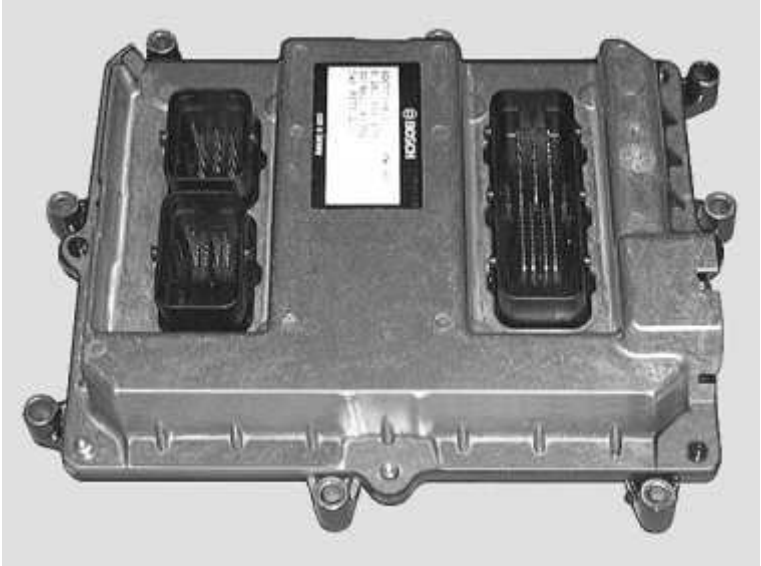
EDC 7 control unit (A435)

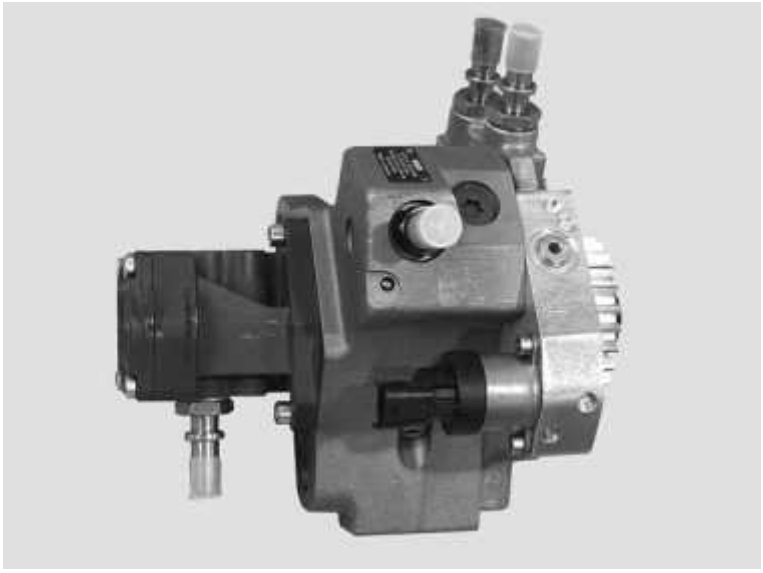
Description
The main task of the EDC 7 control unit is to control the correct injection of fuel and to adapt this control to the different operating conditions and therefore to control the engine output and emissions. The control unit (software/hardware) can be used for a maximum of six cylinders. A second control unit is therefore required for operating an engine with more than six cylinders. The two control units communicate via CAN and operate in “master/slave” mode.



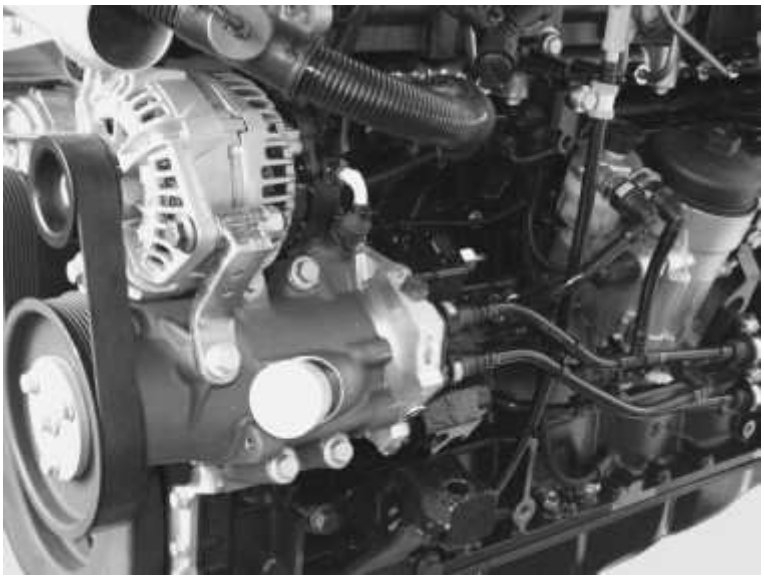
Installation position
The control unit is mounted on the side of the engine block.

CP3.4+ high-pressure pump

Description
The high-pressure pump is a radial piston pump with 3 cylinders. This pump is used in the case of D08 and D20 series engines.



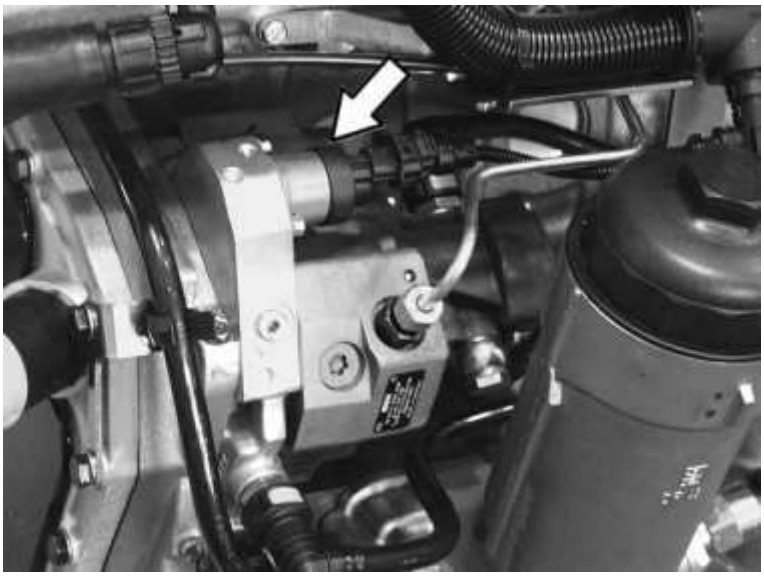
Installation position
The D20 engine is a new design with overhead camshaft. The high-pressure pump is driven by spur gears. The same spur gear drive also drives the alternator, the water pump and, if fitted, the air-conditioning compressor on the front side of the engine by means of a pulley.



Metering unit (MProp) (Y332)

Description
The metering unit (MProp) is an actuator for controlling the fuel pressure in the high-pressure accumulator (rail).

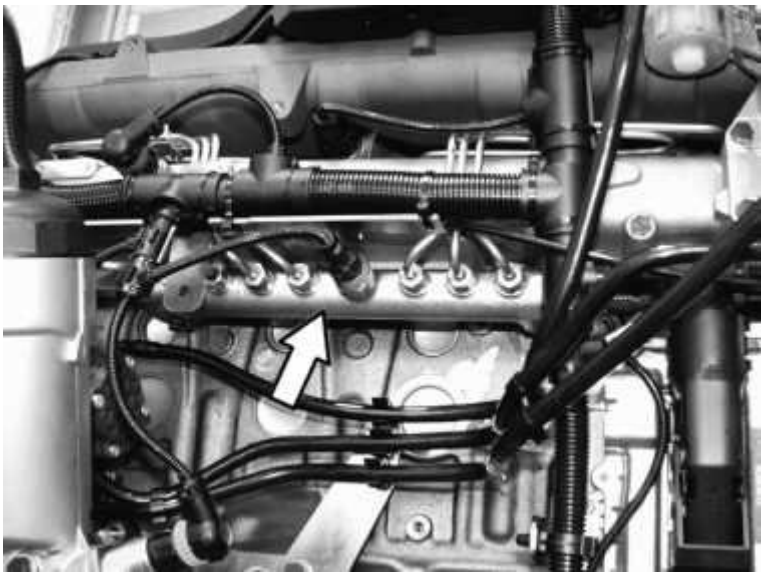
Installation position
The metering unit is located on the suction side of the high-pressure pump and is screwed into the high-pressure pump housing.



High-pressure accumulator (rail)

Description
The name “common rail” is derived from the design and functioning of the high-pressure accumulator. The fuel is injected into the individual cylinders via this common accumulator which is also a fuel distributor or distributor rail. Here the fuel is constantly under high pressure and only needs to be drawn at the right time.

Installation position
The high-pressure accumulator is mounted on the side of the engine block.

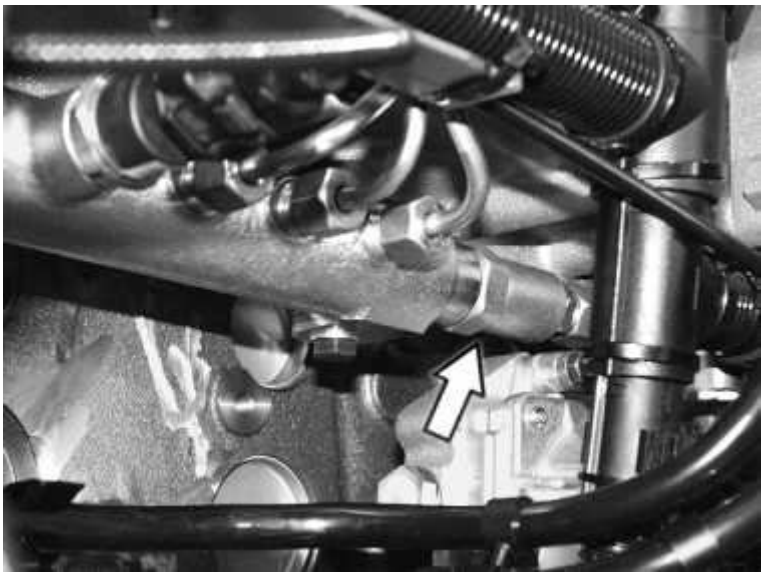


Pressure limiting valve

Pressure limiting valve

Description
The pressure limiting valve limits the pressure in the rail. If the pressure is too high, it uncovers a discharge hole. The pressure limiting valve functions as a pressure relief valve.

Installation position
The pressure limiting valve is mounted on the high-pressure accumulator (rail). This picture shows an installation example on a D08 engine.

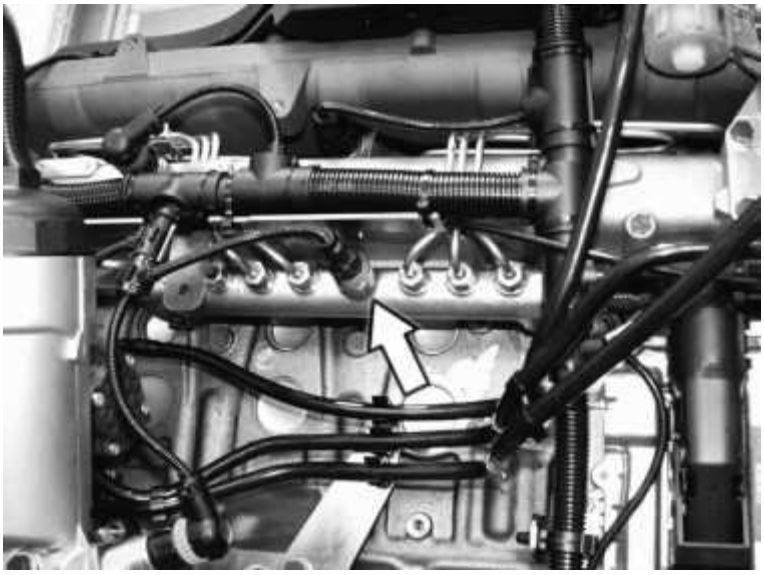


Note: As part of further technical development, the pressure limiting valve has been integrated in the high-pressure accumulator to form an integrated unit with the rail. The PLV has the same function as the previous part and can be replaced as before.

