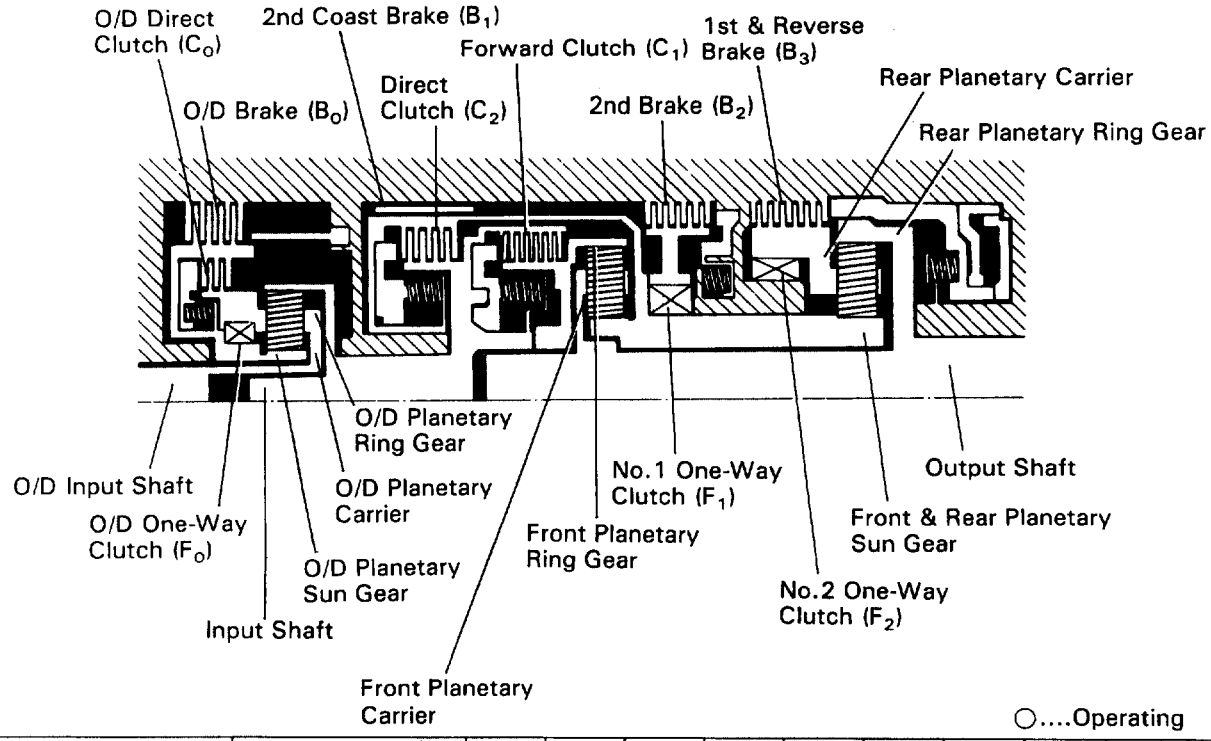
A343F AUTOMATIC TRANSMISSION

OPERATION



○....Operating

Shift lever position	Gear position	C_0	C_1	C_2	B_0	B_1	B_2	B_3	F_0	F_1	F_2
P	Parking	○									
R	Reverse	○		○				○	○		
N	Neutral	○									
D	1st	○	○						○		○
	2nd	○	○				○		○	○	
	3rd	○	○	○			○		○		
	O/D		○	○	○		○				
2	1st	○	○						○		○
	2nd	○	○			○	○		○	○	
	*1 3rd	○	○	○			○		○		
L	1st	○	○					○	○		○
	*2 2nd	○	○			○	○		○	○	

