
Group 30 Electrical system

Industrial Engines

TAD734GE, TAD650VE, TAD660VE, TAD750VE, TAD760VE

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Safety rules


Introduction


This workshop manual contains technical data, descriptions and repair instructions for the Volvo Penta products or product versions noted in the table of contents. Check that you have the correct Workshop Manual for your engine.

Read the available safety information, "General information" and "Repair instructions" in this workshop manual before you start to do any service work.

Important!


The following special warning symbols occur in this book and on the engine.


 **WARNING!** Warns for the risk of personal injury, property damage or that a mechanical fault can occur if the instructions are not followed.


 **IMPORTANT!** Is used to call attention to things which could cause damage or malfunctions to product or property.


NOTE! Is used to call attention to important information, to facilitate work processes or operation.


Below is a summary of the risks involved and safety precautions you should always observe or carry out when performing work on the EMS 2 system.


 Before electric welding is done, the connector on the EMS system must be disconnected. Disconnect the engine from system voltage by turning off the main switch. Disconnect the cable connectors from the control unit. Reconnect the EMS 2 control module terminal when the electric welding is finished and the electric welding equipment has been disconnected.


 Be careful, watch out for the moving components of the engine during function testing and in operation. Approaching the engine during operation entails a risk of personal injury. Remember that loose clothes or long hair can catch on rotating components and cause severe injury.


 Never do any work on an engine which just hangs from a lifting device (crane etc.).

 The engine must not be run in areas where explosive material or any gases are stored.

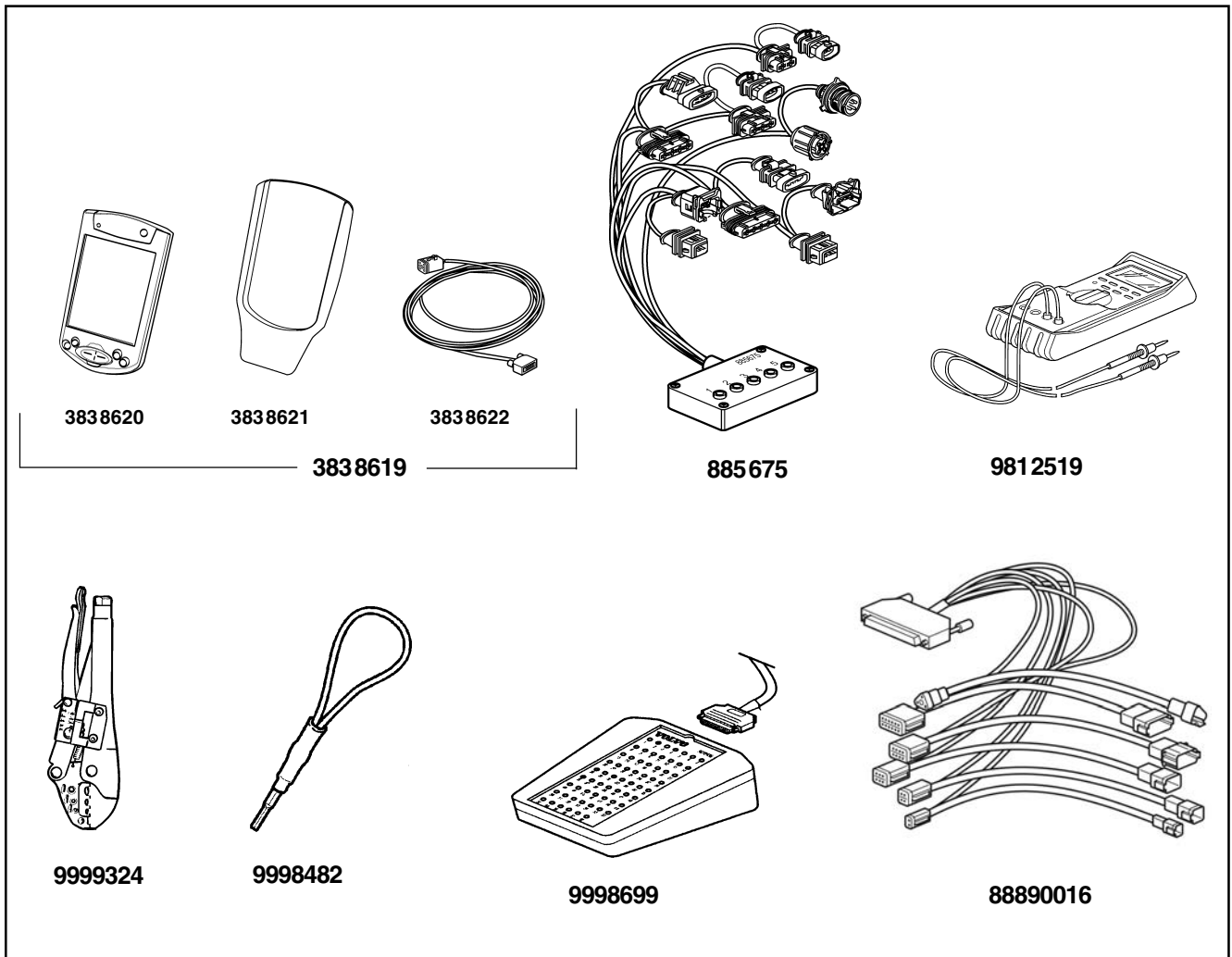
 Only start the engine in a well-ventilated area. If the engine is run in a confined space, make sure that the crankcase ventilation and exhaust gases can be led away from the workplace.