Rail pressure sensor (B487)

Description
The rail pressure sensor monitors the fuel pressure in the high-pressure accumulator (rail).

Installation position
The rail pressure sensor is mounted on the high-pressure accumulator (rail). This picture shows an installation example on a D08 engine.



Injector (Y341 – Y346)

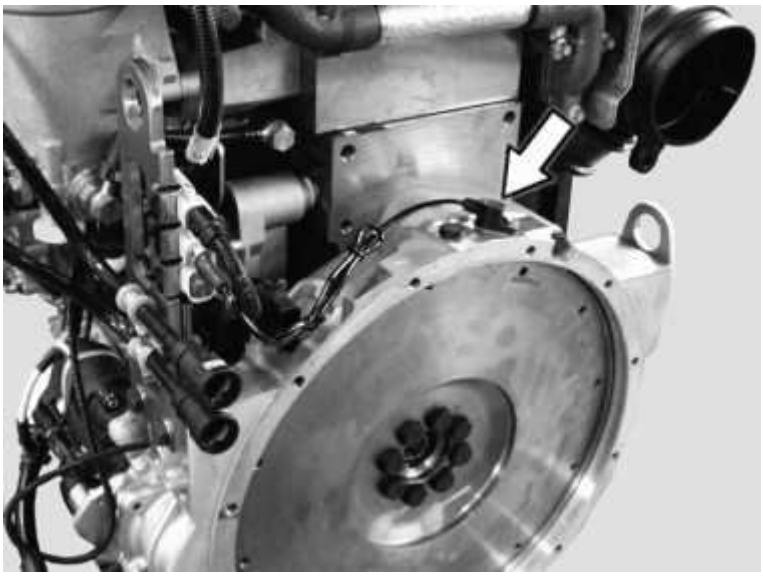
Description
The injector is used to inject fuel into the combustion chamber. The EDC 7 control unit specifies the injection quantity and the injection point and activates an extremely fast solenoid in the injector. The solenoid opens the valve and the fuel is injected into the combustion chamber using the pressure in the high-pressure accumulator.

Installation position
The injectors are located at the same position as the conventional injectors in the cylinder head.

Crankshaft speed sensor (speed increment sensor) (B488)

Description
The speed increment sensor records the engine crankshaft speed and forwards this information to the control unit in the form of an induced voltage.

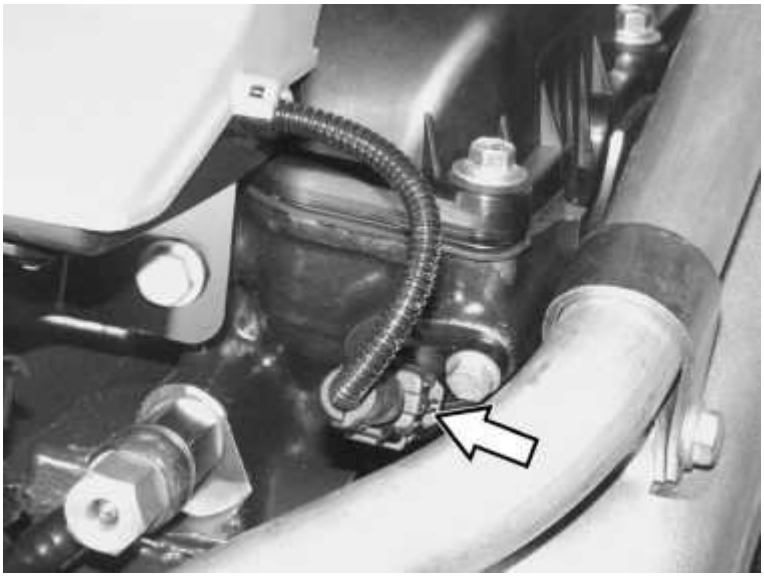
Installation position
The speed increment sensor is mounted on the flywheel housing. This picture shows an installation example on a D08 engine.



Camshaft speed sensor (speed segment sensor) (B489)

Description
The speed segment sensor records the engine camshaft speed and forwards this information to the control unit in the form of an induced voltage.

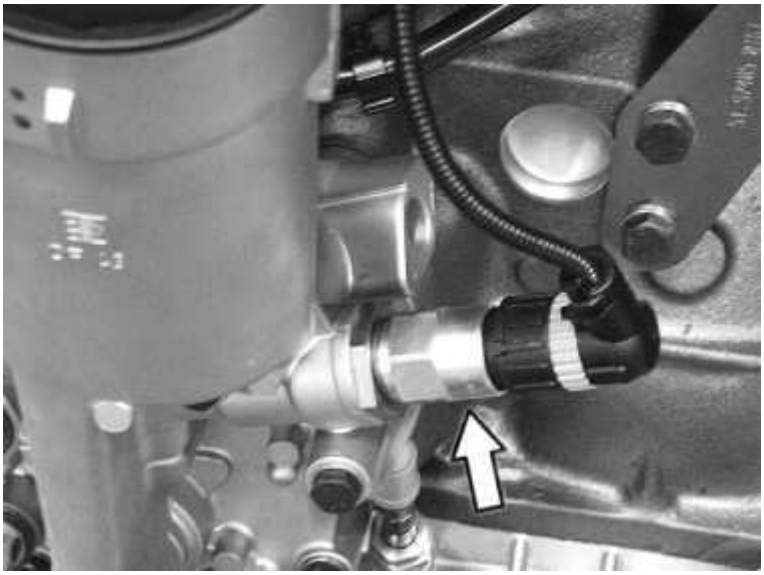
Installation position
The speed segment sensor is mounted at the rear left of the cylinder head in the camshaft drive area.



Oil pressure sensor (B104)

Description
The oil pressure sensor protects the engine. It monitors the oil pressure.

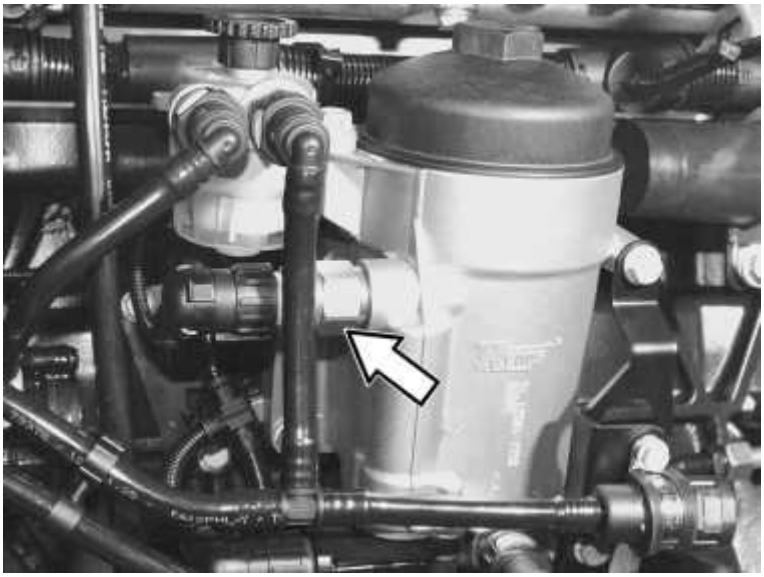
Installation position
The oil pressure sensor is mounted on the oil filter. This picture shows an installation example on a D08 engine.



Fuel pressure sensor (B377)

Description
The fuel pressure sensor monitors the fuel pressure at the pump feed (low-pressure side).

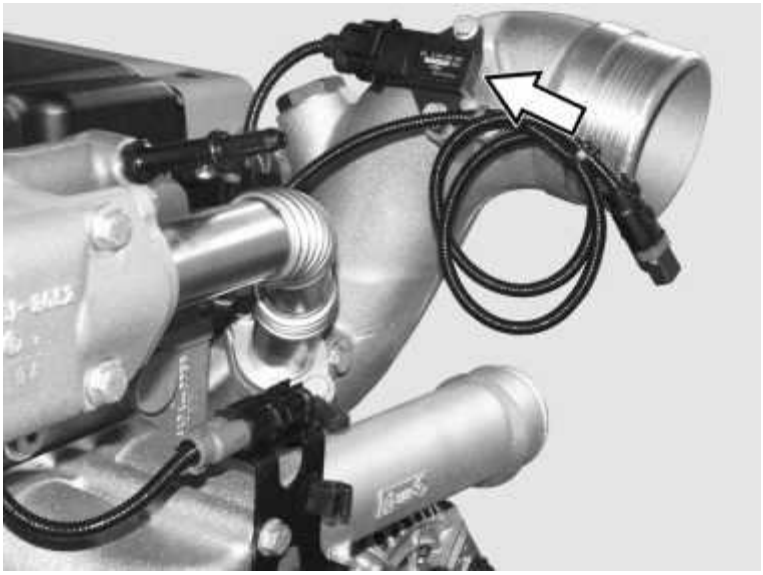
Installation position
The fuel pressure sensor is mounted on the fuel service centre.



Bosch LDF 6T boost pressure sensor (B623)

Description
The boost pressure sensor is used for measuring the absolute boost pressure and the boost air temperature at this point. Together with the boost air temperature sensor (B123), its purpose is to monitor EGR in the Euro 4 engines.

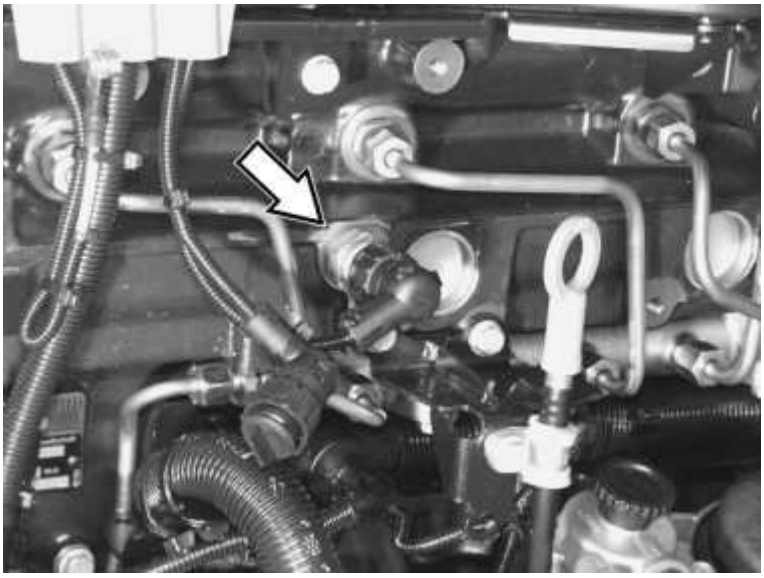
Installation position
The boost air pressure sensor is mounted on the suction pipe.



