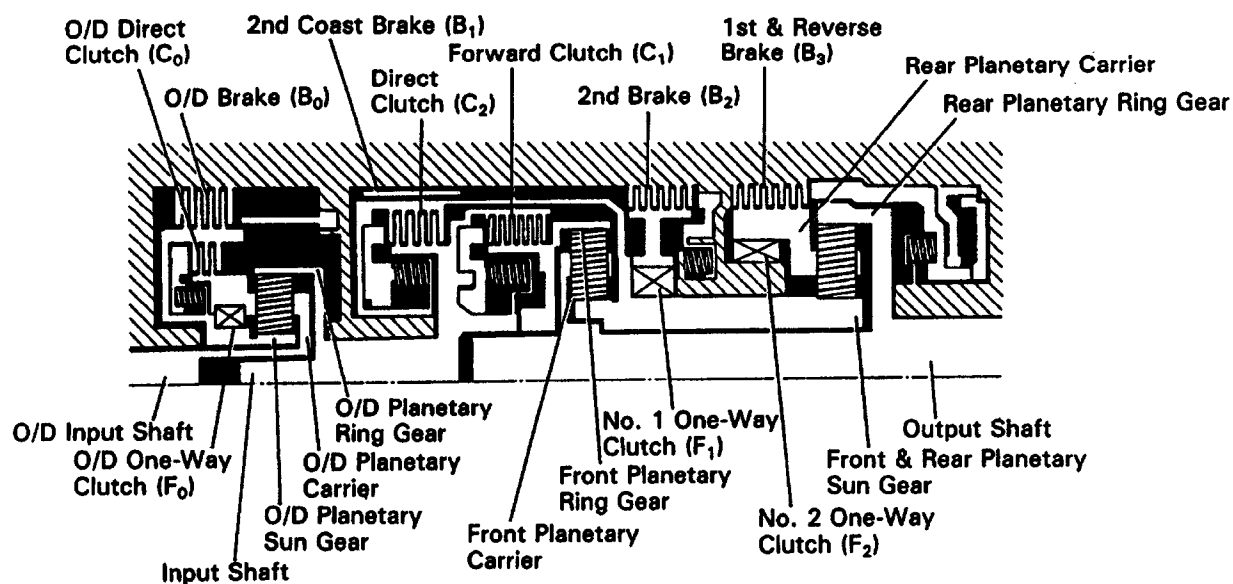


# OPERATION



AT2157

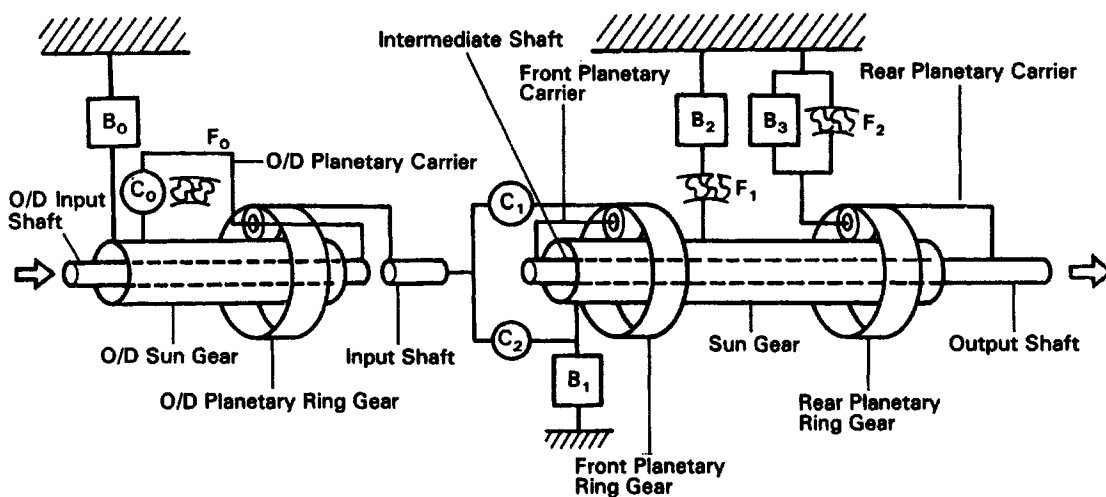
○ ..... Operating

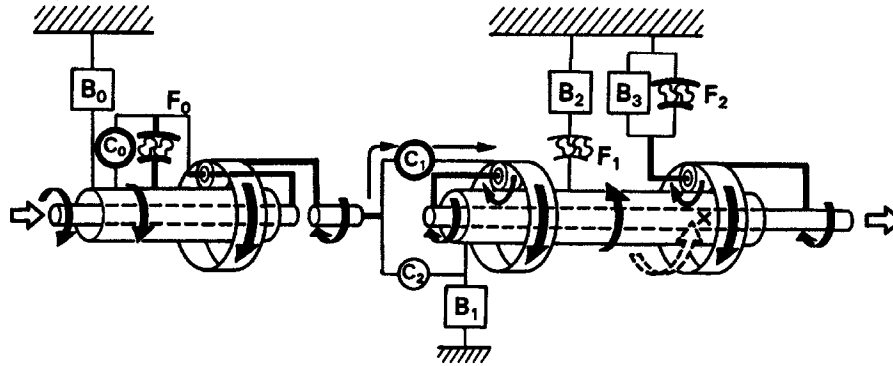
Shift lever position	Gear position	$C_0$	$C_1$	$C_2$	$B_0$	$B_1$	$B_2$	$B_3$	$F_0$	$F_1$	$F_2$
P	Parking	○									
R	Reverse	○		○				○	○		
N	Neutral	○									
D	1st	○	○						○		○
	2nd	○	○				○		○	○	
	3rd	○	○	○			○		○		
	O/D		○	○	○		○				
2	1st	○	○						○		○
	2nd	○	○			○	○		○	○	
	3rd	○	○	○			○		○		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

\* Down-shift only in the L position and 2nd gear no up-shift

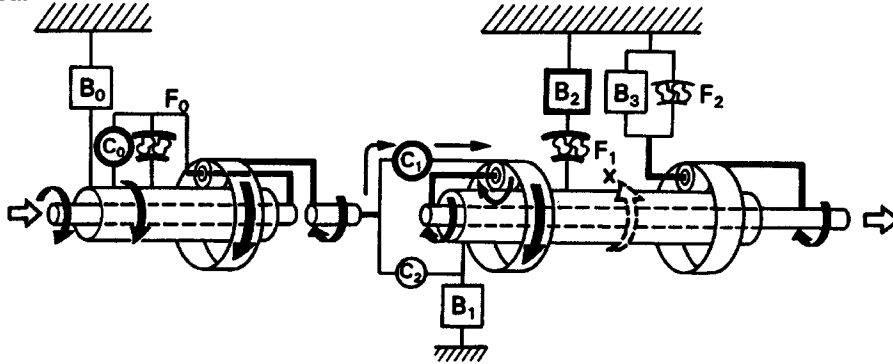
## 1. FUNCTION OF COMPONENTS

Component	Function
O/D Direct Clutch ( $C_0$ )	Connects overdrive sun gear and overdrive carrier
O/D Brake ( $B_0$ )	Prevents overdrive sun gear from turning either clockwise or counterclockwise
O/D One-Way Clutch ( $F_0$ )	When transmission is being driven by engine, connects overdrive sun gear and overdrive carrier
Forward Clutch ( $C_1$ )	Connects input shaft and front planetary ring gear
Direct Clutch ( $C_2$ )	Connects input shaft and front & rear planetary sun gear
2nd Coast Brake ( $B_1$ )	Prevents front & rear planetary sun gear from turning either clockwise or counterclockwise
2nd Brake ( $B_2$ )	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 ( $B_3$ )	Prevents rear planetary carrier from turning either clockwise or counterclockwise
No.1 One-Way Clutch ( $F_1$ )	When $B_2$ is operating, prevents front & rear planetary sun gear from turning counterclockwise
No.2 One-Way Clutch ( $F_2$ )	Prevents rear planetary carrier from turning counterclockwise

