Idling speed control

Idling speed control means a specified speed is set before the accelerator pedal is applied. This is then adapted to the currently active operating condition of the engine.
Therefore, a cold engine will have a higher idling speed than a warm engine. Furthermore, other performance demands are considered such as

- the large amount of energy drawn by the alternator when the electrical system has low power, the power-assisted steering pump,
- the high level of pressure required for diesel injection,
- the energy required to overcome the internal friction of the engine and
- from the torque converter at different loads.

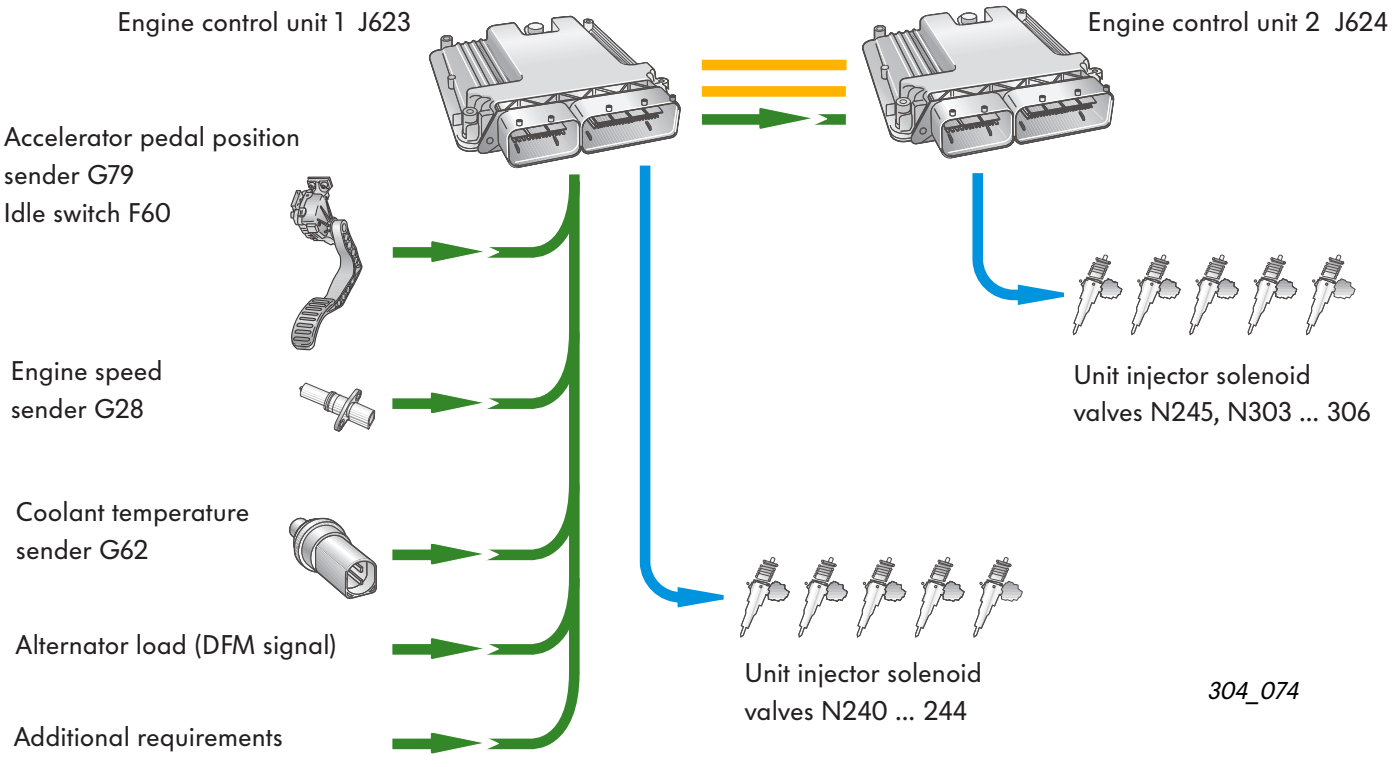
This is how it works:

The specified speed is regulated by a map in the engine control unit. The map draws on information

- from the coolant temperature sender,
- the load on the alternator and
- the load on the vehicle electrical system.

The engine control unit continually adapts the amount of fuel injected until the actual speed equates to the specified value.

To avoid unnecessary emissions, the idling speed is kept to a minimum level, though during this process, demands on smooth running also play a role.



Engine management

Smooth running control

Smooth running control improves engine running at idling speed.

Different cylinders in an engine can often generate different levels of torque even though the same amount of fuel has been injected. Possible causes of this are, among other things, differences in

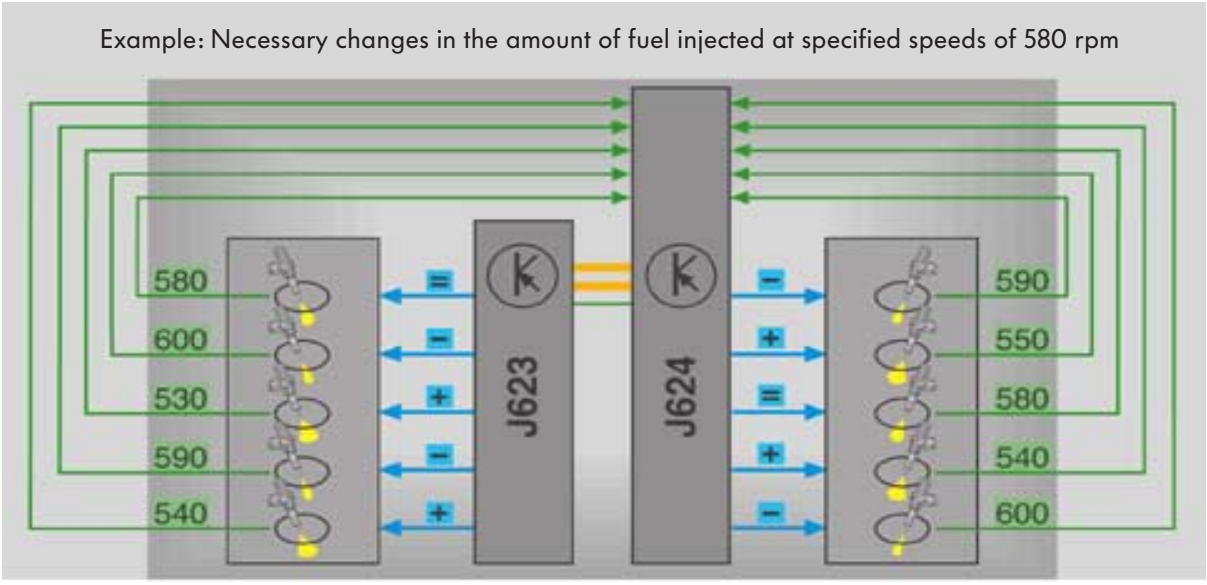
- the tolerances of the parts,
- cylinder compressions,
- friction caused by the cylinders and
- the hydraulic injector components.

