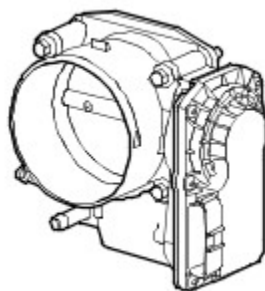## Acceleration Control

Acceleration control for the 4.4 Liter petrol engine is achieved via an electronic throttle drive by wire system. The throttle is electronically connected to the ECM and the ECM then controls the fuelling for the relevant throttle demand signal from the Accelerator Pedal Position sensor (APP). For additional information, refer to   Electronic Engine Controls (303-14B Electronic Engine Controls - 4.4L)

ELECTRONIC THROTTLE

Electronic Throttle Body

E47298

The electric throttle controls the air flow into the engine. In addition to the normal engine power control function, the electric throttle allows the cruise control, idle speed control and engine speed limiting functions to be performed without the need for additional hardware.

The electric throttle consists of a throttle body which incorporates a throttle plate driven by a DC motor via reduction gears. A return spring biases the throttle plate in the closed direction.

Operation of the DC motor is controlled by the ECM, which outputs two Pulse Width Modulated (PWM) signals to an H bridge drive circuit in the motor. The ECM varies the speed and direction of the motor by varying the duty cycle of the PWM signals.

To enable closed loop control, the position of the throttle plate is supplied to the ECM by two feedback Hall effect sensors in the throttle body. The feedback sensors have a common 5 volt supply and a common ground connection from the ECM, and produce separate linear signal voltages to the ECM proportional to the position of the throttle plate. The ECM uses the signal from feedback sensor 1 as the primary signal of throttle plate position, and the signal from feedback sensor 2 for plausibility checks.

- The signal from feedback sensor 1 varies between 0.5 volt (0% throttle open) and 4.5 volts (100% throttle open)
- The signal from feedback sensor 2 varies between 4.5 volts (0% throttle open) and 0.5 volt (100% throttle open)

While the ignition is on, the ECM continuously monitors the two feedback sensors for short and open circuits and checks the feedback sensor signals, against each other and the inputs from the Accelerator Pedal Position (APP) sensor, for plausibility. If a fault is detected in the feedback sensor signals or the DC motor, the ECM:

- Stores a related fault code in memory.
- Illuminates the SERVICE ENGINE warning lamp in the instrument pack.
- Adopts a throttle limp home mode or disables throttle control, depending on the nature of the fault.
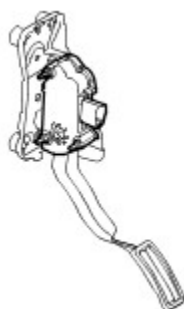
The throttle limp home mode adopted depends on the nature of the fault:

- If there is a fault with one feedback sensor, or the throttle position controller in the ECM, the ECM limits vehicle acceleration by limiting throttle plate opening.
- If there is a fault with both feedback sensors, the ECM uses fuel injection cut-off to limit engine speed to 1300 rev/min maximum.

C0175 Electronic Throttle Pinout Details

Pin No	Description	Input/ Output
1	Throttle +	Input
2	Throttle -	Input
3	Sensor Ground	-
4	Throttle position 2	Input
5	5 Volt reference voltage	Input
6	Throttle position 1	Input

ACCELERATOR PEDAL POSITION SENSOR

E46901

The Accelerator Pedal Position Sensor (APP) is integral to the accelerator pedal assembly.

The APP sensor enables the ECM to determine the throttle position requested by the driver on the accelerator pedal.

The APP sensor is installed on the pedal box and consists of a twin track potentiometer with wipers driven by a linkage connected to the accelerator pedal. Each potentiometer track has a 5 volt supply and ground connection from the ECM, and produces a linear signal voltage to the ECM proportional to the position of the accelerator pedal. The signal voltage from track 1 of the potentiometer is approximately double that of the signal voltage from track 2.

From the sensor signals, the ECM determines driver demand as a percentage of pedal travel, where 0% is with the pedal released and 100% is with the pedal fully depressed. Driver demand is then used to calculate throttle angle, fuel quantity and ignition timing. The ECM also outputs driver demand on the CAN system, for use by the brake and gearbox control systems.

The ECM stores the signal values that correspond with closed and wide open throttle, and adapts to new values to accommodate component wear or replacement.

The signals from the APP sensor are monitored by the ECM for short and open circuits and plausibility. If a fault is detected, the ECM:

- Stores a related fault code in memory.
- Illuminates the SERVICE ENGINE warning lamp in the instrument pack.
- Inhibits the driver demand message on the CAN bus, which disables the Hill Descent Control (HDC) function of the ABS modulator and reduces the performance of the automatic gearbox (harsh gear changes and loss of kickdown).
- Adopts a throttle limp home mode.

The throttle limp home mode adopted depends on the nature of the fault:

- If a fault is detected with one potentiometer track, the ECM limits vehicle acceleration by limiting throttle plate opening.
- If a fault is detected with both potentiometer tracks, the ECM uses the throttle plate to run the engine at a fixed speed of 1472 rev/min while the brake pedal is released, and idle speed (750 rev/min) while the brake pedal is pressed or if there is a brake pedal sensor fault.
- If there is a process fault in the ECM, the ECM either uses fuel injection cut-off to limit engine speed to 1300 rev/min or disables fuel injection to stop the engine.

C0787 Accelerator Pedal Position Sensor Pin Out Table

Pin No	Description	Input/Output
1	APPS 1 ground	-
2	APP 1 demand	Output
3	APP 2 demand	Output
4	N/C	-
5	APP 2 ground	-
6	Reference voltage 2	Input
7	Reference voltage 1	Input