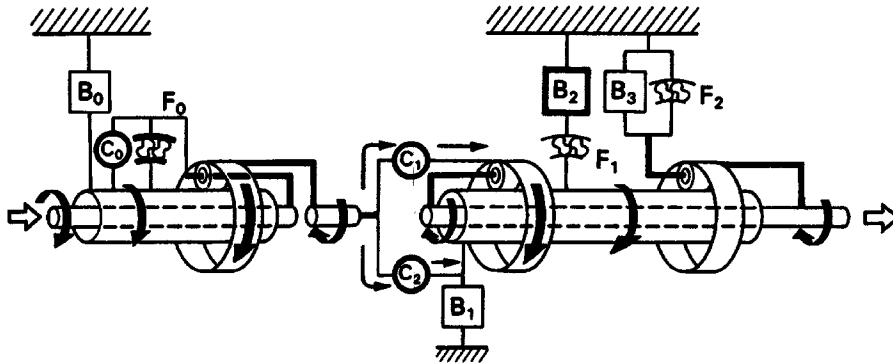


**D or 2 Position 1st Gear**

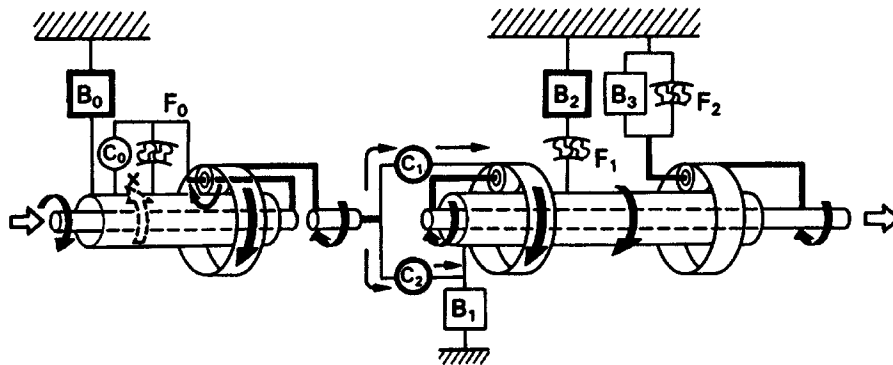
AT6675

**D Position 2nd Gear**

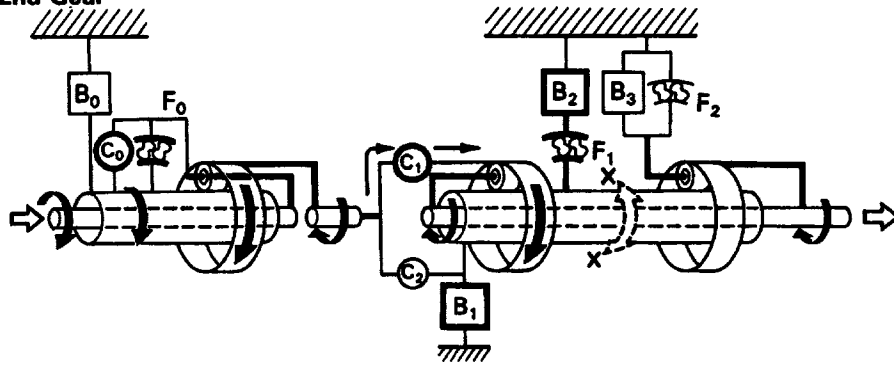
AT6676

**D or 2 Position 3rd Gear**

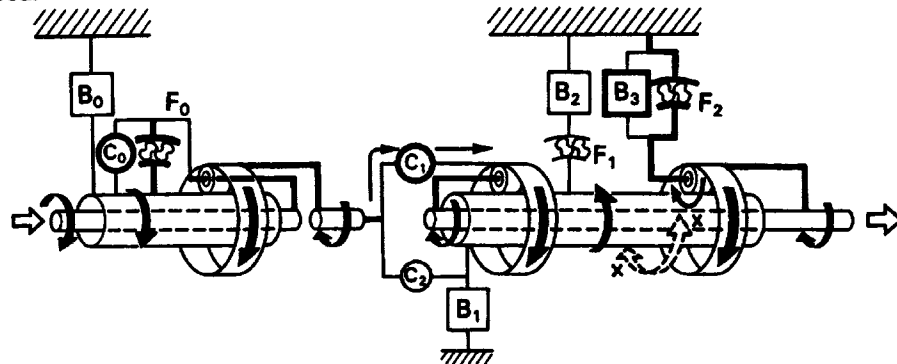
AT6677

**D Position O/D**

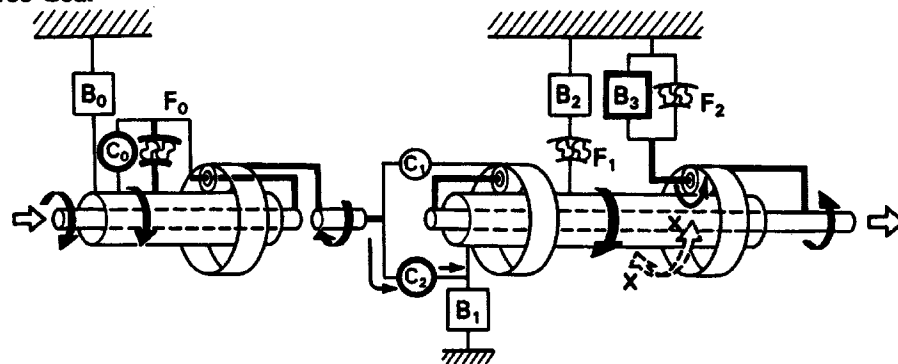
AT6678

**2 or L Position 2nd Gear**

AT6679

**L Position 1st Gear**

AT6680

**R Position Reverse Gear**

AT6681

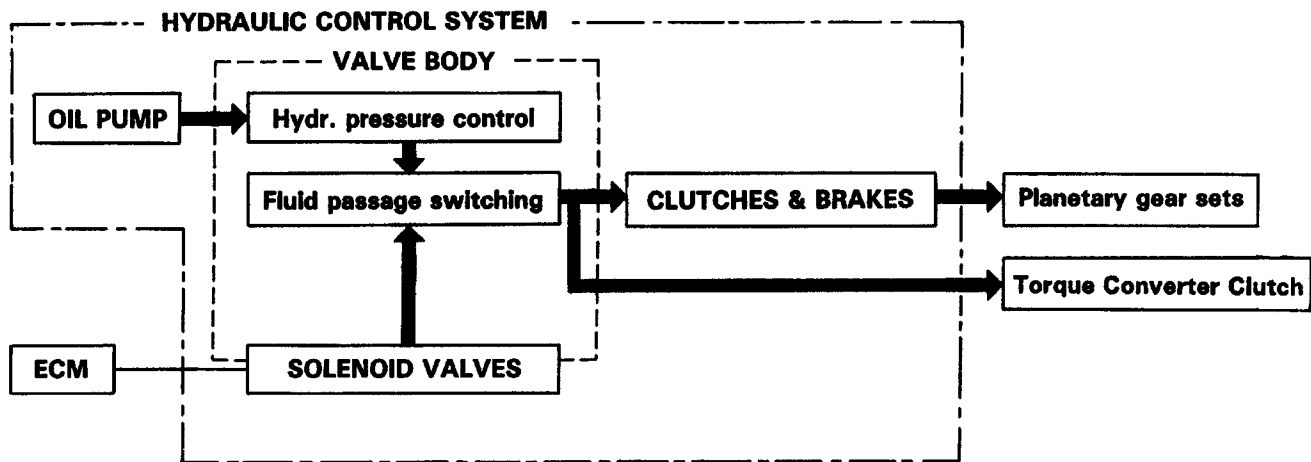
## 2. HYDRAULIC CONTROL SYSTEM

The hydraulic control system is composed of the oil pump, the valve body, the solenoid valves, and the 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 3 solenoid valves on the valve body. These 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 electronically controlled transmission is basically the same as that of the fully hydraulic controlled automatic transmission.



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### • 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 output required from 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 specification.

### • 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, the line pressure is regulated according to the throttle valve opening.

