Installation

EMS 2

Industrial engines

I
1(1)

TAD1640GE, TAD1641GE, TAD1642GE
TAD1641VE, TAD1642VE

Installation

EMS 2

TAD1640GE, TAD1641GE, TAD1642GE, TAD1641VE,TAD1642VE

Contents

Safety instructions

Presentation

The Instruction Book contains the information you need in order to install and test performance of the EMS 2 system (electronic control of the injection system).

Read the instruction book carefully before you start installation. If the installation is done in a faulty manner, this can cause personal injury or damage to property and machinery.

If you do not understand or are unsure of anything in this installation manual, please contact your Volvo Penta dealer for assistance.

Installation

This installation manual is produced for professional use only.

The installation manual is intended to be used together with the relevant engine instruction book.

Volvo Penta declines all responsibility for personal injury or property damage which might occur as a result of not following the installation advice, or if the work is not done by professional personnel.

The installer is responsible for ensuring that the system operates in the manner described in the instruction book.

Work methods

These instructions are intended for qualified personnel. In these instructions, these person(s) is/are referred to as the installer(s).

Also refer to the specific engine instruction book for relevant information when necessary, and in particular for information relating to safety and engine operation.

Work must be performed by Volvo Penta workshops, boat yards or other authorized, well equipped workshop, by qualified and experienced personnel.

Important!

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

⚠ **WARNING!** Possible danger of personal injury, damage to property or serious mechanical malfunction if the instructions are not followed.

⚠ **IMPORTANT!** Used to draw your attention to something that can cause damage or malfunctions on a product or damage to property.

NOTE: Used to draw your attention to important information that will facilitate the work or operation in progress.

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

⚠ Before performing electric welding, the connectors on the EMS control unit must be disconnected.
Disconnect power from the engine at the main breaker.
Disconnect the connectors from the control unit.
Reconnect the connectors to the EMS 2 control unit once the welding is finished and the 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 devise (crane etc.).

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

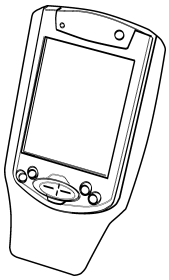
⚠ Only start the engine in a well-ventilated area. If the engine is run in a confined space, make sure that the crankcase ventilation and exhaust gases can be led away from the workplace.

⚠ The batter 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.

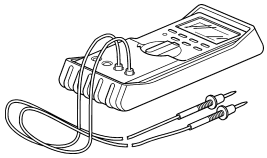
⚠ Always ensure that the + (positive pole) and − (negative pole) are securely connected to their appropriate terminals on the battery. If the batteries are wrongly connected, this can cause severe damage to the electrical equipment. Please refer to the wiring diagram in the engine instruction book.

⚠ Always use goggles when charging and handling batteries. Battery electrolyte contains sulphuric acid, which is very 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.

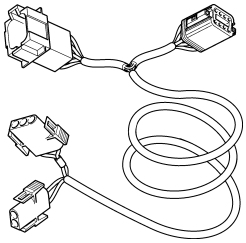
Special tools



3838619



9510060



874427

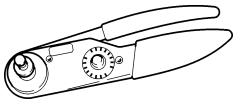
3838619 VODIA, complete with cable harness.
See VODIA Users Guide for ordering separate parts.

9510060-8 Multimeter

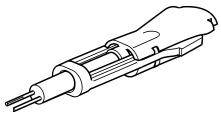
874427 T-piece diagnostic outlet

Other special equipment

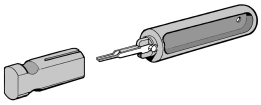
The tools below are used for work on the engine cable harness. The tools are not offered by Volvo Penta, but can be ordered from a local **AMP** or **Deutsch** agents. If you experience problems in contacting a dealer, please contact Volvo Penta Quality Action Center for advice.



