

Tips & Technology

For Bosch business partners

Current topics for successful workshops No. 43/2012

Gasoline / diesel injection



BOSCH

Invented for life

Hot-film air mass meter HFM 6

Purpose of hot-film air mass meter HFM

The HFM is designed to measure the intake air mass and communicate this to the engine management system. This information acts as reference variable for certain engine management system functions. The HFM is used in both gasoline and diesel engines:

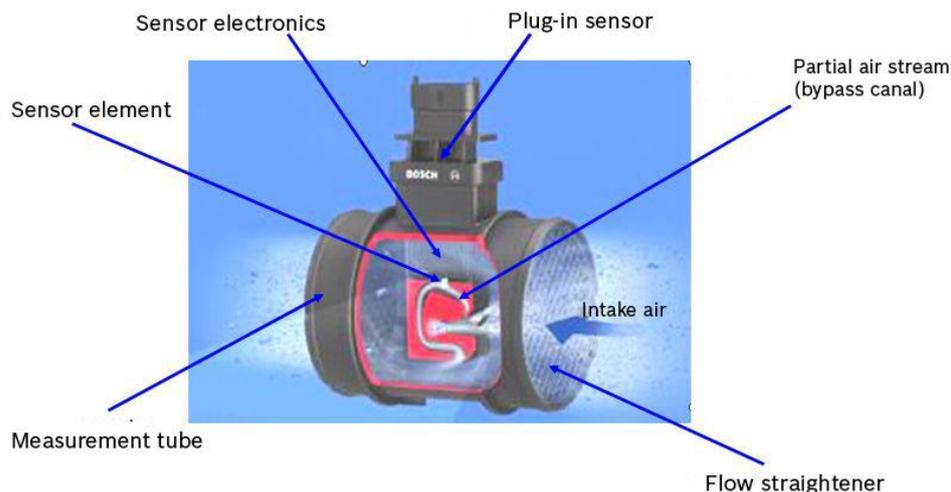
Gasoline engine

- Injection time / injected quantity
- Ignition point
- ACF regeneration
- Torque limitation / monitoring

Diesel engine

- Exhaust gas recirculation volume
- Injection time / injected quantity

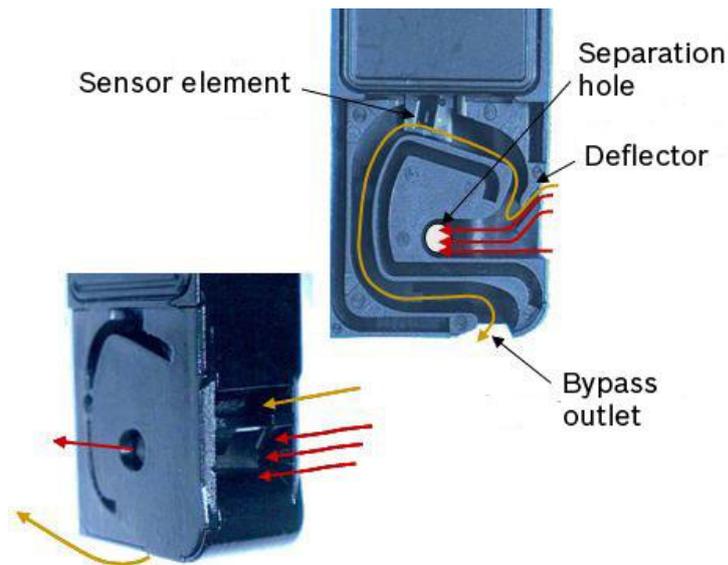
Design of HFM 6



The HFM consists of a plastic measurement tube located between the air filter and the throttle valve. The flow straightener ensures a uniform flow in the measurement

tube. The plug-in sensor contains the sensor element and the evaluation electronics and is accurately fitted in the measurement tube.

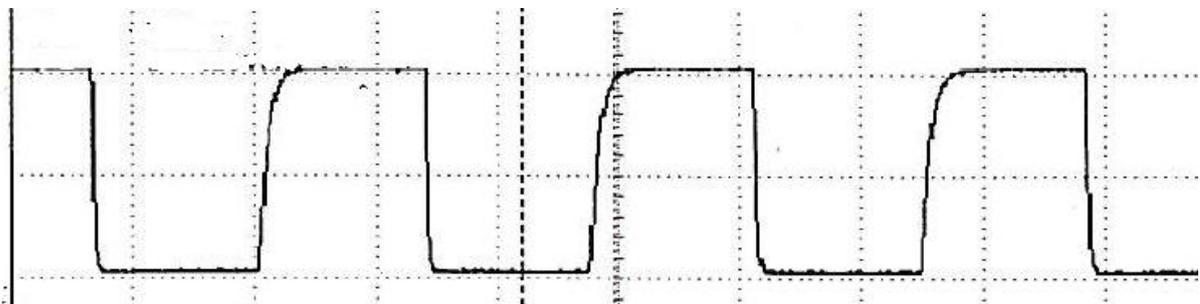
The intake air is measured by routing part of the air flow past the sensor element by way of a bypass duct in the plug-in sensor. This bypass duct has been modified on the HFM 6 as compared to previous models. A vacuum occurring at the bypass outlet draws the part of the air flow required for air mass measurement into the bypass duct. At the duct inlet the air has to flow past a deflector in a very tight bend. The sluggish dirt particles cannot keep up with this rapid flow and are returned to the intake air by way of the separation hole.