The effects of these differences in torque are

- imbalanced engine running and
- an increase in exhaust gas emissions.

The smooth running control is designed to detect the pulses in speed that are caused as a result. The pulses in speed are then balanced by targeted control of the amount injected at the affected cylinders.

Example: Necessary changes in the amount of fuel injected at specified speeds of 580 rpm



304_058

Actual speed Change in quantity of fuel injected

This is how it works:

Detection works at idling speed via a signal from the engine speed sender.
If the signals are received in a balanced rhythm, the cylinders are all working the same way.
If one cylinder performance is less than the others, the crankshaft needs longer to reach the next point of ignition.

And in the same way, a cylinder that performs better than the others will have a shorter path.
If the engine control unit detects a deviation, the affected cylinder will receive a smaller or greater amount of fuel until the engine runs smoothly again.

Active pulse damping

With the active pulse damping system, there is a reduction in jolt-type vehicle movements that are generated by load changes from different acceleration requirements.

Without active pulse damping

When the accelerator pedal is depressed, a large amount of fuel (blue curve) is injected for a brief period.

This sudden load change can lead to pulsations (red curve) in the vehicle drive train due to strong changes in engine torque.

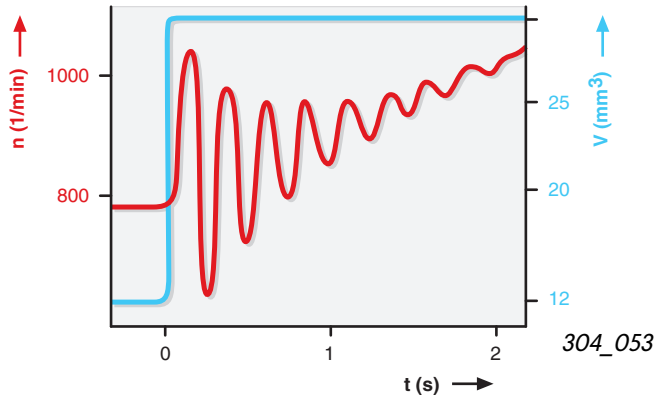
These pulsations are perceived as uncomfortable changes in acceleration by the occupants of the vehicle.

With active pulse damping

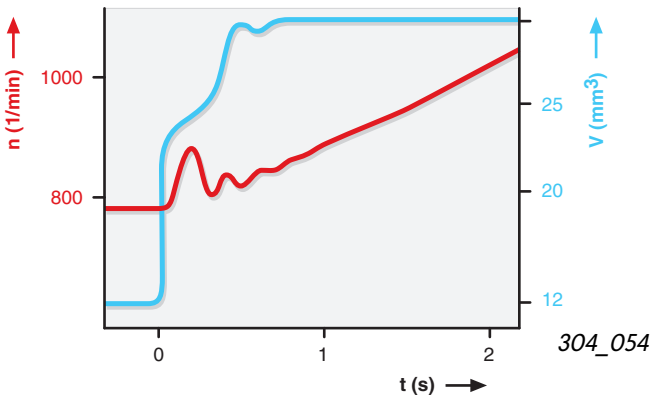
When the accelerator pedal is depressed, the amount of fuel injected (blue curve) is not the full amount demanded at the start. Instead it is delayed half way.
If there are pulsations in the vehicle drive train, these will be detected through evaluation of the engine speed signal. When speed increases, the amount of fuel injected is reduced and likewise when speed decreases, fuel is increased.

These damped pulsations (red curve) are less noticeable by the occupants of the vehicle.

Without active pulse damping



With active pulse damping



n – Engine speed
t – Time
V – Amount of fuel injected

When the clutch is depressed, active pulse damping is switched off. In this way, a quicker response from the engine is achieved.