 The battery lockers must never be exposed to open flames or sparks. Never smoke close to the batteries. The batteries generate hydrogen gas when charged, which can form an explosive gas when mixed with air. This gas mixture is very flammable and highly explosive. A spark, which can be caused by incorrect battery connection, can cause a single spark which is sufficient to cause an explosion with resulting damage. Do not shift the connections when attempting to start the engine (spark risk) and do not lean over any of the batteries. Please refer to the advice in the instruction book.

 Always ensure that the + (positive pole) and – (negative pole) are securely connected to their appropriate terminals on the battery. If the batteries are wrongly connected, this can cause severe damage to the electrical equipment. Please refer to the wiring diagram.

 Always use goggles when charging and handling batteries. Battery electrolyte contains sulfuric acid, which is highly corrosive. If battery acid comes into contact with your skin, wash it off at once with a lot of soap and water, and then get medical help. If battery acid comes into contact with your eyes, flush your eyes at once (preferably with an eye shower) with a lot of clean water, and then get medical help at once.

Special tools



3838619 VODIA complete diagnostic tool.*
Components:

- 3838620 VODIA – palmtop computer (PDA) with SD card.
- 3838621 VODIA – docking station. Used with VODIA PDA (3838620).
- 3838622 VODIA – cable with connector. Used with docking station (3838621) on the engine's communication connector.

885675 Adapter cable for sensor test

9812519 Multimeter

9999324 Terminal crimping tool

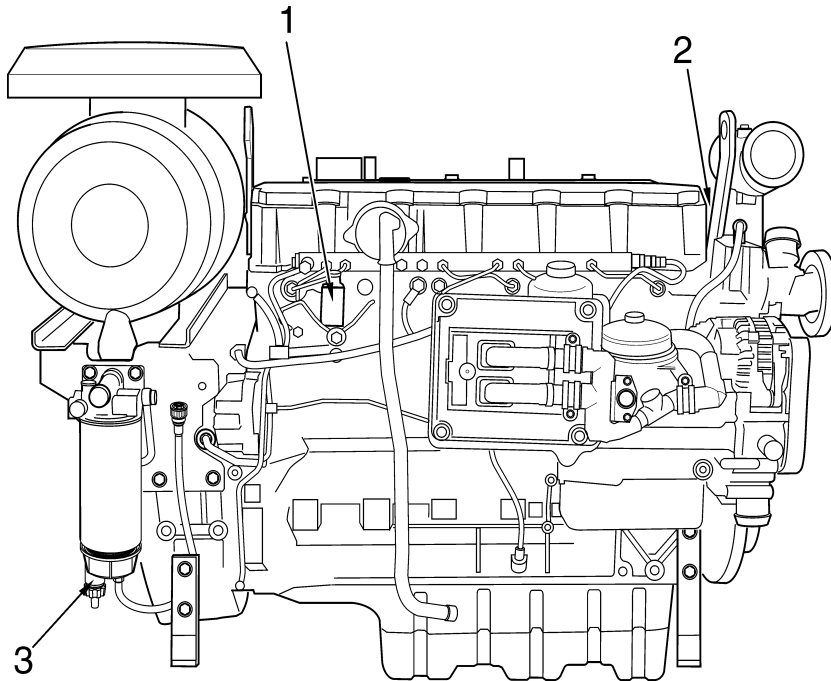
9998482 Gauge for connector on control unit

