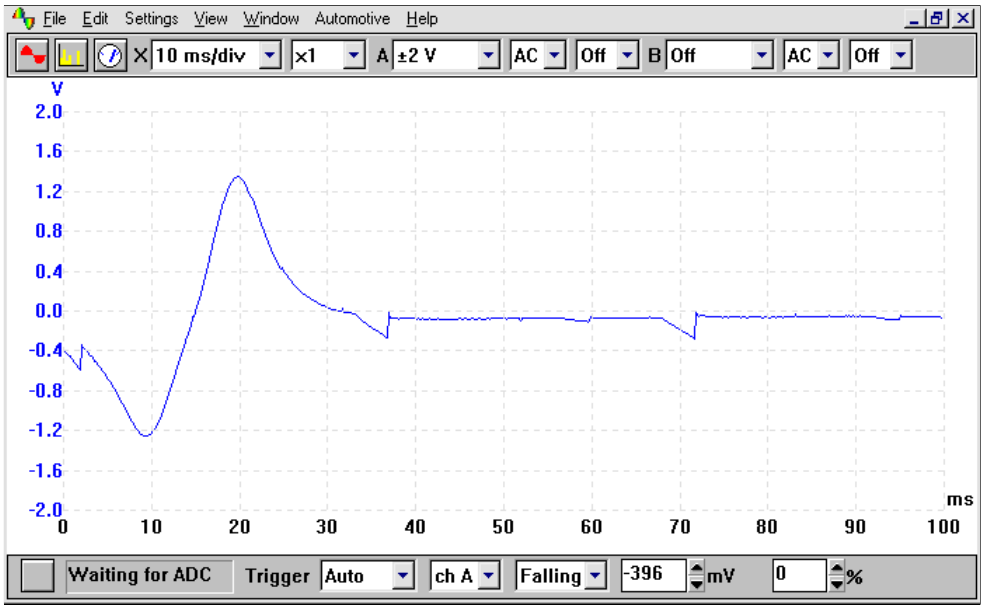
Diagnostic-Assistance

Example: Camshaft Sensor (Inductive) Waveform



Connection Notes

Plug a BNC test lead into channel A on the Scope , place a large black crocodile clip on the test lead with the black moulding (negative) and an acupuncture probe onto the test lead with the red moulding (positive). Probe each of the two connections until the larger waveform is displayed, the smaller waveform being the earth return.

Alternatively the *AS-OS-02* two pin test lead adapter can be used, as illustrated in *figure 14.1.6*.

Fig.14.1.6

As you will see in the preset scope picture and the example on this page the waveform has been stabilised by using a falling trigger.

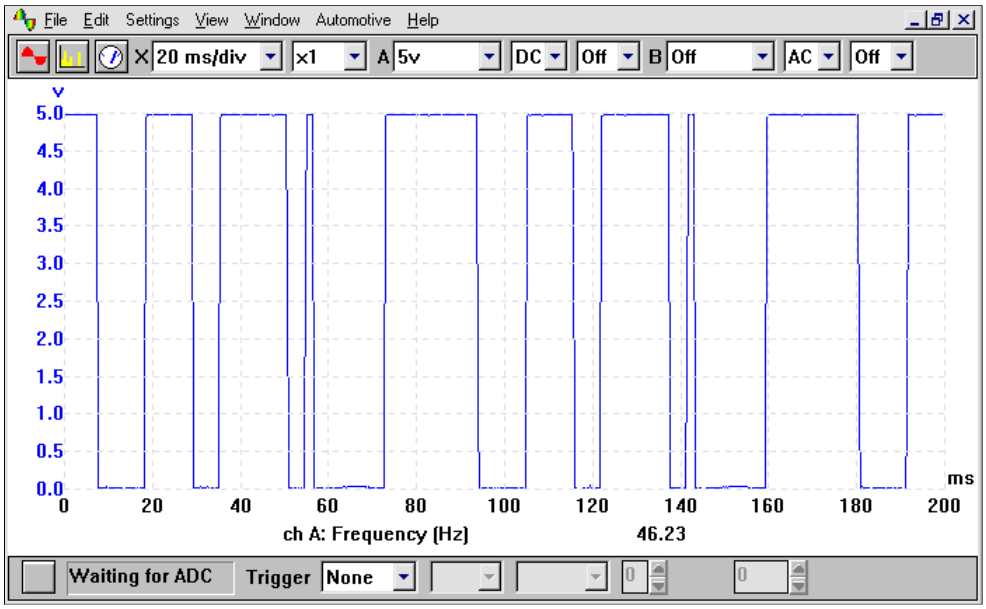
Waveform Notes

The camshaft sensor is sometimes referred to as the Cylinder Identification (CID) sensor or a 'phase' sensor and is used as a reference to time the sequential fuel injection by the Electronic Control Module (ECM).
This particular type of sensor generates its own signal and therefore does not require a voltage supply to power it and is recognisable by its two electrical connections, with the occasional addition of a coaxial shielding wire.

The voltage produced by the camshaft sensor will be determined by several factors, these being the engine's speed, the proximity of the metal rotor to the pick-up and the strength of the magnetic field offered by the sensor. The ECM needs to see the signal when the engine is started for its reference; if absent it can alter the point at which the fuel is injected. The driver of the vehicle may not be aware that the vehicle has a problem if the CID sensor fails, as the drivability may not be affected.