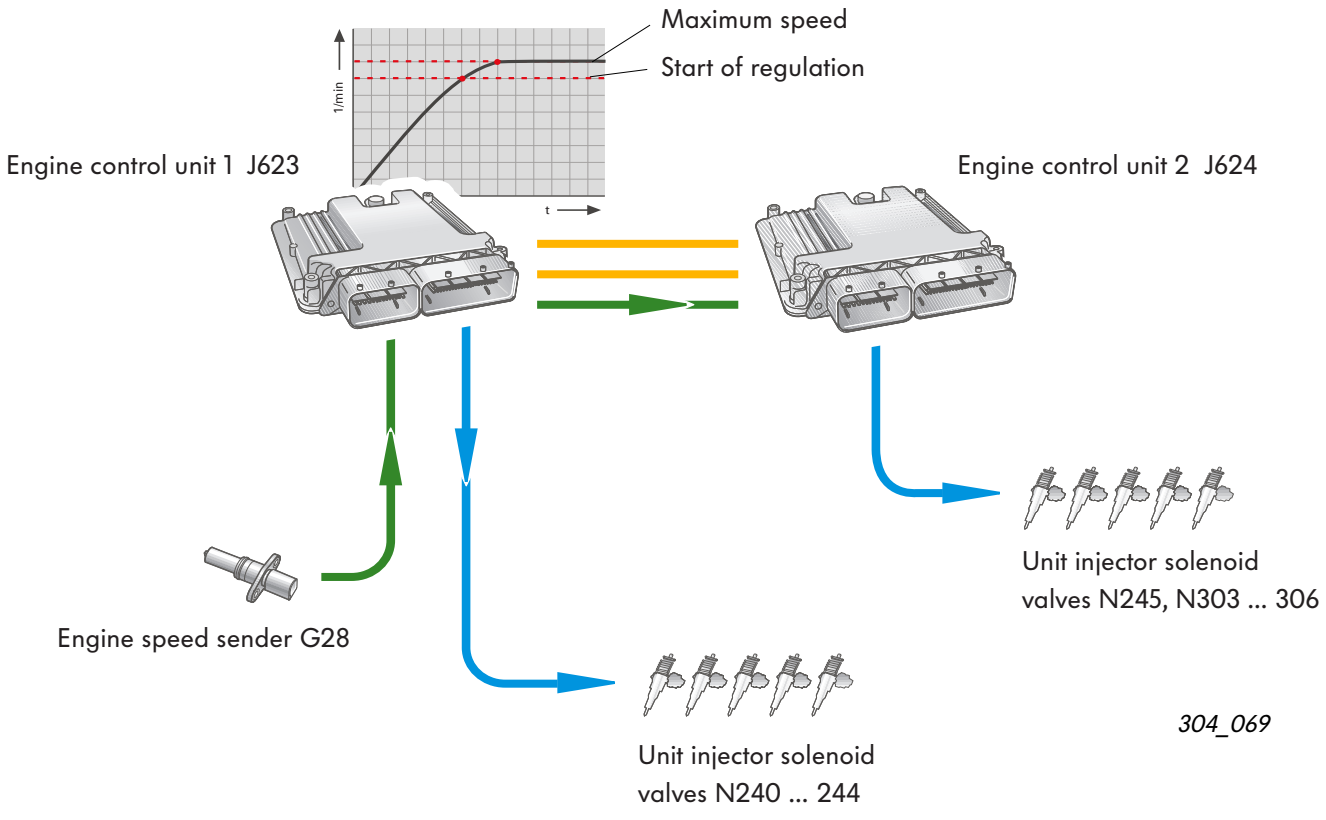
Governor

The governor protects the engine from overrevving and thereby from damage. The engine is therefore governed to a maximum permissible speed that cannot be exceeded for long periods of time.

This is how it works:

After regulation has started, the amount of fuel injected is continually reduced.
If the highest permitted engine speed is reached, the amount of fuel injected remains constant until the driving conditions change again.

The adaptive function is kept as smooth as possible in order that jolts in the amount of fuel injected are not caused during acceleration.



Cruise control

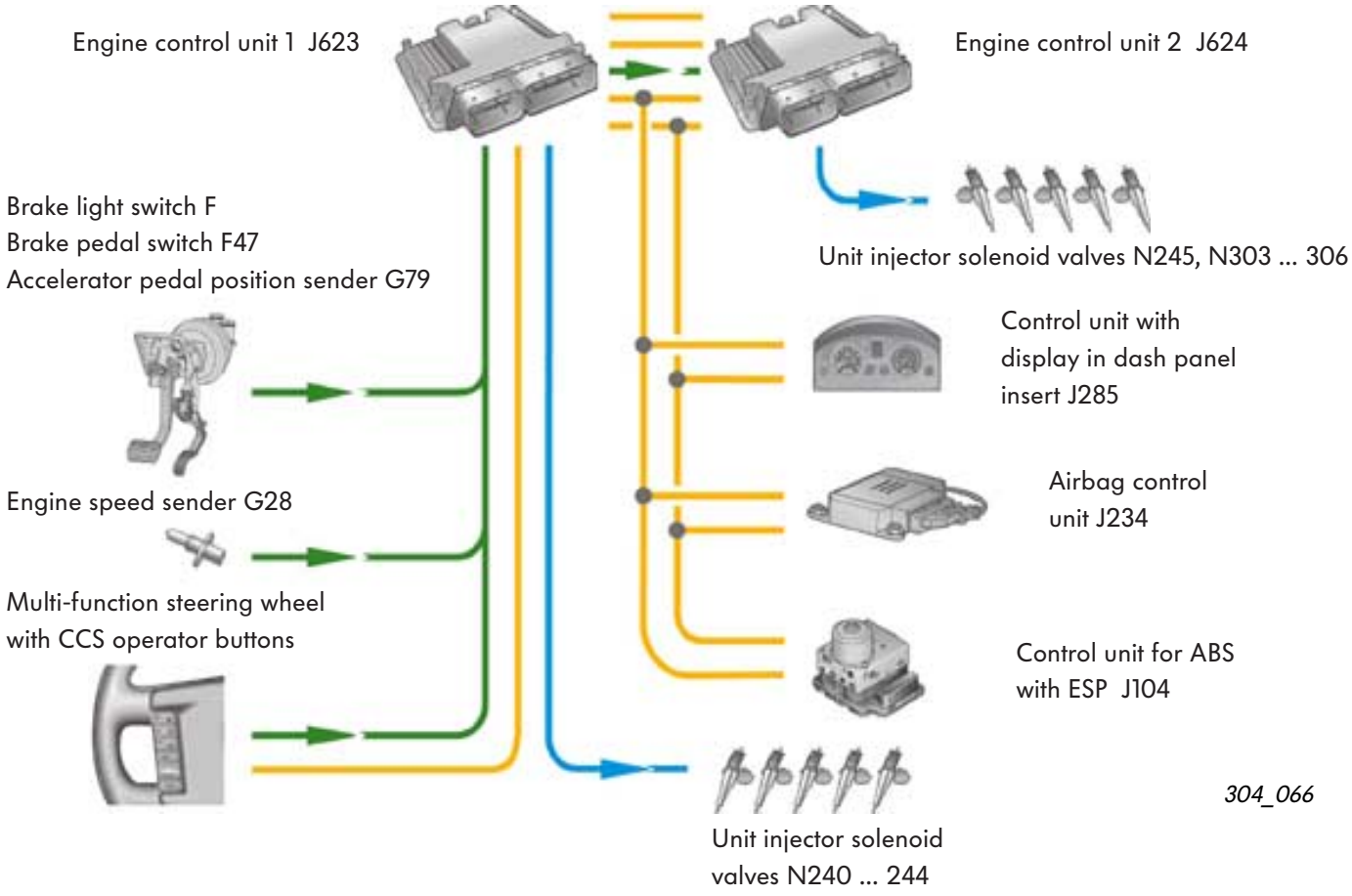
The Cruise Control System (CCS) allows the vehicle to be driven at a constant speed without the driver having to press the accelerator pedal.