9998699 Measurebox

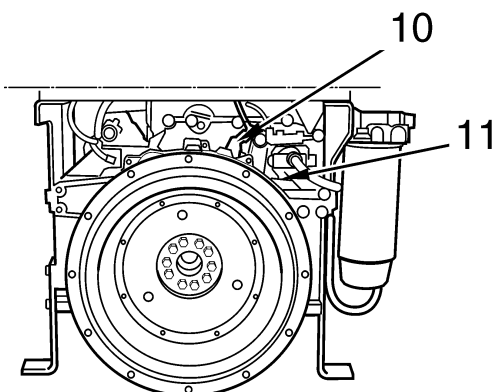
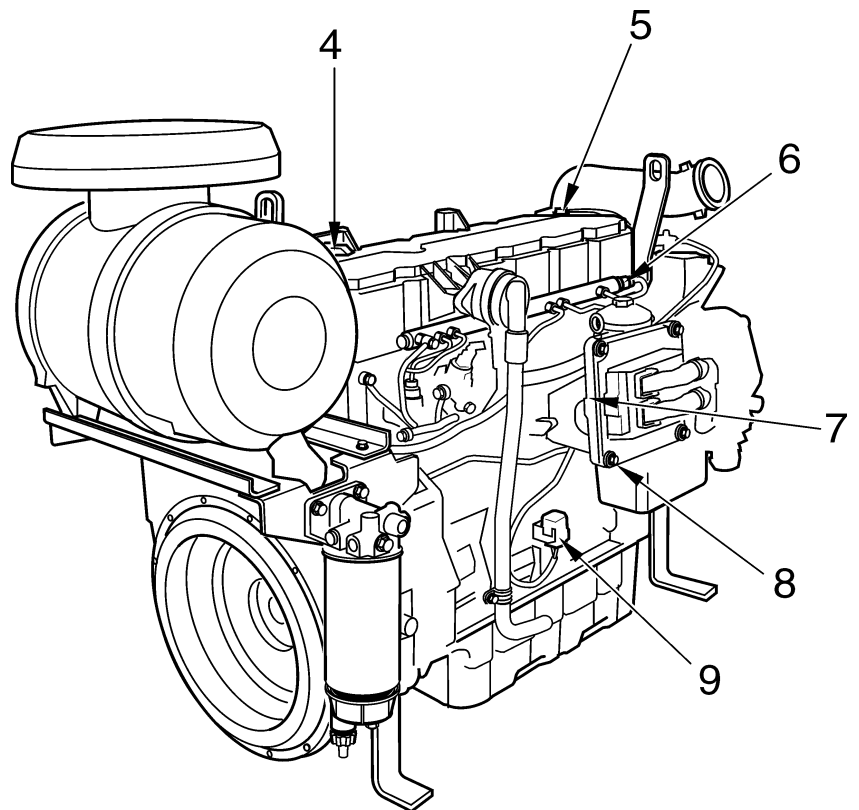
88890016 Adapter cable

***Note.** More detailed information about using the VODIA tool can be found in the tool's instruction manual.

Component location TAD 734 GE



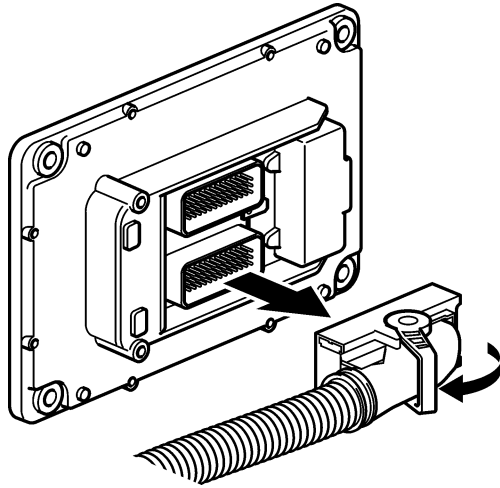
1. Solenoid controlled proportional valve, high pressure pump – fuel (MPROP)
2. Coolant temperature sensor
3. Water in fuel switch(mounted on primary fuel filter).
4. Boost pressure and temperature sensor
5. Preheater, intake manifold
6. Fuel pressure in comnan rail
7. Fuel pressure sensor
8. Oil pressure sensor
9. Main relay
10. Speed sensor, crankshaft
11. Speed sensor, camshaft



Electric welding

1. **NOTE!** Cut the current with the main switch.

⚠ IMPORTANT! The system must be disconnected from system voltage when the engine control module connectors are disconnected or connected.



2. Undo the two connectors from the engine control unit before any electric welding starts. Turn the locking arm down at the same time as the connector is pulled outwards.

3. Disconnect all connections to the alternator.

Connect the welder earth clamp to the component to be welded, or as close as possible to the weld site. The clamp must never be connected to the engine or in such a way that current can pass through a bearing.

