TECHNICAL INFORMATION

TEMPERATURE SENSORS

Temperature sensors of the vehicle are components that play an important role in controlling emissions and fuel consumption. Together with other sensors, the reading makes the ECU parameterize the conditions of the injection system.

Temperature measurement in cars is normally done by resistive sensors which consist of positive (PTC) or negative temperature coefficients (NTC). These sensitive elements, known as thermistors, are thermally sensitive resistors whose prime function is to exhibit a large, predictable and precise change in electrical resistance when subjected to a corresponding change in body temperature. PTC thermistors exhibit an increase in electrical resistance when subjected to an increase in body temperature. NTC thermistors on the contrary exhibit a decrease in electrical resistance when subjected to an increase in body temperature.

There are different types of sensors within the wide range of **FAE** which can be divided as follows:

1- Refrigerant Temperature Sensors.

2- Intake air temperature sensors.

3- Outdoor temperature sensors.

1- Refrigerant Temperature Sensors

Its function is to measure the temperature of the engine refrigerant.
These sensors are mounted through the cooling circuit and its reading is sent directly to the control unit.
The operating temperature range is from -40ºC to +130ºC.

2- Intake air temperature sensors

This sensor mounted on the inlet section records the temperature of intake air with which it is possible to calculate, in combination with a boost pressure sensor, air mass aspirated. Moreover theoretical values can be adapted for regulatory circuits (eg exhaust gas feedback, regulating the boost pressure) to air temperature.
The operating temperature range is from -40ºC to +120ºC.

3- Outdoor temperature sensors

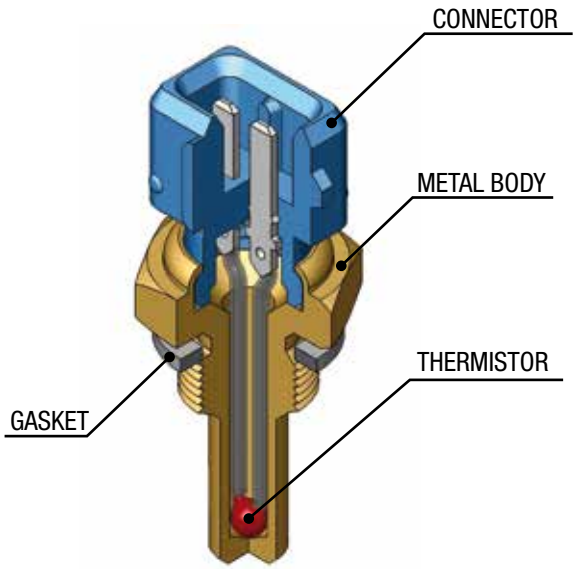
Its function is to read the outside temperature of the vehicle. Like the other temperature sensors, the reading is sent to the control unit, where together with the reading of other sensors injection is managed.

OPERATION PRINCIPLES

FAE sensors are based on a thermistor inserted at one end of a metal body, either cylindrical or hexagonal.

It is this end that comes into contact with the refrigerant (threaded or inserted directly into the cooling system of the vehicle) or with the air and will be responsible for displaying temperature and send the information to the ECU of the vehicle.

The connecting part of the sensors is usually made of plastic. It fits to the different connectors which cover the vast majority of vehicles on the market. A metal or rubber gasket ensures the tightness between the sensor and the engine block.



TECHNICAL INFORMATION

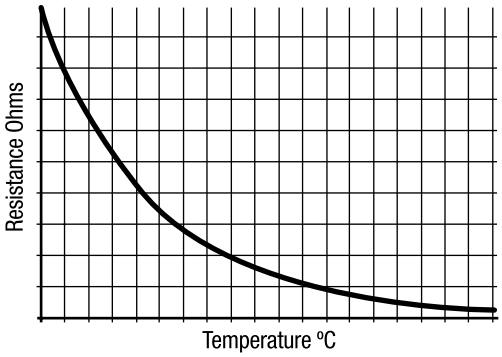
OPERATION PRINCIPLES

Negative Temperature Coefficient thermistors (NTC thermistors) are resistors whose temperature coefficient is negative, i.e. the value of the resistance depends on the temperature. NTC thermistors are made from semiconducting metal oxides such as ferric oxide (Fe2O3) by substituting some of its iron ions by titanium.

For graphical representation we need to apply the following equation:

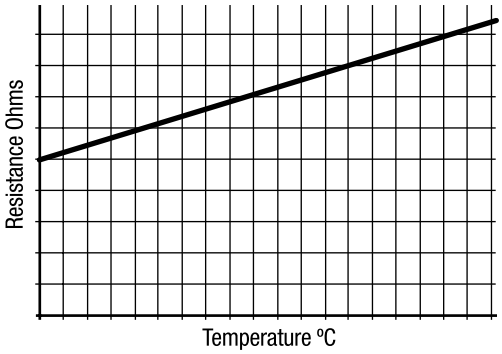
$$R_T = R_{25} exp\left\{B\left(\frac{1}{T + 273,15} - \frac{1}{25 + 273,15}\right)\right\} \quad (\Omega)$$

R_T	Temperature resistance	Ω
R_{25}	Resistance a 25º	Ω
B	Material constant (Beta)	
T	Temperature	(ºC)



Positive Temperature Coefficient Thermistors (PTC) exhibit an increase in electrical resistance when subjected to an increase in body temperature.

The initial materials used are milled, mixed with ceramic additives, pressed into moulds and sintered. Its graphical linear representation, unlike the NTC, is to be found on below chart:



ASSEMBLING INSTRUCTIONS

The torque of the sensor temperature is 30÷50 Nm.

Replace the gasket each time the sensor is changed. The gaskets do not perform their sealing function if these are used or worn.

VISUAL ASPECTS AND CAUSES OF FAILURE OF SENSORS

The good condition of the metal body, the connector and wires must be checked and ensured.
Also verify if the sensor shows any cracks, dents or impacts that might have damaged it.
Keep in mind that, as a general rule, visual inspection is not sufficient to ensure the good or bad performance of the part, but it helps to make an initial diagnosis.

1- Cracks or breaks. Tensions provoked by mechanical stress.
2- Deformations and dents. Overheated sensor.
3- Leaks. Bad anchored sensor to the engine block or a worn out seal.
4- No signal. Failure of the wire due to friction or excessive vibration, short circuit, internal failure of the sensor due to mechanical or thermal stress.

SIGNS OF FAILURE OF SENSORS

- High fuel consumption.
- Power loss.
- Overheating.
- Warning light Engine Check.
- Difficulties starting the engine.
- Increased emissions.

MAINTENANCE

The specific values of the sensors must be checked each maintenance or every 25000km. Remember that refrigerant can cause corrosion and disable the response of the sensors. In case of air sensors the possibility exists that impurities obstruct the pipes which results in the impossibility of performing readings by the sensor. Replace the sensor whenever results are diagnosed which are not within the specified operating limits.