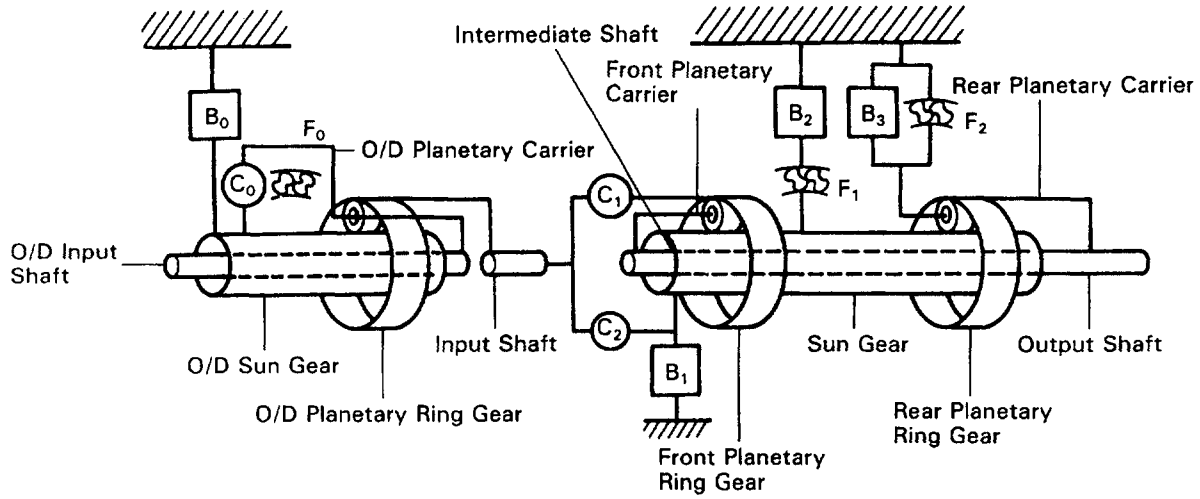
*1 Down–shift only in the 2 position and 3rd gear–no up–shift.

*2 Down–shift only in the L position and 2nd gear–no up–shift.

1. FUNCTION OF COMPONENTS

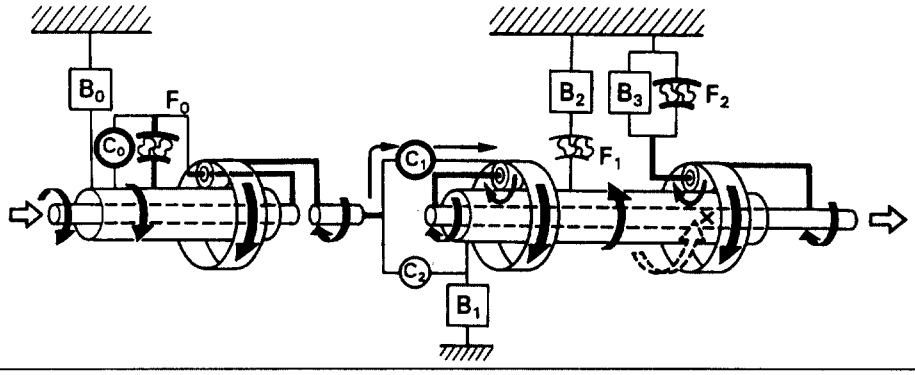
NOMENCLATURE	OPERATION
O/D Direct Clutch (C0)	Connects overdrive sun gear and overdrive carrier
O/D Brake (B0)	Prevents overdrive sun gear from turning either clockwise or counterclockwise
O/D One-Way Clutch (F0)	When transmission is being driven by engine, connects overdrive sun gear and overdrive carrier
Forward Clutch (C1)	Connects input shaft and front planetary ring gear
Direct Clutch (C2)	Connects input shaft and front & rear planetary sun gear
2nd Coast Brake (B1)	Prevents front & rear planetary sun gear from turning either clockwise or counterclockwise
2nd Brake (B2)	Prevents outer race of F_1 from turning either clockwise or counterclockwise, thus preventing front & rear planetary sun gear from turning counterclockwise
1st & Reverse Brake (B3)	Prevents rear planetary carrier from turning either clockwise or counterclockwise
No. 1 One-way Clutch (F1)	When B_2 is operating, prevents front & rear planetary sun gear from turning counterclockwise
No. 2 One-way Clutch (F2)	Prevents rear planetary carrier from turning counterclockwise

2nd



The conditions of operation for each gear position are shown in the following illustrations:

D or 2 Position 1st Gear



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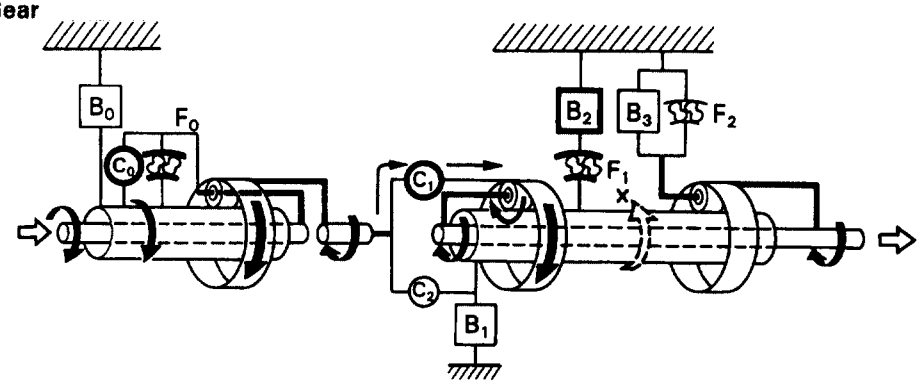
D Position 2nd Gear