The start of cruise control depends on the vehicle. Cruise control on the Touareg, for example, starts in the reduction gear at 6 km/h and in normal operation at 20 km/h. On the Phaeton, it starts at 20 km/h.

This is how it works:

The specified speed is set via a button on the multi-function steering wheel. The signal is sent to engine control unit 1 J623 and passed on to engine control unit 2 J624 via an internal CAN databus.

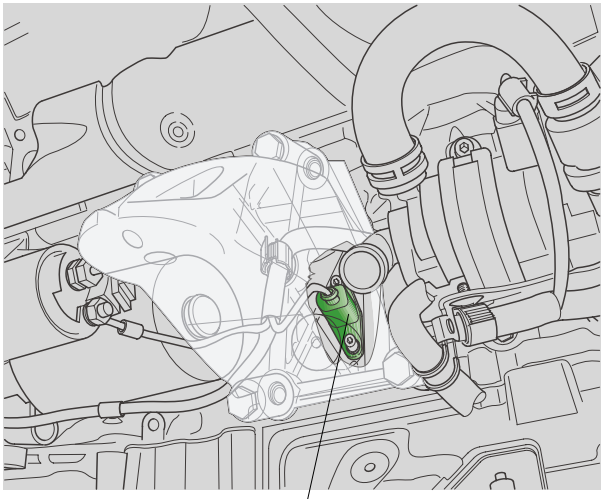
The engine control units adapt the amount of fuel injected so that the actual speed is the same as the specified speed.



Sensors

Engine speed sender G28

The engine speed sender is bolted to the side of the cylinder block. It picks up the position of the crankshaft via a 60–2 ratio sender wheel.



304_008

Engine speed sender G28

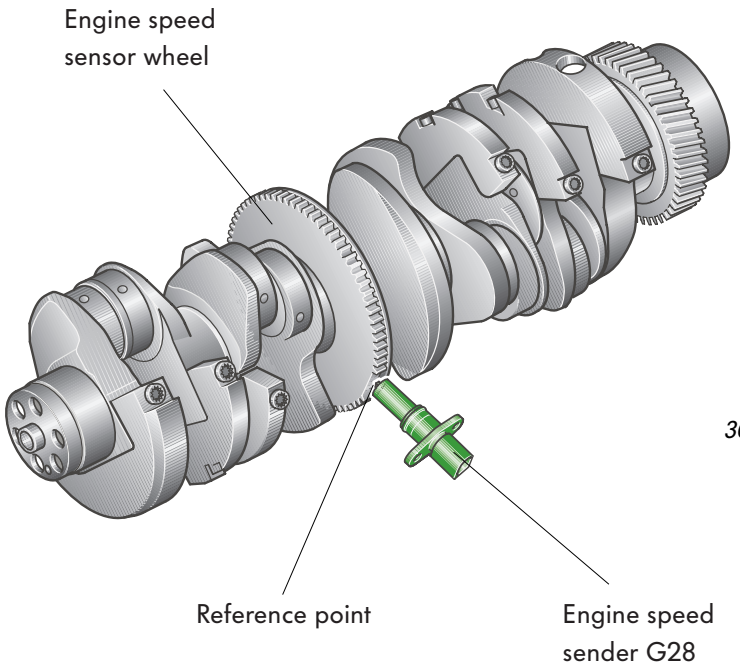
Signal application

The engine speed sensor signal is used to determine the speed of the engine and the precise position of the crankshaft. With this information, the amount of fuel injected and start of injection is calculated.

Effects of signal loss

In the case of signal loss, the engine will switch off and cannot be restarted.

The signal from the engine speed sender is sent to engine control unit 1.
In order that engine control unit 2 can receive the engine speed at the same time, the signal is also sent via a separate cable from engine control unit 1 to engine control unit 2.



304_059

Hall sender G40

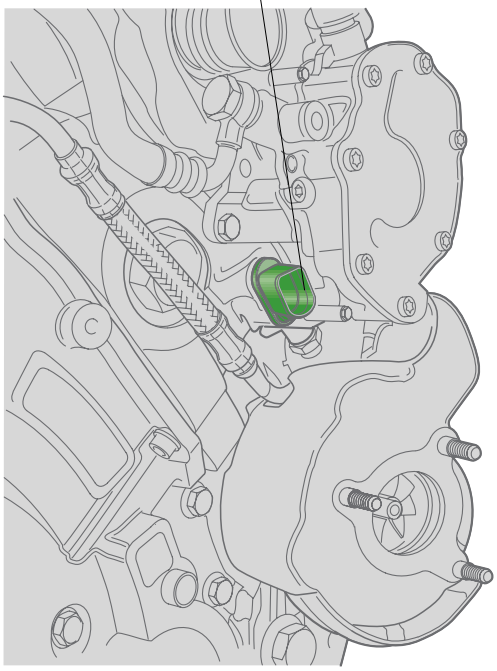
The Hall sender is bolted to the cylinder head at cylinder bank 1 below the mechanical fuel pump. It picks up the signal from the quick start sender wheel with which the position of the camshaft is detected.

Signal application

With the Hall sender signal, the relation of the camshaft to the crankshaft is picked up very quickly when the engine is started. Together with the signal from the engine speed sensor G28, the system can detect which cylinder is at TDC.