Boost air temperature sensor (B123)

Description
The boost air temperature sensor is an NTC thermistor. It monitors exhaust gas recirculation.

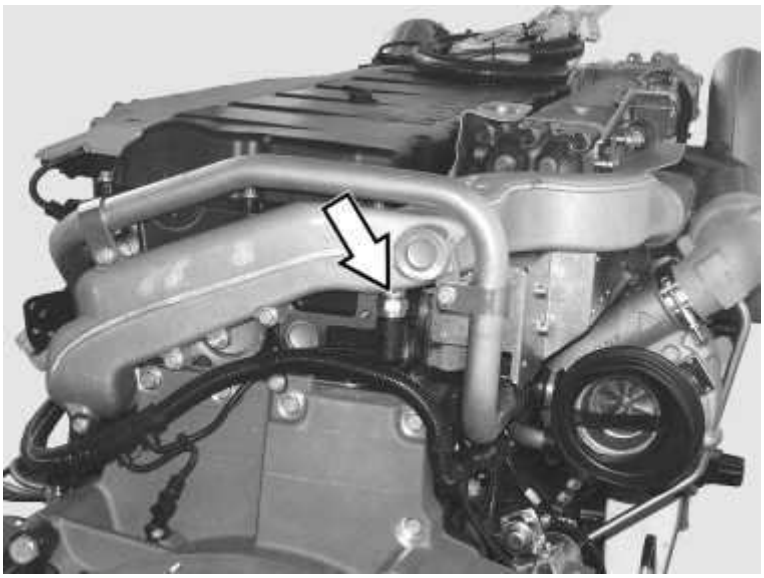
Installation position
The boost air temperature sensor is mounted on the intake manifold.



Coolant temperature sensor (B124)

Description
The coolant temperature sensor is an NTC thermistor. It provides the control unit with information about the coolant temperature. The control unit calls up various engine operating maps, depending on the coolant temperature.

Installation position
The coolant temperature sensor is located in the cooling circuit.



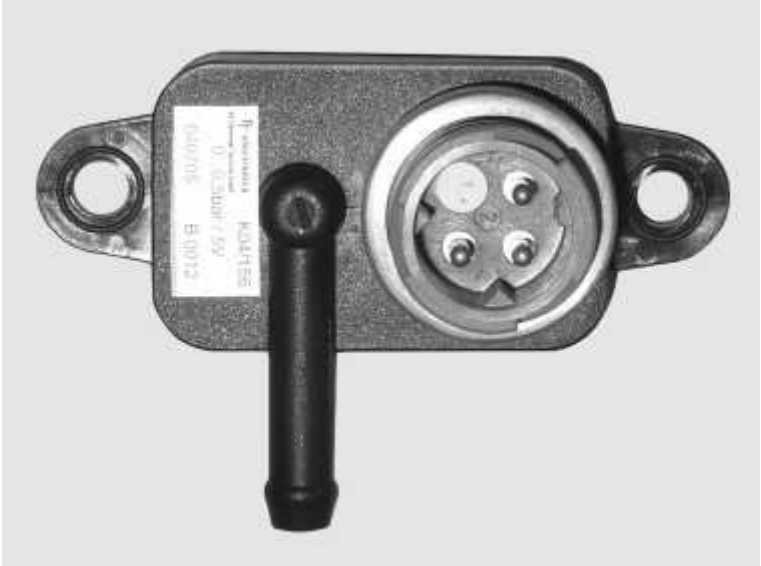
Exhaust temperature sensor (B561)

Description
Temperature sensor B561 monitors the exhaust temperature ahead of the PM catalytic converter.

Installation position
Temperature sensor B561 is mounted ahead of the PM catalytic converter.

Exhaust gas relative pressure sensor (B683)

Description
The exhaust gas relative pressure sensor measures the relative pressure of the exhaust, i.e. the pressure currently existing against atmospheric pressure.

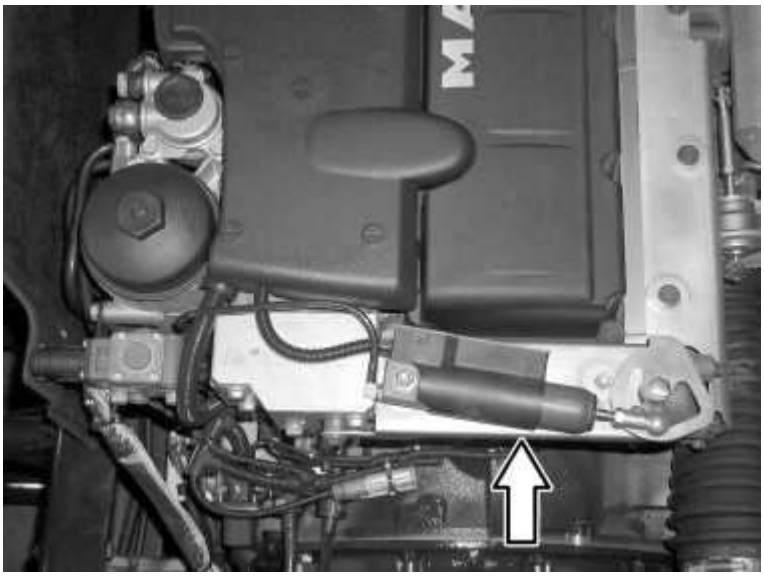


Installation position

Position-controlled EGR actuator (E-EGR) with travel sensor (B673)

Description
The position-controlled EGR actuator (E-EGR) is used in Euro 4 engines with OBD. The status of the EGR flap position is necessary for internal signal processing. This information is provided by the travel sensor mounted on the actuator cylinder (B673).

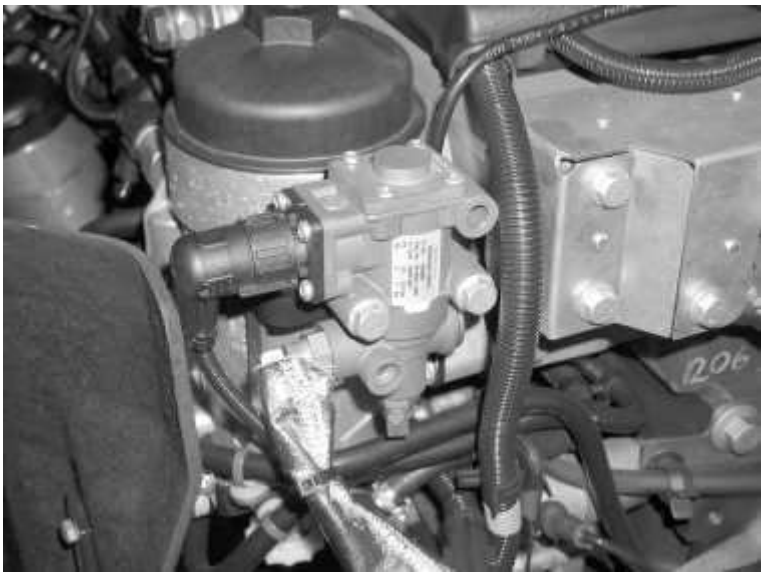
Installation position
This picture shows an installation example on a D08 series engine.



Proportional valve E-EGR (Y458)

Description
The proportional valve (Y458) controls the position-controlled EGR actuator (E-EGR). The operating medium is air at a minimum operating pressure of about 7 bar. A duty factor parameter is specified by the EDC control unit as activation signal.

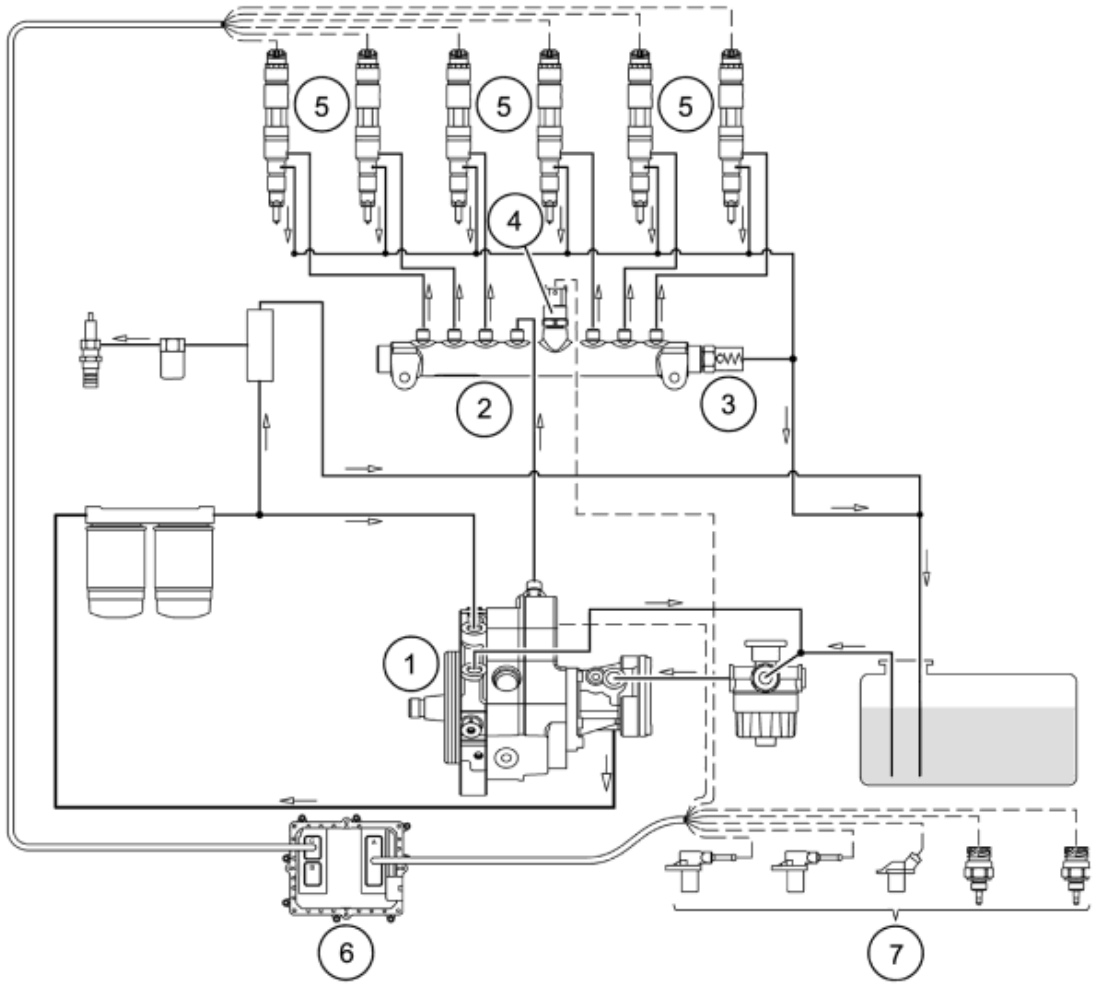
Installation position
This picture shows an installation example on a D08 series engine.



