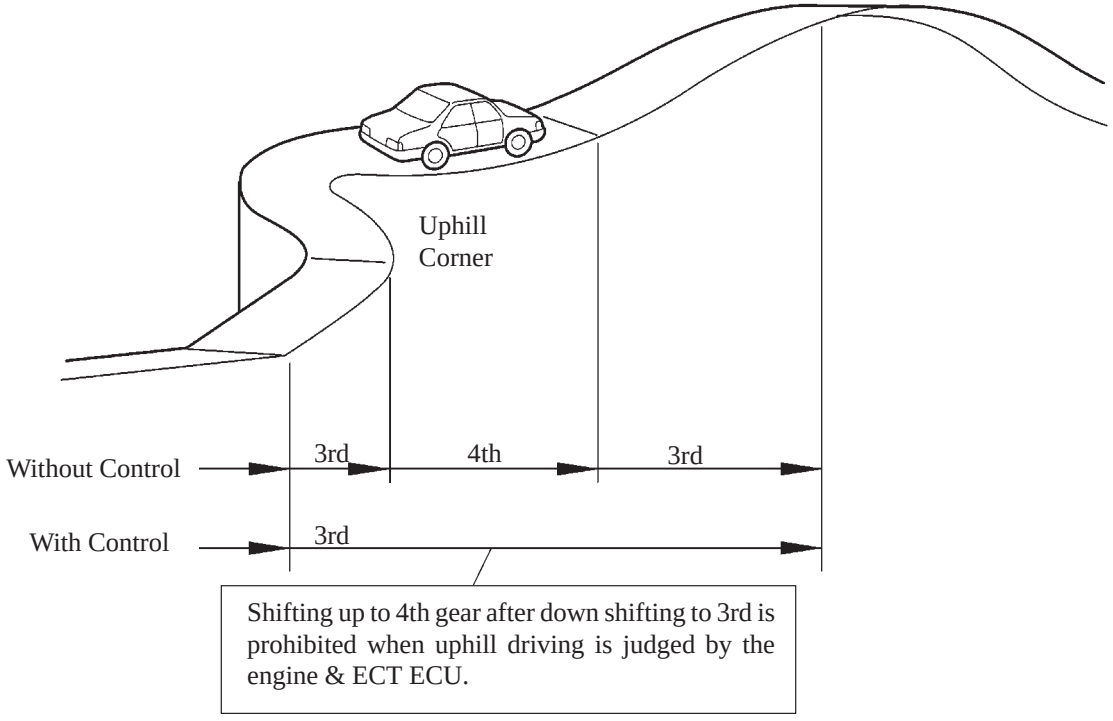
→ : Up Shift ← : Down Shift

Mode		Normal	Snow
Shift Position	D, S mode 4	1st ↔ 2nd ↔ 3rd ↔ 4th	2nd ↔ 3rd ↔ 4th
	S mode 3	1st ↔ 2nd ↔ 3rd	2nd ↔ 3rd
	S mode 2	1st ↔ 2nd ← 3rd	2nd ← 3rd
	S mode 1	1st ← 2nd	1st ← 2nd

Shifting Control in Uphill Driving

1) General

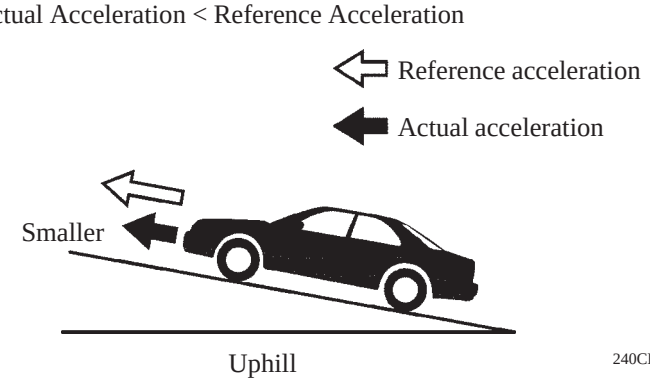
With shifting control in uphill driving, the engine & ECT ECU calculates the throttle opening angle and the acceleration rate to determine whether the vehicle is in the uphill state. While driving uphill on a winding road with ups and downs, the 4th upshift is restricted to ensure a smooth drive.



169CH53

2) Uphill Judgment

The actual acceleration calculated from the speed sensor signal is compared with the reference acceleration stored in the engine & ECT ECU to judge uphill driving.
The engine & ECT ECU judges an uphill condition if the actual acceleration is smaller than the reference acceleration, and restricts the 3rd to 4th upshift after a 4th to 3rd downshift has occurred.



240CH27

Fail Safe

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

▶ Fail Safe List ◀

Malfunction Part	Function
Vehicle Speed Signal	During a vehicle speed signal malfunction, 4th upshift prohibited.
Input Turbine Speed Sensor	During an input turbine speed signal, 4th upshift prohibited.
Fluid Temp. Sensor	During a fluid temp. sensor malfunction, 4th upshift prohibited.
Solenoid Valve SLT or SL	During a solenoid valves SLT or SL malfunction, 4th upshift prohibited.
Solenoid Valve SB	During a solenoid valve SB malfunction, S shift control prohibited, and the driving mode turns to the ordinal D range.
Water Temp. Sensor, Knock Sensor, or Throttle Position Sensor	During a engine coolant temp. sensor, knock sensor, or throttle position sensor malfunction, 4th upshift 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.

When all solenoids are Normal			When solenoid valve S1 is abnormal			When solenoid S2 is abnormal			When solenoid S1 and S2 are abnormal		
Solenoid		Gear	Solenoid		Gear	Solenoid		Gear	Solenoid		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

8. Diagnosis

- When the engine & ECT ECU detects a malfunction, it 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 a hand-held tester. For details, see the Avensis Repair Manual (Pub. No. RM1018E).

Service Tip

The length of time to clear the DTC by disconnecting the battery terminal has been changed from 10 seconds to 1 minute.