■ELECTRONIC CONTROL SYSTEM

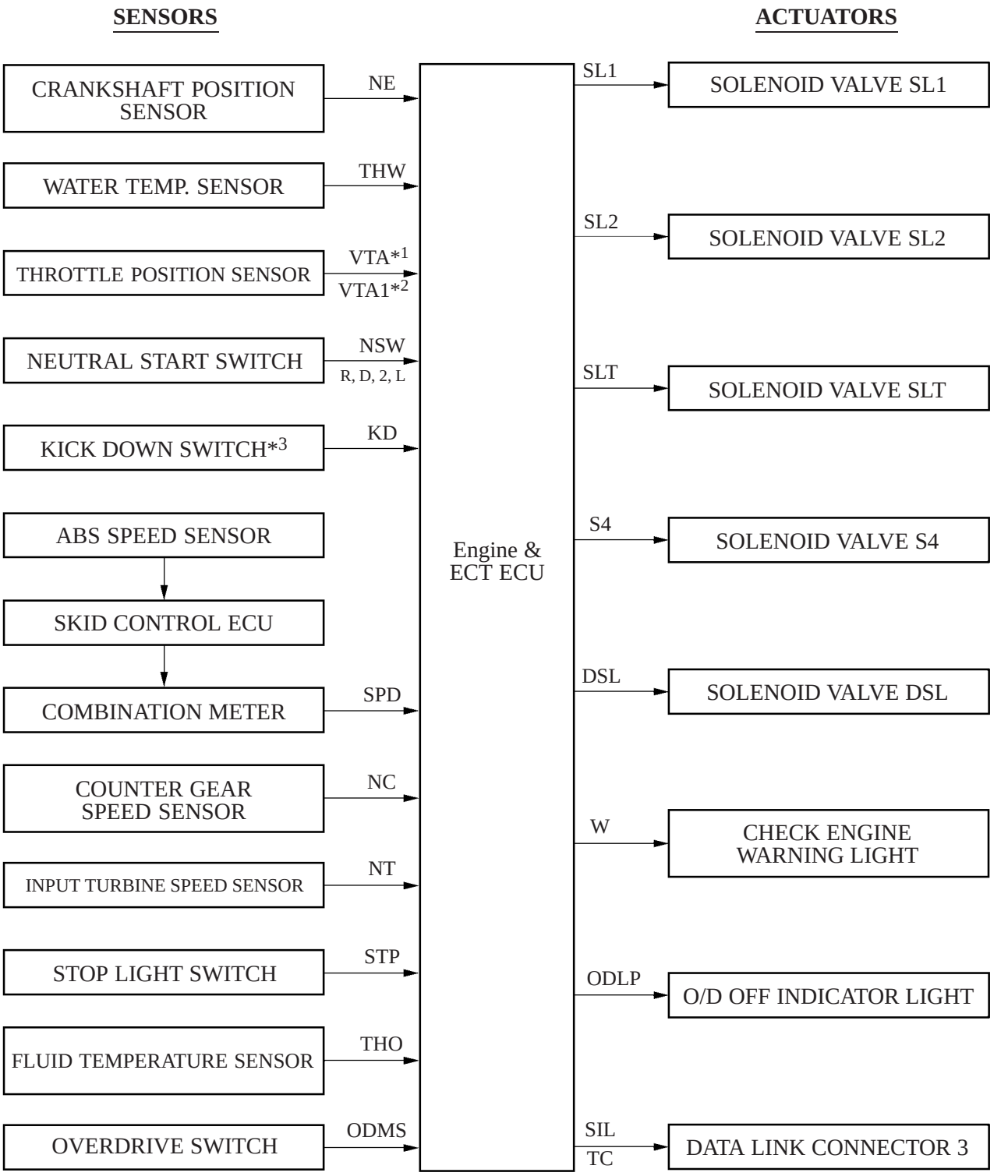
1. General

The electronic control system of the U140E and U241E automatic transaxles consists of the control listed below.