⚠ IMPORTANT! After welding is completed, the disconnected components, such as alternator cables and battery cables must be connected in the correct order. The battery cables must always be connected last.

6

Put the pin back in the right place in the connector before removing the next pin, if several pins are to be changed. Check that the locking tongue locks the pin in the connector.

7

Install the cables with insulation and tie wraps in the connector, in the reverse order to disassembly.

8

Install the connector in the reverse order to disassembly.

9

Check that the connector and the mating connector on the engine control unit or power supply unit are clean and dry.

10

Join up the multi-pin connector. Please refer to "Control unit, changing" for advice on joining up the connector.

11

Start the engine and check carefully that no fault codes occur.

Checking the starter motor voltage

Special tools: Multimeter 981 2519

General

If battery voltage falls below 24.7 V*, the starter motor will not be able to crank the engine at normal speed.

A fully charged battery has an open circuit voltage of about 25.4 V.

* **Note.** Measured on the batteries.

Voltage measurement, check

1

Check that the battery voltage is at least 24.7 V* when unloaded by using multimeter 981 2519 to measure between the battery poles.

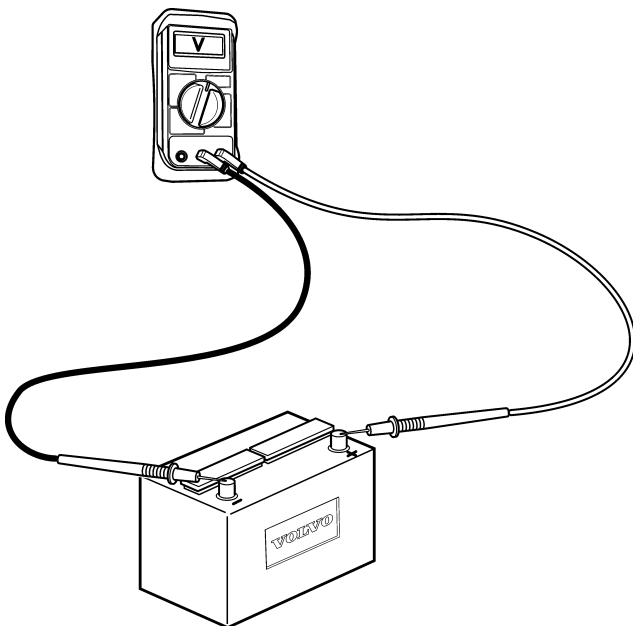
* **Note.** Measured on the batteries.

2

Turn the main switch on.

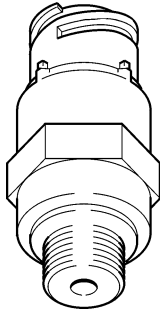
3

Check that the voltage between terminal B+ on the starter motor and battery negatives connection point is the same as the battery voltage.



MID 128, PID 94

Fuel pressure



MID 128: Engine control unit

- FMI 1: The sensor value is valid but below the normal working range.
- FMI 3: The voltage exceeds the normal value or is short circuited to higher voltage.
- FMI 5: The current is less than the normal value or is open circuited.
- FMI 7: Mechanical fault. The system responds incorrectly.

FMI	Fault code explanation
1	Fuel pressure is too low
3, 5	Faulty sensor / Faulty sensor circuit
7	Fuel pressure is critically low

Fault indication

DCU: Engine warning in DCU display.

CIU: Flash code

Flash code

Electrical fault: 3.6

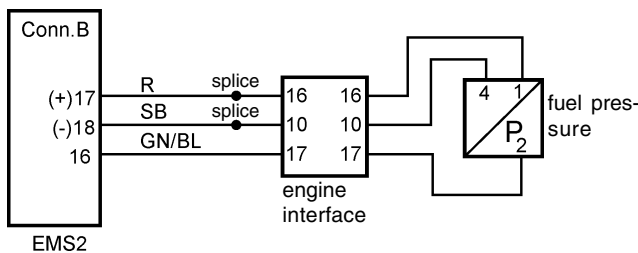
Value fault: 3.8

Symptom

None

Circuit description

The sensor is an active sensor, i.e. the sensor must receive operating voltage. Pin B17 on the engine control unit provides pin 1 on the sensor with an operating voltage of +5 Volt. Pin 4 on the sensor is connected to battery negative via pin B18 on the engine control unit. The output signal from the pressure sensor, pin 2 on the sensor to pin B16 on the EMS 2, is a voltage signal that is proportional to the fuel pressure.