Structure and operation of the common rail system

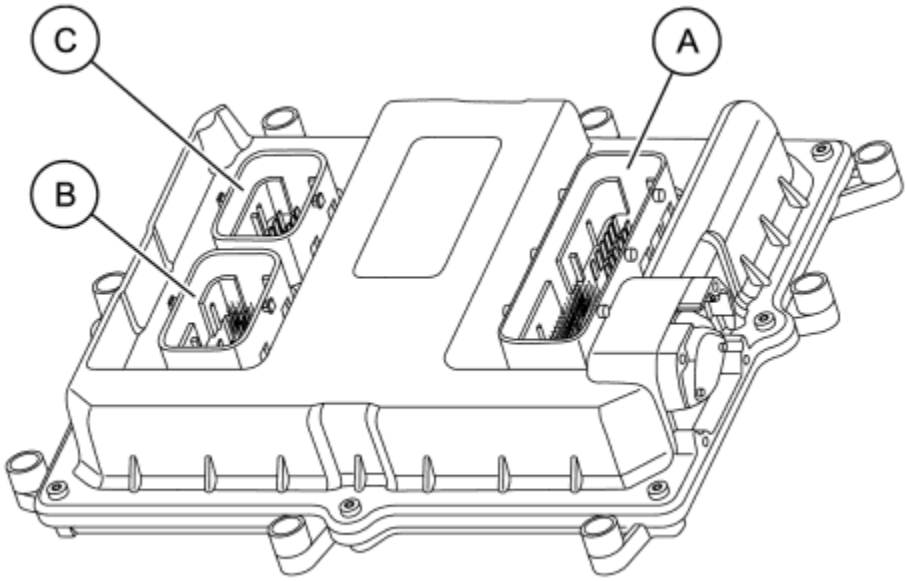
Good mixture formation is the precondition for efficient combustion. The injection system plays a central role in this. The correct quantity of fuel must be injected at the right time and with a high pressure. The common rail system is a trend-setting high-pressure injection system which involves the separation of pressurisation and injection. The fuel for the individual cylinders comes from a shared accumulator which is constantly kept at high pressure. The accumulator is pressurised by a high-pressure pump. This pressure can be changed to suit the operating conditions in question. Each cylinder is equipped with an injector which is controlled by a solenoid valve. The injection quantity is determined by the outlet cross-section of the injector, the solenoid valve opening duration and the accumulator pressure. A system pressure of up to 1600 bar can be reached. Future systems will be capable of reaching 1800 bar. Separation of the pressurisation and injection functions allows a better injection characteristic and, therefore, improves combustion development. Any injection pressure within the map can be selected. Multiple injections, i.e. pre-injections and post-injections, are possible. The fuel quantity, start of injection, pre-injection and post-injection are controlled by extremely fast solenoid valves. Another advantage of common rail systems is that they can be fitted to existing engines without having to modify the cylinder head.

Schematic diagram of the common rail system



1 Quantity-controlled high-pressure pump
2 High-pressure accumulator (rail)
3 Pressure limiting valve
4 Rail pressure sensor
5 Injectors
6 Electronic control unit
7 Further sensors and actuators

EDC 7 control unit (A435)



A Engine connector, 89-pin
B Vehicle connector, 36-pin
C Injector connector, 16-pin

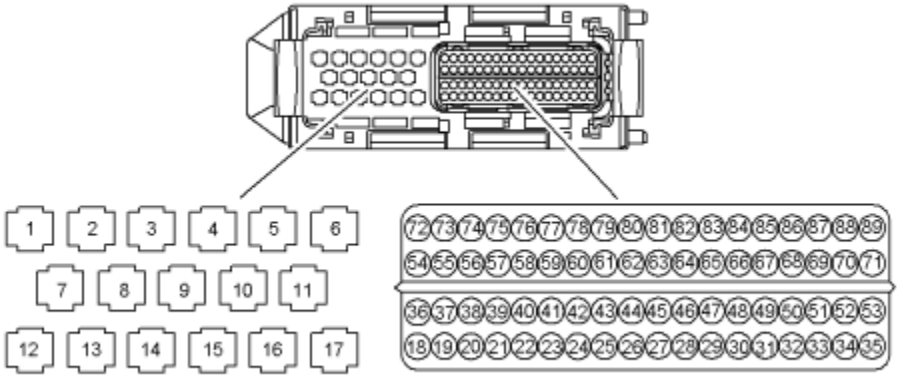
The main tasks of the EDC 7 control unit are to control the injection quantity, control the point of injection and activate the starter. The optimal injection quantity and point of injection are calculated to ensure optimum combustion in all engine operating states.

The control unit evaluates the sensor signals and then calculates the activation signals for the injectors.

The control unit (software/hardware) can be used for a maximum of six cylinders. A second control unit is therefore needed for operating a V-engine. The two control units communicate via CAN and operate in “master/slave” mode.

The control unit software contains the following function groupings:
- Fuel quantity setpoint formation, fuel metering
- Fuel pressure control with high-pressure pump
- Fuel pressure deactivation (limp-home function)
- Idling speed governing
- Maximum speed control, smoke and torque limitation
- Adaptive individual cylinder torque control
- Cylinder shut-off
- Exhaust gas recirculation
- Air system/exhaust gas aftertreatment
- Exhaust gas temperature and exhaust gas management
- Boost pressure control (wastegate control)
- Signal acquisition and calculation of operating variables
- Diagnosis and monitoring functions
- OBD functionality

EDC 7 control unit (A435) Pin assignment, engine connector A

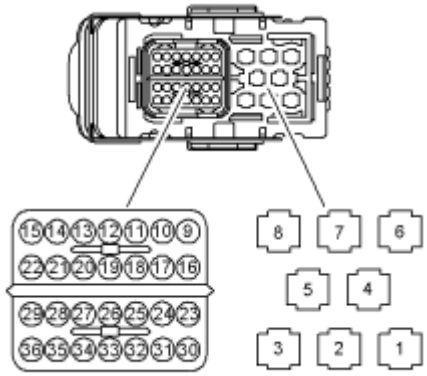


Pin	Designation	Line no./colour	Function
A01	V_V_BAT+1	60034	Supply, control unit (battery +)
A02	O_T_VTG	60384	Activation, proportional valve, turbocharger
A03	G_G_BAT-1	31000	Earth, control unit (battery –)
A04	O_G_VGT	60383	Earth, proportional valve, turbocharger
A05	---	---	Not used
A06	---	---	Not used
A07	V_V_BAT+2	60035	Supply, control unit (battery +)
A08	O_T_MEU	60373	Activation, fuel metering unit
A09	G_G_BAT-2	31000	Earth, control unit (battery –)
A10	O_G_MEU	60374	Fuel metering unit (ZME) earth
A11	O_G_EGR1	60340 / 60393	Earth, activation, uncontrolled EGR/proportional valve, controlled EGR (E-EGR)
A12	V_V_BAT+3	60036	Supply, control unit (battery +)
A13	V_V_BAT+4	60033	Supply, control unit (battery +)
A14	G_G_BAT-3	31000	Earth, control unit (battery –)
A15	G_G_BAT-4	31000	Earth, control unit (battery –)
A16	O_S_STRTH	60314	Activation, IMR (starter), high signal
A17	O_T_EGR1	60367 / 60392	Supply, activation, uncontrolled EGR/proportional valve, controlled EGR (E-EGR)
A18	O_T_EGRT	90316	Supply, activation, EGR throttle valve (CRT)
A19	O_T_STRTL	31330	Activation, IMR (starter), low signal
A20	I_A_FLPS	60137	Signal input, fuel low-pressure sensor
A21	I_A_OPS	60134	Signal input, oil pressure sensor
A22	I_S_EGR1	60153	Feedback signal, EGR (for uncontrolled EGR only)
A23	G_R_EGR1	60031	Earth, feedback signal, EGR (for uncontrolled EGR only)
A24	V_V_5VOPS	60156	Supply, oil pressure sensor (5V)
A25	V_V_5VBPS	60159	Supply, boost pressure sensor (5V)
A26	---	---	Not used
A27	---	---	Not used
A28	---	---	Not used

A29	---	---	Not used
A30	---	---	Not used
A31	---	---	Not used
A32	V_V_5VEGR2	60180	Supply, position sensor (feedback), controlled EGR (5V)
A33	---	---	Not used
A34	---	---	Not used
A35	---	---	Not used
A36	O_G_EGRT	31000	Earth, activation, EGR throttle valve (CRT)
A37	G_R_FLPS	60158	Earth, fuel low-pressure sensor
A38	G_R_OPS	60135	Oil pressure sensor earth
A39	G_R_EGR2	60182	Earth, position sensor (feedback), controlled EGR
A40	V_V_5VFLPS	60155	Supply, fuel low-pressure sensor (5V)
A41	V_V_5VPFDP	90126	Supply, exhaust gas differential pressure sensor (5V)
A42	G_R_EGRT	90005	Earth, feedback signal, EGR throttle valve (CRT)
A43	V_V_5VRAILPS	60161	Supply, rail pressure sensor (5V)
A44	---	---	Not used (spare, signal output, camshaft speed)
A45	---	---	Not used
A46	---	---	Not used
A47	---	---	Not used
A48	---	---	Not used
A49	---	---	Not used
A50	---	---	Not used
A51	O_S_OBD	90132	Check lamp, OBD (MIL)
A52	---	---	Not used
A53	---	---	Not used
A54	G_R_CAS	grey/brown	Earth, speed sensor, camshaft
A55	G_R_CRS	grey/white	Earth, speed sensor, crankshaft
A56	G_R_FTS		Fuel temperature sensor earth
A57	G_R_ACACT	60100	Earth, temperature sensor, boost air upstream of cylinder inlet
A58	G_R_CTS	60101	Coolant temperature sensor earth
A59	G_R_PFDP	60127	Earth, exhaust gas differential pressure sensor
A60	---	---	Not used
A61	G_R_RAILPS	60160	Rail pressure sensor earth
A62	G_R_BPS	60141	Earth, boost pressure sensor (LDF6 and LDF6-T)
A63	---	---	Not used
A64	---	---	Not used
A65	---	---	Not used
A66	---	---	Not used
A67	---	---	Not used
A68	---	---	Not used
A69	---	---	Not used
A70	I_A_BTS	90121	Signal output, temperature sensor, boost air (integrated in boost pressure sensor LDF6-T)
A71	---	---	Not used

A72	I_F_CAS	Grey	Signal input, speed sensor, camshaft
A73	I_F_CRSPOS	grey/green	Signal input, speed sensor, crankshaft
A74	---	---	Not used
A75	I_A_FTS	---	Signal input, temperature sensor, fuel
A76	I_A_ACACT	60151	Signal input, temperature sensor, boost air upstream of cylinder inlet
A77	I_A_CTS	60131	Signal input, temperature sensor, coolant
A78	I_A_PFDP	90128	Signal input, exhaust gas differential pressure sensor
A79	I_S_EGRT	90129	Feedback signal, EGR throttle valve (CRT)
A80	I_A_RAILPS	60162	Signal input, rail pressure sensor
A81	I_A_BPS	60102	Signal input, boost pressure sensor
A82	---	---	Not used
A83	G_R_OTS	---	Earth, temperature sensor, engine oil
A84	---	---	Not used
A85	I_A_OTS	---	Signal input, temperature sensor, engine oil
A86	---	---	Not used
A87	I_A_EGR2	60181	Signal input, position sensor (feedback), controlled EGR
A88	---	---	Not used
A89	---	---	Not used

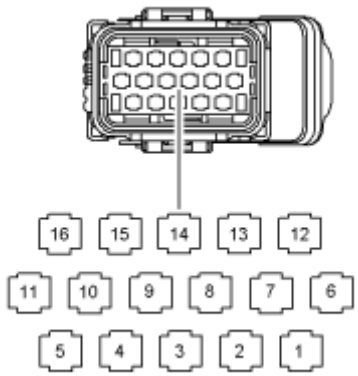
EDC 7 control unit (A435) Pin assignment, vehicle connector B