In the fully hydraulically 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 electronically controlled 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

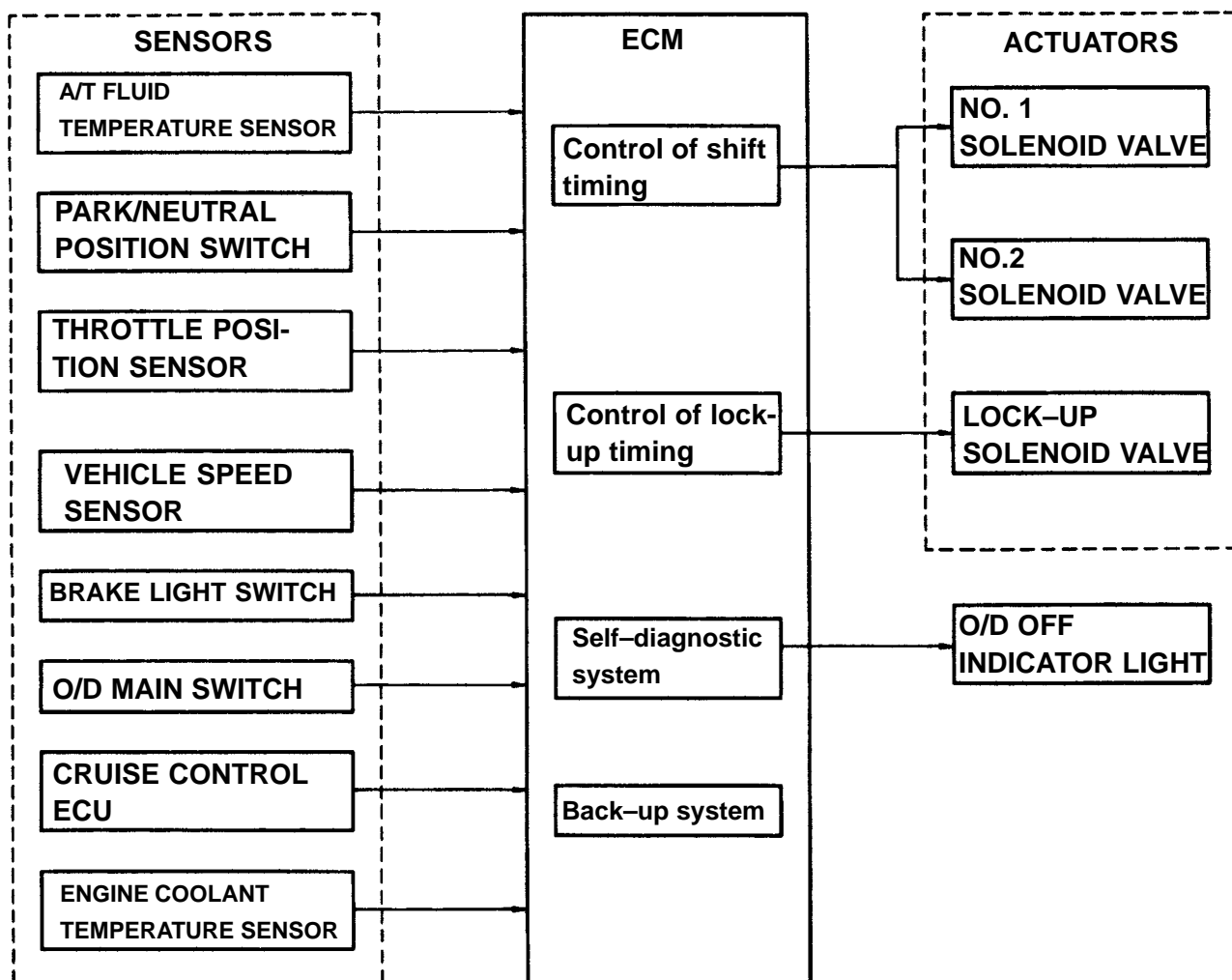
These sensors respond to the vehicle speed, throttle opening and other conditions and transmit these data to the ECM in the form of electrical signals.

#### 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 solenoid valves that control hydraulic pressure acting on the hydraulic valves to control shifting and lock-up timing.



#### 4. FUNCTION OF ECM

- **Control of Shifting Timing**

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

Based on the appropriate shift pattern, the ECM turns No. 1 and No.2 solenoid valves 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 downshift 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 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 70°C (158°F), preventing the transmission from up-shifting into overdrive.

- **Control of Lock-Up System**

The ECM has programmed in its memory a lock-up clutch operation pattern for each driving mode (Normal and Power).

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 vehicle drops 4 km/h (2 mph) or more below the set speed while the cruise control system is operating.

(4) The engine coolant temperature falls below 70°C (158°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) and (4) is both to improve general driveability, and to speed up transmission warm-up.

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