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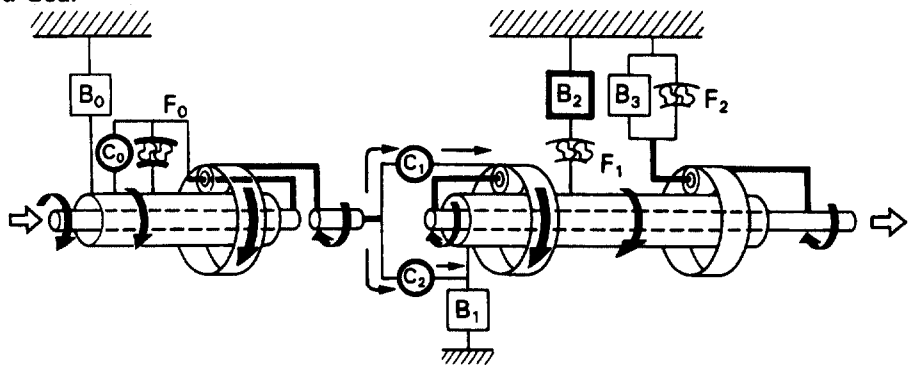
D or 2 Position 3rd Gear



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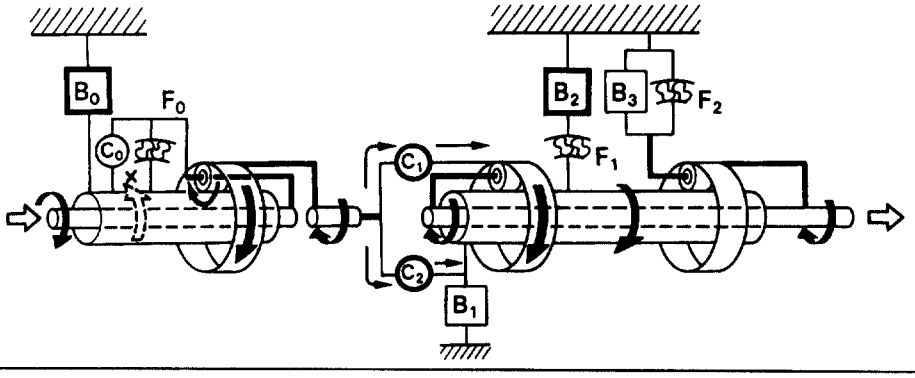
D Position O/D



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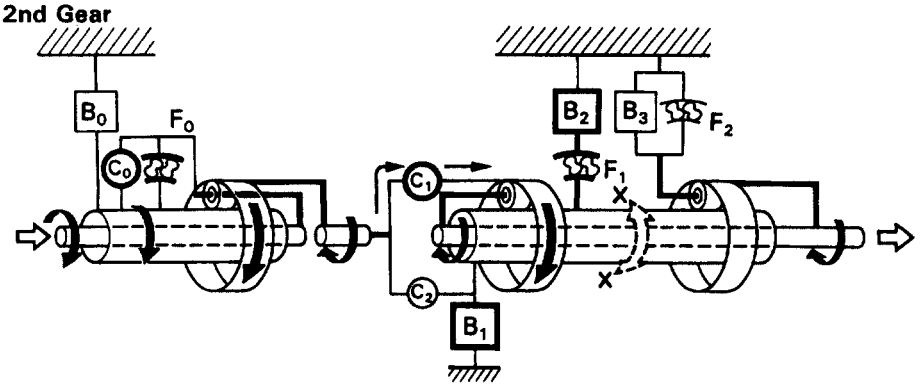
2 or L Position 2nd Gear



