PRINT

437: Transmission control module (TCM), TF-80SC AWD

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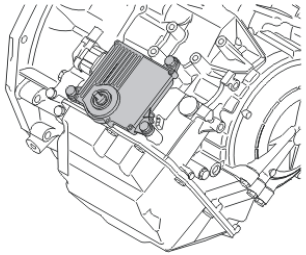
System overview

General



TF-80SC (TF-80SC AWD) is 6-speed electronically controlled automatic transmission with lock-up function on the five highest gears. The Transmission Control Module (TCM) adapts gearshifts so that the correct gear is always selected with respect to driving style, engine load, driver requirements, speed etc. This provides good fuel economy and increased comfort through gentler gearshifts and lower noise level.

The Transmission Control Module (TCM) receives information on required gear position and required driving style (driving program) from the driver.

Together with signals from a number of sensors in the transmission and the engine management system, this enables the calculation of optimum gearshift timing and lock-up engagement, in contrast to a gearbox with only a hydraulic control system. The control module takes consideration of small changes in operating conditions and adapts the different transmission functions so that the correct gear is always selected in accordance with the driving program selected by the driver.

The Transmission Control Module (TCM) has an adaptive capacity intended to ensure even gearshift quality during the whole service life of the transmission.

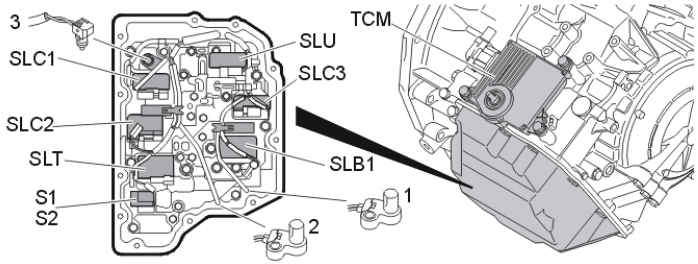
In order to be able to determine gearshift timing and lock-up engagement precisely, based on the selected driving program, the control module receives information on the following:

- Selected gear position - from the gear position indicator.
- Speed of transmission input shaft - from transmission speed sensor, input shaft.
- Speed of transmission output shaft - from transmission speed sensor, output shaft.
- Transmission oil temperature - from temperature sensor in the transmission.
- Engine speed and torque, and throttle opening - from Engine Control Module (ECM) via the Controller Area Network (CAN).
- Whether and how much the accelerator pedal is depressed - from Engine Control Module (ECM) via the Controller Area Network (CAN).
- Engine temperature - from Engine Control Module (ECM) via the Controller Area Network (CAN).
- Vehicle speed - from Brake Control Module (BCM)

via the Controller Area Network (CAN).

- Whether and how much the brake pedal is depressed - from Brake Control Module (BCM) via the Controller Area Network (CAN).

Components



The following components are included in the automatic transmission control system:

- Transmission Control Module (TCM) – Controls activation/deactivation of the solenoids by means of processing the input signals from the transmission speed and temperature sensors. Also stores adaptive data and diagnostic trouble codes (DTC) and frozen values for diagnostics.
- Gear position indicator, integrated with Transmission Control Module (TCM) (4) - Provides Transmission Control Module (TCM) information on selected gear position.
- Solenoid S1 - Controls engine braking on 1st gear.
- Solenoid S2 - Controls engine braking on 1st gear.
- Lock-up solenoid - Controls the lock-up function and also used with certain shiftings.
- Linear pressure solenoid SLT - Controls transmission system pressure.
- Linear pressure solenoid SLC1 - Controls transmission shift pressure and also used with certain shiftings.
- Linear pressure solenoid SLC2 - Controls transmission shift pressure and also used with certain shiftings.

- Linear pressure solenoid SLC3 - Controls transmission shift pressure and also used with certain shiftings.
- Linear pressure solenoid SLB1 - Controls transmission shift pressure and also used with certain shiftings.
- Speed sensor, input shaft (1) - Provides Transmission Control Module (TCM) information on input shaft speed from the engine.
- Speed sensor, output shaft (2) - Provides Transmission Control Module (TCM) information on output shaft speed from the transmission.
- Oil temperature sensor (3) - Provides Transmission Control Module (TCM) information on transmission oil temperature.
- Gear Selector Module (GSM) - Provides Transmission Control Module (TCM) information on Geartronic position and winter mode (W) etc.