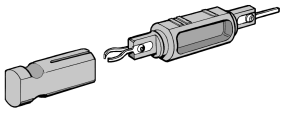
HDT-48-00



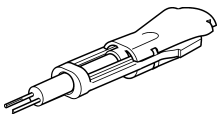
AMP 539 968



AMP 726,534



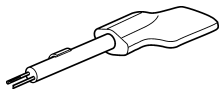
AMP 726,519



AMP 929,039

AMP 239,635

AMP 825,514



GHW 50000 017 586

Deutsch connectors

HDT-48-00 Crimping tool

AMP contact (42-pin CIU, 62-pin EMS, 2- and 3-pin Bosch etc.)

539,968-1 Removal tool, 1.5 mm pin width

726 534-1 Removal tool, 0.06 in pin width

726 519-1 Removal tool, 2.8 mm pin width

929 039-1 Removal tool, 2.8 mm pin width

239 635-1 Crimping tool

825 514-1 Crimping tool

4.8 mm and 6.3 mm cable clamps. Tongues and socket terminals

825 514-1 Crimping tool

GHW contact (relay box)

50000 017 586 Removal tool, 4.8 mm pin width pin width

General information

The EMS 2-system

EMS 2 stands for “Engine Management System” and is an electronic system with CAN communications (Controller Area Network) for control of diesel engines. The system has been developed by Volvo Penta and includes fuel control and diagnosis function. The system consists of a control module, six unit injectors, a number of sensors that supply the control module with measurements, sockets for diagnosis and functional checks. The engine can be connected to a communication interface comprising a CAN-link and a serial link.

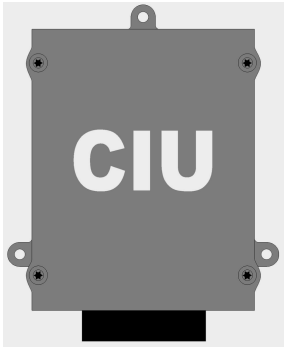
CAN (Controller Area Network)

The CAN J1939 link handles all communication between the engine control module EMS 2 and the CIU, in addition to the diagnostics that are handled by the so called J1708/J1587 link. The CAN link is much faster than the J1708/J1587 link. The CAN link has been prepared to connect to other components with SAE J1939 protocol such as instrument panels and transmissions.

If, for some reason, a fault develops on the CAN link, signals for the rpm-potentiometer and the start and stop knobs are taken over by the J1708/J1587 link. However, instrument and indicator lamps are completely turned off. If a fault occurs on both links, GE engines maintain engine speed, while VE engines go to idle. The only way to shut off the engine in this case is to use the auxiliary stop (AUX-STOP) placed on the engine’s left side.

CIU (Control Interface Unit)

The CIU is a “translator” between the CAN bus and the customer’s own control panel. This unit has two serial communication links, one fast and one slow. The fast one is a CAN link that features a bus speed of 250 Kbit/s. All data regarding instruments, indicator lamps, contacts and potentiometers are controlled by this bus. The slower J1708/J1587 link handles diagnostic information for, among other things, the flashing code. The diagnosis tool VODIA also uses the J1708/J1587 link to communicate with the system.



DCU (Display Control Unit)

DCU is a digital instrument panel that communicates with the engine control unit via the CAN-link. DCU has several functions, such as:

Engine control

– Start, stop, rpm regulation, preheating, etc.

Monitoring

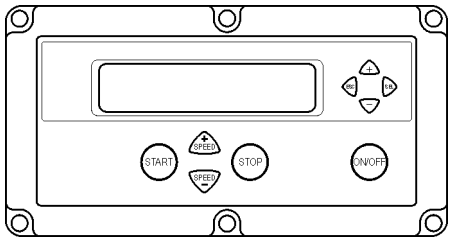
– Shows engine speed, charge pressure, charge temperature, coolant temperature, oil pressure, oil temperature, engine hours, battery voltage, instantaneous fuel consumption and fuel consumption (trip fuel).

Diagnostic

– Shows fault codes in text. Lists previous faults.

