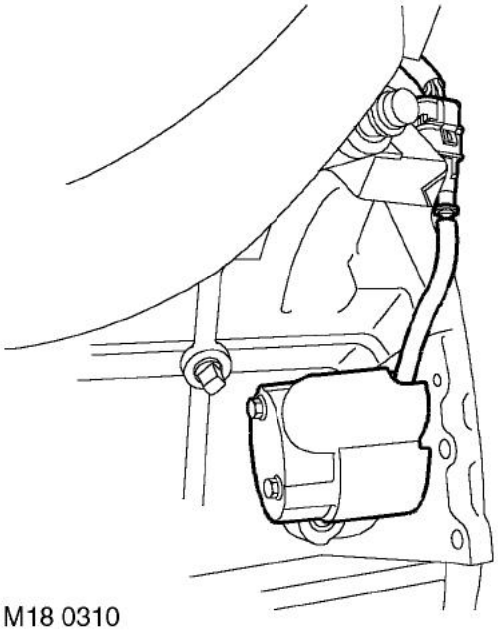
Crankshaft speed and Position (CKP) sensor (C0168)



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The CKP sensor is located towards the rear of the engine below cylinder number 7, with its tip adjacent to the outer circumference of the flywheel. The CKP sensor is the most important sensor on the vehicle and without its signal the engine will not run. The signal produced by the CKP sensor allows the ECM to determine crankshaft angle and speed of rotation. The ECM uses this information to calculate ignition timing and fuel injection timing.

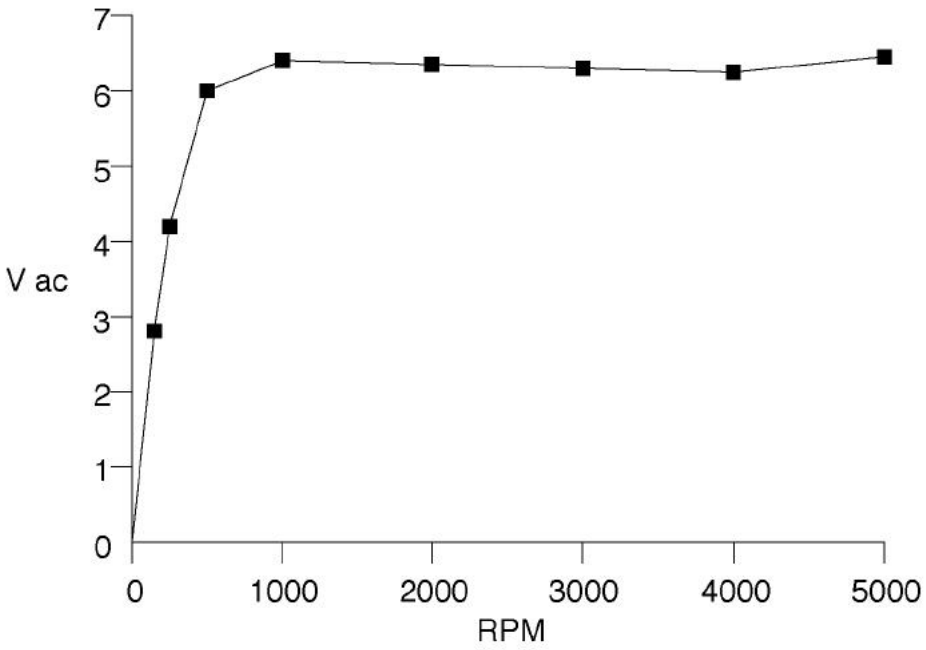
The CKP sensor works as a variable reluctance sensor. It uses an electromagnet and a reluctor ring to generate a signal. As the reluctor ring passes the tip of the CKP sensor the magnetic field produced by the sensor is cut and then re-instated. The ECM measures the signal as an ac voltage.

The output voltage varies in proportion to engine speed. The reluctor ring has a set tooth pattern, 60 teeth are spaced at 6° intervals and are 3° wide, two teeth are removed to provide a reference mark at 60° BTDC for number 1 cylinder. There is no back up strategy or limp home facility if this sensor fails, the engine does not run.

Input/Output

Because of the nature of its operation the CKP sensor does not require any electrical input source. The CKP sensor is a 3 pin variable reluctance sensor generating its own electrical output. The 2 output sources from the sensor are earthed via pin 46 of connector C0636 of the ECM and sensor output is via pin 32 of connector C0636 of the ECM. This output is in the form of an ac voltage waveform. The 3rd pin is used by the ECM as an earth screen, this screen protects the integrity of the CKP sensor signal to ensure that outside electrical interference is eliminated, it is controlled via pin 45 of connector C0636 of the ECM. The ac voltage generated from the CKP sensor is relative to engine speed.

Typical CKP sensor output



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The above readings are dependent upon correct air gap between the tip of the CKP sensor and the passing teeth of the reluctor ring. The correct air gap between the tip of the CKP sensor and the passing teeth of the reluctor ring can be set by the correct fitting of a spacer as follows:

- 9.2 mm spacer for vehicles with manual gearbox fitted.
- 18 mm spacer for vehicles with automatic gearbox fitted.

It is vital that the correct air gap is maintained, if the air gap becomes too wide the CKP signal becomes too weak, causing possible engine misfires to occur.

The CKP sensor can fail the following ways or supply incorrect signal:

- Sensor assembly loose.
- Incorrect spacer fitted.
- Sensor open circuit.
- Sensor short circuit.
- Incorrect fitting and integrity of the sensor.
- Water ingress at sensor connector
- ECM unable to detect the software reference point.
- Ferrous contamination of crank sensor pin/reluctor

In the event of a CKP sensor signal failure any of the following symptoms may be observed:

- Engine cranks but fails to start.
- MIL remains on at all times.
- Engine misfires (CKP sensor incorrectly fitted).
- Engine runs roughly or even stalls (CKP sensor incorrectly fitted).
- Tachometer fails to work.
- Flywheel adaption reset – ferrous contamination

If the CKP sensor fails while the engine is running the engine will suddenly stall, this is because the CKP sensor has no backup strategy. If this happens the ECM will produce a fault code that it can store in its memory. If the engine is not running when the CKP sensor fails, the vehicle will crank but will be unlikely to start, and no fault code will be generated. In this instance the MIL lamp will remain illuminated and the tachometer will fail to read.

It is vital that the CKP sensor output wires are not reversed (i.e. the connector is fitted incorrectly) as this will cause a 3° advance in ignition timing. This happens because the ECM uses the falling edge of the signal waveform as its reference or timing point for each passing tooth on the reluctor.

Whenever a new crankshaft position sensor is fitted or the flywheel is removed, the adaptive values will have to be reset, using TestBook.

Should a malfunction of the component occur, the following fault codes may be evident and can be retrieved by TestBook:

P Code	J2012 description	Land Rover description
P0335	Crankshaft position sensor a circuit malfunction	Reference mark outside search window for more than two revs, with engine speed above 500 rev/min
P0336	Crankshaft position sensor a circuit range/ performance	Incorrect number of teeth detected ±1 tooth between reference marks with engine speed above 500 rpm