System	Function	U140E, U241E	A541E
Clutch Pressure Control	• Controls the pressure that is applied directly to B_1 brake and C_2 clutch by actuating the shift solenoid valve (SL1, SL2) in accordance with engine & ECT ECU signals. • The solenoid valves SL1 and SL2 minutely controls the clutch pressure in accordance with the engine output and driving conditions.	○	—
Line Pressure Optimal 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 Timing Control	The engine & ECT ECU sends current to the solenoid valve SL1 and/or SL2 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 (DSL) based on signals from each sensor and engages or disengages the lock-up clutch.	○	○
Accumulator Back Pressure Control	The engine & ECT ECU sends signals to solenoid valve SLN when gear shift occurs to temporarily lower the accumulator back pressure so that the gear shift is completed smoothly.	—	○
"N" to "D" Squat Control	When the shift lever is shifted from "N" to "D" position, the gear is temporarily shifted to 2nd or O/D and then to 1st to reduce vehicle squat.	—	○
	When the shift lever is shifted from "N" to "D" position, the gear is temporarily shifted to 3rd and then to 1st to reduce vehicle squat.	○	—
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

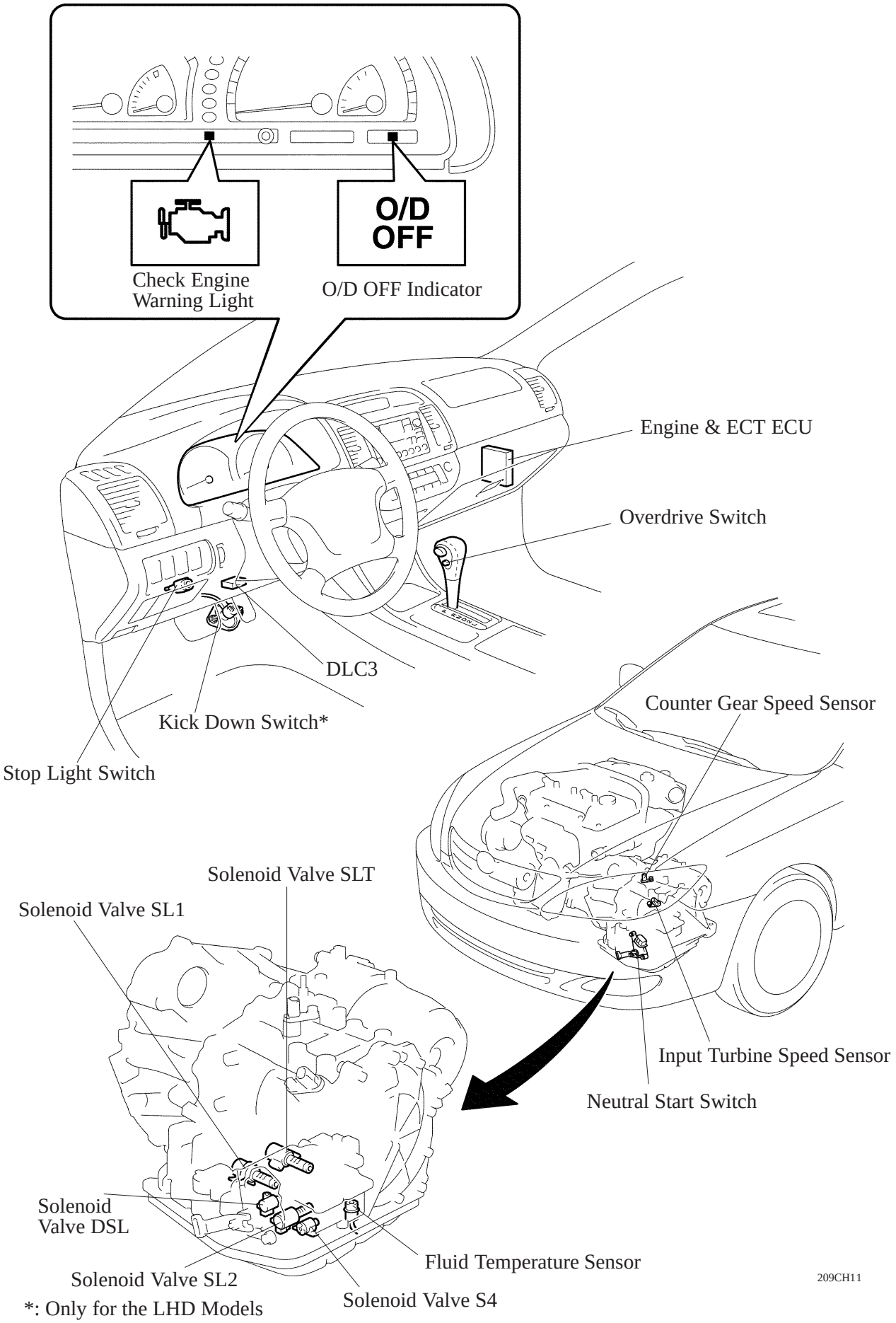
The configuration of the electronic control system in the U140E and U241E automatic transaxles are as shown in the following chart.