Signals

The table below summarizes the input and output signals to and from the Transmission Control Module (TCM). The signal types are divided into directly connected signals, serial communication and Controller Area Network (CAN) communication. The illustration below displays the same information with the Volvo component designations.

Input signals	Output signals
Directly connected: **Speed sensor, input shaft** (7/61): ■ Provides information on transmission input speed. Amongst other things, used to calculate the gearshift process, to check lock-up and to diagnose the hydraulic/mechanical function in the transmission.	**Directly connected:** (power supply unless otherwise stated) **Solenoids S1-S2** (8/38-39): ■ Transmission Control Module (TCM) activates the solenoids with engine braking on 1st gear. **Lock-up solenoid, SLU** (8/40):

Speed sensor, output shaft (7/62):

- Provides information on transmission output speed. Amongst other things, used to calculate vehicle speed, and to diagnose the hydraulic/mechanical function in the transmission.

Oil temperature sensor (7/74):

- Provides information on transmission oil temperature. The information is used to adjust gearshift timing and oil pressure.

Gear position indicator (4/28):

- Provides information on selected gear position to the transmission control module (TCM). Enables starting only in P and N. Consists of a permanent magnet that is moved across a number of Hall elements, creating a specific voltage for each gear position.

- Adapts system pressure to a lock-up pressure. Also used with certain gearshifts.

Linear pressure solenoid, SLT (8/71):

- Adapts linear system pressure during gearshifts.

Linear pressure solenoid, SLC1 (8/143):

- Adapts system pressure to a gearshift pressure to clutch C1 and is activated with certain gearshifts.

Linear pressure solenoid, SLC2 (8/144):

- Adapts system pressure to a gearshift pressure to clutch C2 and is activated with certain gearshifts.

Linear pressure solenoid, SLC3 (8/145):

- Adapts system pressure to a gearshift pressure to clutch C3 and is activated with certain gearshifts.

Linear pressure solenoid, SLB1 (8/142):

- Adapts system pressure to a gearshift pressure to brake band B1 and is activated with certain gearshifts.

Gear Selector Module (GSM) (3/156):

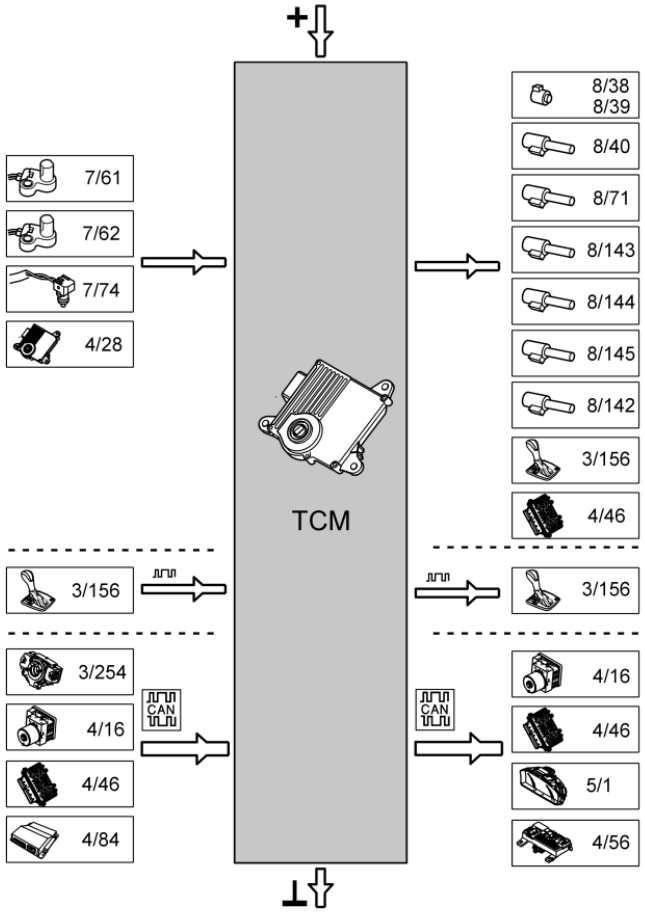
- Controls shift-lock solenoid for the shift-lock function in the gear selector assembly.

