

Diagnostic function

The diagnostic function monitors and checks that the EMS 2 system functions normally.

The diagnostic function has the following tasks:

- Detecting and locating disturbances
- Reporting detection of disturbances
- Providing guidance when troubleshooting

Message regarding disturbance

If the diagnostic function discovers a malfunction in the EMS 2 system, this is reported by means of fault codes/fault cause on the instruments.

Both inactive (rectified) and active (un-mended) faults are stored in the control unit.

Please refer to the "Operation" heading for reading fault codes.

All fault codes are found in the fault code list, with information about the reason, reaction and measures to be taken. Please refer to the "Fault codes" chapter.

NOTE! All instruments are optional

Active faults

DCU (Display Control Unit) / DU (Display Unit)

- text "!! ENGINE WARNING !!" is shown on the display.

NOTE! It's possible to choose which language the information will be presented in.

CIU (Control Interface Unit)

- the diagnostic lamp starts to flash.
- "Easy-link" instrument (requires a CIU)
 - warning lamp on the alarm panel lights up
 - after the diagnostic button has been pressed, the fault code is shown as text on the tachometer display.

DU (Display Unit)

- Either "WARNING!" or "ALARM STOP" (a buzzer sounds) will be shown on the display, depending on the severity of the fault.

NOTE! You can choose the language used for the information presented on the.

- Fault codes can also be read by means of the **VODIA** tool. Please refer to the "VODIA User's Guide" for advice on use.

At the same time, the fault is stored in the control unit memory. When the fault has been attended to and the ignition is switched off and on again, the fault disappears as active.

Inactive faults

- DCU - the fault is indicated as passive
- CIU - the diagnostic lamp goes out
- DU - the fault message disappears (inactive faults can not be read)
- "Easy Link" - the warning lamp on the alarm panel turns off

Effect on engine

Engines are affected differently, depending on the severity of the fault discovered by the diagnostic function.

A fault message in the form of a fault code is always generated when a malfunction is discovered by the diagnostic function.

Engines are affected differently, depending on the severity of the fault.

- The engine is not affected
- Engine idles
- Engine torque is restricted to a certain amount
- Engine is stopped

Operation

When a malfunction has occurred and the diagnostic system has generated one or more fault codes, these are read out differently, depending on the equipment used. Please refer to "Fault codes".

If the system indicates that a fault code has been set:

1. Cut engine speed to idle, or shut the engine off.
2. **For DCU/DU**
Read the fault code set from the display, please refer to "Reading fault cause via the DCU" or "Reading fault cause via DU".
For CIU
Press the diagnostic button and read the fault code that has been set, by observing the flashing of the diagnostic lamp. Please refer to "Reading fault codes via the diagnostic lamp, CIU"
3. Look up the fault code/cause in the "Fault Code" chapter and take the recommended measures.

Reading fault cause via the DCU (Display Control Unit)

When a fault code is set, the following text is shown on the display:

"!! ENGINE WARNING !!"

alternated with

"Press SEL for information".

NOTE! You can choose the language used for the information presented on the.

Read the fault code as follows:

1. Press the SEL button (to come to the error list).
The fault list shows:
 - Operation hours
 - Fault cause
 - Active/inactive
2. Look up the fault code in the "Fault Code" chapter and take the recommended measures.
3. Press the ESC button to leave the fault list.

NOTE! To enter the fault list when no fault code has been set, press the SEL button and select "Diagnostics" from the menu.

Reading fault cause via the DU (Display Unit)

Depending on the severity of the faults, one of the following messages will appear on the display: "**WARNING!**" or "**ALARM STOP**" (a buzzer sounds).

1. Press any button to come to the fault list.
The fault list shows:
 - Operation hours
 - Fault cause
2. Look up the fault code in the "Fault Code" chapter and take the recommended measures.
3. Press **ACK** to confirm the fault code. The display background will change color (the buzzer stops sounding).
4. Press **EXIT** to leave the fault list.

Reading fault codes via the diagnostic lamp on the instrument panel, CIU

When the system has discovered a malfunction, the diagnostic lamp starts to flash. If the diagnostic button is depressed and then released, a fault code is flashed out.

The fault code consists of two groups of flashes, separated by a pause of two seconds. A fault code is obtained by counting the number of flashes in each group.

Example: ✨ ✨ pause ✨ ✨ ✨ ✨ = Fault code 2.4

The fault code is stored and can be read as long as the malfunction remains. You can find information about cause, reaction and actions in the "Fault Code" chapter.

