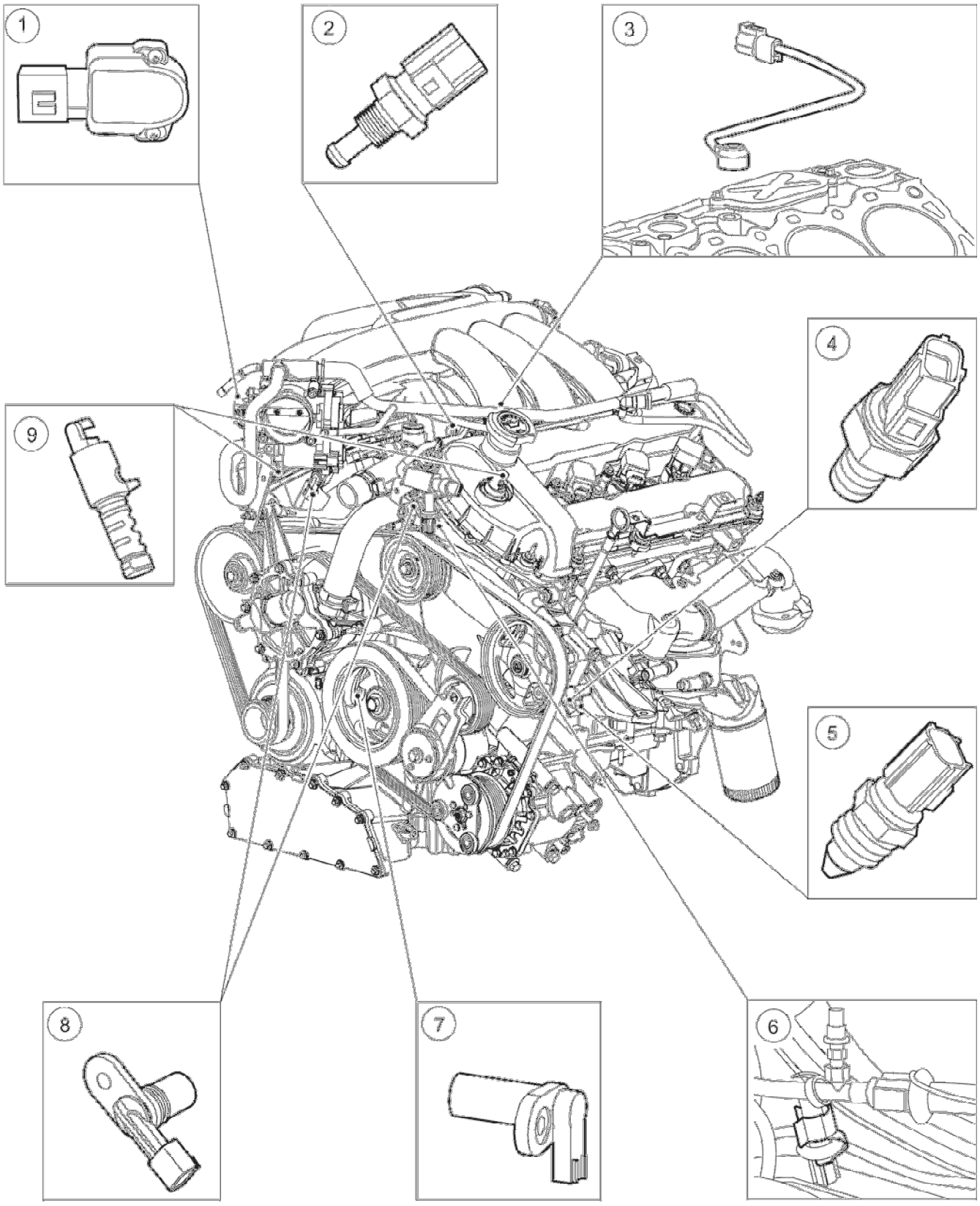
