4.1
Fuel system

operate vehicles and machines with combustion engines, normally petrol or diesel fuel is required.
The components used for this purpose are classified under the term “fuel system”.

Fig. 14: fuel pumps and fuel in-tank modules, different versions

The fuel tank ventilation system (also referred to as “AKF system”) and the fuel tank leakage diagnosis are handled separately in the following sections (see Sections 4.2 and 4.3).

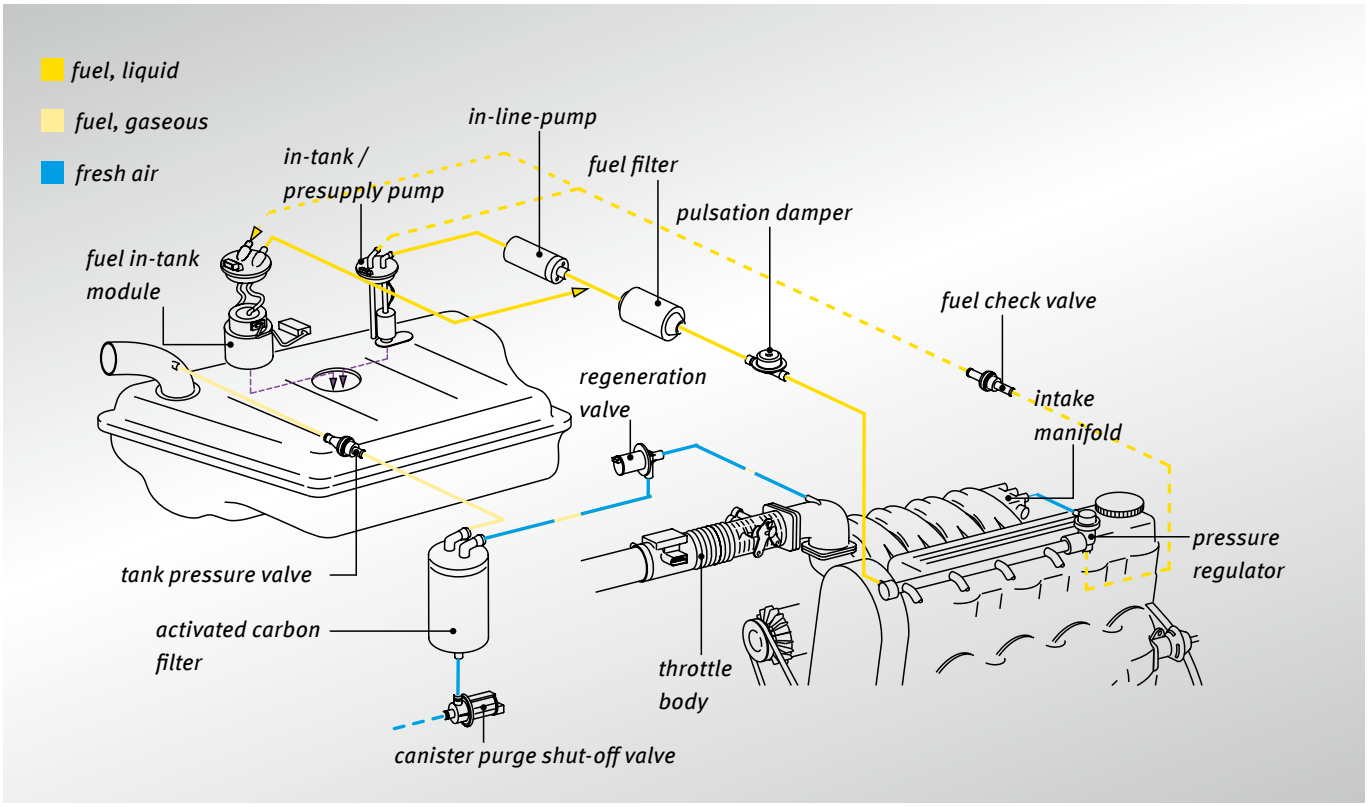

Fig. 15: fuel system, schematic

4.1.1 Monitoring

When there are greater deviations in the fuel system, similar malfunctions can occur, as described under combustion misfire or uneven running detection (please refer to Section 5.3.3):

- lack of power, jerking
- misfires until the uneven running detection responds
- oil dilution

Malfunctions or component errors that affect the mixture in such a way that they are exhaust gas relevant are detected by the lambda probe control position.