Engine Control Module (ECM) (4/46):

- Start inhibiting. Provides the Engine Control Module (ECM) with a signal on whether or not the engine may be started.

Via serial communication: **Gear Selector Module (GSM)** (3/156): ■ Provides in formation on whether the gear selector is locked in postition P plus information on the status of the winter mode (W) button (status of the sport mode (S) button for S60R/V70R). ■ Also provides a control signal with Geartronic shifting, and information on fault status in the Gear Selector Module (GSM) to generate diagnostic trouble codes (DTC) for faults in the Gear Selector Module (GSM).	**Via serial communication:** **Gear Selector Module (GSM)** (3/156): ■ The Transmission Control Module (TCM) provides the Gear Selector Module (GSM) with signals on which diodes shall be lit on the gear selector assembly panel, depending on gear position selected.
Via Controller Area Network (CAN) communication: **Steering Wheel Module (SWM)** (3/254), via Central Electronic Module (CEM) (4/56): ■ Cruise control, used when calculating acceleration, depending on Resume and Set button position. **Brake Control Module (BCM)** (4/16): ■ Provides information on vehicle speed and difference in speed between right and left-hand wheels. Prevents upshifting if the difference in speed is above 40 km/h, in order to protect the differential in the transmission. **Engine Control Module (ECM)** (4/46): ■ Stop lamp switch OFF/ON, used with torque converter lock-up. ■ Engine temperature, used to diagnose the transmission temperature sensor and with the catalytic converter start function (Cat-start). ■ Engine speed, more than 400 rpm = engine running. Used to start transmission oil pressure and diagnostic function. ■ Engine speed. Used to check torque converter slipping speed and pressure build-up, which	**Via Controller Area Network (CAN) communication:** **Brake Control Module (BCM)** (4/16): ■ Current gear, used to provide the signal for no control when gearshifting. ■ Vehicle speed, used as back-up. **Engine Control Module (ECM)** (4/46): ■ Transmission temperature, used to compensate increased load at low oil temperatures. ■ Selected gear, used by the engine so that the engine can compensate for different loads. ■ Lock-up, used by the engine so that the engine can compensate for different loads. ■ Next gear planned by Transmission Control Module (TCM), used by the engine so that the engine can compensate for different loads. ■ Request for reduction in engine torque when gearshifting, the engine reduces the engine torque when gearshifting. ■ Request for torque limitation, the engine limits the engine torque, depending on current gear and whether winter mode (W) is selected. **Driver Information Module (DIM)** (5/1):

increases gearshift comfort. ■ Kickdown, if the accelerator pedal is depressed and the throttle is fully open then the Engine Control Module (ECM) sends a signal to the Transmission Control Module (TCM) on kickdown. ■ Current engine torque, used to check transmission system pressure. ■ Throttle opening, used to calculate gearshifts. Sport mode and kickdown. ■ Accelerator pedal position, used to calculate gearshift timing. **Suspension module (SUM)** (4/84) (only applies to S60R/V70R): ■ Selected driving mode (Advanced)	■ Current gear selector lever position. Used to indicate lever position in the Driver Information Module (DIM). ■ Via Central Electronic Module (CEM), checking of warning lamps. Lights the general warning lamp in the event of a fault. ■ Via Central Electronic Module (CEM), text message in Driver Information Module (DIM). The driver can obtain different fault messages from the Transmission Control Module (TCM). ■ The Transmission Control Module (TCM) transmits a signal via the Controller Area Network (CAN) to the Engine Control Module (ECM) to light the malfunction indicator lamp (MIL) in the Driver Information Module (DIM) in the event of an emission related fault. **Central Electronic Module (CEM)** (4/56): ■ The Transmission Control Module (TCM) transmits a signal via the Central Electronic Module (CEM) to light the reversing lamp.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TCM
CAN
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