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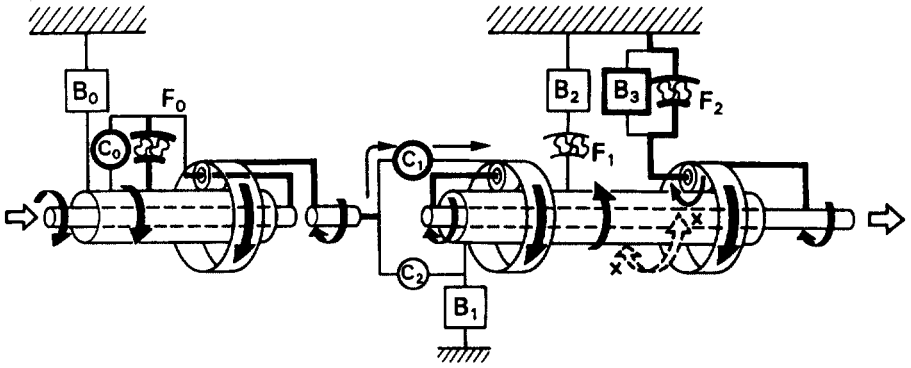
L Position 1st Gear



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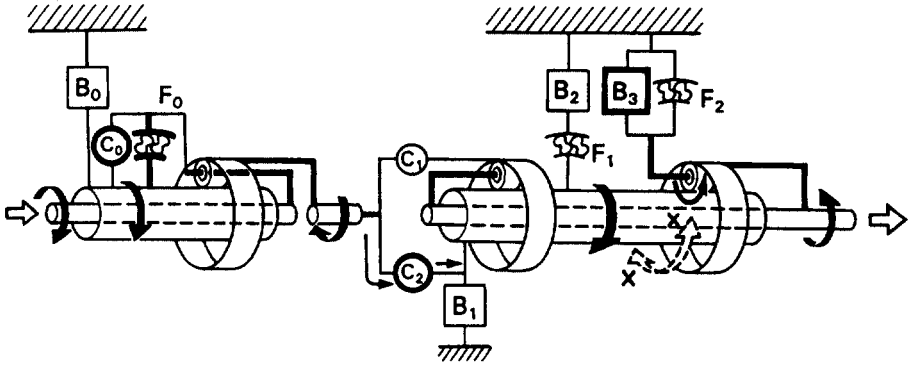
R Position Reverse Gear



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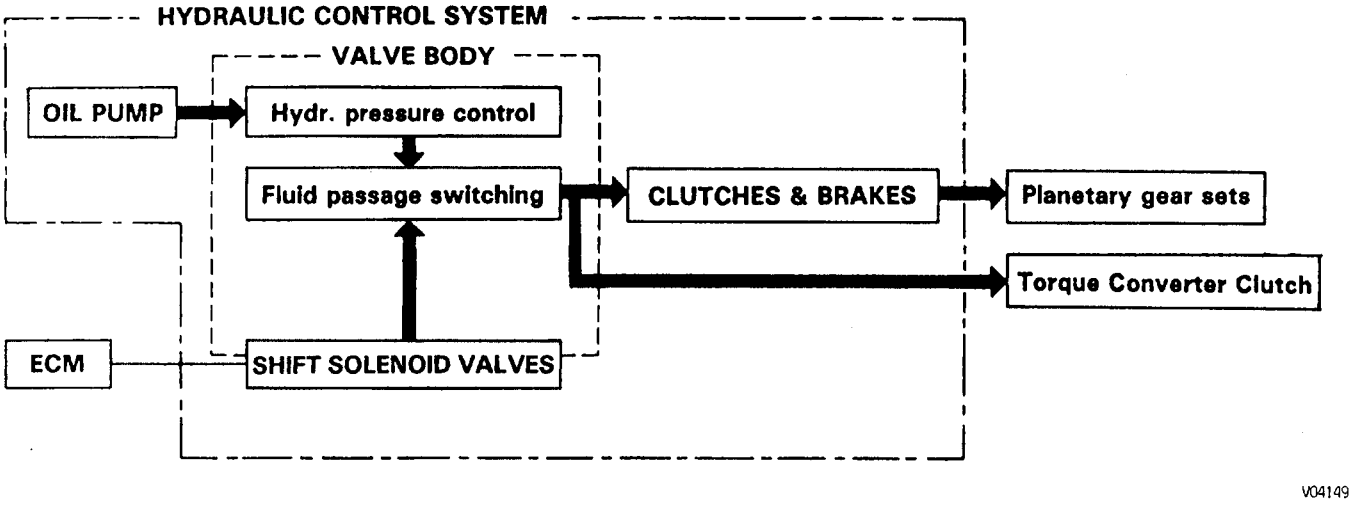
2. HYDRAULIC CONTROL SYSTEM

The hydraulic control system is composed of the oil pump, valve body, solenoid valves, clutches and brakes, as well as the fluid passages which connect all of these components. Based on the hydraulic pressure created by the oil pump, the hydraulic control system governs the hydraulic pressure acting on the torque converter clutch, clutches and brakes in accordance with the vehicle driving conditions.