Parameter setting

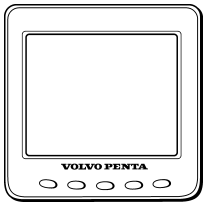
– Idle speed, alarm limits for oil temperature/coolant temperature, regulation mode (speed drop/isochronous).



DU (Display Unit)

DU is an instrument for showing the engines operating values. The values are shown graphically on an LCD display. The display communicates via the CAN link and consists of a computerized unit for attachment to the control panel.

It is connected to the CAN link between the engine control unit and CIU or DCU.



Input signals

The control module receives input signals about the engines operating conditions and other things from the following components:

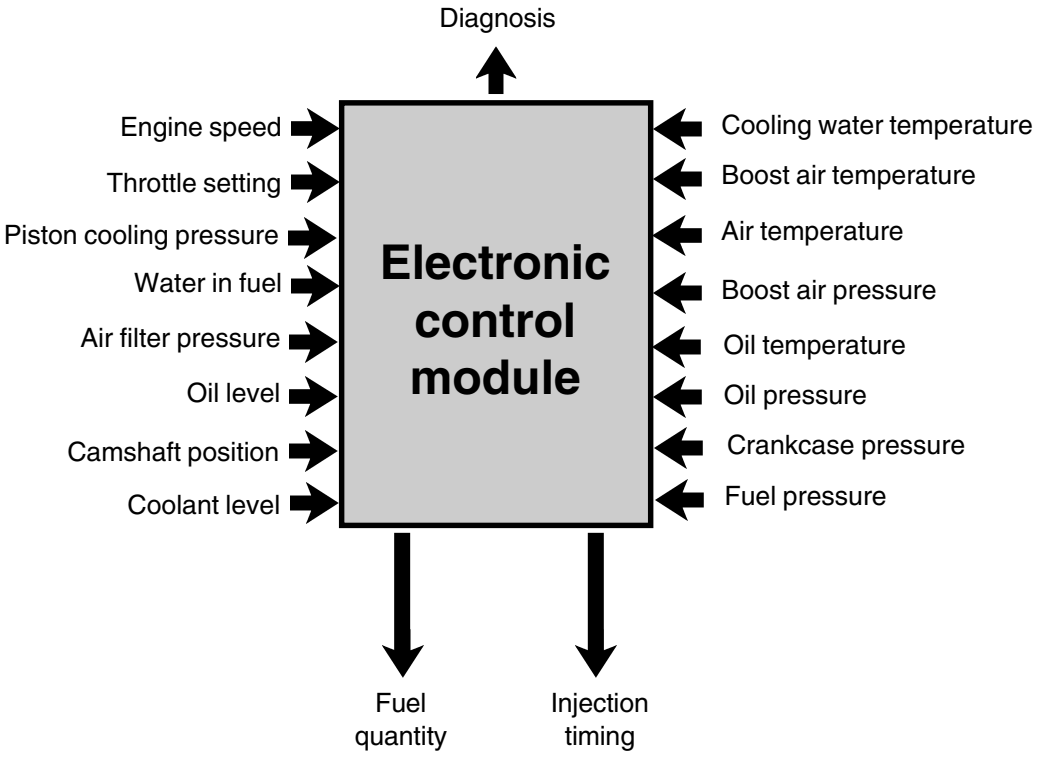
- coolant temperature
- charge pressure / charge temperature sensor
- crankcase pressure sensor
- position sensor, camshaft
- speed sensor, flywheel
- piston cooling pressure sensor
- coolant level sensor
- oil pressure sensor
- oil level and oil temperature sensor
- fuel pressure sensor
- water in fuel indicator
- air filter pressure
- air temperature sensor

Output signals

Based on the input signals the control module controls the following components:

- unit injectors
- starter motor
- alternator
- main relay
- preheater relay

The information from the sensors give exact data about prevailing operating conditions and allows the processor in the control module to, among other things, calculate correct injection amount, injection timing and check the engine's condition.