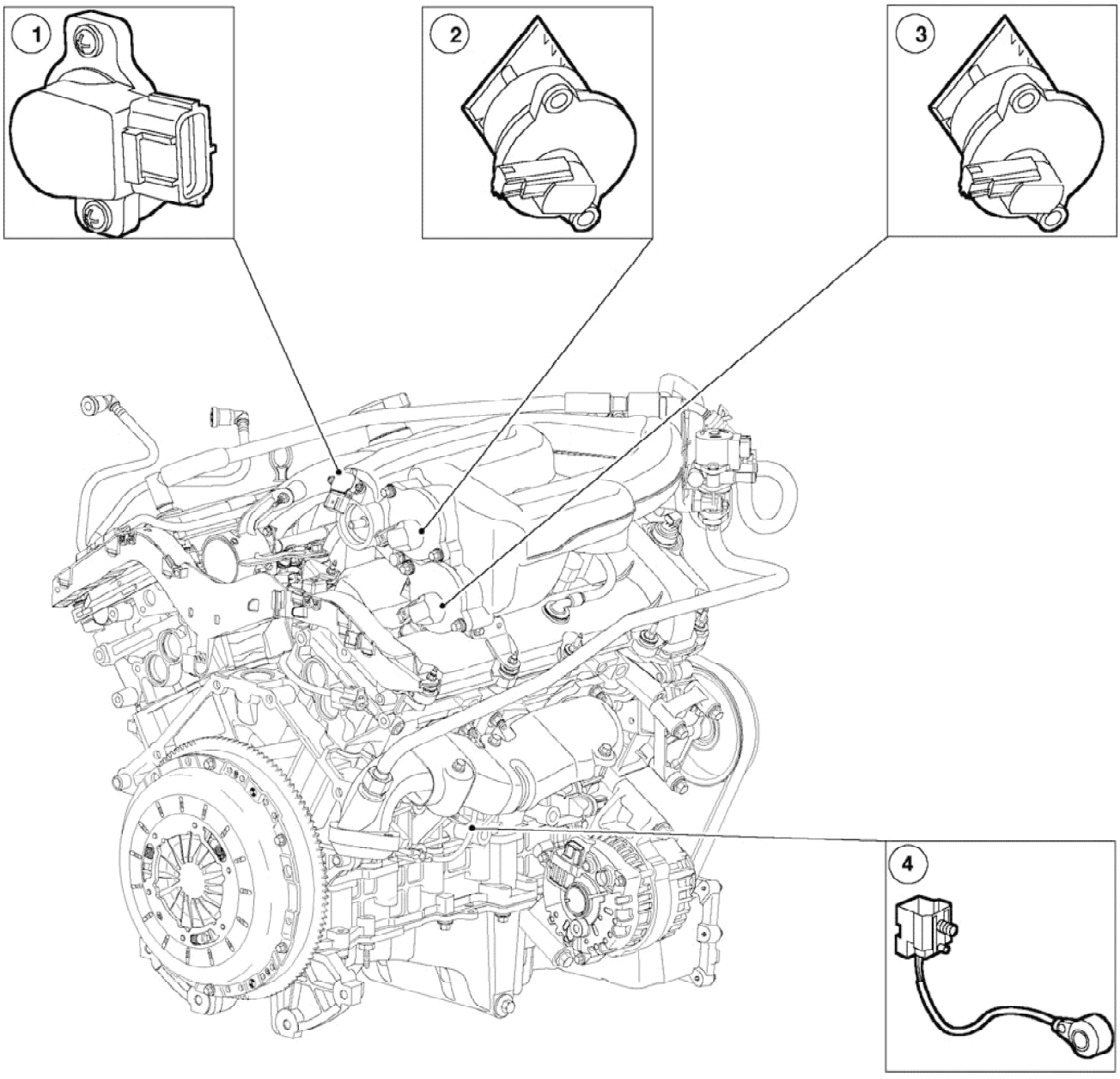
Electronic Engine Controls