*1: 1AZ, 2AZ-FE Engine Model
*2: 1MZ-FE Engine Model
*3: Only for the LHD Models

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3. Layout of Component

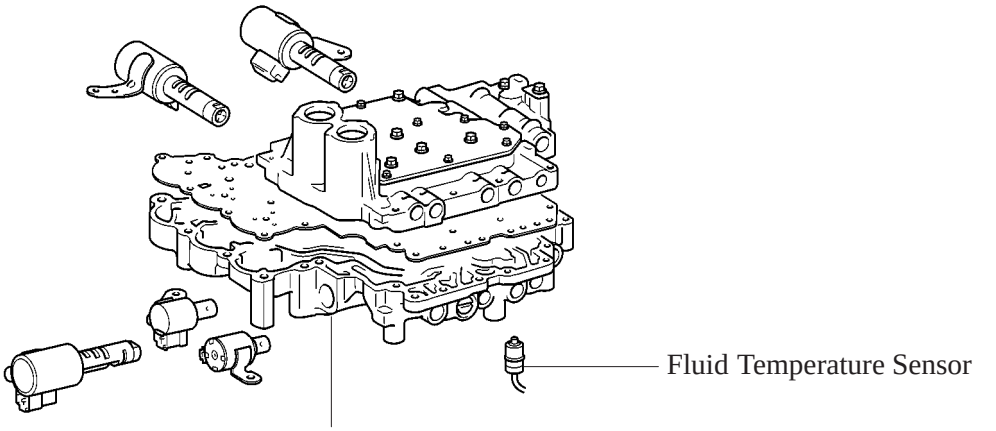


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4. Construction and Operation of Main Component

Fluid Temperature Sensor

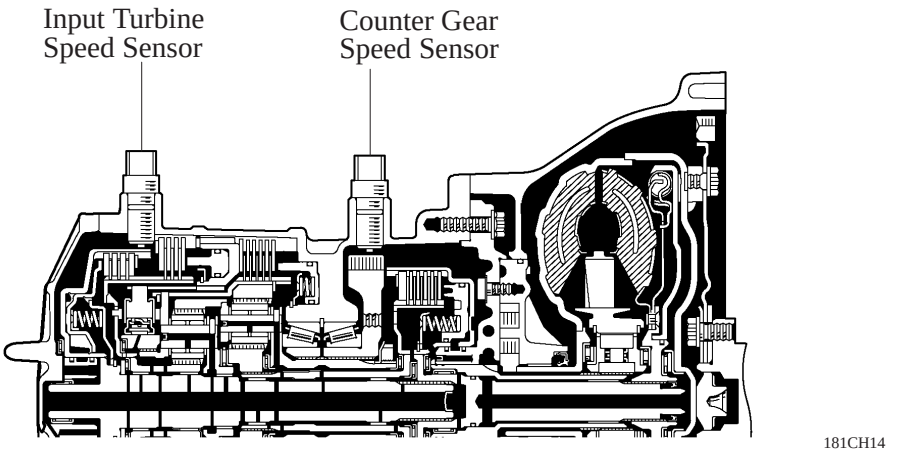
A fluid temperature sensor is installed in the valve body for direct detection of the fluid temperature. Fluid temperature sensor is used for revision of clutches and brakes pressure to keep smooth shift quality every time.



Speed Sensors

The U140E and U241E automatic transaxles have adopted an input turbine speed sensor (for the NT signal) and a counter gear speed sensor (for the NC signal). 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.