Read the fault code as follows:

1. Press the diagnostic button.
2. Release the diagnostic button and make a note of the fault that is flashed out.
3. Repeat items 1-2. A new fault code is flashed out if more are stored. Repeat until the first fault code is repeated.
4. Look up the fault code in the "Fault Code" chapter and take the recommended measures.

NOTE! When the first fault code is repeated, all fault codes have been read out.

If the diagnostic button is pressed after the fault has been mended and the fault codes have been erased, code 1.1 "No fault" will be displayed.

Reading fault codes via "Easy Link" instrument (only with CIU)

When the system has discovered a malfunction, the diagnostic lamp starts to flash and the fault code will show in the display of the tachometer.

1. Press the diagnostic button, the fault code will show in the display of the tachometer.
2. Look up the fault code in the "Fault Code" chapter and take the recommended measures.
3. When the fault has been attended to, the fault code disappears from the display and the diagnostic lamp goes out.

Erasing fault codes

Fault codes must be erased by means of the VODIA tool.

Fault codes

⚠ WARNING! Read through the safety advice for care and maintenance work in the "Safety information" chapter before you start work.

NOTE! Reading the fault codes below, such as **Code 2.1, PID 97** means that **2.1** is the flashing code indicated by the diagnostic lamp. **PID 97** is read with the VODIA diagnostic tool. With the use of DCU or DU the fault message will be shown as text in the display.

NOTE! Please refer to "Wiring schedule CIU and DCU" for references to the sleeves in the electrical connectors on the engine control unit.

Code 1.1 No faults

There are no active faults.

Code 2.1, PID / SPN 97. Water in fuel

Cause:

- Water in fuel.

Reaction:

- None.

Remedy:

- Empty the primary fuel filter.

Code 2.2, PID / SPN 111. Coolant level

Cause:

- Low coolant level.

Reaction:

- Warning indication.
- Engine control module reduces engine power (unless the protection has been shut off with the VODIA diagnostic tool).

Remedy:

- Check the coolant level.
- Check coolant level monitor function.

Code 2.3, PID / SPN 111. Coolant level sensor

Cause:

- Short circuit to positive (+).
- Fault in sensor.

Reaction:

- None.

Remedy:

- Check that the coolant level sensor cable is not damaged.
- Check coolant level sensor function.

Code 2.4. SID21 / SPN 637 Flywheel speed sensor

Cause:

- No signal.
- Abnormal frequency.
- "Intermittent" signal from the sensor.
- Fault in sensor.

Reaction:

- Engine is very difficult to start and runs roughly when it starts.

Remedy:

- Check that the sensor connector is correctly installed.
- Check that the engine speed sensor cable is not damaged.
- Check that the engine speed sensor is correctly installed in the flywheelhousing.
- Check engine speed sensor function.

Code 2.5. SID22 / SPN 636 Camshaft drive speed sensor

Cause:

- No signal.
- Abnormal frequency.
- Fault in sensor.

Reaction:

- Engine takes longer to start than normal. Engine runs normally when running.

Remedy:

- Check that the engine speed sensor connector is correctly installed.
- Check that the engine speed sensor cable is not damaged.
- Check that the engine speed sensor is correctly installed in the upper timing gear cover.
- Check engine speed sensor function.

Code 2.6, PID / SPN 190. Engine speed**Cause:**

- Engine speed too high.

Reaction:

- None.

Remedy:

- After the engine has stopped, look for the reason for the high speed.

**Code 2.8, PPID 132 / SPN 608
Speed potentiometer connected to CIU****Cause:**

- Shorted to plus (+) or minus (-).
- Fault in sensor.

Reaction:

- Engine goes to idle.

If you release the accelerator first, and then press it down again, the engine can be forced to run using the idle contact.

Remedy:

- Check that the potentiometer has been connected correctly.
- Check that the cable harness to the potentiometer has not been damaged.
- Check the potentiometer function.

**Code 2.9. PID / SPN 97
Indicator for water in fuel****Cause:**

- Short circuit
- Open circuit.
- Fault in indicator.

Reaction:

- None.

Remedy:

- Check the indicator cables for breaks and short circuits.
- Check indicator function. Change indicator as necessary

Code 3.1, PID / SPN 100. Oil pressure sensor**Cause:**

- Short circuit to positive (+) or earth (ground) (-).
- Open circuit.

Reaction:

- None.

Remedy:

- Check that the oil pressure sensor cable is not damaged.
- Check that the oil pressure sensor is correctly connected.

**Code 3.2. PID / SPN 105
Charge air temperature sensor****Cause:**

- Short circuit to positive (+) or earth (ground) (-).
- Open circuit.