E30343

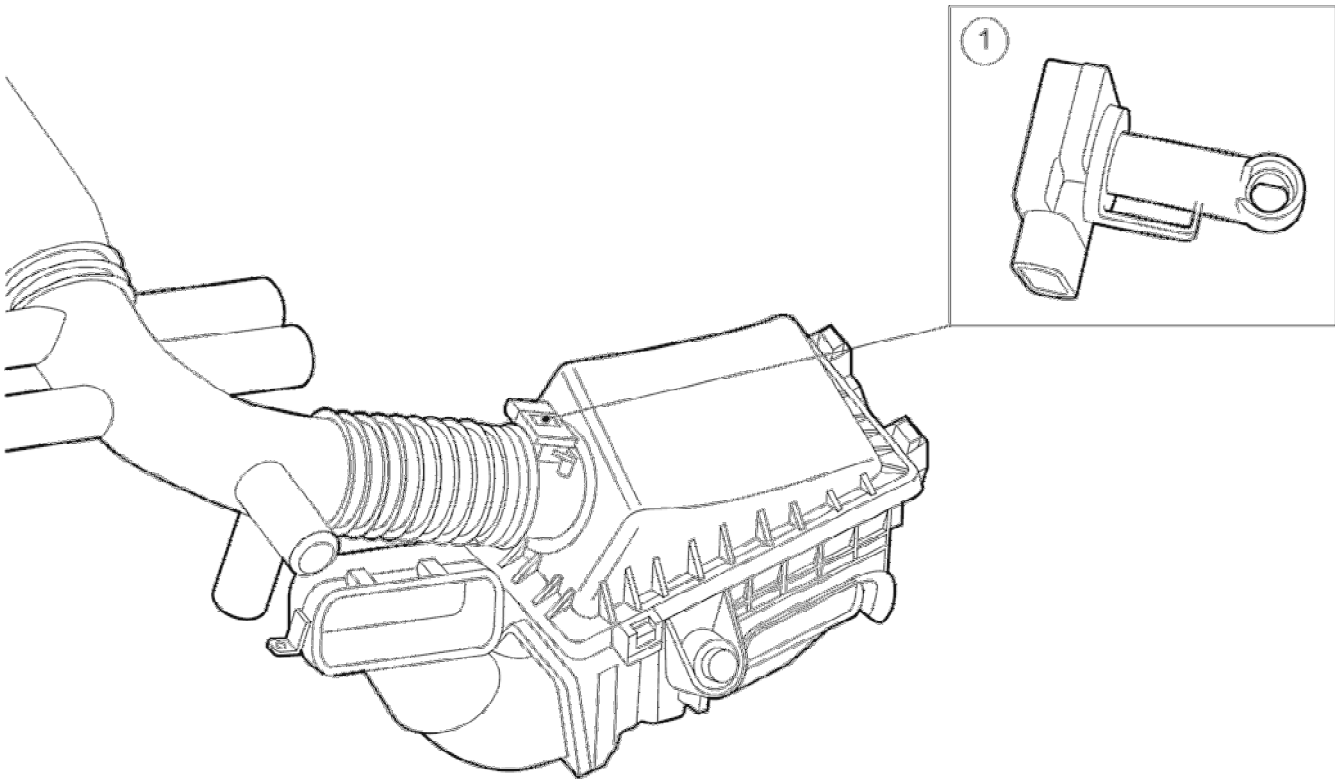
Item	Description

1	Throttle position (TP) sensor
2	Engine coolant temperature (ECT) sensor
3	Knock sensor - LH
4	Oil pressure sensor
5	Oil temperature sensor
6	Fuel pressure sensor
7	Crankshaft position (CKP) sensor
8	Camshaft position (CMP) sensor
9	Variable camshaft timing oil control solenoid