In contrast to the HFM 5, the intake air mass signal of the HFM 6 is transmitted digitally to the control unit in the form of a variable frequency. The temperature of the intake air is also transmitted digitally in the form of a pulse width modulated (PWM) signal.

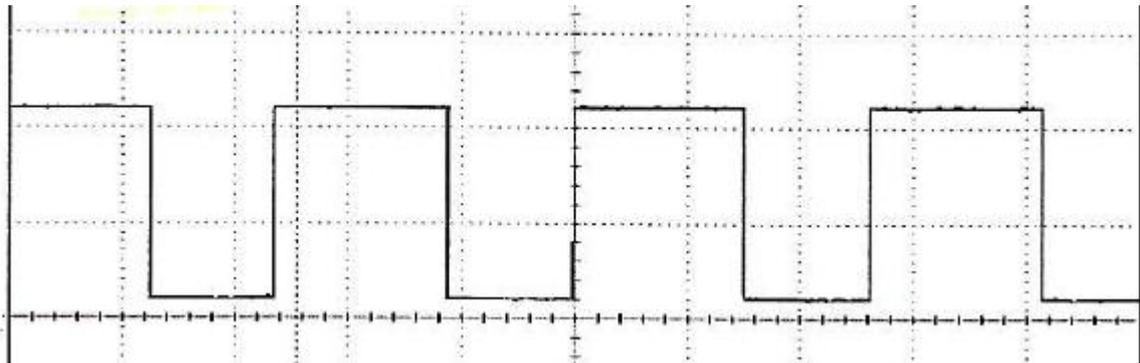
Signal patterns:

Assessment of "air mass" signal pattern ("Go" pattern):



- With zero air, the frequency is 1.76...1.93 kHz
- The greater the air mass, the higher the frequency
- The voltage excursion is approx. 4 V

Assessment of "temperature" signal pattern ("Go" pattern):



- The frequency is 18.5...20.8 Hz irrespective of temperature
- The higher the temperature, the higher the duty cycle (PWM signal)
- The voltage excursion is approx. 4 V

Workshop testing of HFM 6

For testing the HFM 6, workshops require a diagnostic unit, a multimeter featuring integrated frequency measurement or a frequency meter or an oscilloscope and a suitable test adapter (refer to the following table for the Bosch order numbers for test adapters).

Connector designation	Connector illustration	Vehicle manufacturer	Test adapter
AK 4-pin		BMW Mercedes Benz VW	0 986 610 195
MLK 5-pin		BMW Mercedes Benz Opel	0 986 610 196
Compact 4-pin		Fiat Opel Volvo	0 986 610 067
RD 5-pin		VW	0 986 610 441
US Car		GM	0 986 610 651

All the operations are performed with the hot-film air mass meter fitted. The first step is to read out the fault memory. The actual values (in particular for the intake and calculated air mass) may provide an indication of any HFM 6 malfunctioning. Such malfunctions can be reliably checked in 3 steps:

Step 1: Checking current input of HFM 6

Switch off the ignition and use a suitable test adapter to connect the multimeter in series with the power supply cable. When the ignition is switched on, the current reading on the multimeter

must be between 32 and 38 mA. A current input below the specified value most probably indicates a ruptured sensor diaphragm.

Step 2: Measurement of air mass signal with engine stopped (zero air)

Switch off the ignition and connect the corresponding wires of the test adapter to the multimeter for frequency measurement (alternatively: use an oscilloscope). Switch off or remove the exhaust gas extraction system during the zero air measurement. When the ignition is switched on, the measured frequency must be between 1.76 and 1.93 kHz. The greater the intake air mass, the higher the frequency. This can be measured by starting the engine and giving a burst of throttle. Detailed information can be found in ESI[tronic].

Step 3: Checking of temperature signal

Measure the frequency with the ignition switched on and the engine stopped. The measured frequency must be between 18.5 and 20.8 kHz and must remain constant.

Replacement

The HFM must be replaced if the measured values deviate from the specifications. The sensor element is never to be cleaned using brake cleaners or other chemical products. Separate replacement of the sensor element is not recommended for any of the hot-film air mass meter generations. In some cases this is not even possible if the plug-in sensor is welded to the measurement tube.

Preventive action

As a means of avoiding HFM damage, use air filter elements of original equipment standard, make sure none of the air pipes are leaking and always use a lint-free cloth to clean the air filter housing.