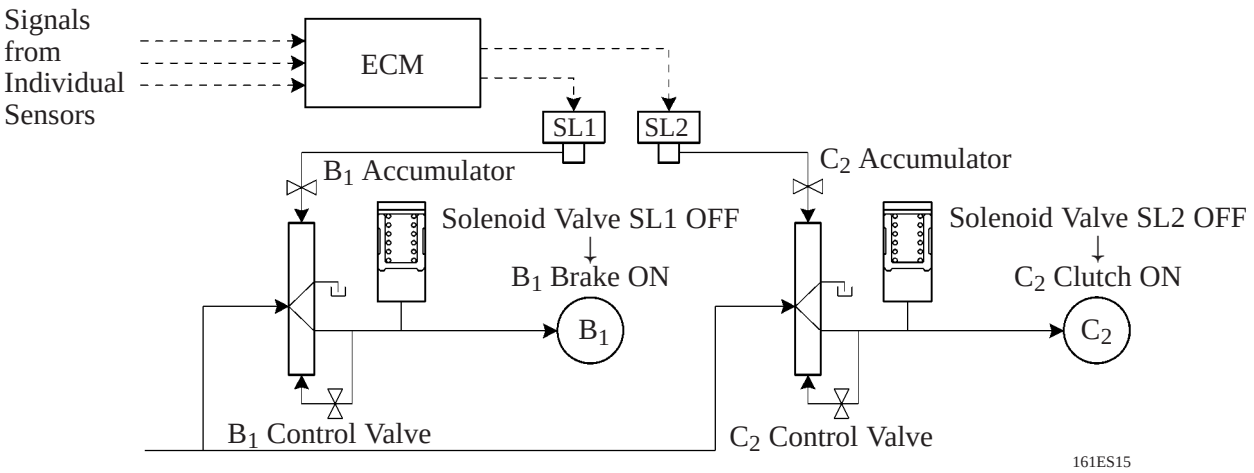
- The input turbine speed sensor detects the input speed of the transaxle. The direct clutch (C_2) drum is used as the timing rotor for this sensor.
- The counter gear speed sensor detects the speed of the counter gear. The counter drive gear is used as the timing rotor for this sensor.