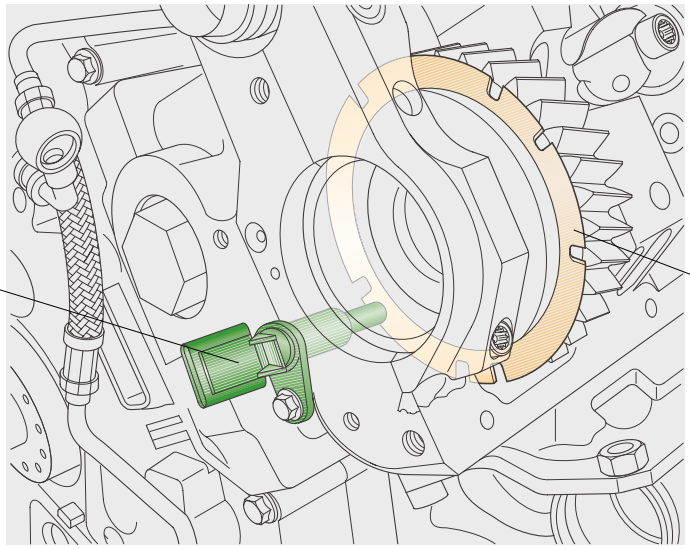
Effects of signal loss

If the signal fails, the signal from the engine speed sender G28 is used in its place. Because the position of the camshaft and the cylinders cannot be detected immediately, starting of the engine could take slightly longer than normal.



304_007

On the V10-TDI-engine, just one Hall sender is installed. However, the signal is sent to both engine control units.



304_020

Engine management

Accelerator pedal position sender G79, Kick-down switch F8, Idle switch F60

The accelerator pedal position sender, the idle switch and the kick-down switch can be found in an accelerator pedal module on the pedal cluster.

Signal application

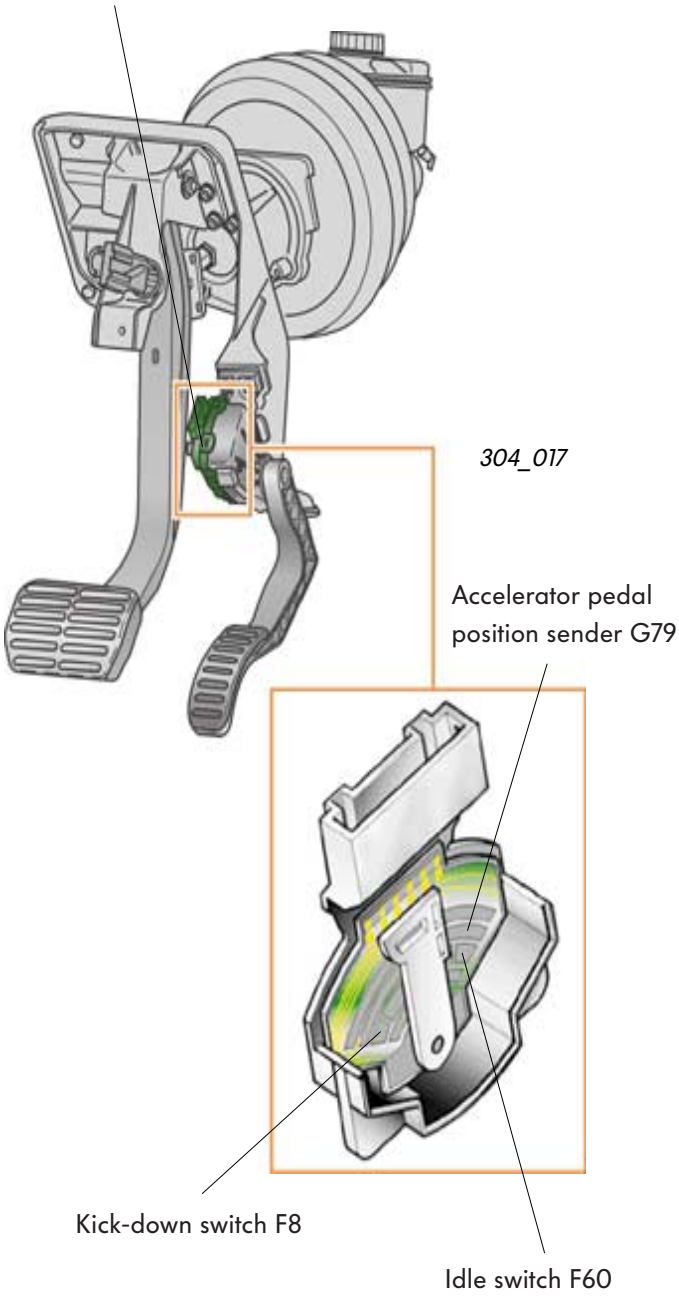
The **accelerator pedal position sender G79** detects the position of the accelerator pedal across the entire range. It is a main input signal to calculate the amount of fuel to be injected.

The **idle switch F60** detects when there is no pressure on the accelerator pedal and activates idling speed control.

The **kick-down switch F8** sends a message to the engine control unit when the accelerator pedal is depressed fully. This information is sent by the engine control unit to the automatic gearbox control unit and the kick-down function is then activated.

Effects of signal loss

If the signal fails, the position of the accelerator pedal will no longer be detected. The engine will only run at increased idling speed and the glow period warning lamp K29 will flash.
The driver can still reach the nearest workshop. The engine should then be checked.



Air mass meters G70 and G246

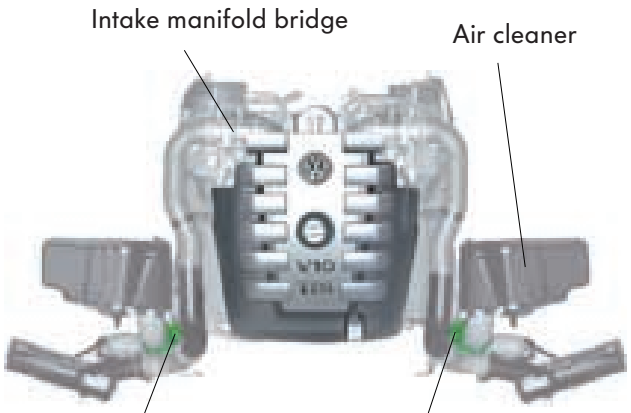
Each cylinder bank has a hot film air mass meter with backflow detection. It is installed in the intake passage in front of the intake manifold bridge.
The meters determine the actual air mass drawn in for both cylinder banks.