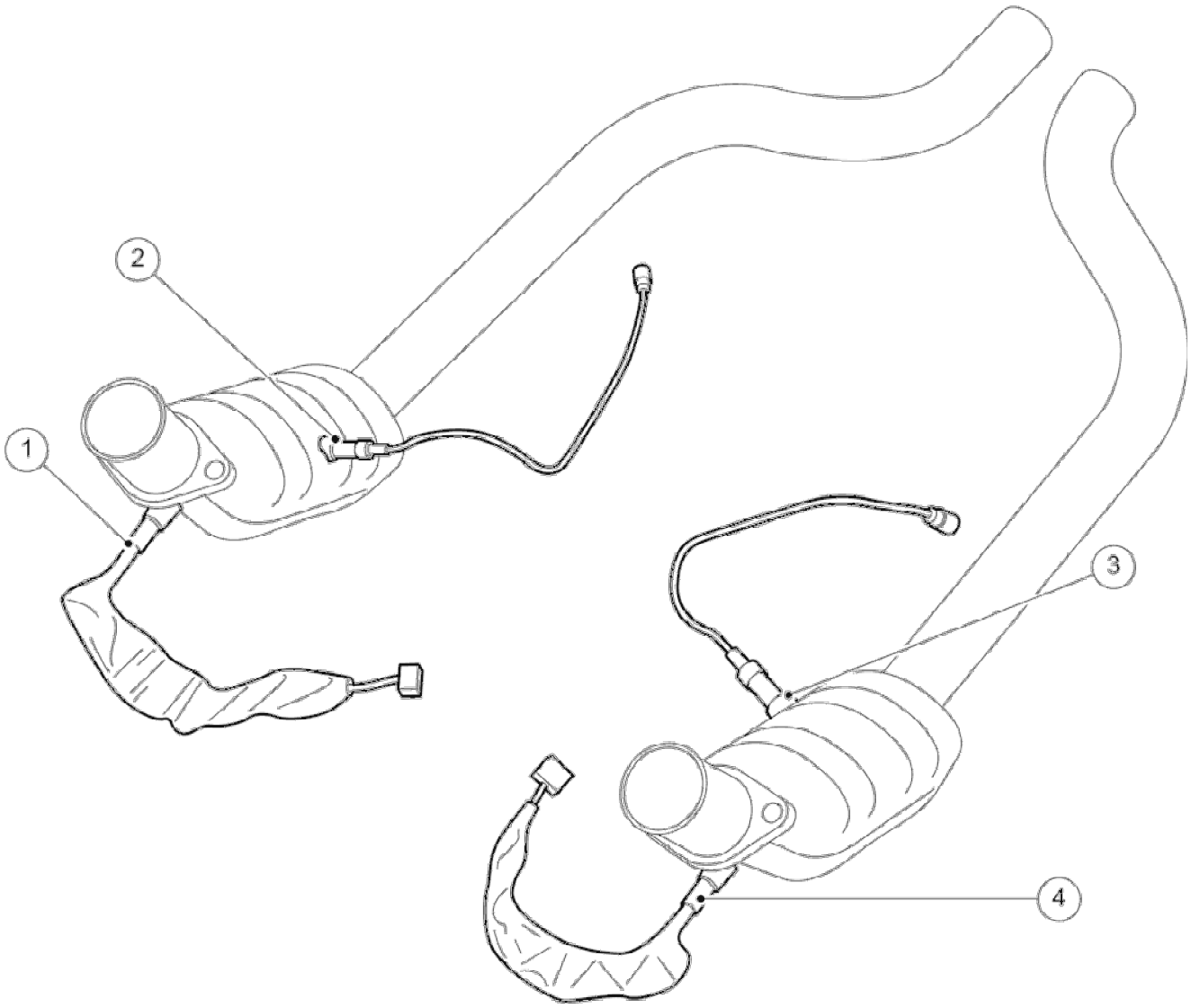
E30345

Item	Description
1	Manifold absolute pressure (MAP) sensor
2	Intake manifold tuning (IMT) valve
3	Intake manifold tuning (IMT) valve
4	Knock sensor - RH



E30344

Item	Description
1	Mass air flow (MAF) sensor



E30438

Item	Description
1	Heated oxygen sensor - RH
2	Catalyst monitor sensor - RH
3	Catalyst monitor sensor - LH
4	Heated oxygen sensor (HO2S) - LH

Engine Control Module (ECM)

The electronic engine control system consists of an engine control module (ECM), located behind the glove compartment, and a number of sensing and actuating devices. The sensors supply the ECM with input signals which relate to the engine operating conditions and driver requirements. The sensor information is evaluated by the ECM using the results to activate the appropriate response from the actuating devices. The system provides the necessary engine control accuracy and adaptability to:

- Minimize exhaust emissions and fuel consumption.
- Provide optimum driver control under all conditions.
- Minimize evaporative emissions.
- Provide system diagnostics.