5. Clutch Pressure Control

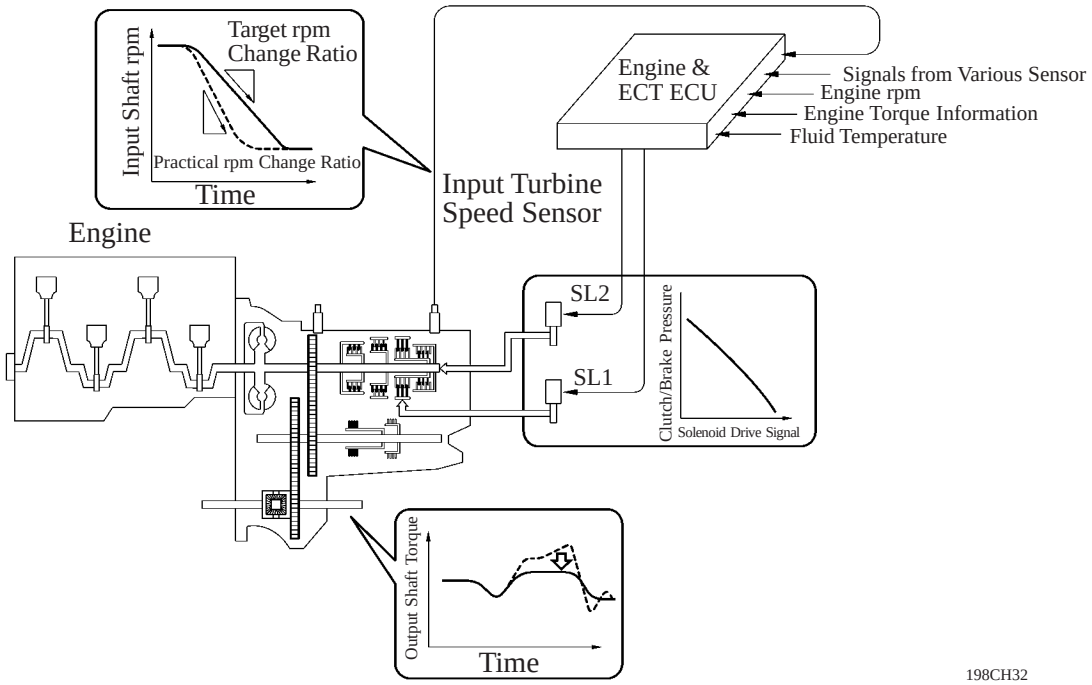
Clutch to Clutch Pressure Control

This control has been adopted for shifting from the 1st to 2nd gear, and from the 2nd to 3rd gear.
Actuates solenoid valves SL1 and SL2 in accordance with the signals from the engine & ECT ECU, and guides this output pressure directly to the control valves B_1 and C_2 in order to regulate the line pressure that acts on the B_1 brake and C_2 clutch.
As a result, compact B_1 and C_2 accumulators without a back pressure chamber have been realized.



Clutch Pressure Optimal Control

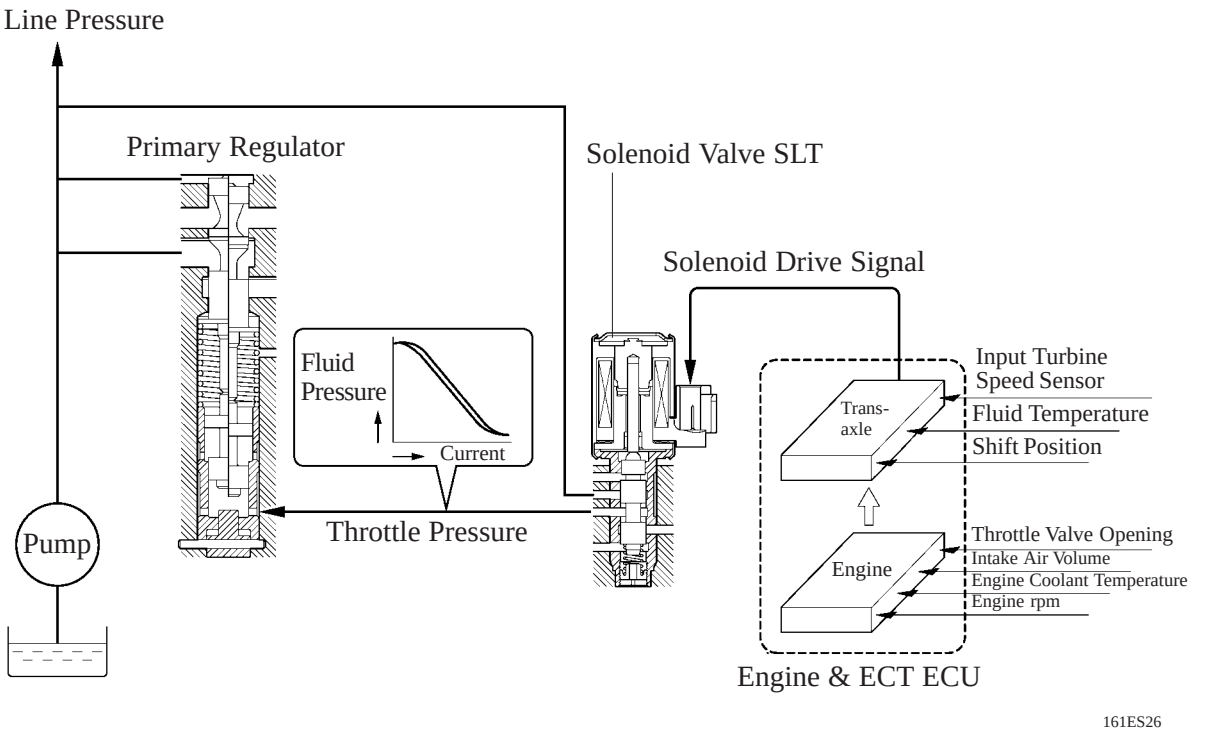
The engine & ECT ECU monitors the signals from various types of sensor such as the input turbine speed sensor, allowing shift solenoid valves SL1 and SL2 to minutely control the clutch pressure in accordance with engine output and driving conditions.
As a result, smooth shift characteristics have been realized.



