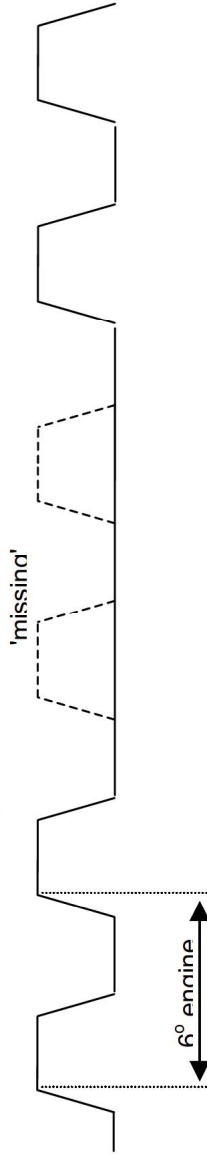


4.9 Engine Speed and Position Sensor (Crankshaft Sensor)

4.9.1 Description

This sensor is the most important sensor on the vehicle, without it the engine cannot run. There is no backup strategy or limp home facility should it fail. The sensor produces the signal which enables the ECM to determine the angle of the crankshaft, and the engine rpm. From this, the point of ignition, fuel injection, etc. is calculated. If the signal wires are reversed a 3° advance in timing will occur, as the electronics within the ECM uses the falling edge of the signal waveform as its reference/timing point for each tooth.

The reluctor is machined and has a tooth pattern based on 60 teeth at 6° intervals and 3° wide: two of the teeth are removed to provide a hardware reference mark which is 60 degrees before top dead centre No. 1 cylinder.



The sensor operates by generating an output voltage caused by the change in magnetic field, which occurs as the teeth pass in front of the sensor. The output voltage varies with the speed of the teeth passing the sensor; the higher the engine speed, the higher the output voltage. Note that the output is also dependent on the air gap between the sensor and the teeth (the larger the gap, the weaker the signal, the lower the output voltage).

There are two diagnostic checks on the output signal of this sensor: -

1. The hardware reference mark created by the missing teeth is outside the search window and the engine speed is greater than 500 rpm.
2. The hardware reference mark is outside the search window by more than one tooth and the engine speed is greater than 500 rpm.



The ECM transmits the engine speed to the automatic TCM using CAN, while all other control modules are hardwired.

Engine Speed and Position Sensor								
Component/ System	Fault Codes	Monitoring Strategy Description	Malfunction Criteria	Threshold value	Secondary Parameter	Enable Conditions	Time Required	MIL Illumination
Engine Speed and Position Sensor	P0335	rationality check	reference mark outside search window	> 2 occurrences	engine speed	> 500 rpm	2 revolutions/continuous	two driving cycles
	P0336		counted teeth – actual number of teeth	+ 1 tooth			1 revolution/continuous	

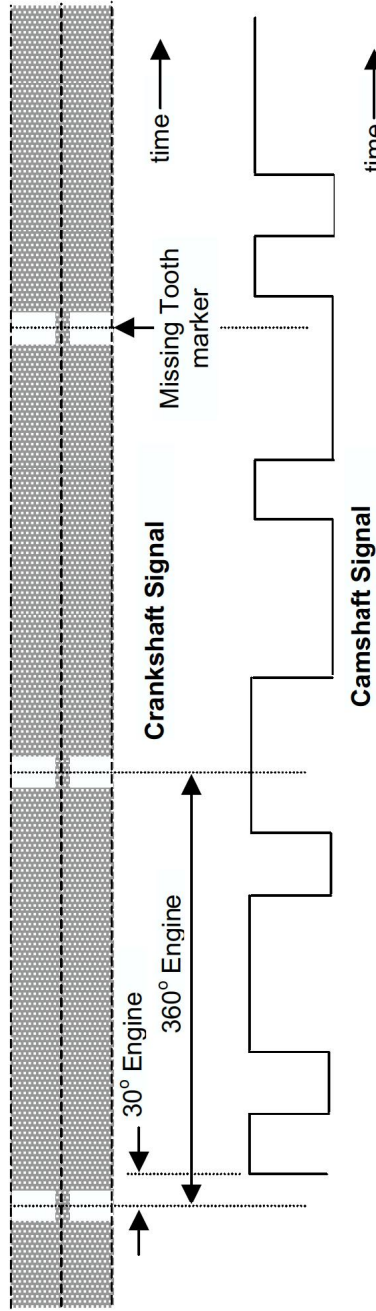
If the above table does not include details of the following enabling conditions: - IAT, ECT, vehicle speed range, and time after engine start-up then the state of these parameters has no influence upon the execution of the monitor.



4.10 Camshaft Position Sensor

4.10.1 Description

This is a Hall effect sensor producing four pulses for every two engine revolutions. The sensing element is positioned between 0 and 2mm from the side of the cam gear wheel. The sensor is, in effect, a magnetically operated electrical switch, switching a battery supply level voltage on or off dependent on the position of the cam gear wheel with respect to the sensor.



The cam gear wheel has four slots machined in it enabling cylinder identification every 90°. The signal is used for cylinder recognition; enabling sequential fuel injection, knock control and cylinder identification for diagnostic purposes.

The system checks the camshaft position sensor signal at every software reference mark i.e., 54° before top dead centre (2 teeth after the reluctor 2nd missing tooth). A fault condition is recognised if the signal does not change state (high to low or low to high voltage) every crankshaft revolution.

Camshaft Position Sensor								
Component/System	Fault Codes	Monitoring Strategy Description	Malfuction Criteria	Threshold value	Secondary Parameter	Enable Conditions	Time Required	MIL Illumination
Camshaft Position Sensor	P0340	rationality check	signal sequence	incorrect signal	crankshaft revolutions	> 100 revolutions	0.500 sec/continuous	two driving cycles

If the above table does not include details of the following enabling conditions: - IAT, ECT, vehicle speed range, and time after engine start-up then the state of these parameters has no influence upon the execution of the monitor.