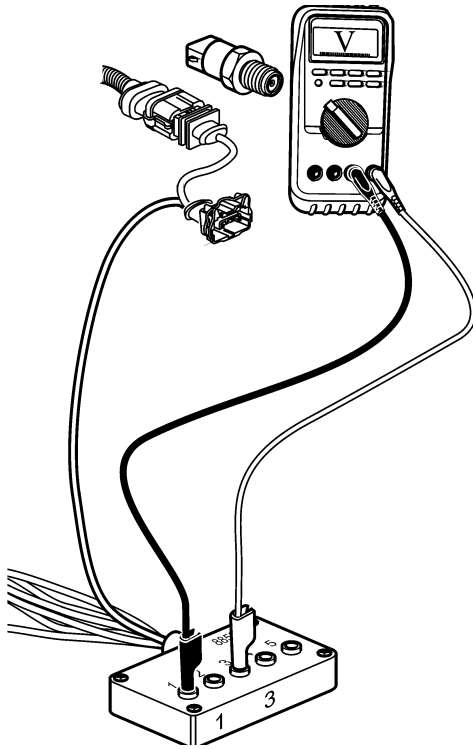
Note! Only TAD 650, 660, 750, 760 has an engine interface. On TAD 734 the wiring to the EMS 2 is the same but without any engine interface.

Measurements

NOTE! If any of the measurements shows an abnormal value, check the wiring to and from the engine interface.

Supply cable:

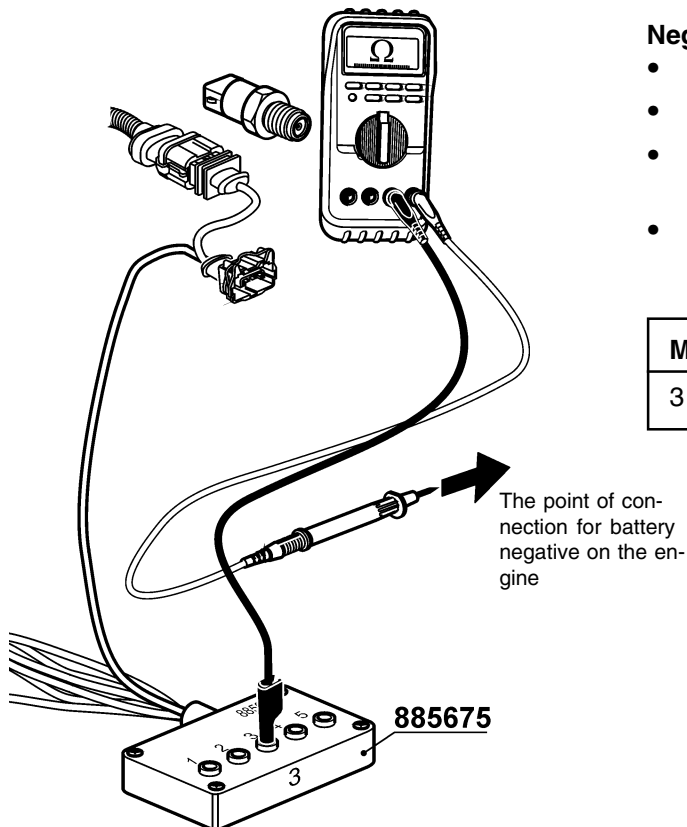
- **NOTE!** Turn ignition off.
- Remove the connector from the sensor.
- Connect adapter cable 885675 between the sensor and engine control unit.
- Use multimeter 9812519 for voltage measurement
- **NOTE!** Turn ignition on.



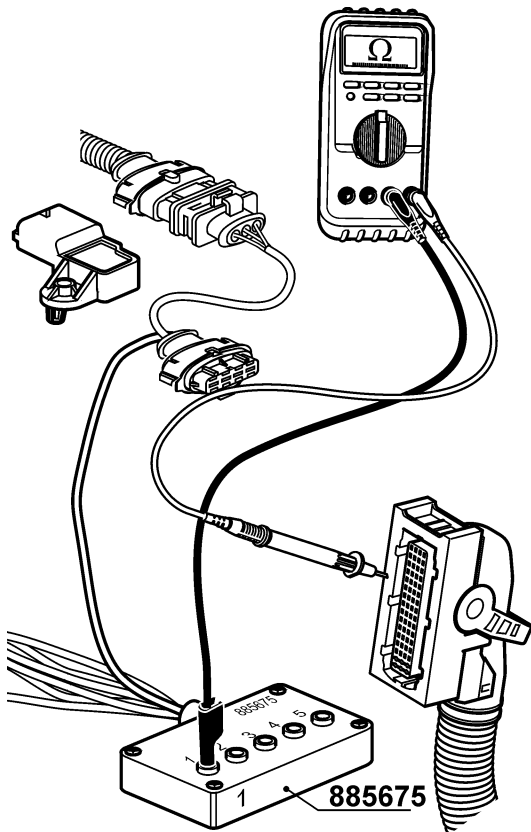
Measurement points	Nominal value
1 – 3	U ≈ 5 V

