TECHNICAL INFORMATION

PRESSURE SENSORS

Pressure sensors are the sensors that detect the air pressure in the vehicle's intake and convert it into an electrical signal, which is then sent to the control unit so the stoichiometric mixture or air-fuel mixture can be regulated.

The importance of these sensors lies in the fact that at higher altitude, with respect to sea level, there is less oxygen in the air. Consequently, the control unit needs to recalculate the amount of fuel injected so it can maintain a balance between the air in the engine and the amount of fuel supplied. This ensures that the emission of pollutants remains within the regulations and the power of the engine is the same at any altitude.
Some sensor models incorporate an NTC type temperature sensor which allows the sensor to detect, not only the pressure, but also the air temperature in the intake. This information is necessary for the control unit to calculate the aspirated air mass and thus regulate the air-fuel mixture.

Pressure sensors must operate in critical installation conditions, they must be capable of operating at temperatures between -40ºC and +120ºC and also be resistant to hydrocarbons. To make this possible, **FAE** subjects its pressure sensors to exhaustive approval tests that include:

- Cyclic operation at high and low pressure in extreme environmental conditions.
- Resistance to vibrations and to impacts.
- Overpressure operation at low and high temperature.
- Resistance to damp and temperature.
- Thermal shock -40 to 150ºC.

During assembly, all our sensors are subjected to leak-tightness tests and to output voltage checks. Pressure sensors are located directly in the intake manifold or connected to it by means of a flexible pipe.

Pressure sensors are classified into:

1. **Intake manifold pressure sensor**: These measure vacuum ranges between 10 and 130 kPa, they are found in vehicles with naturally aspirated engines.
2. **Boost pressure sensor**: These measure boost pressure ranges of 10-130 kPa ≤ P2 ≥ 400 kPa. They are fitted in turbocharged engines. The use of this type of sensor is very common in vehicles with a variable geometry turbocharger (VGT), as they allow the control unit to measure and control the amount of compressed air in the intake pipe.
3. **Brake booster pressure sensor**: In contrast to the pressure and boost pressure sensor, the function of the brake booster pressure sensor is to inform the engine control unit if the vacuum in the brake booster is sufficient for it to operate correctly. If the vacuum is not within range, the control unit will change the position of the butterfly valve. The unit will close it to increase the vacuum generated by the engine and the vacuum in the brake booster will move into the permitted parameters.

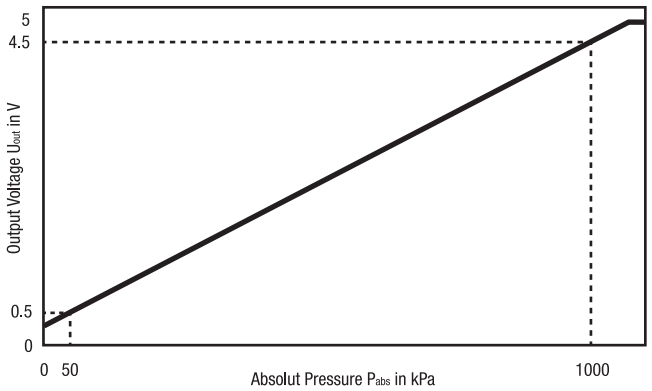
SENSOR ELEMENT

The sensor element of the pressure sensors is the piezo-resistive type with a Wheatstone bridge configuration. This means it varies its electrical resistance according to the mechanical deformation of a diaphragm.

The sensor element is integrated into a MEMS type DIE which amplifies, thermally compensates and conditions the signal. The incorporated digital electronics allows the output signal to be programmed from 0 to 5 V, depending on the requirements that we need for each sensor model. The DIE is mounted on a ceramic circuit and its electrical connections are made by bonding. This is all protected within a receptacle and by silicon gel. The electronic circuit is produced with the use of hybrid technology and it is handled in a clean room due to its delicate nature.

The pressure sensor output has a linear relationship between the intake pressure and the output voltage according to the following equation:

Vout = S*P+Of where: Vout: Output voltage (V).
S: Sensitivity.
P: Intake air pressure (kPa).
Of: Offset.