Reaction:

- None.

Remedy:

- Check that the charge air temperature sensor connector is correctly installed.
- Check that the charge air temperature sensor cable is not damaged.
- Check that the charge air temperature sensor is correctly installed.
- Check charge air temperature sensor function.

**Code 3.3. PID / SPN 110
Coolant temperature sensor****Cause:**

- Short circuit to positive (+) or earth (ground) (-).
- Open circuit.

Reaction:

- Preheating is also activated when the engine is hot.

Remedy:

- Check that the coolant temperature sensor connector is correctly installed.
- Check that the coolant temperature sensor cable is not damaged.
- Check that the coolant temperature sensor is correctly installed.
- Check coolant temperature sensor function.

Code 3.6, PID / SPN 94. Fuel pressure sensor

Cause:

- Short circuit to positive (+) or earth (ground) (-).
- Open circuit.

Reaction:

- None.

Remedy:

- Check that the fuel pressure sensor connector is correctly installed.
- Check that the fuel pressure sensor cable is not damaged.
- Check that the fuel pressure sensor is correctly installed.
- Check fuel pressure sensor function.

Code 3.7, PID / SPN 175. Oil temperature sensor

Cause:

- Shorted to plus (+) or minus (-).
- Break.

Reaction:

- None.

Remedy:

- Check that the cable harness to the oil temperature sensor has not been damaged.
- Check that the oil temperature sensor has been connected correctly.

Code 3.8, PID / SPN 94. Fuel pressure

Cause:

- Low supply pressure.

Reaction:

- None.

Remedy:

- Check if it is possible to build up pressure with the hand pump.
- Check the fuel filter.
- Check the fuel pre-filter.

Code 3.9, PID / SPN 158. Battery voltage, EMS

Cause:

- Faulty alternator.
- Faulty battery, battery cables.

Reaction:

- None.

Remedy:

- Check the supply voltage from the control unit.

**Code 4.6, PPID 3 / SID 39 / SPN 677
Start output / Start motor relay**

Cause:

- Shorted to plus (+) or minus (-).
- Activated for too long.

Reaction:

- The engine cannot be started.
- The engine starts immediately when ignition is turned on.

Remedy:

- Check that connections to the ignition key have not been damaged.
- Check that the cable harness to the ignition key has not been damaged.

Code 4.8, PPID 6/ SPN 520195. Stop input EMS

Cause:

- Short circuit to negative (-).
- Open circuit.

Reaction:

- Engine can only be stopped with the auxiliary stop.

Remedy:

- Check that the starter switch connections are not damaged.

Code 5.2, PPID 4 / SPN 520194. Starter input CIU

Cause:

- Shorted to minus (-).
- Activated for too long.

Reaction:

- The engine cannot be started.
- The engine starts immediately when ignition is turned on.

Remedy:

- Check that connections to the ignition key have not been damaged.
- Check that the cable harness to the ignition key has not been damaged.

Code 5.3, PPID 6/ SPN 970. Stop input CIU**Cause:**

- Short circuit to negative (-).
- Open circuit.
- Activated for too long time.

Reaction:

- Engine can only be stopped with the auxiliary stop (AUX STOP) on engine.
- Engine stops. A fault code is displayed for 40 seconds and the engine can not be started during this time. When a fault code is active, the engine can be started but not stopped.

Remedy:

- Check that the starter switch connections are not damaged.
- Check that the ignition switch cable is not damaged.

Code 5.4, PID 45/ SPN 626. Preheating relay**Cause:**

- Short circuit to positive (+) or earth (ground) (-).
- Open circuit.

Reaction:

- Preheating can not be activated.
- Preheating is constantly connected.

Remedy:

- Check that the relay input cable is not damaged.
- Check relay function.

Code 5.6, PID/SPN 107. Air filter sensor**Cause:**

- Shorted to plus (+) or minus (-).
- Break.

Reaction:

- None

Remedy:

- Check that the air filter sensor contact is correctly installed.
- Check that the cable harness to air filter sensor has not been damaged.
- Check the air filter sensor functionality.

Code 5.7. PID / SPN 98, Oil level**Cause:**

- Oil level is too low.

Reaction:

- Warning indication.

Remedy:

- Check the oil level.

Code 5.8, PID / SPN 175. Oil temperature**Cause:**

- Oil temperature is too high

Reaction:

- Warning indication.
- The engine control module limits engine output (unless protection has been turned off with the diagnosis tool VODIA).

Remedy:

- Check the oil level.
- Check the oil temperature.
- Check the oil temperature sensor function.