Negative cable:

- **NOTE!** Cut the current with the main switch.
- Disconnect the connector from the sensor
- Connect adapter cable 885675 to the cable harness connector to the engine control unit.
- Use multimeter 9812519 to do resistance measurement against the engine control unit.



Measurement points	Nominal value
3 – Battery negative	R ≈ 0 Ω

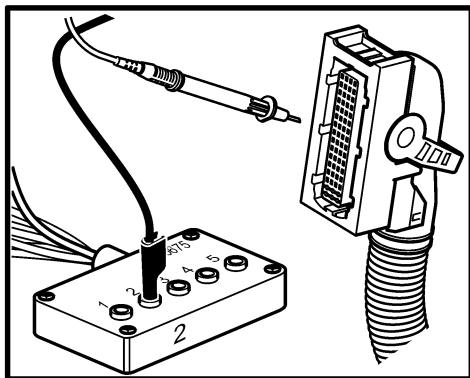


Checking the sensor cable for open circuit or short-circuit:

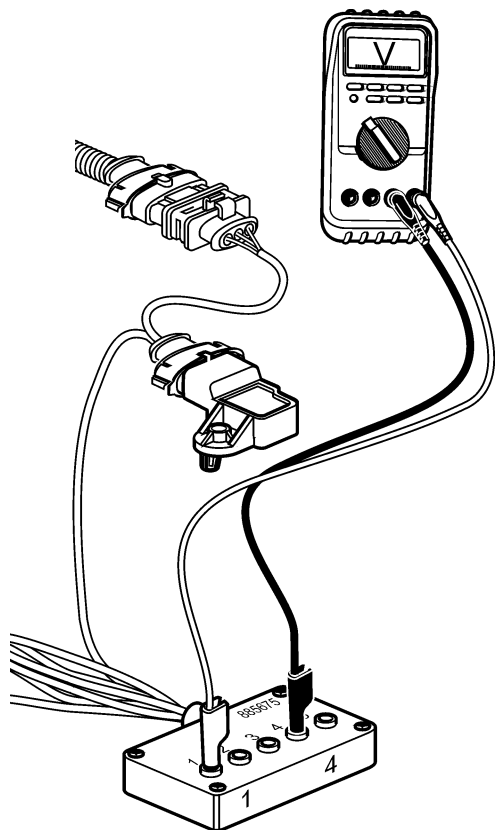
- **NOTE!** Cut the current with the main switch.
- Disconnect the connector from the sensor.
- Connect adapter cable 885675 to the cable harness connector to the engine control unit.
- Remove connector A from the engine control unit.
- Use multimeter 9812519 to do a resistance measurement against the engine control unit connector A.

Measurement points	Nominal value
2 (885675)– 47 (EMS 2, conn.A)	$R \approx 0 \Omega$
2 (885675)– 11(EMS 2, conn.A)	$R \approx \infty \Omega$
1 (885675)– 47 (EMS 2, conn.A)	$R \approx \infty \Omega$
1 (885675)– 11(EMS 2, conn.A)	$R \approx 0 \Omega$

NOTE! Measurement is done to eliminate short circuiting or breaks in the cable to the engine control unit.

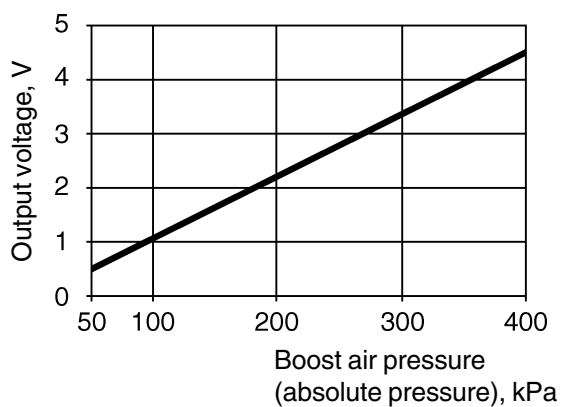


Checking boost pressure sensor



- **NOTE!** Turn ignition off.
- Disconnect the connector from the sensor
- Connect adapter cable 885675 between the sensor and the engine control unit.
- Use multimeter 9812519 for voltage measurement.
- Turn ignition on.