Technical Data

- Supply voltage.....5 V ± 0.5 V.
- Temperature range .....-20 to 120°C *.
- Maximum and minimum temperatures.....-40 to 140ºC.
- The sensor response time (t 10/90).....1.5 ms.
- The maximum pressure.....700kPa **.

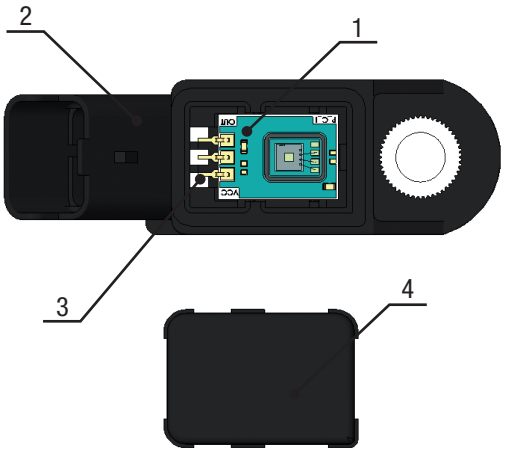
* (within tolerances)
** (30ºC for 5s)

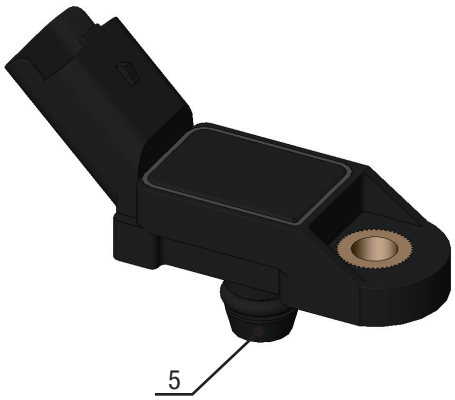
All this data is common for all the **FAE** pressure sensors, each specific type of sensor has its operating curve and its specific tolerances

TECHNICAL INFORMATION

COMPONENTS
The pressure sensors are made up of the following parts:

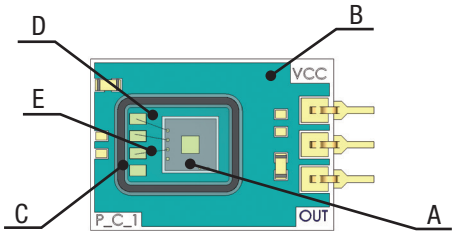
1- Sensor element: made up of the electronic circuit mounted on a ceramic board.
2- Body: generally PBT+30FV, it contains the circuit and terminals. It is normally where the air inlet to the sensor is located (5).
3- Terminals: to which the circuit is joined by means of conventional tin solder.
4- Cover: which may, in some cases, be fitted to the sensor air inlet (5).





On the sensor element are:

A- Electronic circuit
B- Ceramic board.
C- Die protector.
D- Silicon gel (which protects the electronic circuit).
E- Bonding.



ASSEMBLY INSTRUCTIONS
To change a pressure sensor, take the following steps:

- Locate the pressure sensor in the vehicle (mounted on the intake manifold or fixed nearby).
- Disconnect the vacuum pipe.
- Disconnect the pressure sensor connector.
- Remove the fastening bolts or its anchoring system.
- Install the new sensor and fasten it.
- Connect the vacuum pipe.

VISUAL INSPECTION / CAUSE OF FAULTS
The sensor body, the connector and the cable should be checked to ensure that they are in good condition. Also check if the sensor body has any cracks, dents or knocks that could have damaged it.

Bear in mind that, as a general rule, a visual inspection is not sufficient to ascertain if the sensor is working correctly or not, but it is a useful first diagnostic.

Causes of failure may be:

- Deterioration of the vacuum pipes.
- Deterioration of the connection cables or the connector.
- Deterioration of the sensor element which will result in an incorrect pressure reading.
- A leakage problem in the pressure sensor.

The possible effects of the malfunctioning of the pressure sensor are:

- Switching on of the check engine warning light.
- Difficulty in starting.
- Low power or increase in fuel consumption.
- Emission of black smoke due to spark delay or excessive injection time.
- Detonation due to excessive advance.