There are three shift solenoid valves on the valve body. These shift solenoid valves are turned on and off by signals from the ECM to operate the shift valves. These shift valves then switch the fluid passages so that fluid goes to the torque converter clutch and planetary gear units.

(Except for the solenoid valves, the hydraulic control system of the electronic control transmission is basically the same as that of the fully hydraulic controlled automatic transmission.)



- **LINE PRESSURE**

Line pressure is the most basic and important pressure used in the automatic transmission, because it is used to operate all of the clutches and brakes in the transmission.

If the primary regulator valve does not operate correctly, line pressure will be either too high or too low. Line pressure that is too high will lead to shifting shock and consequent engine power loss due to the greater effort required of the oil pump; line pressure that is too low will cause slippage of clutches and brakes, which will, in extreme cases, prevent the vehicle from moving. Therefore, if either of these problems are noted, the line pressure should be measured to see if it is within standard.

- **THROTTLE PRESSURE**

Throttle pressure is always kept in accordance with the opening angle of the engine throttle valve. This throttle pressure acts on the primary regulator valve and, accordingly, line pressure is regulated in response to the throttle valve opening.

In the fully hydraulic controlled automatic transmission, throttle pressure is used for regulating line pressure and as signal pressure for up–shift and down–shift of the transmission. In the electronic control transmission, however, throttle pressure is used only for regulating line pressure. Consequently, improper adjustment of the transmission throttle cable may result in a line pressure that is too high or too low. This, in turn, will lead to shifting shock or clutch and brake slippage.

3. ELECTRONIC CONTROL SYSTEM

The electronic control system, which controls the shift points and the operation of the lock–up clutch, is composed of the following three parts:

1. Sensors

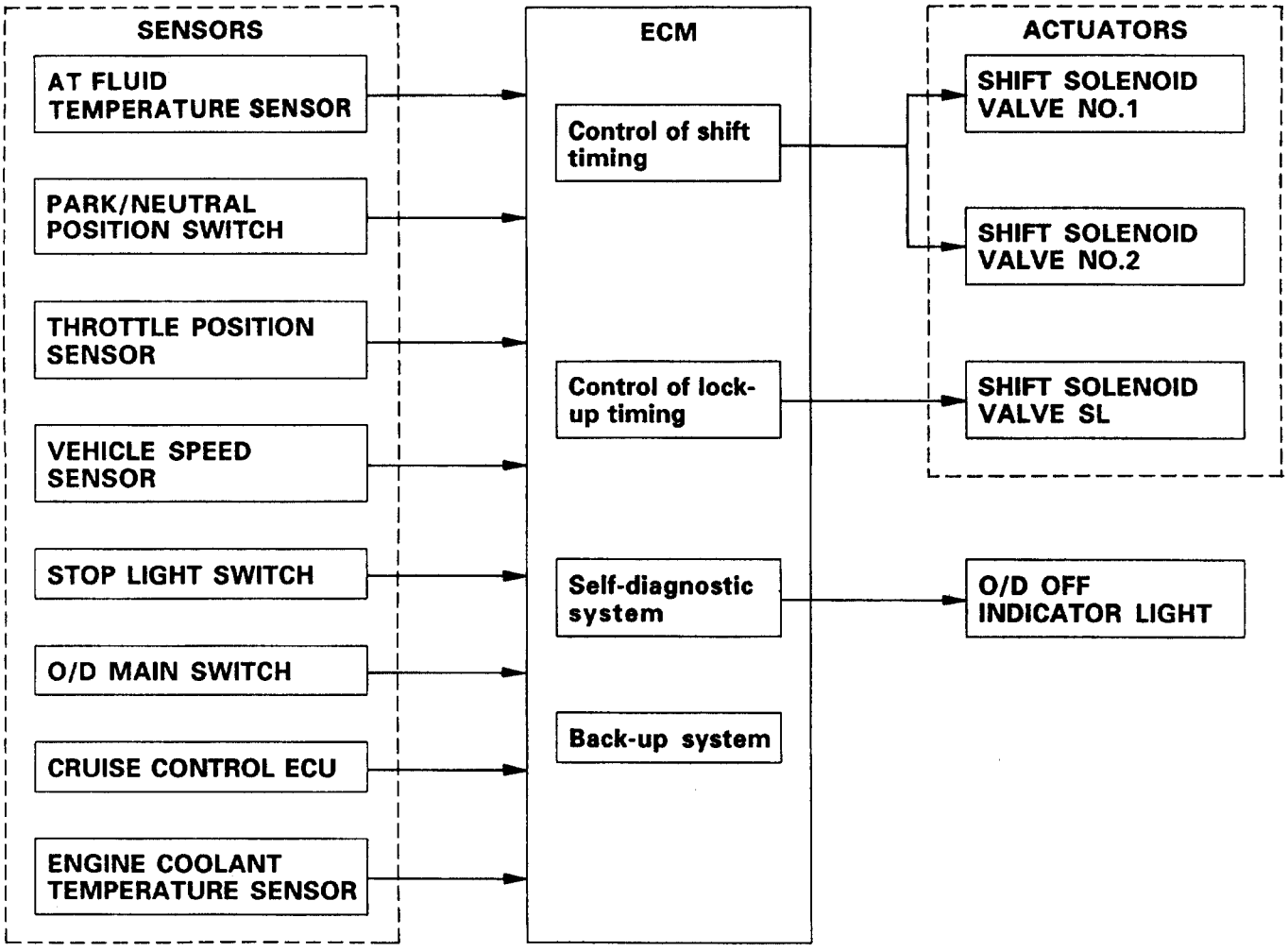
These sensors respond to the vehicle speed, throttle opening and other conditions and transmit these data to the ECM in the form of electrical signals.