Measurement points	Nominal value
1 – 4	$U \approx 1,1 \text{ V}$ (at normal atmospheric pressure)



Component specification

Working range: 0,5 – 4,0 bar = 50 – 400 kPa

Supply voltage: 5,00 +/- 0,25 VDC

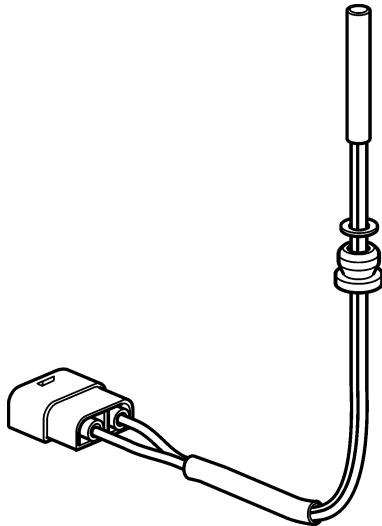
Nominal output voltage at 25 °C and at supply voltage 5,00 VDC:

0,5 VDC at 0,5 bar = 50 kPa

4,5 VDC at 4 bar = 400 kPa

MID 128, PID 111

Coolant level



MID 128: Engine control unit

FMI 1: The sensor value is valid but below the normal working range.

FMI 3: The voltage exceeds the normal value or is short circuited to higher voltage.

FMI	Fault code explanation
1	Coolant level is too low
3	Faulty sensor / Faulty sensor circuit

Fault indication

DCU: Engine warning in DCU display.

CIU: Flash code

Flash code

Electrical fault: 2.3

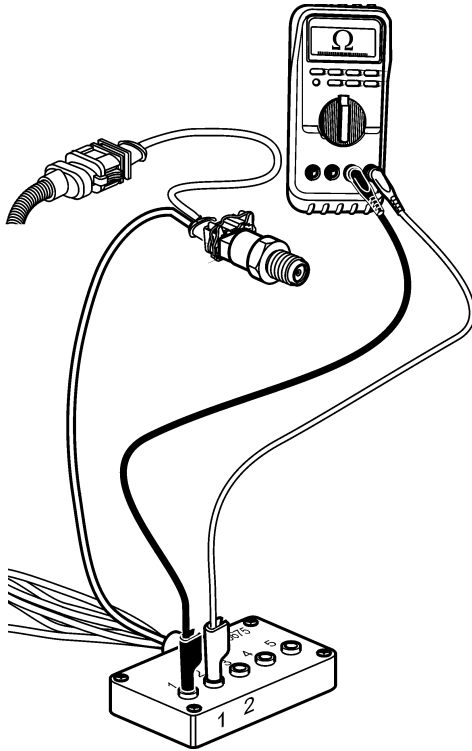
Value fault: 2.2

Symptom

FMI 1

VE engines: Engine is derated if engine protection parameter is activated.

GE engines: Engine is shutdown.



Checking fuel pressure sensor

- **NOTE!** Turn ignition off.
- Disconnect the connector from the sensor
- Connect adapter cable 885675 between the sensor and the engine control unit.
- Use multimeter 9812519 for voltage measurement.
- Turn ignition on.

Measurement points	Nominal value
1 – 2	$U \approx 0,5 \text{ V}$ (at normal atmospheric pressure)

Component specification

Working range: 0 – 1800 bar = 0 – 180 MPa

Supply voltage: 5.00 +/- 0.25 VDC

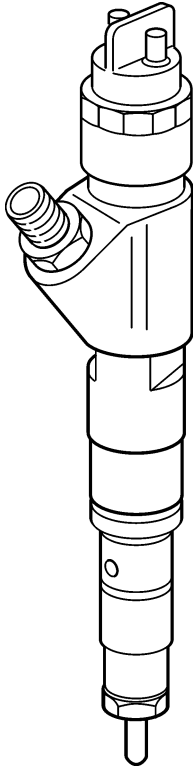
Nominal output voltage at 25 °C and at supply voltage 5.00 VDC:

0.5 VDC at 0 bar = 0 kPa

4.5 VDC at 1800 bar = 180 MPa

MID 128, SID 1-6

Injector common rail # 1-6



MID 128: Engine control unit.

- FMI 3: Short to battery voltage, injector low voltage side.
- FMI 4: Short to battery negative, injector high voltage side.
- FMI 5: Break in injector circuit.
- FMI 7: Mechanical fault. The system responds incorrectly.
- FMI 12: Low injector hold current.
- FMI 14: Special instructions.

