

# Crank Position Sensor

From E30 Zone Wiki

The Crank Position Sensor, or CPS, is the single most important sensor in the engine management system. It tells the ECU how fast the engine is turning, and if the ECU doesn't have that information then it will not activate the Fuel or Ignition circuits.

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Motronic 1.3 Crank Position Sensor

## Overview

Any electronically-controlled car needs a way of knowing that the engine is turning, and the E30 is no different. For that reason, a CPS is fitted to the engine.

By reading a pulse from a toothed wheel, the CPS can tell when the crankshaft is at TDC; by measuring the time between each pulse, the ECU can tell how fast the engine is moving. With that data, the ECU knows exactly when to pulse the fuel injectors and fire the spark plugs.

The E30 was fitted with two types of Crank Position Sensor during its lifetime. Earlier models with either Jetronic or Motronic 1.0 engine management were fitted with two sensors, which read pulses from the flywheel at the back of the engine. These sensors are mounted in the bell-housing of the gearbox. With the introduction of Motronic 1.1 in 1987, the two sensors were replaced by a single unit at the front of the engine. This new sensor reads the pulses of a specially-fitted toothed wheel, mounted onto the crank.

## Operation

The sensor itself is a Variable Reluctance sensor. In simple terms, it's a magnet that gets attracted to the teeth of the wheel as they spin past the sensor. The magnet pulls close as each tooth moves closer to it, and then falls back as the tooth moves away. The sensor converts this into a variable sine wave voltage, then cleans it up into an on/off square wave.

All of this is packaged into a single unit, mounted on a bracket at the front of the engine, or in the bell housing on earlier cars. A two-wire cable will then plug into the engine loom to send this wave to the ECU.

## Problems

Since the CPS is directly responsible for engine management, a broken sensor will prevent the engine from firing. More specifically, there will be no spark or fuel. If your engine cranks but refuses to fire, it is essential to test for spark and fuel.

Test for spark first. You can do this in two ways: a) Pull a spark plug from the engine, still connected to its HT lead. Rest it on the rocker cover to earth it, and crank the engine. Look for spark b) Connect a 12V 5W bulb between pin 15 (green wire) of the coil and earth, and confirm that it glows with the ignition on (recommended).

Now check for fuel. Crank the engine and listen for the fuel pump behind the rear seats. Lift the rear seats to help you. If you cannot hear the pump working, confirm this by opening up the access hatch, disconnecting the plug to the pump and wiring in your 12V bulb. This should glow when the engine is cranked.

If you have neither fuel nor spark, the likely culprit is the CPS.

## Testing

Because the sensor outputs a square wave, it can only be read with specialist tools. However, a basic multimeter will give an indication as to whether the CPS is completely broken or not, by testing the resistance between its two pins.

First, locate the Crank Position Sensor on your vehicle. Ensure that it is still mounted solidly to its bracket, and it is not covered with oil or road grime. Then trace the wire back to its plug, checking for breaks or damage. Often, the wire comes loose and rubs against the engine pulleys, so a damaged wire will render the CPS useless.

Once you have found the correct plug, disconnect the CPS from the engine loom and check the resistance between the two pins. You should read 540 ohms +/- 10%.

If you get a positive result, you should confirm that the signal is reaching the ECU. Reconnect the CPS to the loom, then undo the ECU plug and check for the same resistance across pins 47 and 48 of the ECU plug.

**WARNING:** Getting a reading of approx 540 Ohms does not mean that the CPS is in working condition. However, NOT getting a reading means that the CPS is broken, and will need to be replaced.

## Replacing

For the vast majority of E30s, the CPS is mounted to the front of the engine on its own bracket. Removal is therefore a simple case of undoing the lone bolt holding it in place, pulling it from its bracket, and unclipping its wiring plug from the engine loom.

For Jetronic or early Motronic vehicles, where the CPS is located in the bellhousing, removal can be troublesome. Application of heat to the area around the sensors prior to removal should help prevent breakages. If you are removing these sensors as part of a conversion to Motronic 1.3, it's recommended to leave them where they are, so that they can serve as blanking plugs.

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CPS and TDC sensors mounted to an M20 engine running Jetronic

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