Pin	Designation	Line no./colour	Function
B01	---	---	Not used
B02	O_G_SOVCAEGR	60394	Earth, pressure shut-off valve, E-EGR
B03	---	---	Not used
B04	---	---	Not used
B05	---	---	Not used
B06	O_T_SOVCAEGR	60395	Activation, pressure shut-off valve, E-EGR
B07	---	---	Not used
B08	O_T_LSH	---	Lambda probe heating
B09	---	---	Not used
B10	---	---	Not used
B11	---	---	Not used
B12	O_T_EXPL	90315	Activation, engine air flow sensor flap (CRT)

B13	---	---	Not used
B14	---	---	Not used
B15	---	---	Not used
B16	---	---	Not used
B17	---	---	Not used
B18	---	---	Not used
B19	O_G_EXPL	31000	Earth, engine air flow sensor flap (CRT)
B20	---	---	Not used
B21	B_D_CANL1	green/black (160)	M-CAN low
B22	B_D_CANH1	black/green (159)	M-CAN high
B23	---	---	Not used
B24	I_A_LSCP	---	Lambda probe
B25	B_D_CANH3	185	HD-OBD-CAN high
B26	G_R_EXTS1	60100/90119	Earth, exhaust gas temperature sensor 1 (upstream of filter)
B27	G_R_EXTS2	90123	Earth, exhaust gas temperature sensor 2 (downstream of filter)
B28	---	---	Not used
B29	---	---	Not used
B20	---	---	Not used
B30	---	---	Not used
B31	---	---	Not used
B32	B_D_CANL3	186	HD-OBD-CAN low
B33	I_A_EXTS1	90122	Signal input, exhaust gas temperature sensor 1 (upstream of filter)
B34	I_A_EXTS2	90124	Signal input, exhaust gas temperature sensor 2 (downstream of filter)
B35	B_D_ISOK	60201	ISO K-line
B36	I_S_T15	15014	Supply, control unit (terminal 15)

EDC 7 control unit (A435) Pin assignment, injector connector C

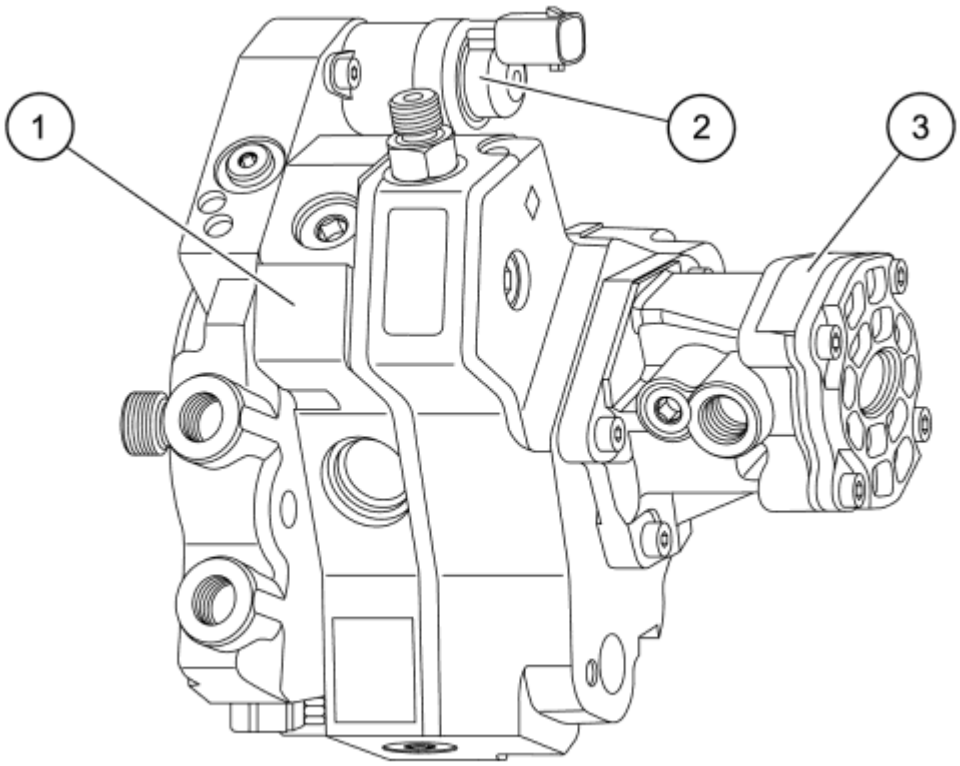


Pin	Designation	Line no./colour	Function
C01	O_P_SVH21	Black	Injector, cylinder 5, high signal
C02	O_P_SVH22	Red	Injector, cylinder 6, high signal
C03	O_P_SVH23	Red	Injector, cylinder 4, high signal

C04	O_P_MVH11	Black	Injector, cylinder 1, high signal
C05	O_P_SVH12	Black	Injector, cylinder 3, high signal
C06	O_P_SVL13	White/red	Injector, cylinder 2, low signal
C07	---	---	Not used
C08	---	---	Not used
C09	---	---	Not used
C10	---	---	Not used
C11	O_P_SVH13	Red	Injector, cylinder 2, high signal
C12	O_P_SVL12	White/black	Injector, cylinder 3, low signal
C13	O_P_SVL11	White/black	Injector, cylinder 1, low signal
C14	O_P_SVL23	White/red	Injector, cylinder 4, low signal
C15	O_P_SVL22	White/red	Injector, cylinder 6, low signal
C16	O_P_SVL21	White/black	Injector, cylinder 5, low signal

CP3.4+ high-pressure pump
The tasks of the high-pressure pump are to generate the high pressure required for injection and to supply an adequate quantity of fuel in all operating states. The high-pressure pump is driven by spur gears. The same spur gear drive also drives the alternator, the water pump and, if fitted, the air-conditioning compressor on the front side of the engine by means of a pulley.

The fuel is forced from a pre-supply pump to the fuel filter (fuel service centre) via fuel lines and then into the high-pressure pump “suction chamber” via the metering unit. The pre-supply pump is flange-mounted on the high-pressure pump. The metering unit (MProp) is mounted on the suction side of the high-pressure pump. The metering unit is an actuator for controlling the fuel pressure in the high-pressure accumulator (rail).



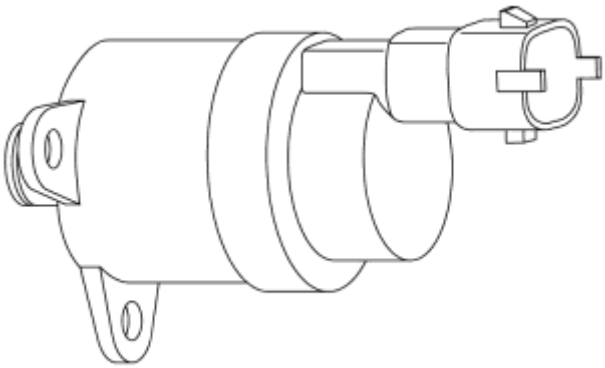
1 High-pressure pump
2 Fuel metering unit ZME (MProp)
3 Fuel pump

The CP3.4+ high-pressure pump is a radial piston pump with 3 cylinders. This pump is used in the case of D08 and D20 engines. Depending on the application, high-pressure pumps with fuel lubrication or high-pressure pumps with engine oil lubrication can be used. Fuel lubricated pumps (CP3-4+) are generally used for Euro 4 engines.

The ratio relative to the crankshaft is 1:1.33 in the case of D08 engines and 1:1.67 in the case of D20 engines, i.e. the high-pressure pump rotates faster than the crankshaft.

Note: According to the manufacturer’s instructions, the fuel-lubricated high-pressure pump CP3.4+ must be filled with 60 ml fuel before a pump replacement. It is certainly not possible and not advisable to fill 60 ml by hand. This means it is sufficient and necessary for the fill to be performed by operating the hand pump (bleeder pump) after mounting and connecting the new high-pressure pump but before it is started for the first time. In any case, this procedure will be common practice for those who have already worked on the high-pressure pump. In the past, however, the oil-lubricated pump could only be bled with the return line to the high-pressure pump disconnected and sealed because of the hot/cold circuit.

Metering unit (proportional valve for fuel, MProp) (Y332)



The metering unit (MProp) is an actuator for controlling the fuel pressure in the high-pressure accumulator (rail). The metering unit is located on the suction side of the high-pressure pump and is screwed into the high-pressure pump housing.

The metering unit is controlled using a PWM output (pulse width modulated signal):

Duty factor 100%	Metering unit closed (zero fuel quantity delivery)
Duty factor 0%	Metering unit open (maximum delivery)

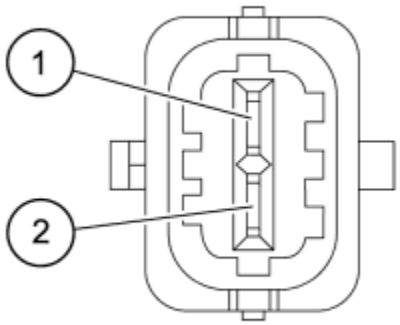
The control circuit consists of a rail pressure sensor, control unit and metering unit.

Terminology note: The metering unit can also be designated “MProp”. Both terms are used in this manual. MProp is the German abbreviation for (fuel) quantity proportional valve.

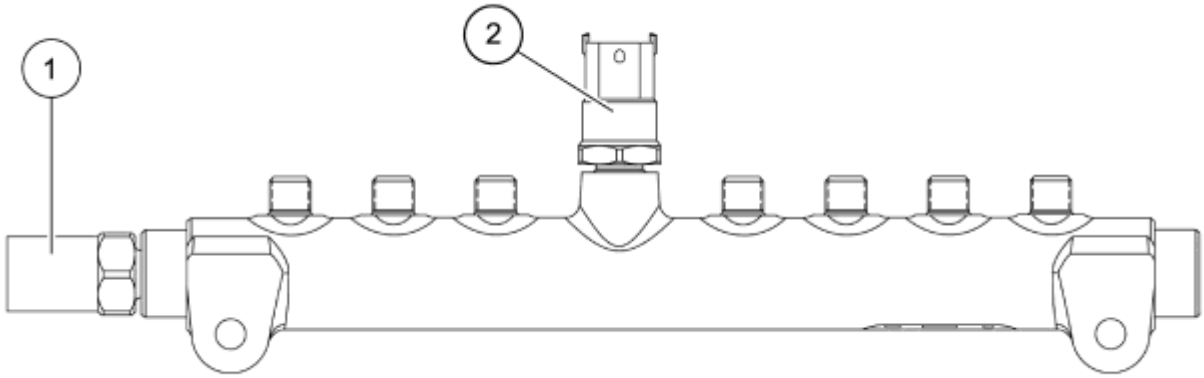
Table of connector pin assignment

Pin	Line number	Function	Control unit A435 pin
1	60373	Input signal, PWM	A08
2	60374	Earth	A10

Connector pin assignment



High-pressure accumulator (rail)



The name “common rail” is derived from the design and functioning of the high-pressure accumulator. The fuel is injected into the individual cylinders via this common accumulator which is also a fuel distributor or distributor rail. Here the fuel is constantly under high pressure and only needs to be drawn at the right time.