Signal application

With these signals, the amount of fuel injected and the amount of recirculated exhaust gas for each cylinder bank is calculated.

Effects of signal loss

If the signal from the air mass meter fails, the respective engine control unit operates using a replacement value and exhaust gas recirculation is switched off.



304_060

Lambda probes G39 and G108 (V10-TDI-engine)

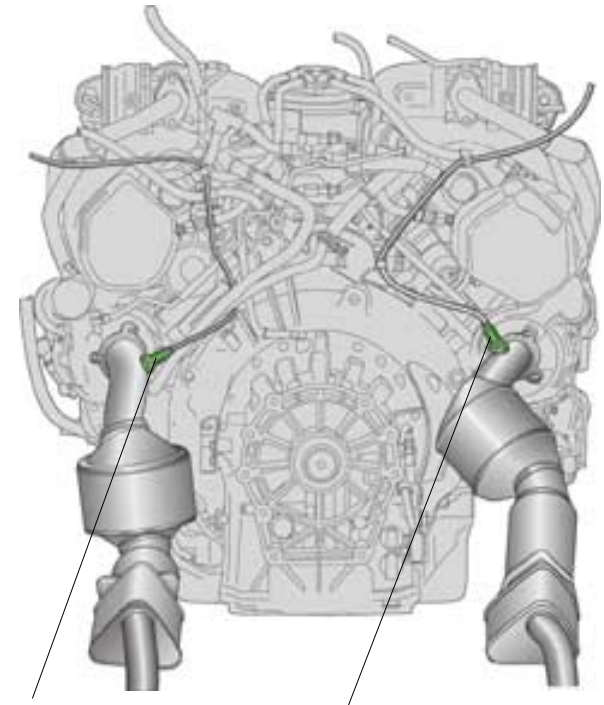
Both broadband Lambda probes can be found in the exhaust system in front of the starter catalyst.
With these probes, the remaining oxygen content in the exhaust gas is measured.

Signal application

With the signals from both Lambda probes, the amount of recirculated exhaust gas is corrected.

Effects of signal loss

If the signals fail, the amount of recirculated exhaust gas will be determined by the air mass meter. Because this type of regulation is not precise, the level of nitrogen oxide emissions may rise.

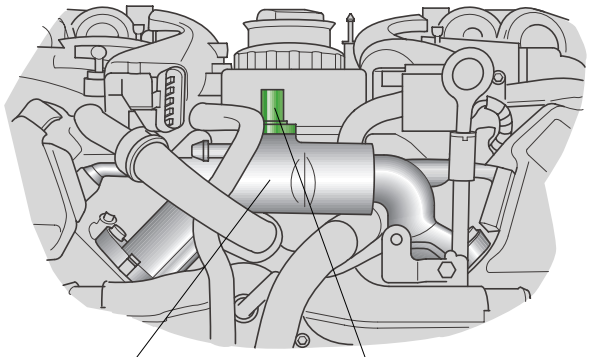


304_033

Engine management

Coolant temperature sender G62

The coolant temperature sender can be found in the coolant connecting pipe between the cylinder heads. It sends the coolant temperature to engine control unit 1 J623.



304_035

Coolant connecting pipe

Coolant temperature sender G62

Signal application

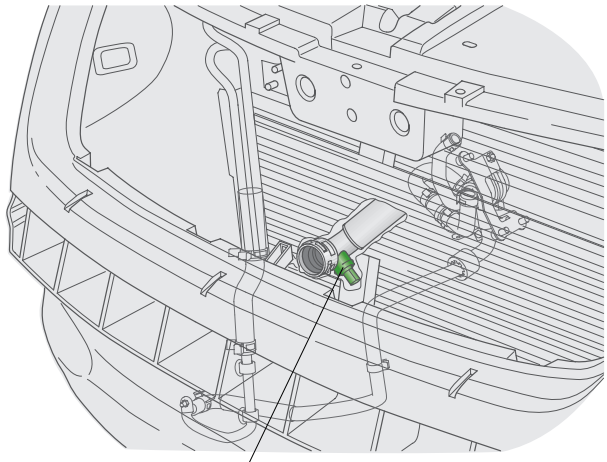
The coolant temperature is used by the engine control units as a correction value to calculate the amount of fuel to be injected, the charge pressure, start of delivery and the amount of recirculated exhaust gas, for example. In addition, this information is used to regulate the coolant temperature depending on the operating conditions.

Effects of signal loss

If the signal fails, the engine control units use the signals from the coolant temperature sender G83 and the fuel temperature senders G81 and G248.

Coolant temperature sender - radiator outlet G83

The coolant temperature sender G83 can be found in the line at the radiator outlet and it is from this position that the coolant temperature is measured.



304_034

Coolant temperature sender - radiator outlet G83

Signal application

By comparing both signals from coolant temperature senders G62 and G83, the radiator fans can be actuated.

Effects of signal loss

If the signal from coolant temperature sender G83 fails, radiator fan output stage 1 remains constantly active. Coolant temperature regulation is continued.