Fuel control

The engine's fuel requirement is analyzed up to 100 times per second (depending on engine rpm). The engine's injection amount and injection timing is controlled electronically via fuel valves on the unit injectors.

This means that the engine always receives the correct volume of fuel in all operating conditions, which offers lower fuel consumption, minimal exhaust emissions etc.

The control module checks and controls the unit injectors so that the correct amount of fuel is injected into each cylinder. It calculates and sets the injection angle. The control is primarily performed using the speed sensors and the combined sensor for boost pressure/charge air temperature.

The control module affects the unit injectors via an electronic signal to the unit injectors' electromagnetic fuel valve, which can open and close.

When the fuel valve is open, fuel flows through the unit injector hole and out through the fuel channel. Fuel is not sprayed into the cylinder in this position.

When the fuel valve closes, pressure starts to build from the unit injector's mechanically operated pump plunger. When sufficient pressure has developed, fuel is injected into the cylinder via the unit injector's injector section.

The fuel valve is re-opened and pressure in the unit injector decreases at the same time as the fuel injection to the cylinder stops.

In order to determine when the fuel valve shall open or close, the control module has access to signals from sensors and switch contacts.

Calculating fuel quantity

The amount of fuel that is sprayed into a cylinder is calculated by the control module. The calculation determines the time that the fuel valve is closed (when the fuel valve is closed fuel is sprayed into the cylinder). The parameters controlling injected amount of fuel are:

- Requested engine speed
- Motor protector
- Temperature
- Boost air pressure

Cylinder balancing

When idling, the control module can supply the cylinder with different amounts of fuel. This so the engine will have a more even idle. At higher rpm, this problem does not exist, and the cylinders receive the same amount of fuel.

Altitude correction

The control unit is fitted with an atmospheric air pressure sensor and an altitude correction function for engines operating at high altitudes. This function limits the fuel volume in relation to ambient air pressure. This is to prevent smoke, high exhaust temperature and to protect the turbocharger from over-speeding.