If an error is detected, a correction will be made by an adjustment of the injection times by the control unit. This correction is a short-term adjustment that is recalculated for each operating point.

The self adjustment of the mixture formation allows for an independent fine adjustment of the measured fuel quantities.

Short-term adjustment
When there are changes to the lambda value (e.g. “leaner” mixture) an immediate mixture correction will be made (in this case, for example, in the direction of “richer” mixture) so that the fuel/air ratio will again match that of the set-point.

Long-term adjustment
If corrections are necessary in the same direction over a longer time period, the control unit will apply a permanent correction value to the operating data memory. A long-term adjustment, also referred to as “adaptive precontrol”, will be made. Examples of such changes are changed leak air rates in the intake air system or changes to the air density when there are extreme changes in the elevation (mountain/valley driving).

This map, and therefore the average, are shifted so that the lambda control range for the short-term adjustment is fully retained in the “rich” as well as the “lean” direction.

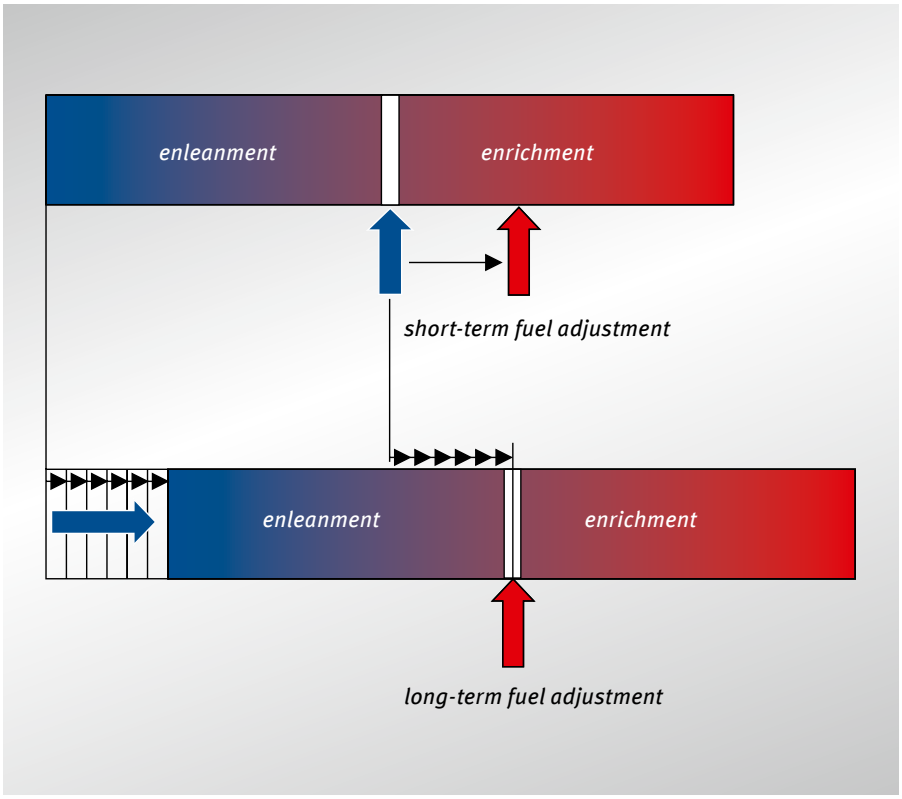

Fig. 16: self adjustment of the fuel system (mixture adjustment)

A shifting of the map, however, is possible only within specific limits (adjustment limits). If the adjustment limit is exceeded, an error will be recorded and the malfunction indicator lamp will be activated.