The characteristics of a good inductive camshaft sensor waveform is a sinewave that increases in magnitude as the engine speed is increased and usually provides one signal per 720° of crankshaft rotation (360° of camshaft rotation). The voltage will be approximately 0.5 volts peak to peak while the engine is cranking, rising to around 2.5 volts peak to peak at idle as seen in the example show.

Example: Camshaft Sensor (Hall effect) Waveform



Connection Notes

Plug a BNC test lead into channel A on the Scope , place a large black crocodile clip on the test lead with the black moulding (negative) and an acupuncture probe onto the test lead with the red moulding (positive). Probe each of the three connections. The three connections being: the sensor's voltage supply, an earth and the Hall Effect output. The Hall Effect output has been monitored in the example waveform shown on this page.

Fig. 14.1.7.1

Figure 14.1.7.1 shows the fly lead multiplug for the Hall Effect camshaft sensor being probed on a Vauxhall ECO TEC engine.

The time-base may need to be altered if the signal is checked at varying engine speeds.

Waveform Notes

The camshaft sensor is sometimes referred to as the Cylinder Identification (CID) sensor and is used as a reference to time the sequential fuel injection. The signal waveform can be either a permanent magnetic sine wave or in this particular case a digital square wave.
The Electronic Control Module (ECM) needs to see the signal when the engine is started for its reference; if absent, it can put the ECM into 'limp-home'.

The characteristics of a good Hall effect waveform is clean, sharp switching and as with all other Hall units has 3 electrical connections.

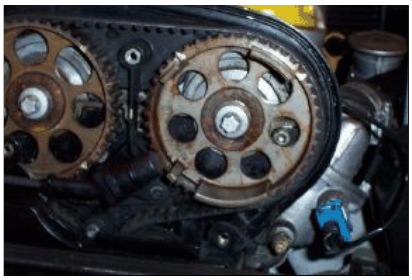
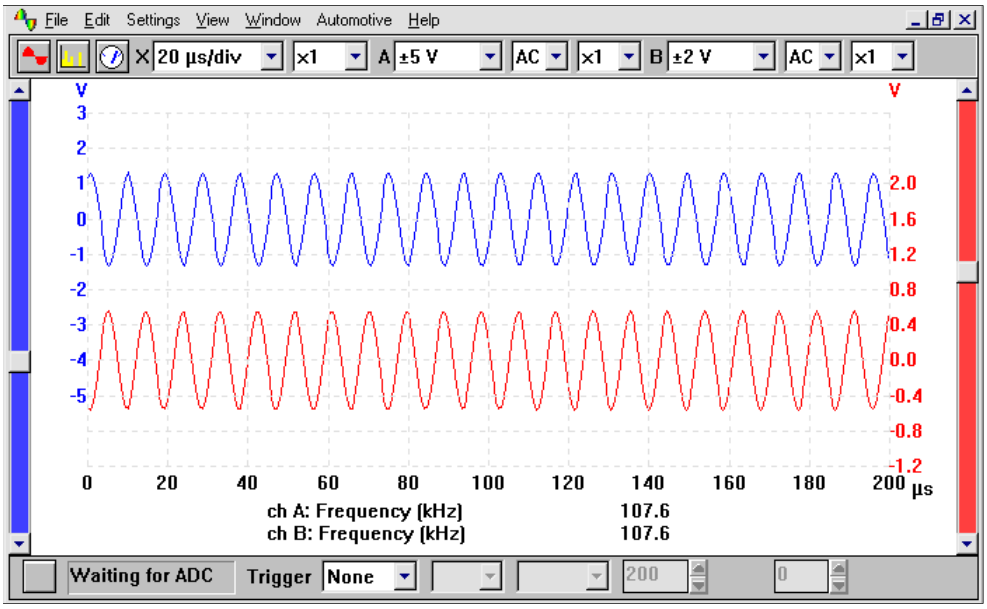


Fig. 14.1.7.2

Figure 14.1.7.2 shows the camshaft sensor in situ. The rotor disc on the camshaft pulley can clear be seen with the four cut outs that generate the waveform above.

Example: Camshaft Sensor (AC Exicited) Waveform



Connection Notes

Plug a BNC test lead into channel A on the Scope , place a large black crocodile clip on the test lead with the black moulding (negative) and an acupuncture probe onto the test lead with the red moulding (positive). Plug a BNC test lead into channel B on the PicoScope , place an acupuncture probe onto the test lead with the red moulding (positive). Place the large black crocodile clip onto the battery negative and probe the sensor with the two acupuncture probes .

The sensor will have three wires, two of these will display the alternating current (ac) waveform as illustrated in the example on this page, the other wire will be an earth.

Fig. 14.1.5

Figure 14.1.5 shows the two acupuncture probes back probing the camshaft sensor multiplug at the connection within the recess of the cam cover on the Vauxhall ECO TEC engine.

Waveform Notes

This type of sensor is used on some of the Vauxhall ECO TEC engines. This Cylinder Identification (CID) sensor differs in operation from the other inductive sensors by having an Alternating Current (AC) voltage supply to the CID sensor.
The Electronic Control Module (ECM) supplies a very high frequency at around 120 kHz to an exciter coil that is located in close proximity to a rotating disc. The disc is located at the end of the camshaft and has a section removed that when 'open' allows the frequency to excite the receptor (through mutual inductance) and returns the signal to the ECM, indicating the position of number 1 cylinder.

As the frequency is so fast, the time scale should be set as fast as possible so as the oscilloscope can capture the frequency. The CID sensor is used as a reference for the ECM to determine the camshaft's position, from which the correct timing for the sequential fuel injection can be determined.