FMI	Fault code explanation
3, 4, 5, 7, 12	Fault in the injection system

Fault indication

- DCU: Engine warning in DCU display.
- CIU: Flash code

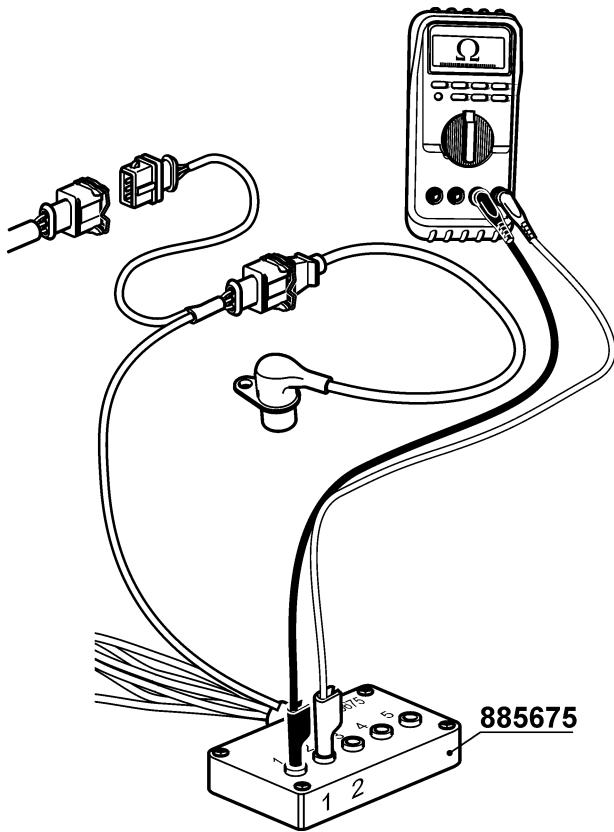
Flash code

- Electrical fault: 7.1–7.6
- Value fault: None

Symptom

- FMI 3, 4, 5: Faulty injector is shut off. Limp home on rest of injectors.

Checking speed sensor



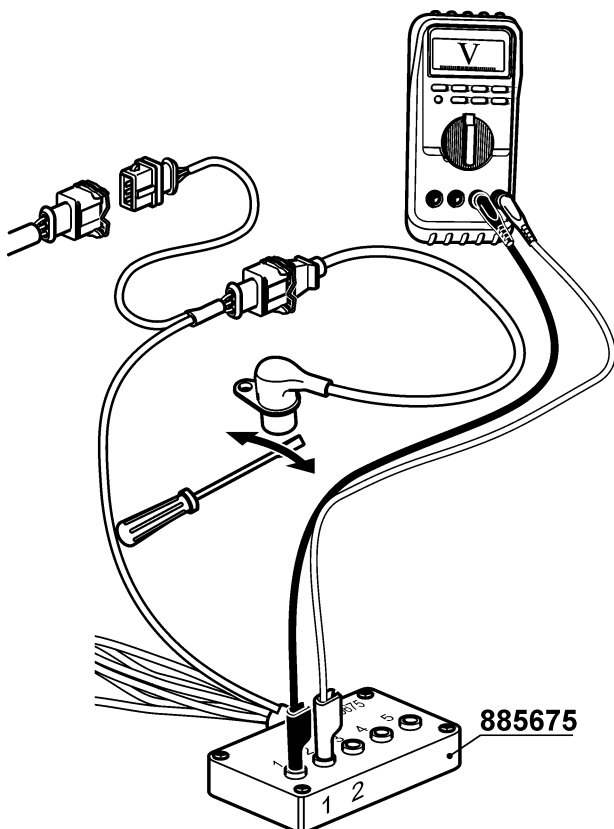
1. **NOTE!** Cut the current with the main switch.
2. Undo the connector from the sensor and remove the sensor from the cylinder head. Check that the sensor does not have any external damage, or any swarf which has got stuck on it.
3. Connect adapter cable 885675 to sensor.

NOTE! Do **not** connect the other end of the adapter cable to the engine cable harness, since this can cause a measurement error.

4. Use multimeter 9812519 for resistance measurement.

Measurement points	Nominal value
1 – 2	$R \approx 0,9 \text{ k}\Omega$ at 20°C

NOTE! The measurement must exclude short circuit or open circuit to the engine control unit.



5. Use multimeter 9812519 for a AC voltage measurement.

Move a metal object rapidly back and forwards not more than 1 mm in front of the sensor. Check that the multimeter gives a reading.

6. Install the sensor.