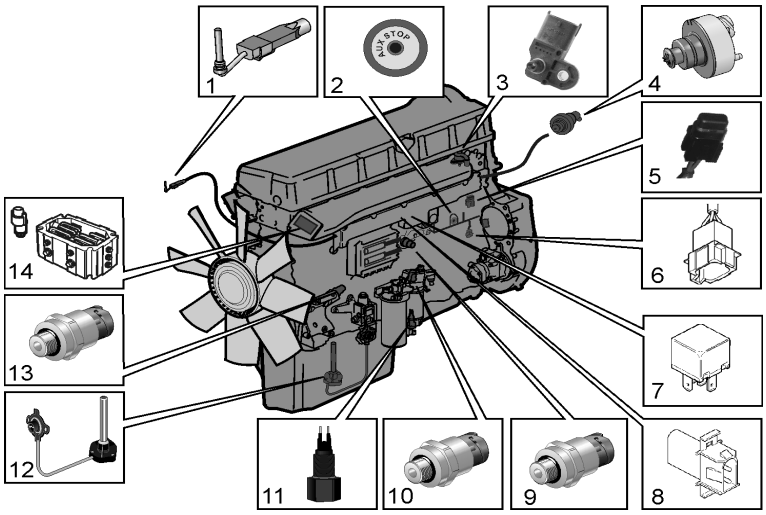
Diagnosis function

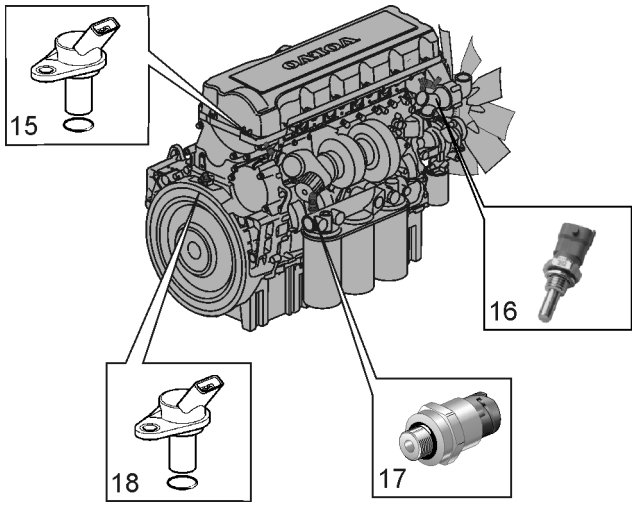
The task of the diagnosis function is to detect and locate disturbances within the EMS 2 system, to protect the engine, and to provide information about problems that have developed.

If a malfunction is discovered, this is announced by warning lamps, a flashing diagnostic lamp or in plain language on the instrument panel, depending on the equipment used. If a fault code is obtained as a flashing code or in plain language, this is used for guidance in any troubleshooting. Fault codes can also be read by Volvo's VODIA tool at authorized Volvo Penta workshops.

In case of serious malfunctions, the engine is shut down completely, or the control unit reduces the power output (depending on application). A fault code is set as a guide when fault tracing.

Component location





1. Coolant level sensor (in the expansion tank)
2. Extra stop
3. Charge pressure / charge temperature sensor
4. Air filter pressure and temperature sensor
5. Main fuse 10 A
6. Connector interface (8-pin connector)
7. Main relay
8. Diagnostic connector (2-pin connector)
9. Oil pressure sensor
10. Fuel pressure sensor
11. Sensor, water in fuel
12. Oil level and oil temperature sensor (installed inside the oil pan)
13. Crankcase pressure sensor
14. Air preheater with preheater relay
15. Camshaft position sensor
16. Coolant temperature sensor
17. Piston cooling pressure sensor
18. Flywheel position and speed sensor

Voltage supply 24 V

NOTE: All engines are equipped with a 2-pole electrical system. This means that the battery's plus and minus cables must be connected to the starter motor connections.
The battery plus cable shall be routed via a main switch to connection 30 on the starter motor.
The battery minus cable shall be connected directly to connection 31 on the starter motor.