The high-pressure accumulator has the following tasks:

- Storing the fuel
- Preventing pressure fluctuations

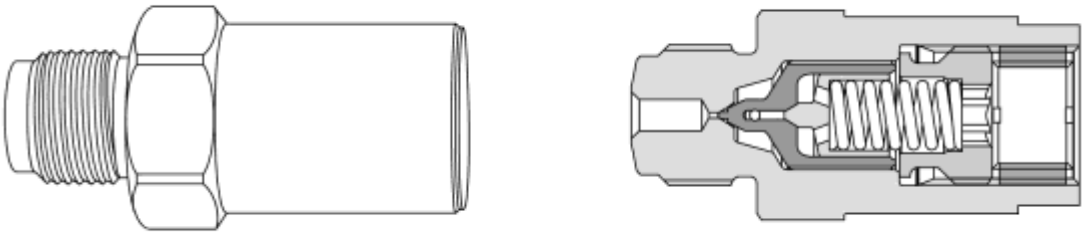
The high-pressure accumulator is a pipe made from forged steel. The diameter and length of this pipe depends on the engine. To prevent pressure fluctuations, the largest possible volume must be aimed for, i.e. pipe as long as possible and pipe diameter as large as possible. However, a small volume is better for fast starting of the engine. Therefore, the volume has to be configured as precisely as possible to suit the engine in question. The illustration above is therefore a configuration example only. The pressure limiting valve (1) and the rail pressure sensor (2) are also mounted on the high-pressure accumulator.

The fuel flows from the high-pressure pump to the high-pressure accumulator via a line. There is a port on the high-pressure accumulator for each cylinder. The fuel flows to the injector via this port and a line.

Note: As part of further technical development, the pressure limiting valve has been integrated in the high-pressure accumulator to form an integrated unit with the rail.

Pressure limiting valve

Pressure limiting valve



The pressure limiting valve is mounted on the high-pressure accumulator (rail) and functions as a pressure relief valve with pressure limiting. The pressure limiting valve limits the pressure in the rail. If the pressure is too high, it uncovers a discharge hole. At normal operating pressure, a spring pushes a piston tight into the valve seat so that the rail remains closed. Only once the maximum system pressure is exceeded is a piston pressured against a spring by the pressure in the rail.

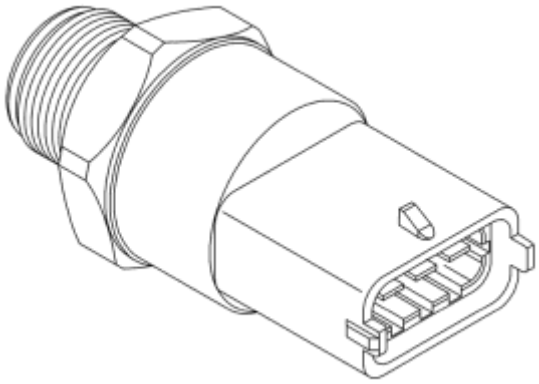
The pressure limiting valve consists of two pistons. If the rail pressure is too high (at approx. 1800 bar) the first piston moves and uncovers part of a cross-section permanently so that the fuel can flow out of the rail. The rail pressure is then kept constant at around 700 to 800 bar. The engine continues running and the vehicle can be driven to the nearest MAN Service outlet at reduced full-load quantity.

The pressure limiting valve does not close again until the engine has been stopped and the rail pressure has fallen below 50 bar, i.e. once it has opened, the 2nd stage remains open for as long as the engine is running.

If the pressure limiting valve does not open quickly enough, it is forced open. To force open the pressure limiting valve, the fuel metering unit is opened by interrupting the voltage supply and the drawing of fuel via the injectors is blocked. The rail pressure rises rapidly until the pressure limiting valve opening pressure is reached. If forcing open the valve does not bring about the desired success, e.g. due to jamming of the pressure limiting valve, the engine is stopped.

Note: As part of further technical development, the pressure limiting valve has been integrated in the high-pressure accumulator to form an integrated unit with the rail. The PLV has the same function as the previous part and can be replaced as before.

Rail pressure sensor (B487)



The rail pressure sensor monitors the fuel pressure in the high-pressure accumulator (rail). The aim is to ensure a specified pressure for the operating point concerned in the high-pressure accumulator (rail). The rail pressure sensor is mounted on the high-pressure accumulator.

The sensor measuring range is 0 – 1800 bar.

D2840 series engines (V-engines) have two high-pressure accumulators fitted (one for each bank of cylinders). Therefore there are also two rail pressure sensors.

Sensor curve

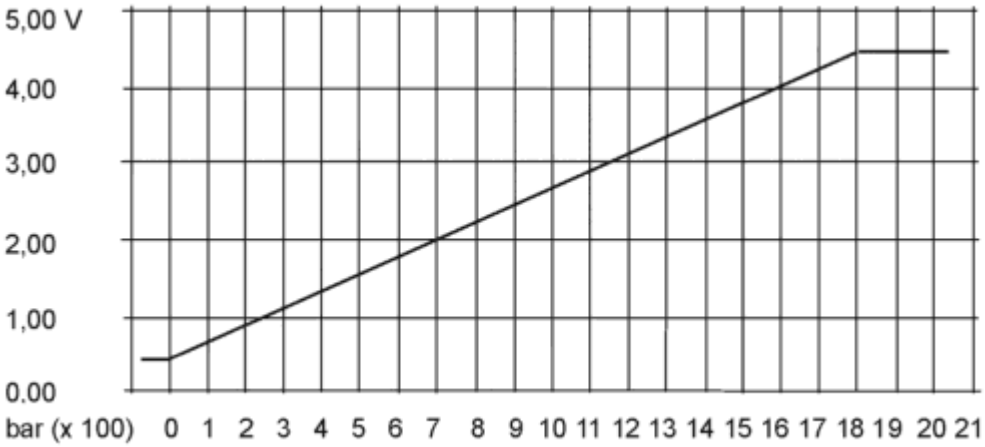
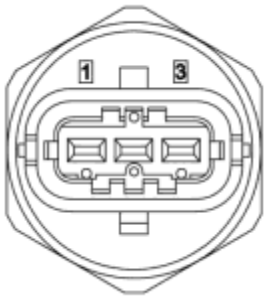


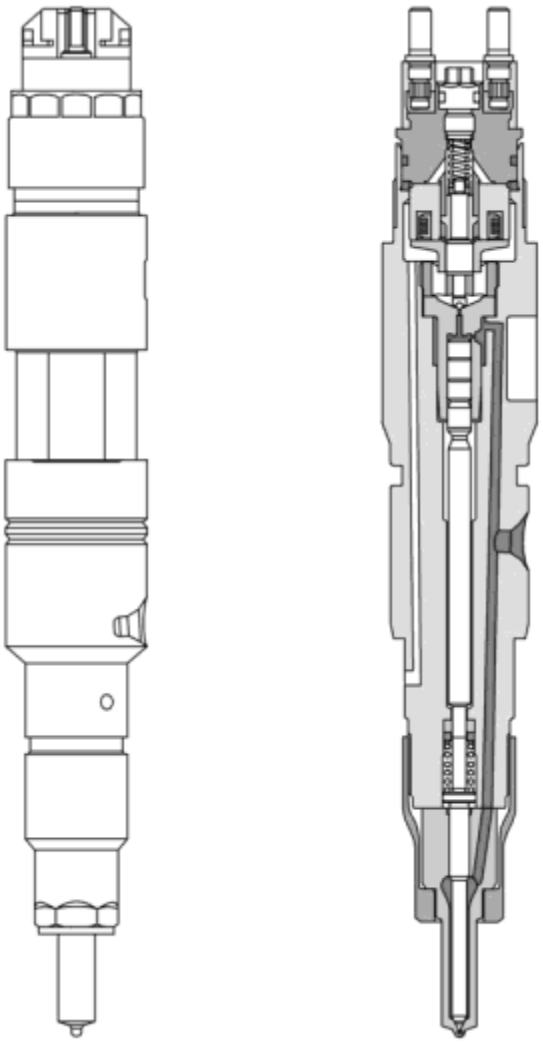
Table of connector pin assignment

Pin	Line no.	Function	Control unit A435 pin
1	60160	Sensor earth	A61
2	60162	Output signal	A80
3	60161	Power supply 5 V	A43

Connector pin assignment


1
3

Injector (Y341 – Y346)

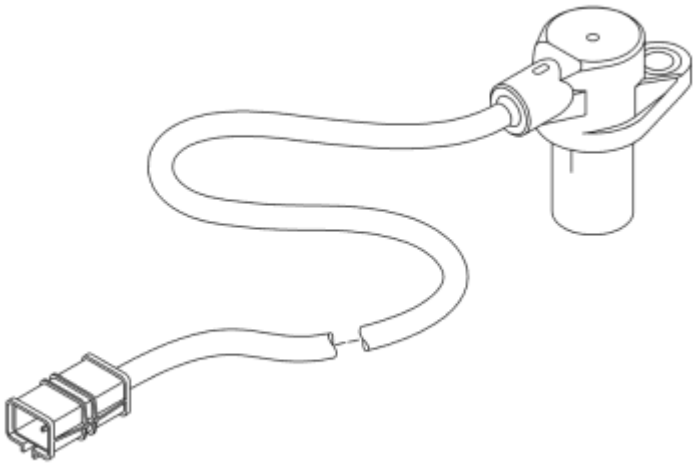


The injector is used to inject fuel into the combustion chamber. The EDC 7 specifies the injection period (injector coil activation period for pre-injection, main injection and possibly post-injection) and the injection point and activates an extremely fast solenoid valve in the injector. The solenoid valve armature opens or closes the control chamber discharge throttle. If the discharge throttle is open, the pressure in the control chamber falls and the injector needle opens. If the discharge throttle is close, the pressure in the control chamber rises and the injector needle is closed. The opening behaviour of the injector needle (opening and closing speed) is therefore determined by the feed and discharge throttle in the injector control chamber.

The injector leakage quantity (leakage via discharge throttle and injector needle) is returned to the tank via the return line. The exact injection quantity is determined by the outlet cross-section of the injector, the solenoid valve opening duration and the accumulator pressure.

Important note when exchanging injectors: When exchanging, ensure that injectors with the same Bosch number are installed again. There are currently two types of injectors. **It is not possible to replace "old" injectors (CRIN1) by "new" injectors (CRIN2)! Do not mix!** If it is necessary to change over to the latest type of injectors, the rail must be replaced and the control unit reprogrammed. Note Service Information 132400!

Crankshaft speed sensor (speed increment sensor) (B488)



This sensor on the flywheel is used to measure (calculate) the crankshaft angle (crank angle). This information is vital for ensuring the correct activation point of the injectors for the individual cylinders.

The pulse-generating wheel is designed as an increment wheel. This speed sensor is therefore referred to as a speed increment sensor. The increment wheel is part of the flywheel and has 60–2 = 58 holes (6x5 mm) spaced at 6° intervals. Two of the holes are missing in order to form a gap. The purpose of the gap is to determine the 360° crank angle of the engine (one crankshaft revolution) and is assigned to a defined cylinder 1 crankshaft position. The engine can also start with crankshaft sensor only or with camshaft sensor only. In the case of operation with crankshaft sensor only, test injections are carried out at gas flow TDC and ignition TDC as the EDC without camshaft sensor first has to locate the correct ignition TDC. If the control unit detects a speed reaction (ignition), it has found the correct TDC. The engine then starts and runs as with both sensors.