2. ECM

The ECM determines the shift and lock–up timing based upon the signals from sensors, and controls the solenoid valves of the hydraulic control unit accordingly.

3. Actuators

These are three shift solenoid valves that control hydraulic pressure acting on the hydraulic valves to control shifting and lock–up timing.



4. FUNCTION OF ECU

- **Control of Shifting Timing**

The ECM has programmed into its memory the optimum shift pattern for each shift lever position (D, 2, L position).

Based on the appropriate shift pattern, the ECM turns shift solenoid valves No.1 and No.2 on or off in accordance with the vehicle speed signal from the vehicle speed sensor and the throttle opening signal from the throttle position sensor. In this manner, the ECM operates each shift valve, opening or closing the fluid passages to the clutches and brakes to permit up–shift or down–shift of the transmission.

HINT: The electronic control system provides shift timing and lock–up control only while the vehicle is traveling forward. In REVERSE, PARK and NEUTRAL, the transmission is mechanically, not electronically controlled.

- **Control of Overdrive**

Driving in overdrive is possible if the O/D main switch is on and shift lever is in the D position. However, when the vehicle is being driven using the cruise control system (CCS), if the actual vehicle speed drops to about 4 km/h (2 mph) below the set speed while the vehicle is running in overdrive, the CCS ECU sends a signal to the ECM to release the overdrive and prevent the transmission from shifting back into overdrive until the actual vehicle speed reaches the speed set in the CCS memory.

On this model, if the engine coolant temperature falls below 55°C (131°F), preventing the transmission from up–shifting into overdrive.

- **Control of Lock–Up System**

Based on this lock–up pattern, the ECM turns lock–up solenoid valve on or off in accordance with the vehicle speed signals received from the vehicle speed sensor and the throttle opening signals from the throttle position sensor.

Depending on whether lock–up solenoid valve is on or off, the lock–up relay valve performs changeover of the fluid passages for the converter pressure acting on the torque converter clutch to engage or disengage the lock–up clutch.

Mandatory Cancellation of Lock–Up System:

If any of the following conditions exist, the ECM turns off lock–up solenoid valve to disengage the lock–up clutch.