Possible flaut codes

P0170	volume control (bank 1)	malfunction
P0171	volume control (bank 1)	system too lean
P0172	volume control (bank 1)	system too rich
⋮		
P0175	volume control (bank 2)	system too rich
P0176	fuel composition measuring probe	malfunction
P0177	fuel composition measuring probe	measuring range or power problem
⋮		
P0178	measuring probe fuel composition	low input
P0179	measuring probe fuel composition	high input
⋮		
P0263	injection cylinder 1	contribution or synchronisation problem
P0266	injection cylinder 2	contribution or synchronisation problem
⋮		
P0296	injection cylinder 12	contribution or synchronisation problem
P0301	cylinder 1	ignition misfire
⋮		
P0312	cylinder 12	ignition misfire
P0313	ignition misfire detected	when fuel is too low
P0314	single cylinder (cyl. not defined)	ignition misfire

Important note:
Further reading:
please refer to Section 6.4.

Diagnostic instructions

Component	Possible causes/errors	Possible solutions/actions
Fuel system/mixture formation		
fuel	• defective fuel quality, fuel deficiency • soiling, blending with external substances such as diesel in the petrol fuel	• visual inspection, odour check • cleaning of the fuel systems • replacement of the fuel • replace the fuel filter and possibly the injection valves
fuel pumps	• fuel pump delivery rate (prefeeder and main pump) too low • fuel pressure too low	• measure pressure and delivery rate if present as well in the prefeeder pump • replace faulty pump
pressure regulator	• pressure controller defective, pressure too high/too low – thus injection quantity deviating	• check pressure and regulation function • replace faulty pressure controller • check fuel system
fuel filter	• clogged fuel filters; flow too low	• measure delivery rate behind the filter • replace filter
fuel lines	• fuel lines broken off • in the flow – fuel supply insufficient • in the return – fuel pressure too high	• when delivery rate is insufficient and pressure deviates, visual inspection • align lines and replace if necessary

Component	Possible causes/errors	Possible solutions/actions
Fuel system/mixture formation		
injection valves	• function errors • incorrect injection times • incorrect injection direction • leaky injection valves	• when the engine is off use a suitable instrument to check the HC value in the intake manifold • check injection times, injection signal and impermeability • clean valves or replace if necessary
AKF system	• AKF system leaking or not functioning • valves stuck • fuel overflow	• please refer to Section 4.2.3
Secondary air system		
secondary air system	• damage to the secondary air pump, the lines or the shut-off valve causing leak air in the exhaust manifold	• please refer to Sections 4.4.2 and 4.4.3
Engine control		
air mass sensor (LMS)	• wrong signal • sensor soiled or damaged	• check with scan tool (measure voltage signal) • replace defective lms
air mass sensor	• wrong signal • sporadic error (especially at high elevations)	test with scan tool: • check lines and plug-in connections • replace defective sensor if necessary
coolant sensor	• wrong signal • sporadic error	test with scan tool: • check lines and plug-in connections • replace defective sensor if necessary
air supply		
throttle body and attachments	• leak air • sensor for throttle valve position gives faulty signal • limit switch gives faulty signal or no signal	• check for leaks, replace damaged seal if necessary • check closing and end position and adjust if necessary, otherwise replace throttle body • check potentiometer signal, if necessary replace throttle body • check for wear, if necessary replace throttle body
intake manifold	• leak air in intake manifold • leak air behind the air mass sensor • leak air	• check for leaks, replace damaged seal if necessary • check closing position and adjust if necessary, otherwise replace wear parts, if necessary variable intake manifold • check for wear, if necessary replace variable intake manifold

Important note:
Modern engine control units have adaptive “storage modules“, i.e. some of the map data required for operation must be “learned“. If the power supply to the engine control unit is removed, it may be required to “teach” the control unit again.
The map data will first be recorded during driving and stored in the memory. This may take a few minutes! For this reason a test drive should be taken and only then should the function be checked again.