Fuel temperature senders G81 and G248

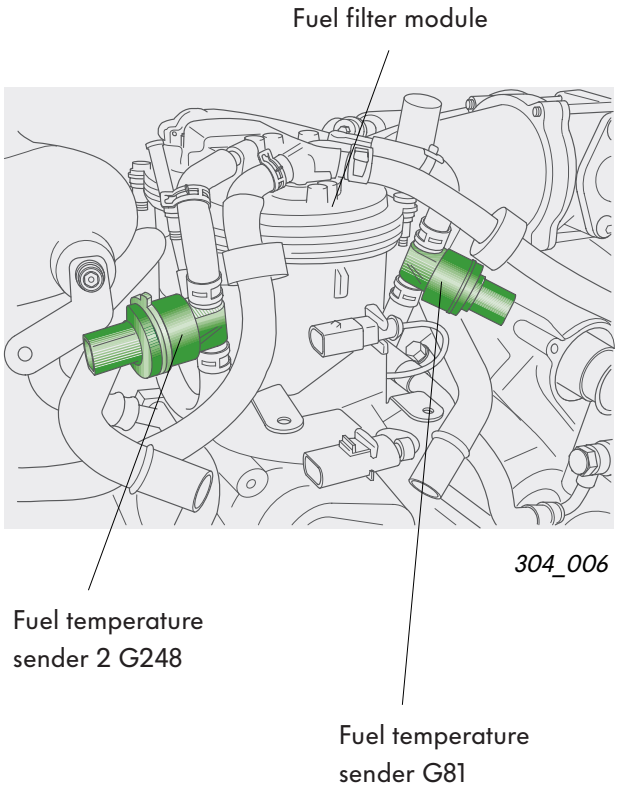
The engine has a fuel temperature sender for each cylinder bank. The senders can be found in the return line to the fuel filter module on each side. The senders are used to determine the fuel temperature.

Signal application

The respective engine control unit calculates the fuel density from the fuel temperature. This is used as a correction value to calculate the amount of fuel to be injected.

Effects of signal loss

If the signal fails, the relevant engine control unit will use a replacement value from the signal sent by the coolant temperature sender G62.



304_006

The altitude sensor

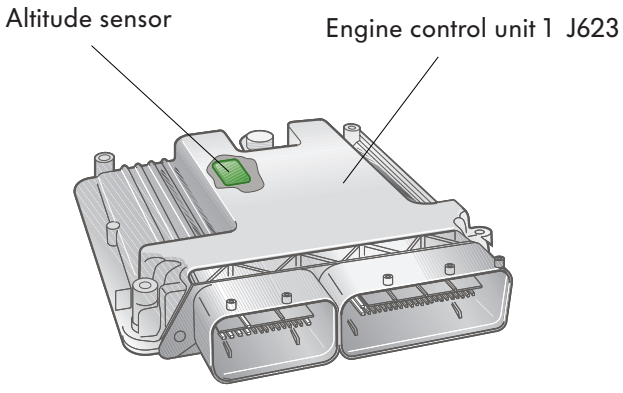
The sender can be found in engine control unit 1 J623 and is a permanent element of the control unit.

Signal application

The signal is used to determine a correction value for charge pressure control and exhaust gas recirculation. If air pressure is lost, exhaust gas recirculation will be switched off and charge pressure increased. In this way, the same performance at sea level is guaranteed at high altitudes.

Effects of signal loss

If the signal fails, a replacement value is used. At high altitudes black smoke could be the result.



304_039

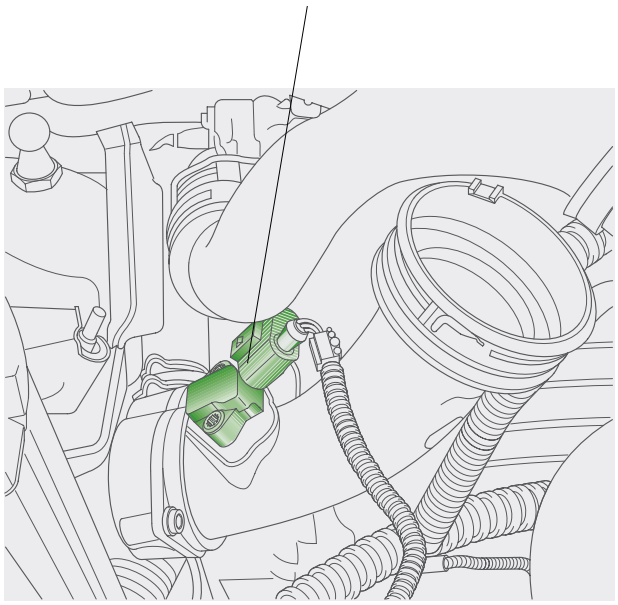
Engine management

Charge pressure sender G31,
Charge pressure sender 2 G447,
Intake air temperature sender G42,
Intake air temperature sender 2 G299

Charge pressure sender G31 and intake air temperature sender G42 are integrated as one component and can be found in the intake manifold for cylinder bank 1.

Charge pressure sender 2 G447 and intake air temperature sender 2 G299 are installed in the intake manifold for cylinder bank 2. They are also combined together to form one component.

Charge pressure sender 2 G447 and intake air temperature sender 2 G299



304_024

Charge pressure senders G31 and G447

Signal application

The signals from the charge pressure senders are required to regulate and monitor the charge pressure.
The calculated value is compared by the respective engine control units with the specifications from the charge pressure maps. If the actual value deviates from the specification, the charge pressure is altered accordingly by the engine control unit via the turbocharger positioning motor.

Effects of signal loss

The charge pressure is controlled at an extremely low level to protect the engine from damage. Because of this, performance is impaired considerably.

Intake air temperature senders G42 and G299

Signal application

The signal from the intake air temperature senders is required by the engine control units to calculate a correction value for the charge pressure. When the signal from these senders is evaluated, the influence of the temperature on the density of the fuel is also considered.

Effects of signal loss

If a signal fails, the engine control units will use a fixed replacement value. The result could be impaired performance.

Brake light switch F and Brake pedal switch F47

The brake light switch and the brake pedal switch are part of one component and can be found on the pedal cluster. Both switches send a signal to engine control unit 1 when the brake is applied.

Signal application

When the brake is applied, the cruise control system is switched off.
If actuation of the accelerator pedal and the brake pedal is detected, idling speed is increased.

Effects of signal loss

If the signal fails from one of the senders, the amount of fuel injected will be reduced and the engine will have less output.
In addition, the cruise control system will be switched off.