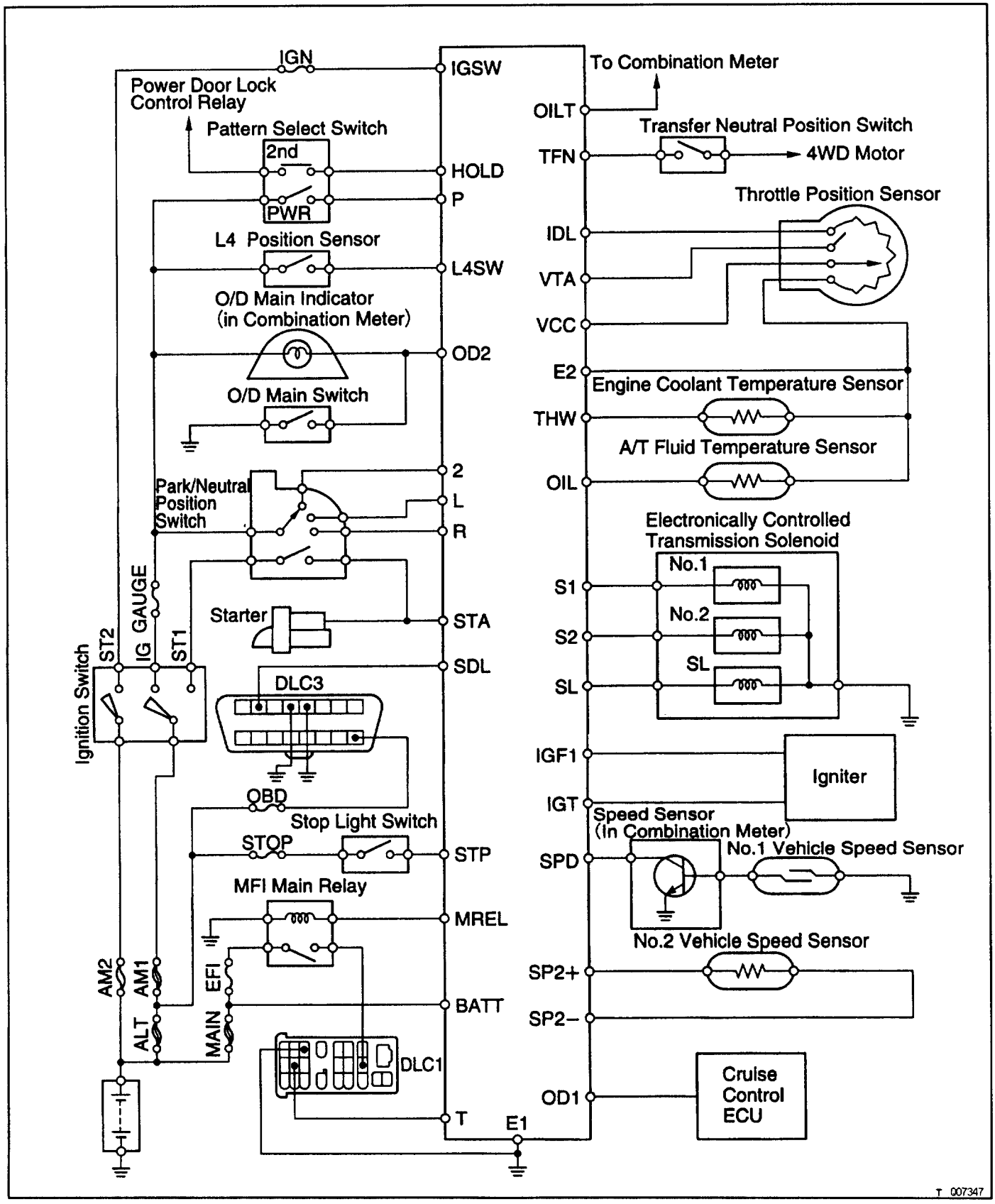
(1) The stop light switch comes on (during braking).
(2) The IDL points of the throttle position sensor close (throttle valve fully closed).
(3) The engine coolant temperature falls below 60°C (140°F).

The purpose of (1) and (2) above is to prevent the engine from stalling if the rear wheels lock up.