Battery specification

Max. battery 2x220 Ah (series connection),
800 A CCA DIN

Battery charge

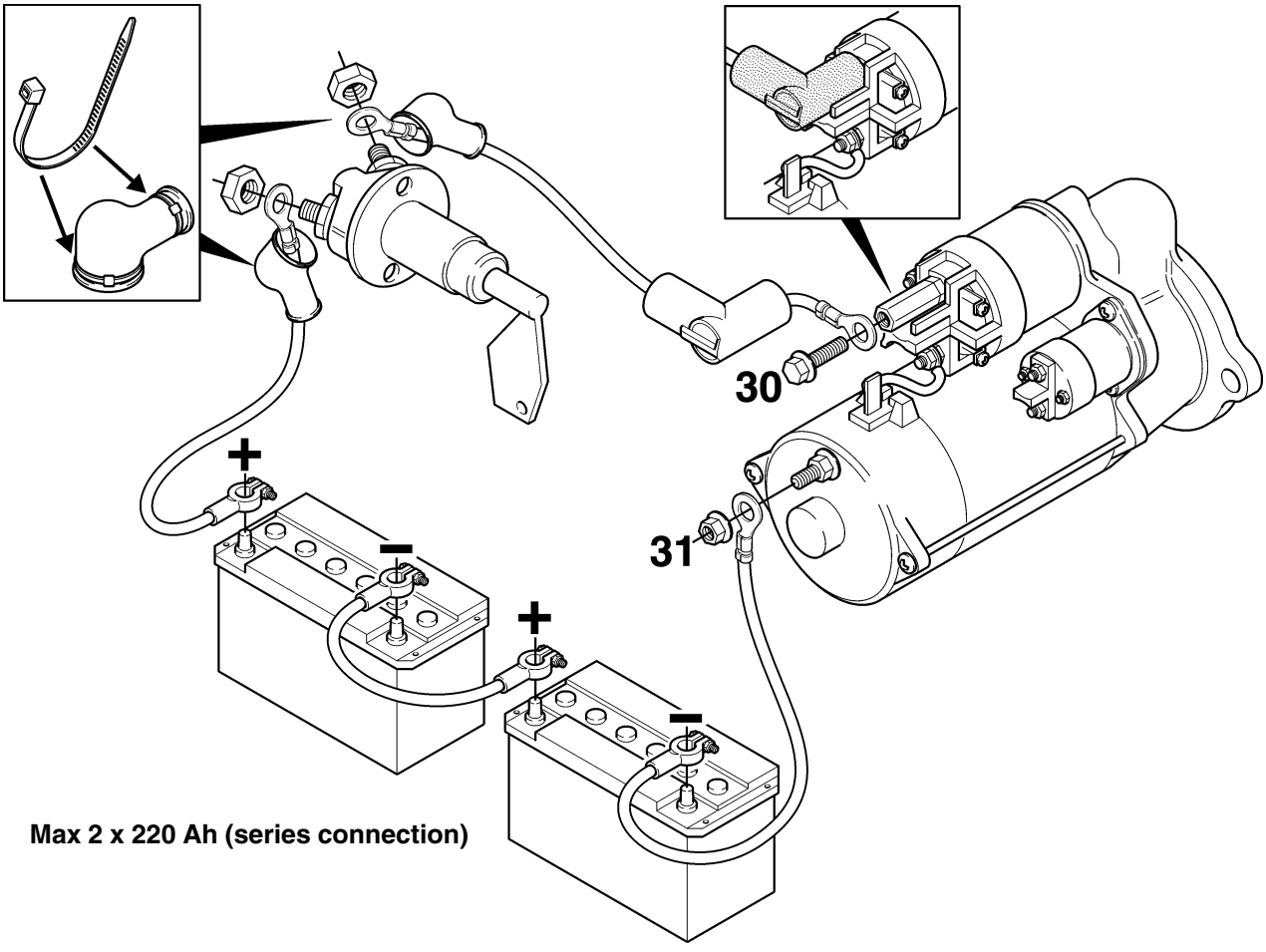
Standard practice on all engines is that the batteries are provided with power from the alternator.

Battery cable area

The total length (L) of the plus- **and** minus cable determines the cable cross sections (A).