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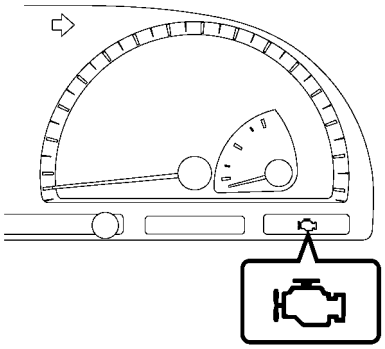
6. Line Pressure Optimal Control

Through the use of the solenoid valve SLT, the line pressure is optimally controlled in accordance with the engine toque 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, traveling condition, and the ATF temperature, thus realizing smooth shift characteristics and optimizing the workload in the oil pump.



7. Diagnosis

- When the engine & ECT ECU detected a malfunction, the engine & ECT ECU makes a diagnosis and memorizes the failed section.
  Furthermore, the engine check 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 the hand-held tester.



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— ***Changes (from A541E)*** —

- The DTC outputs have been changed from the O/D OFF indicator light to the check engine warning light.
- The DTCs listed below have been added or discontinued.

DTC No.		Detection Item
Added DTC	P0710	Transmission Fluid Temp. Sensor Malfunction (Fluid Temp. Sensor)
	P0711	Transmission Fluid Temp. Sensor Circuit Range/Performance Problem
	P0750	Shift Solenoid A Malfunction (SL1 Solenoid Valve)
	P0755	Shift Solenoid B Malfunction (SL2 Solenoid Valve)
	P0765	Shift Solenoid D Malfunction (Solenoid Valve S4)
	P0768	Shift Solenoid D Electrical Malfunction (Solenoid Valve S4)
	P0770	Shift Solenoid E Malfunction (DSL Solenoid Valve)
	P0773	Shift Solenoid E Electrical Malfunction (DSL Solenoid Valve)
	P1520	Stop Light Switch Circuit
	P1725	NT Revolution Sensor Circuit Malfunction (Input Turbine Speed Sensor)
	P1730	NC Revolution Sensor Circuit Malfunction (Counter Gear Speed Sensor)
	P1760	Linear Solenoid for Line Pressure Control Circuit Malfunction (Solenoid Valve SLT)
	P1780	Park/Neutral Position Switch Malfunction (Neutral Start Switch)
Discontinued DTC	P1705	NC2 Revolution Sensor Circuit Malfunction (Direct Clutch Speed Sensor)
	P1765	Linear Solenoid for Accumulator Pressure Control Circuit Malfunction (Solenoid Valve SLN)

Service Tip

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

8. Fail Safe

General

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

▶ Fail-Safe Control List ◀

Malfunction Part	Function
Speed Sensor	During a speed sensor malfunction, the vehicle speed is detected through the signals from the counter gear speed sensor to effect normal control.
Fluid Temp. Sensor	During a fluid temp. sensor malfunction, 4th upshift is prohibited.
Counter Gear Speed Sensor	During a counter gear speed sensor malfunction, 4th upshift is prohibited.
Solenoid Valve SL1, SL2, and S4	The current to the failed solenoid valve is cut off and control is effected by operating the other solenoid valves with normal operation. Shift control is effected as described in the table below, depending on the failed solenoid.

When all solenoids are normal				When shift solenoid SL1 is abnormal								When SL2 is abnormal			
				Traveling 3rd or 4th				Traveling 1st or 2nd							
Solenoid			Gear	Solenoid			Gear	Solenoid			Gear	Solenoid			Gear
SL1	SL2	S4		SL1	SL2	S4		SL1	SL2	S4		SL1	SL2	S4	
ON	ON	OFF	1st	×	ON ↓ OFF	OFF	3rd	×*	ON	OFF	2nd	ON ↓ OFF	×	OFF	3rd
OFF	ON	OFF	2nd	×	ON ↓ OFF	OFF	3rd	×*	ON	OFF	2nd	OFF	×	OFF	3rd
OFF	OFF	OFF	3rd	×	OFF	OFF	3rd	×*	OFF ↓ ON	OFF ↓ ON	3rd	OFF	×	OFF ↓ ON	3rd
OFF	OFF	ON	4th	×	OFF	ON	4th	×*	OFF ↓ ON	ON	3rd	OFF	×	ON	4th

*: B_1 is constantly operating.