Code 5.9, PID / SPN 98. Oil level sensor**Cause:**

- Shorted to plus (+) or minus (-).
- Break.

Reaction:

- None.

Remedy:

- Check that the cable harness to the oil level sensor has not been damaged.
- Check the oil level sensor function.

Code 6.1, PID / SPN 110. Coolant temperature**Cause:**

- Coolant temperature is too high.

Reaction:

- Engine control module reduces engine power (unless the protection has been shut off with the VODIA diagnostic tool).

Remedy:

- Check the coolant level.
- Check the intercooler (cleanliness).
- Check if there is air in the cooling system.
- Check the pressure cap on the expansion tank.
- Check coolant temperature sensor function.
- Check thermostat function.

Code 6.2, PID / SPN 105. Charge air temperature

Cause:

- Charge air temperature is too high.

Reaction:

- Engine control module reduces engine power (unless the protection has been shut off with the VODIA diagnostic tool).

Remedy:

- Check the coolant level.
- Check the intercooler (cleanliness).
- Check charge air temperature sensor function.
- Check the function of the thermostat.

Code 6.4. PPID 231 / SPN 639. Data link (CAN). CIU

Cause:

- Faulty data link (CAN), CIU.

Reaction:

- Instruments and warning lamps stop working.

Remedy:

- Check that the 8-pin connector is not damaged.
- Check that the cables between the CIU and the engine management unit are not damaged.

Code 6.5. PPID 231 / SPN 639. Data link (CAN), EMS 2

Cause:

- Internal fault in control module.

Reaction:

- Engine not operating: engine can not be started.
Engine operating: engine idles and can only be stopped with the auxiliary stop (AUX-stop).

Remedy:

- Check that the 8-pin connector is not damaged.
- Check that the cables between the CIU and the engine management unit are not damaged.
- Check that sleeves 11 and 12 in the connector on the CIU are not damaged.

Code 6.6, PID / SPN 100, Oil pressure

Cause:

- Oil pressure is too low.

Reaction:

- Engine control module reduces engine power (unless the protection has been shut off with the VODIA diagnostic tool).

Remedy:

- Check oil level.
- Check that the air filters are not blocked.
- Check system pressure valves and safety valves in the oil system.
- Check oil pressure sensor function.

Code 6.7, PPID 8 / SPN 520192, Piston cooling pressure

Cause:

- Piston cooling pressure is too low.

Reaction:

- Engine stopped. The fault code is de-activated at engine speeds below 1000 rpm.

Remedy:

- Check that the oil pressure in the engine exceeds 175 kPa (25.4 psi).

Code 6.8, PPID 8 / SPN 520192, Piston cooling pressure sensor

Cause:

- Shorted to plus (+) or minus (-).
- Break.

Reaction:

- None.

Remedy:

- Check that the piston cooling pressure sensor contact is correctly installed.
- Check that the cable harness to the piston cooling pressure sensor has not been damaged.
- Check the piston cooling pressure sensor functionality.

Code 6.9, PID / SPN 158, Battery voltage, CIU**Cause:**

- Short circuit to negative (-).
- Faulty alternator.
- Faulty battery, battery cables.

Reaction:

- Problems in engine starting.

Remedy:

- Check the supply voltage from the control unit.
- Check the battery.
- Check the alternator.
- Check the 8-pin contact.

**Code 7.1. SID 1 / SPN 651
Injector, cylinder #1****Cause:**

- Electrical fault.
- Faulty compression or injector.

Reaction:

- Engine runs on 5 cylinders.
- Abnormal sound.
- Reduced performance.

Remedy:

- Check that the injector cables are not damaged.
- Check that the injector connections are not damaged.
- Check fuel supply pressure.
- Check the valve clearance.
- Do a compression test and check cylinder #1.

**Code 7.2. SID 2 / SPN 652
Injector, cylinder #2****Cause:**

- Electrical fault.
- Faulty compression or injector.

Reaction:

- Engine runs on 5 cylinders.
- Abnormal sound.
- Reduced performance.

Remedy:

- Check that the injector cables are not damaged.
- Check that the injector connections are not damaged.
- Check fuel supply pressure.
- Check the valve clearance.
- Do a compression test and check cylinder #2.

**Code 7.3. SID 3 / SPN 653
Injector, cylinder #3****Cause:**

- Electrical fault.
- Faulty compression or injector.

Reaction:

- Engine runs on 5 cylinders.
- Abnormal sound.
- Reduced performance.

Remedy:

- Check that the injector cables are not damaged.
- Check that the injector connections are not damaged.
- Check fuel supply pressure.
- Check the valve clearance.
- Do a compression test and check cylinder #3.

