Document title	Smooth running control, basic function
Document number	gf0710p1048a

Engine all (CAR)

Overview

This document contains information on:

- **General**
- **Function requirements**
- **Function**

General

The smooth running control reduces any rough running in the rpm range from 750 to 2600 rpm. It also protects the catalytic converter from overheating.

Signal path for smooth running

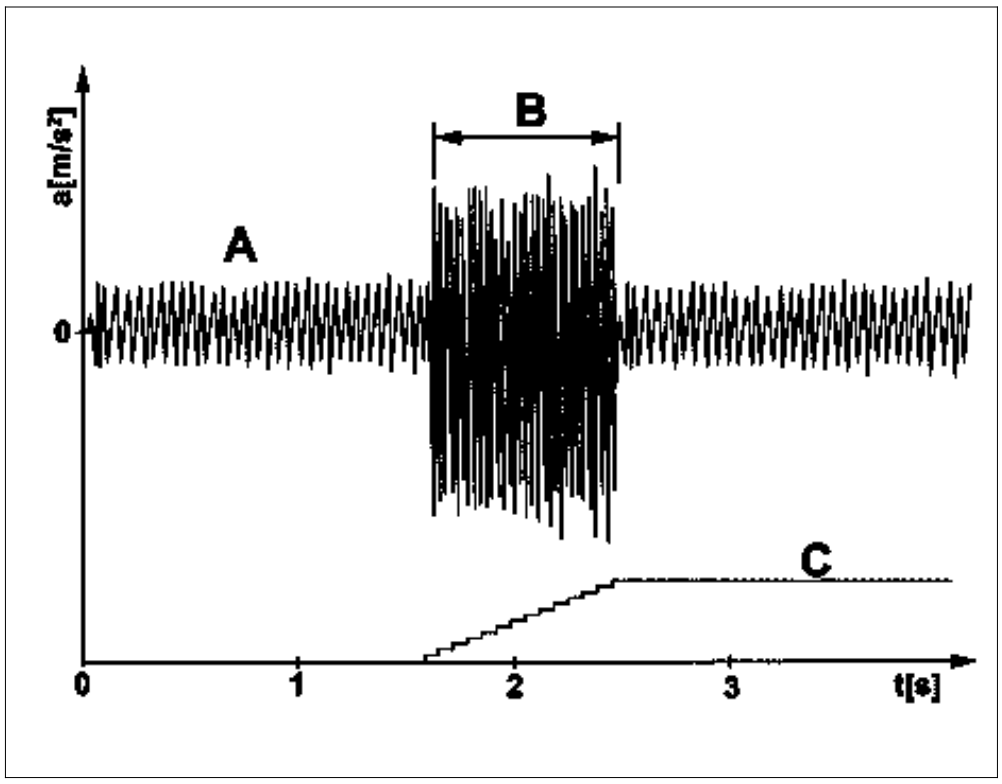
A Engine running without combustion misfiring ! Acceleration values within tolerance range (up to approx. 3 m/s 2)

B Engine running with combustion misfiring ! Acceleration values too great (more than 3 m/s 2)

C Misfire counter ! starts with misfire detection

a Acceleration

t Time



P07.61-3854-11

The following causes of combustion misfiring are detected:

- Faulty ignition system
- Faulty fuel injection system
- Mechanical engine components (for example, valve seats, valve springs, unmetered air)
- Fuel deficiency

Deactivating fuel injectors (spark-ignition engine)

When the smooth running control detects combustion misfires, the affected fuel injector is deactivated after a certain number of combustion misfires. In four-cylinder engines, a maximum of two fuel injectors are deactivated at the same time. In six-cylinder engines, a maximum of three fuel injectors are deactivated at the same time. In 8-cylinder engines, a maximum of four fuel injectors are deactivated at the same time.

Spark-ignition engines: counting and storing combustion misfires

The total number of combustion misfires detected is stored in the fault memory and subdivided into:

- "Cylinder-specific" combustion misfires
- "Emission limit" combustion misfires
- "Catalytic converter damaging" combustion misfires

Adjusting the fuel injection quantity (diesel engines)

When the smooth running control detects combustion misfires, the combustion engine control unit adjusts the fuel injection quantity. To this end, the combustion engine control unit adjusts the following parameters:

- The fuel pressure in the fuel distributor is regulated via the pressure regulating valve and the quantity control valve.
- The injection duration is regulated via the actuation duration of the fuel injectors.

Influencing factors for smooth running control

The following factors affect smooth running control:

Function requirements

- Engine management ON (circuit 87M)
- Engine in operation

Function

Smooth running control

In the event of combustion misfiring, unburnt fuel can find its way into the catalytic converter. When this fuel ignites in the catalytic converter, the catalytic converter may be damaged by thermal overload. In order to prevent unburnt fuel from getting into the catalytic converter, the smooth running control detects combustion misfiring and intervenes in the engine running.

Detecting combustion misfiring

In order to detect combustion misfiring, the combustion engine control unit evaluates the engine speed signal from the crankshaft Hall sensor.

Each combustion produces an acceleration at the multipole wheel on the crankshaft. If a combustion misfires, the multipole wheel turns measurably more slowly until the next combustion. The engine torque fluctuates.

- Engine speed and engine load
- Coolant temperature
- Road bumps
- Synchronization of fuel injection and firing order
- Engine smooth running characteristics

Engine speed and engine load

Using the engine speed and engine load, the combustion engine control unit calculates a reference value for the time between two power strokes.

Coolant temperature

The smooth running control permits more combustion misfires for a cold engine than for an engine at operating temperature.

Road bumps

Vibration influences on the drivetrain may have a negative effect on the evaluation of the engine running at certain engine speeds and load conditions. Therefore, the tolerance range for the smooth running control is increased on poor road surfaces.

In order to detect road bumps, the combustion engine control unit evaluates the wheel speed signal.

Synchronization of fuel injection and firing order

The cylinder recognition is required for the storage and assessment of faults. The cylinder recognition evaluates the signals from the Hall sensors of the crankshaft and the intake and exhaust camshafts. Using these signals, the cylinder recognition can determine the stroke sequence of the individual cylinders.

Engine smooth running characteristics

When the vehicle is in overrun mode and the engine is operating in a uniform, smooth manner, the combustion engine control unit stores the smooth running characteristics of the engine as reference values. The combustion engine control unit uses these reference values to detect combustion misfiring.

Once the reference value has been successfully stored, the tolerance range of the smooth running control is downsized. In this way, the smooth running control is adapted to the specific smooth running characteristics of the engine.

	Function schematics		
	Function schematic for smooth running control	Engine 608 in model 118, 177, 247Engine 654 in model 167Engine 654 in model 213, 238, 257 as of model year 2021	PE07.10-P-2502-97A
		Engine 282 in model 118, 177, 247	PE07.10-P-2502-97B
		Engine 254, 264 in model 213, 238, 257 as of model year 2021Engine 256 in model 213, 238 as of model year 2021Engine 260 in model 118, 177, 247Engine 264 in model 167	PE07.10-P-2502-97C
		Engine 176, 177 in model 167	PE07.10-P-2502-97E
		Engine 139 in model 118, 177	PE07.10-P-2502-97F
	Control units		
	Combustion engine control unit, basic function	Engine all (CAR)	GF07.08-P-9890A