When S4 is abnormal				When SL1 and SL2 are abnormal				When SL1 and S4 are abnormal							
								Traveling 3rd or 4th				Traveling 1st or 2nd			
Solenoid			Gear	Solenoid			Gear	Solenoid			Gear	Solenoid			Gear
SL1	SL2	S4		SL1	SL2	S4		SL1	SL2	S4		SL1	SL2	S4	
ON	ON	×	1st	×	×	OFF	3rd	×	ON ↓ OFF	×	3rd	×	ON	×	2nd
OFF	ON	×	2nd	×	×	OFF	3rd	×	ON ↓ OFF	×	3rd	×	ON	×	2nd
OFF	OFF	×	3rd	×	×	OFF	3rd	×	OFF ↓ ON	×	3rd	×	OFF ↓ ON	×	2nd
OFF	OFF	×	4th	×	×	ON	4th	×	OFF ↓ ON	×	3rd	×	OFF ↓ ON	×	2nd

(Continued)

When SL2 and S4 are abnormal				When SL1, SL2 and S4 are abnormal			
Solenoid			Gear	Solenoid			Gear
SL1	SL2	S4		SL1	SL2	S4	
ON ↓ OFF	×	×	3rd	×	×	×	3rd
OFF	×	×	3rd	×	×	×	3rd
OFF	×	×	3rd	×	×	×	3rd
OFF	×	×	3rd	×	×	×	3rd

■SHIFT CONTROL MECHANISM

1. General

- As in the past, the shift control mechanism of the new Camry consists of a straight shift lever that uses a shift control cable.
- The O/D (overdrive) switch has been adopted on the momentary type.
- A shift lock system consists of the key interlock device and shift lock mechanism, has been adopted.

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2. Overdrive Switch

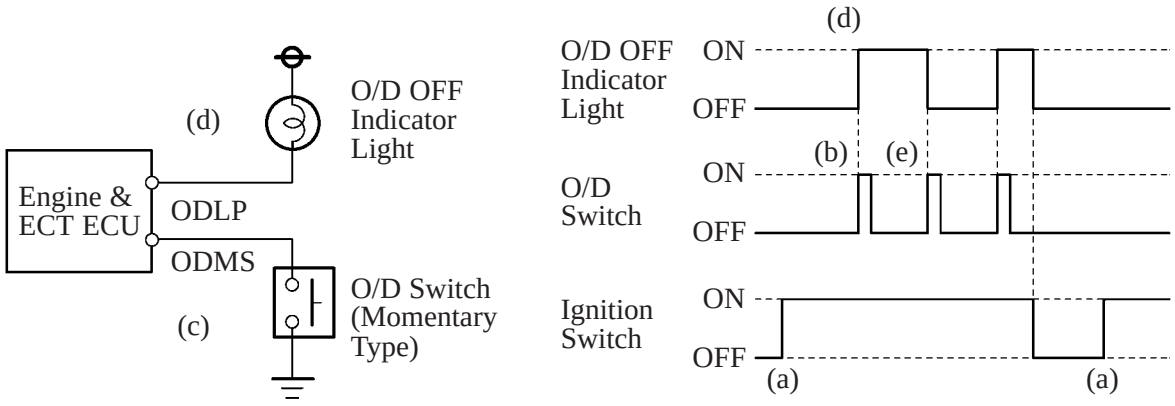
a) Turn the ignition switch from OFF to ON turns the overdrive ON.

b) Pressing the O/D switch close (turn ON) the contact points, and releasing the switch opens (turn OFF) the contact points.

c) Accordingly, pressing the switch cause the signal to be input into the engine & ECT ECU.

d) The engine & ECT ECU turns OFF the overdrive (O/D OFF indicator light turn ON).

e) Pressing the O/D switch again turns the overdrive back ON (O/D OFF indicator light turns OFF).



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