Clutch pedal switch F36 (manual gearbox)

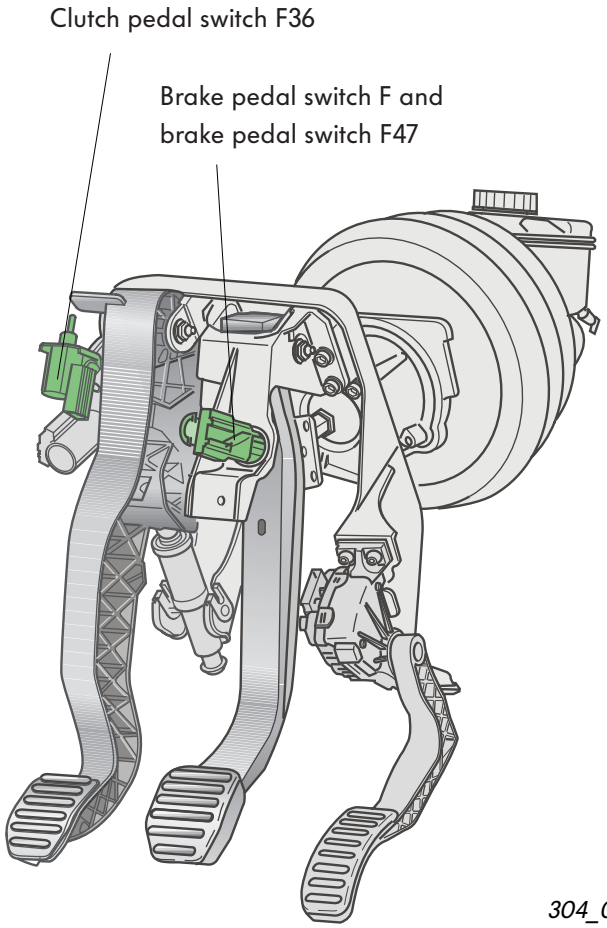
The clutch pedal switch can be found on the pedal cluster. The switch detects whether the clutch is depressed or not.

Signal application

When the clutch is depressed, the amount of fuel injected is reduced for a brief period to prevent engine jolts during gear selection.

Effects of signal loss

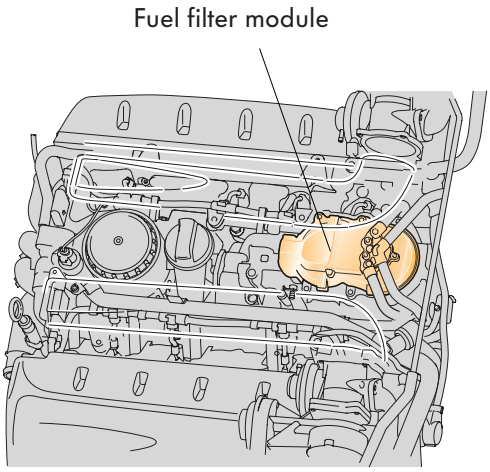
If signal failure is encountered from the clutch pedal switch, load jolts could become noticeable from gear changes.
The cruise control system and active pulse damping are no longer available.



304_081

Fuel composition sender G133

The fuel composition sender is bolted to the fuel filter module and is engaged in the filter. The sender detects excessive levels of water in the fuel filter module and informs the engine control unit.



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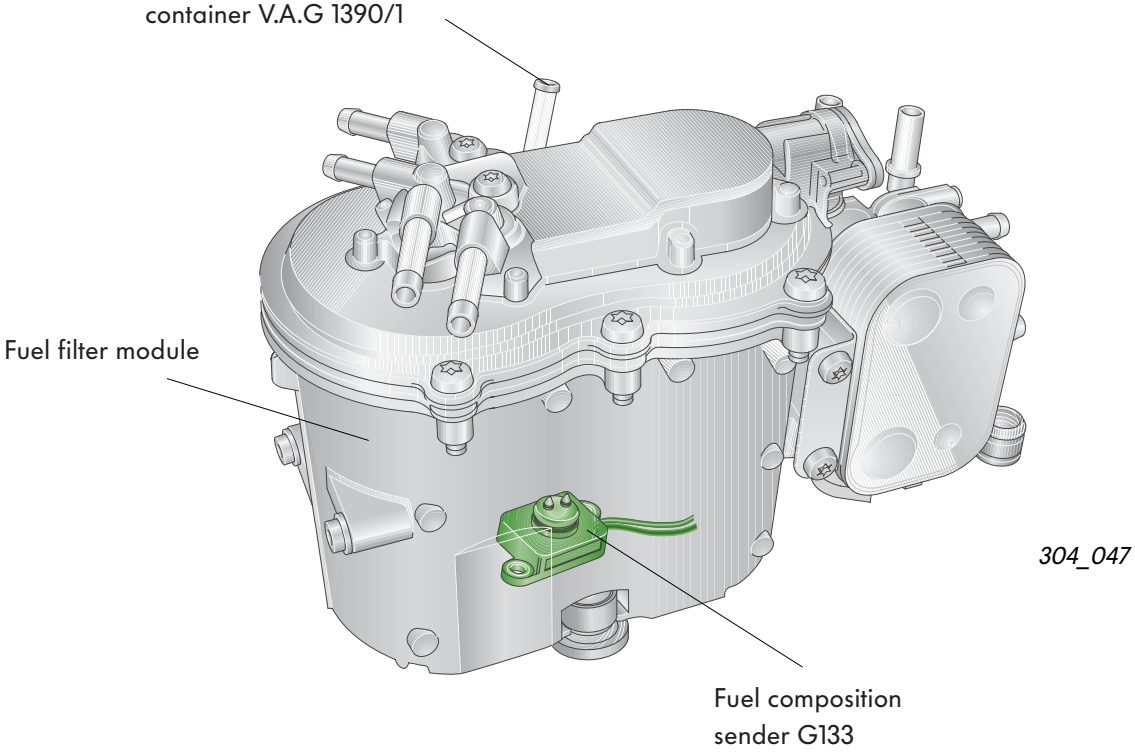

304_047

Signal application

The signal from the sender prevents water from entering the injection system and thereby prevents corrosion.