The speed increment sensor consists of a permanent magnet and a coil with a large number of windings. The magnet “touches” the rotating component – in this case the increment wheel mounted on the crankshaft – with its magnetic field. The current flow is amplified whenever a hole moves past the sensor. The current flow is weaker in the gaps in-between. This gives rise to an inductive voltage in the sensor coil. This voltage is evaluated by the control electronics. The gap between the sensor and the increment wheel is approx. 1 mm.

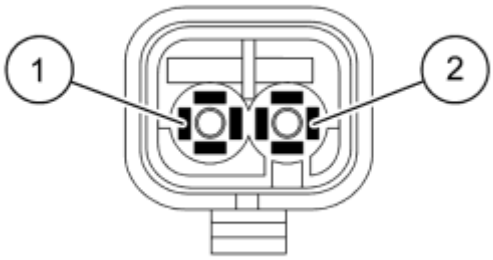
Signal sequence: At pin 2, the 1st half wave appears positive when a magnetically conductive material passes by.

Note: The first half wave must be positive, otherwise a fault is entered: SPN 3753.

Table of connector pin assignment

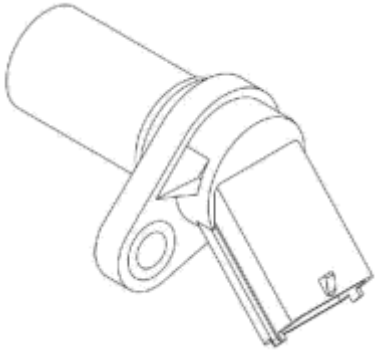
Pin	Cable colour	Function	Control unit A435 pin
1(2)	yellow (grey/green)	Output signal	A73
2(1)	black (grey/white)	Sensor earth	A55

Connector pin assignment **Diagram**


1
2


N
S
1
3
2

Camshaft speed sensor (speed segment sensor) (B489)



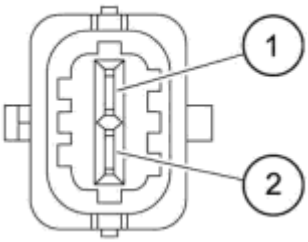
The camshaft controls the engine intake and exhaust valves. It rotates at half the speed of the crankshaft. Its position determines whether a piston is in the compression stroke or the exhaust stroke whilst it moves towards TDC. This information cannot be obtained based on the crankshaft position during starting. However, when driving, the information generated by the speed increment sensor on the crankshaft is sufficient for determining the engine state. This means that, if the speed sensor on the camshaft fails during driving, the control unit is still aware of the engine state. The pulse-generating wheel is designed as a segment wheel and is driven by the camshaft. This speed sensor is therefore referred to as a speed segment sensor. The segment wheel is also referred to as a phase wheel. It has one phase mark per cylinder (e.g. 6 marks in the case of 6-cylinder engines or 4 marks in the case of 4-cylinder engines) and a synchronisation mark. The phase mark is a tooth on the phase wheel. The phase marks are equally spread around the phase wheel. The synchronisation mark is an additional mark on the phase wheel right behind one of the phase marks. Its purpose is to determine the engine angle position within 720° crank angle. The engine can also start with camshaft sensor only or with crankshaft sensor only. In the case of operation with crankshaft sensor only, test injections are carried out at gas flow TDC and ignition TDC as the EDC without camshaft sensor first has to locate the correct ignition TDC. If the control unit detects a speed reaction (ignition), it has found the correct TDC. The engine then starts and runs as with both sensors. In the case of operation with camshaft sensor only, angle corrections are stored in the control unit so that the injection point can also be determined correctly without precisely calculating the crank angle using the increment sensor. The speed segment sensor has the same design and operation as the speed increment sensor for acquiring the crankshaft speed. **Signal sequence:** At pin 2, the 1st half wave appears positive when a magnetically conductive material passes by.

Note: The first half wave must be positive, otherwise a fault is entered: SPN 3753.

Table of connector pin assignment

Pin	Cable colour	Function	Control unit A435 pin
1(2)	yellow (grey)	Output signal	A72
2(1)	black (grey/brown)	Sensor earth	A54

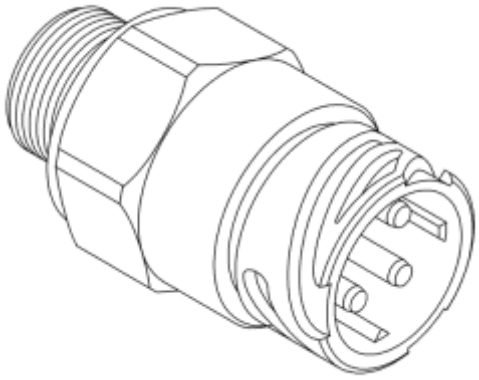
Connector pin assignment



Diagram

Oil pressure sensor (B104)

Oil pressure sensor (B104)



The oil pressure sensor protects the engine. It monitors the oil pressure. The pressure measuring range is from 0 bar (0.5 V) to 6 bar (4.5 V).

Sensor curve

Table of connector pin assignment

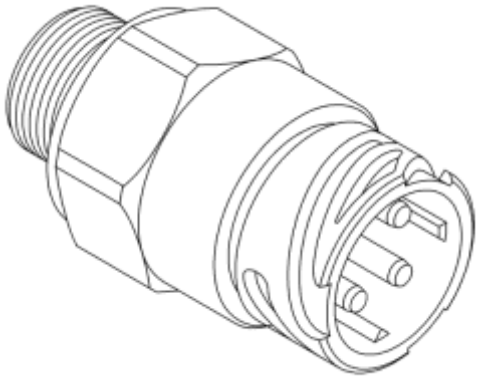
Pin	Line number	Function	Control unit A435 pin
1	60156	Supply voltage 5 V	A24
2	60135	Sensor earth	A38
3	60134	Output signal	A21
4	---	---	---

Connector pin assignment


1
3
2

Fuel pressure sensor (B377)

Fuel pressure sensor (B377)



The fuel pressure sensor monitors the fuel pressure at the pump feed (low-pressure side). The pressure measuring range is from 0 bar (0.5 V) to 15 bar (4.5 V).

Sensor curve

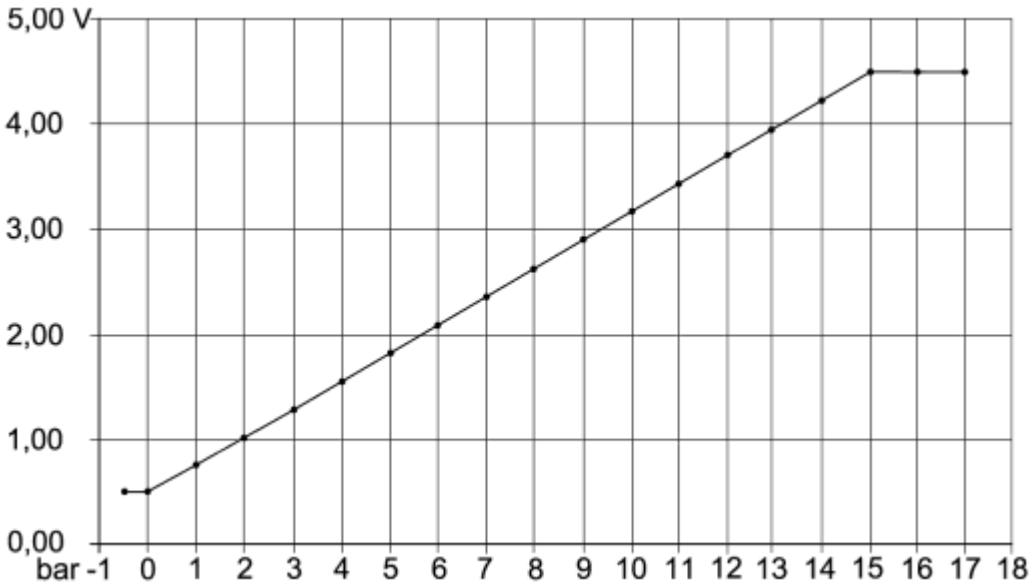


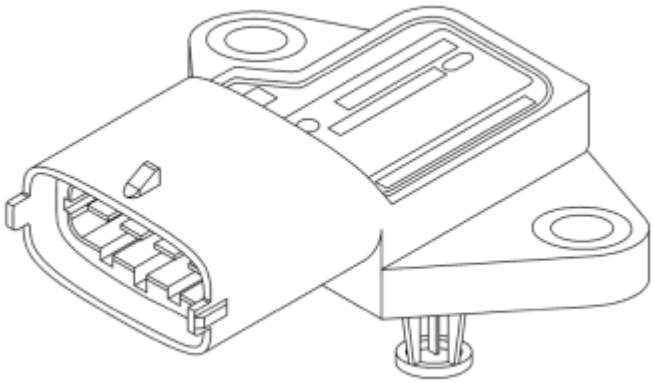
Table of connector pin assignment

Pin	Line number	Function	Control unit A435 pin
1	60155	Supply voltage 5 V	A40
2	60158	Sensor earth	A37
3	60137	Output signal	A20
4	---	---	---

Connector pin assignment


1
2
3
4

Bosch LDF 6T boost pressure sensor (B623)



The Bosch LDF 6T boost pressure sensor is used in D08 and D20 series Euro 4 engines. The LDF 6T boost pressure sensor is also equipped with a temperature sensor. Together with the boost air temperature sensor (B123), its purpose is to monitor EGR in the Euro 4 engines. The LDF 6T is fitted upstream of the EGR inlet line whilst the boost air temperature sensor is fitted downstream of the inlet line. The different temperatures of the two sensors enables the plausibility of the EGR rate to be checked.

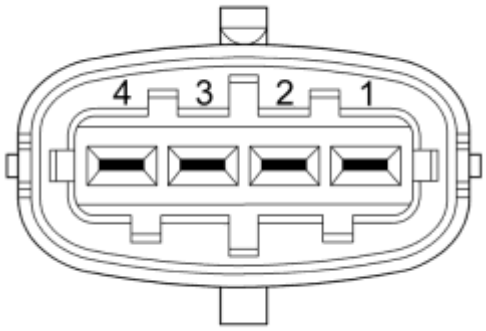
Table of measurements

Temperature in °C	120	100	80	60	40	20	0	–20	–40
Resistance in ohm	112	186	322	595	1175	2500	5896	15462	45313
Voltage in volts	0.643	0.982	1.480	2.170	2.980	3.740	4.300	4.613	4.754

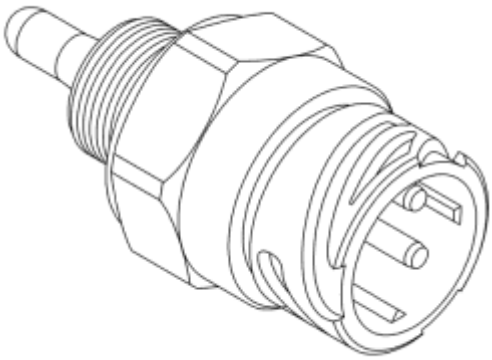
Table of connector pin assignment

Pin	Line number	Function	Control unit A435 pin
1	60141	Sensor earth	A62
2	90121	Output signal, temperature	A70
3	60159	Supply voltage 5 V	A25
4	60102	Output signal, boost pressure	A81

Connector pin assignment



Boost air temperature sensor (B123)



The boost air temperature sensor is an NTC thermistor. It monitors exhaust gas recirculation. Exhaust gas recirculation is deactivated under certain temperature conditions, firstly to prevent the condensation of sulphurous acids at low boost air temperatures and secondly to protect the engine against excessive heating of the intake air in the event of exhaust gas recirculation defects.