**Code 7.4. SID 4 / SPN 654
Injector, cylinder #4**

Cause:

- Electrical fault.
- Faulty compression or injector.

Reaction:

- Engine runs on 5 cylinders.
- Abnormal sound.
- Reduced performance.

Remedy:

- Check that the injector cables are not damaged.
- Check that the injector connections are not damaged.
- Check fuel supply pressure.
- Check the valve clearance.
- Do a compression test and check cylinder #4.

**Code 7.5. SID 5 / SPN 655
Injector, cylinder #5**

Cause:

- Electrical fault.
- Faulty compression or injector.

Reaction:

- Engine runs on 5 cylinders.
- Abnormal sound.
- Reduced performance.

Remedy:

- Check that the injector cables are not damaged.
- Check that the injector connections are not damaged.
- Check fuel supply pressure.
- Check the valve clearance.
- Do a compression test and check cylinder #5.

**Code 7.6. SID 6 / SPN 656
Injector, cylinder #6**

Cause:

- Electrical fault.
- Faulty compression or injector.

Reaction:

- Engine runs on 5 cylinders.
- Abnormal sound.
- Reduced performance.

Remedy:

- Check that the injector cables are not damaged.
- Check that the injector connections are not damaged.
- Check fuel supply pressure.
- Check the valve clearance.
- Do a compression test and check cylinder #6.

**Code 7.7. PID / SPN 153
Crankcase ventilation pressure**

Cause:

- Crankcase ventilation pressure too high.

Reaction:

- The engine is shut down (if the protection has not been shut off by the parameter tool).

Remedy:

- Check whether the crankcase ventilation is blocked.
- Check whether cylinder liner, piston or piston rings are worn or damaged.

**Code 7.8. PID / SPN 153
Crankcase ventilation pressure sensor**

Cause:

- Shorted to plus (+) or minus (-).
- Break.

Reaction:

- None.

Remedy:

- Check that the crankcase ventilation pressure sensor contact is correctly installed.
- Check that the cable harness to the crankcase ventilation pressure sensor has not been damaged.
- Check crankcase ventilation pressure sensor function.

Code 7.9, PID / SPN 172
Air temperature sensor, inlet
Cause:

- Shorted to plus (+) or minus (-).
- Break.

Reaction:

- None.

Remedy:

- Check that the air temperature sensor contact is correctly installed.
- Check that the cable harness to the air temperature sensor has not been damaged.
- Check the air temperature sensor functionality.
- Check the preheating relay.

Code 9.2. SID250 / SPN 608
Faulty data link (J1587)
Cause:

- Faulty data link.

Reaction:

- None.

Remedy:

- Check that the 8-pin connector is not damaged.
- Check that the cables between the CIU/DCU and the engine management unit are not damaged.

Code 9.3. SID 232 / SPN 620
Power supply to sensor
Cause:

- Shortcut.
- Fault in sensor.

Reaction:

- Faulty values in oil pressure and charge air pressure sensors.
- Fault code for oil pressure- and charge air pressure sensor.
- Low engine output.
- The instrument shows zero oil pressure and boost pressure.

Remedy:

- Check that the cable harness to oil pressure and charge air pressure sensor has not been damaged.
- Check oil pressure and charge air pressure sensors.

Code 9.8, SID 253 / SPN 630
Data set memory EEPROM, CIU
Cause:

- Internal fault in control module
- Programming faulty.

Reaction:

- Engine does not start.

Remedy:

- Re-program the control module. If the fault remains, change the control module.

Code 9.8. PPID 254 / SPN 629
Fault in control unit, CIU
Cause:

- Faulty EEPROM, CIU.
- Faulty flash memory, CIU.
- Fault in control module, CIU

Reaction:

- CIU returns to factory setting.
- Engine goes to idle.
- Engine can not be started.

Remedy:

- Re-program the unit
- Change CIU unit.

Code 9.9, SID 240 / SPN 639. Memory fault
Cause:

- Memory fault in engine management system.

Reaction:

- Engine might not start.

Remedy:

- Re-program the unit.

Code 9.9, SID 253 / SPN 630
Data set memory EEPROM, EMS

Cause:

- Internal fault in control module
- Programming faulty.

Reaction:

- Engine does not start.

Remedy:

- Re-program the control module. If the fault remains, change the control module.

Code 9.9, SID 254 / SPN 629
Control module EMS

Cause:

- Internal fault in control module.

Reaction:

- Engine misfires.
- Engine does not start.

Remedy:

- Change engine control unit.