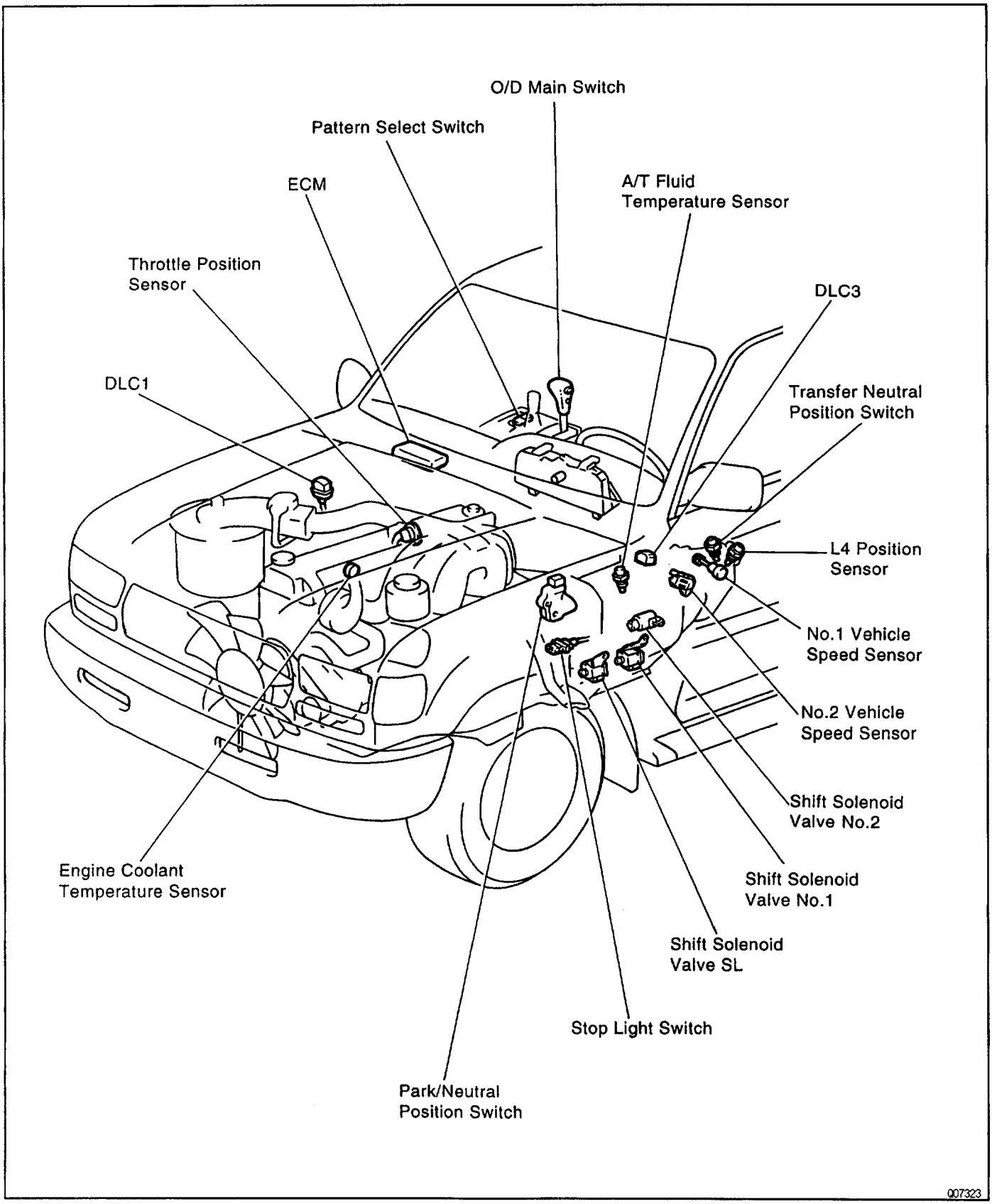
The purpose of (3) is both to improve general driveability, and to speed up engine warm–up.

Also, while the lock–up system is in operation, the ECM will temporarily turn it off during up–shift or down–shift in order to decrease shifting shock.

SYSTEM DIAGRAM



ARRANGEMENT OF COMPONENTS



Components	Function
Park/Neutral Position Switch	Detects the shift lever position.
Stop Light Switch	Detects if the brake pedal is depressed.
Throttle Position Sensor	Detects the throttle valve opening angle.
O/D Main Switch	Prevents up–shift to the O/D gear if the O/D switch is off.
Cruise Control ECU	This ECU prevents the transmission from shifting into O/D when the vehicle's speed drops below the cruise control set speed parameter.
No.1 and No.2 Vehicle Speed Sensor	Detects the vehicle speed. Ordinarily, transmission control uses signals from the No.2 vehicle speed sensor, and the No.1 vehicle speed sensor is used as a back–up.
Engine Coolant Temperature Sensor	Detects the engine coolant temperature.
ECM	Controls the engine and transmission actuators based on signals from each sensor.
Shift Solenoid Valves No.1 and No.2	Controls the hydraulic pressure applied to each shift valve, and controls the gear position and timing.
Sift Solenoid Valve SL (For lock–up control pressure modulation)	Controls the hydraulic pressure applied to the lock–up clutch and controls lock–up timing.
O/D OFF Indicator Light	Blinks and warns the driver, while the O/D main switch is pushed in, when the electronic control circuit is malfunctioning.
AT Fluid Temperature Sensor	Detects the AT fluid temperature.
DLC3	By connecting the OBD II scan tool or TOYOTA hand–held tester the transmission control data can be read.
Pattern Select Switch	Selects the PWR mode or NORM mode and 2nd start mode for shift and lock–up timing.
Transfer Neutral Position Switch	Detect the transfer neutral position.
L4 Position Sensor	Detect the transfer L position.