Table of measurements

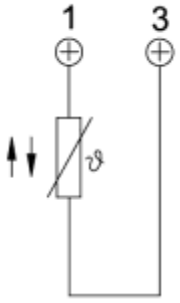
Temperature in °C	120	100	80	60	40	20	0	–20	–40
Resistance in ohm	112	186	322	595	1175	2500	5896	15462	45313
Voltage in volts	0.643	0.982	1.480	2.170	2.980	3.740	4.300	4.613	4.754

Table of connector pin assignment

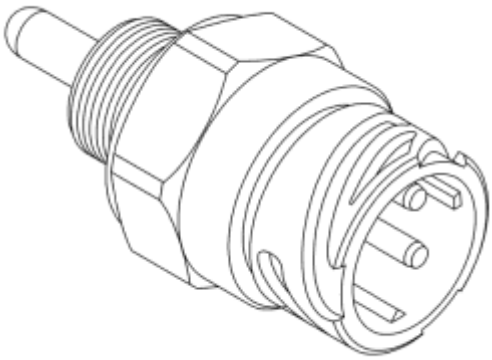
Pin	Line number	Function	Control unit A435 pin
1	60151	Output signal	A76
2	---	Not used	---
3	60100	Sensor earth	A57
4	---	Not used	---

Connector pin assignment

Diagram



Coolant temperature sensor (B124)



The coolant temperature sensor is an NTC thermistor. It is located in the cooling circuit and provides the control unit with information about the coolant temperature. The control unit calls up various engine operating maps, depending on the coolant temperature.

Table of measurements

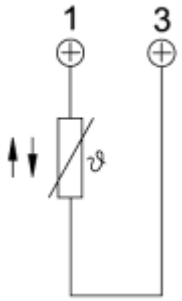
Temperature in °C	120	100	80	60	40	20	0	–20	–40
Resistance in ohm	112	186	322	595	1175	2500	5896	15462	45313
Voltage in volts	0.643	0.982	1.480	2.170	2.980	3.740	4.300	4.613	4.754

Table of connector pin assignment

Pin	Line number	Function	Control unit A435 pin
1	60131	Output signal	A77
2	---	Not used	---
3	60101	Sensor earth	A58
4	---	Not used	---

Connector pin assignment

Diagram



Exhaust temperature sensor (B561)

Exhaust temperature sensor (B561)

Temperature sensor B561 monitors the exhaust temperature ahead of the PM catalytic converter.

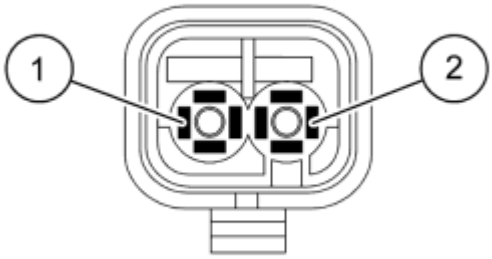
Table of measurements

Temperature in °C	0	25	200	400	600	800
Resistance in ohm	200	220	352	494	627	751

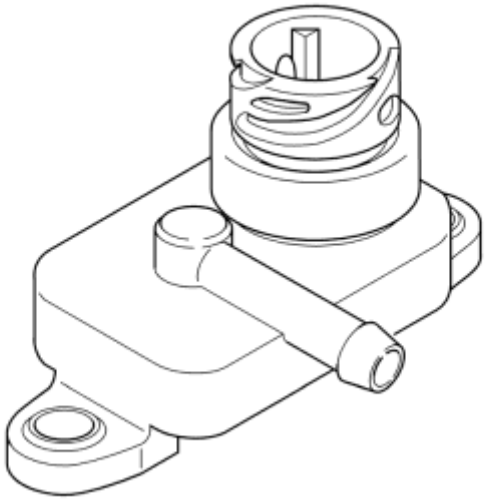
Table of connector pin assignment

Pin	Line number	Function	Control unit A435 pin
1 (2)	90122	Output signal	B33
2 (1)	90119	Sensor earth	B26

Pin assignment



Exhaust gas relative pressure sensor (B683)



The exhaust gas relative pressure sensor measures the relative pressure of the exhaust, i.e. the pressure currently existing against atmospheric pressure.

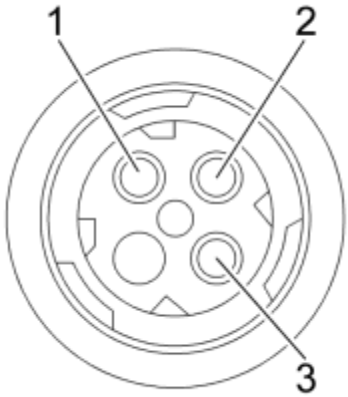
Table of measurements

Pressure in kPa	0.0	5.0	10	15	20	30	40	50	65
Voltage in volts	0.50	0.90	1.30	1.70	2.10	2.90	3.70	4.50	4.50

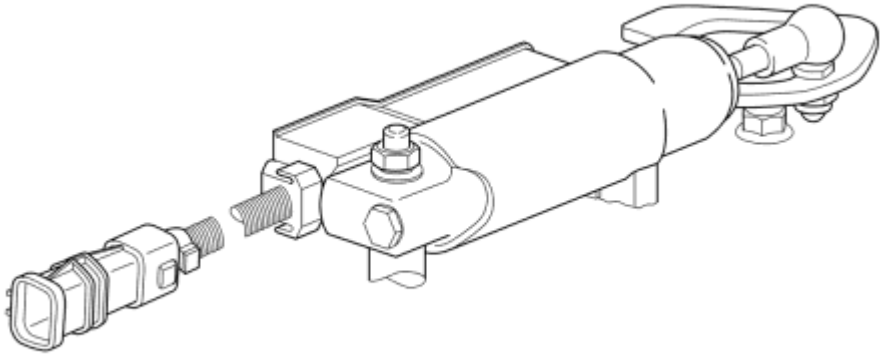
Table of connector pin assignment

Pin	Line number	Function	Control unit A435 pin
1	90126	Supply voltage 5V	A41
2	90127	Sensor earth	A59
3	90128	Output signal	A78

Pin assignment



Position-controlled EGR actuator (E-EGR) with travel sensor (B673)

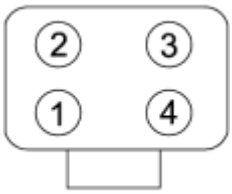


The position-controlled EGR actuator (E-EGR) is used in Euro 4 engines with OBD. The status of the EGR flap position is necessary for internal signal processing. This information is provided by the travel sensor mounted on the actuator cylinder (B673).

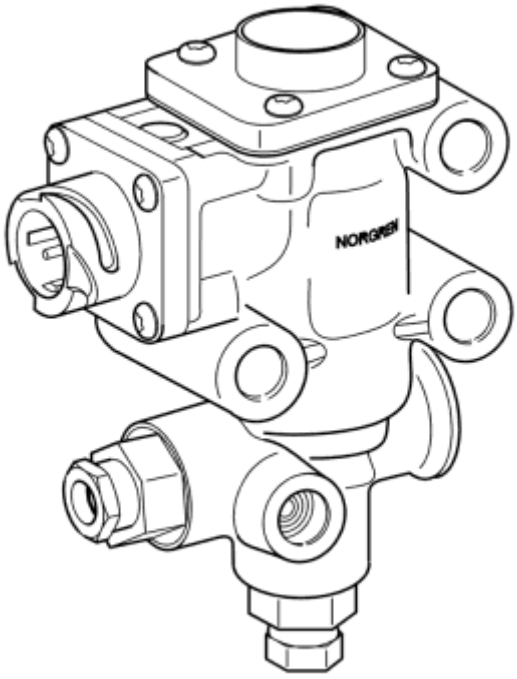
Table of connector pin assignment

Pin	Line number	Function	Control unit A435 pin
1 (4)	60182	Earth, position sensor	A39
2 (3)	60181	Output signal	A87
3 (2)	60180	Supply voltage 5V	A32
4 (1)	---	Not used	---

Pin assignment



Proportional valve E-EGR (Y458)

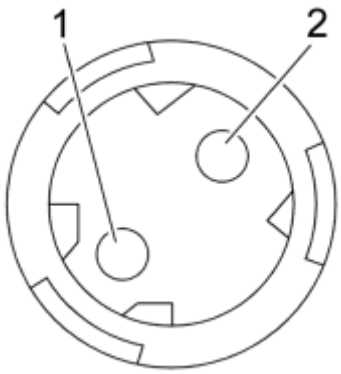


The proportional valve (Y458) controls the position-controlled EGR actuator (E-EGR). The operating medium is air at a minimum operating pressure of about 7 bar. A duty factor parameter is specified by the EDC control unit as activation signal.

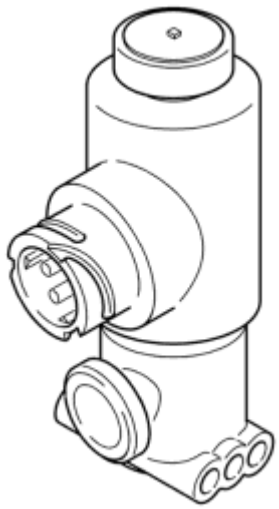
Table of connector pin assignment

Pin	Line number	Function	Control unit A435 pin
1	60392	Earth	A17
2	60393	Proportional valve activation	A11

Pin assignment



Pressure shut-off valve E-EGR (Y460)



The pressure shut-off valve E-EGR (Y460) is a 3/2 way valve that is closed when deenergised. It supplies the motor actuator with compressed air when the engine is running. This prevents a pressure loss when the engine is stopped.

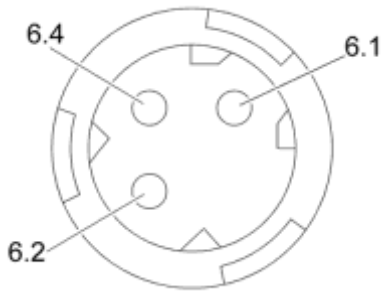
At present, activation is performed via a separate relay that is activated when the engine is running (tl. D+) and switches through tl. 15. The valve is mounted on the solenoid valve block on the frame crossmember.

In future, the valve will be mounted on the engine and controlled by the EDC control unit.

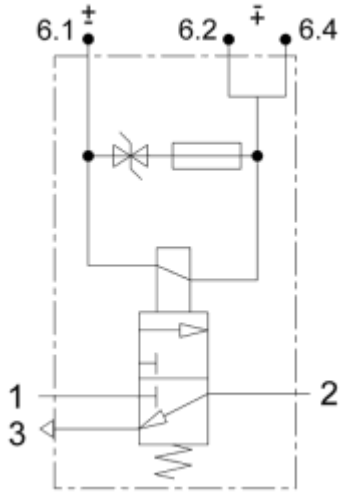
Table of connector pin assignment

Pin	Line number	Function	Control unit A435 pin
1 (6.1)	60395	Pressure shut-off valve activation	B06
2 (6.2)	60394	Earth	B02

Pin assignment



Diagram



1 Power in from supply
2 Power out into the working line
3 Atmosphere connection