In addition to these functions the ECM also interfaces with other vehicle systems through the controller area network (CAN).

Camshaft Position (CMP) Sensor

The camshaft position (CMP) sensors monitor the position of both camshafts to allow the ECM to control the phase of the inlet camshafts relative to the position of the crankshaft.

Variable Camshaft Timing Oil Control Solenoid

The variable camshaft timing oil control solenoid is a hydraulic actuator, which advances and retards the inlet camshaft timing, thereby altering the camshaft to crankshaft phasing for optimum engine performance.

Intake Manifold Tuning (IMT) Valve

There are two intake manifold tuning (IMT) valves, an upper and a lower, sometimes referred to as number one and two respectively. They are a two position (open and close) device used to create a variable air intake system. The IMT valve positions are switched by signals from the ECM to optimize torque across the engine's speed and load range. On vehicles fitted with a 2.5L engine the upper IMT valve opens between 4,500 and 6,400 rpm while the lower IMT valve opens between 3,700 and 6,400 rpm. On vehicles fitted with a 3.0L engine the upper IMT valve opens between 4,100 and 6,150 rpm while the lower IMT valve opens between 3,900 and 6,150 rpm.

Knock Sensors (KS)

The knock sensors (KS) detect combustion knock within the engine cylinders and sends a signal to the ECM. The ECM uses this information to gradually adjust the ignition timing until the combustion knock is eliminated.

Mass Air flow (MAF) Sensor

The mass air flow (MAF) sensor informs the ECM of the rate of air flow entering the engine by producing a voltage which is proportional to the rate of air flow into the engine. The voltage produced by the MAF sensor increases as the rate of air flow increases. The ECM also takes into account the density of the air entering the air intake system so that it is possible to maintain the required air to fuel ratio, and to compensate for variations in atmospheric pressure.

Integral to the MAF sensor is the intake air temperature sensor (IAT) which measures the temperature of the air entering the air intake system. The ECM uses this information to compensate for higher than normal air intake temperatures.

Throttle Position (TP) Sensor

The ECM monitors the angle of the throttle blade within the throttle housing through the throttle position (TP) sensor. The TP sends a voltage to the ECM which is proportional to the angle of the throttle plate. The voltage from the TP increases with the angle of the throttle plate. There are two sensor tracks within the TP sensor.

Crankshaft Position (CKP) Sensor

The crankshaft position (CKP) sensor is an inductive pulse generator, which scans protrusions on a pulse ring fitted to the front of the crankshaft to inform the ECM of the crankshaft's position and speed. The CKP sensor produces an alternating voltage. The frequency of this voltage increases proportional to engine speed.

Engine Coolant Temperature (ECT) Sensor

The engine coolant temperature (ECT) sensor is a thermistor type sensor that provides an input signal to the ECM which is proportional to the engine coolant temperature. The ECT sensor is a negative temperature

coefficient (NTC) sensor and its resistance decreases with a proportional increase in engine coolant temperature.

Oil Temperature Sensor

The oil temperature sensor is a thermistor type sensor that provides an input signal to the ECM which is proportional to the engine oil temperature.

Oil Pressure Switch

The oil pressure switch is connected to the instrument cluster and is not directly part of the electronic engine control system.

Heated Oxygen Sensor (HO2S)

The heated oxygen sensor (HO2S) is a linear characteristic type sensor, fitted forward of the exhaust system's catalytic converter. The ECM uses this as it's primary sensor to measure the oxygen content of the exhaust gasses within the exhaust system to provide closed-loop fuelling control.

Catalyst Monitor Sensor

The catalyst monitor sensor is a non-linear characteristic type sensor fitted to the exhaust system's catalytic converter. The ECM uses this as it's secondary sensor to measure the oxygen content of the exhaust gasses within the exhaust after they have passed through the catalytic converter. As well as providing additional closed-loop fuelling control the ECM uses this information to determine the efficiency of the catalytic converter.