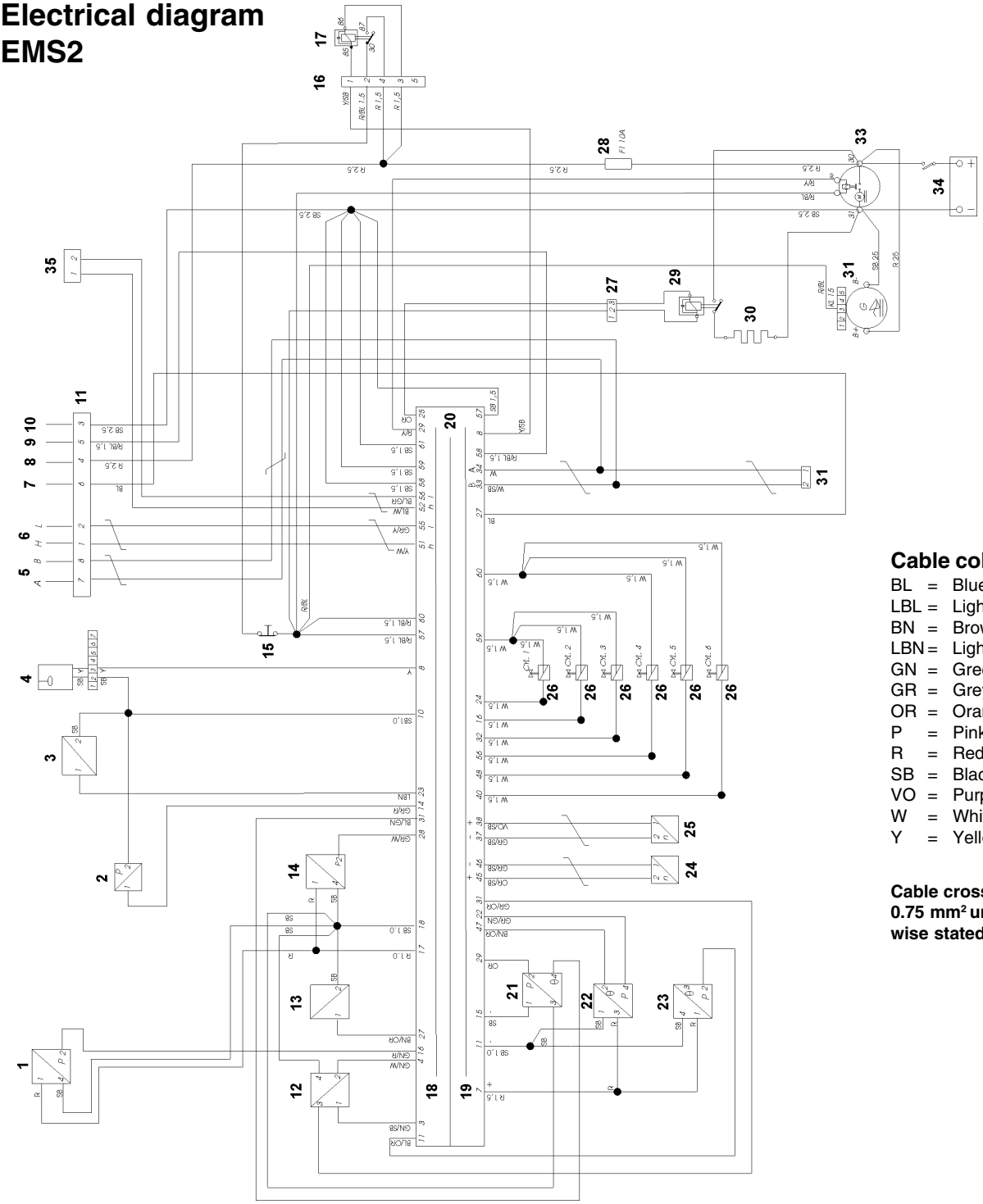
Note! Due to fire risk, the cable area should never be less than 70 mm^2

Max. L (m)	4	5	6,5
Min A (mm^2)	70	95	120



Max 2 x 220 Ah (series connection)

Electrical diagram EMS2



Cable colors

BL = Blue
LBL = Light blue
BN = Brown
LBN = Light brown
GN = Green
GR = Grey
OR = Orange
P = Pink
R = Red
SB = Black
VO = Purple
W = White
Y = Yellow

Cable cross section = 0.75 mm² unless otherwise stated.

1. Sensor, fuel pressure
2. Piston cooling pressure sensor
3. Sensor, coolant level
4. Sensor, water in fuel
5. J1587 (bus)
6. J1939 CAN (bus)
7. STOP button.
8. Battery plus
9. Voltage after key
10. Battery minus
11. Connector interface
12. Sensor, oil level/oil temperature
13. Sensor, coolant temperature
14. Sensor, crankcase pressure
15. Extra stop
16. Relay socket
17. Main relay
18. Connector block B
19. Connector block A
20. Control module EMS 2
21. Air filter pressure and temperature sensor
22. Sensor, charge air pressure/charge air temperature.
23. Sensor, oil pressure
24. Sensor, camshaft
25. Sensor, flywheel
26. Unit injector (Cyl. 1-6)
27. Connector block
28. Main fuse 10 A
29. Relay preheater
30. Preheating
31. VODIA input
32. Alternator
33. Starter
34. Battery (24 V)
35. Connecter (not used)

Electrical diagram CIU

Cable colors

BL = Blue
LBL = Light blue
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LBN = Light brown
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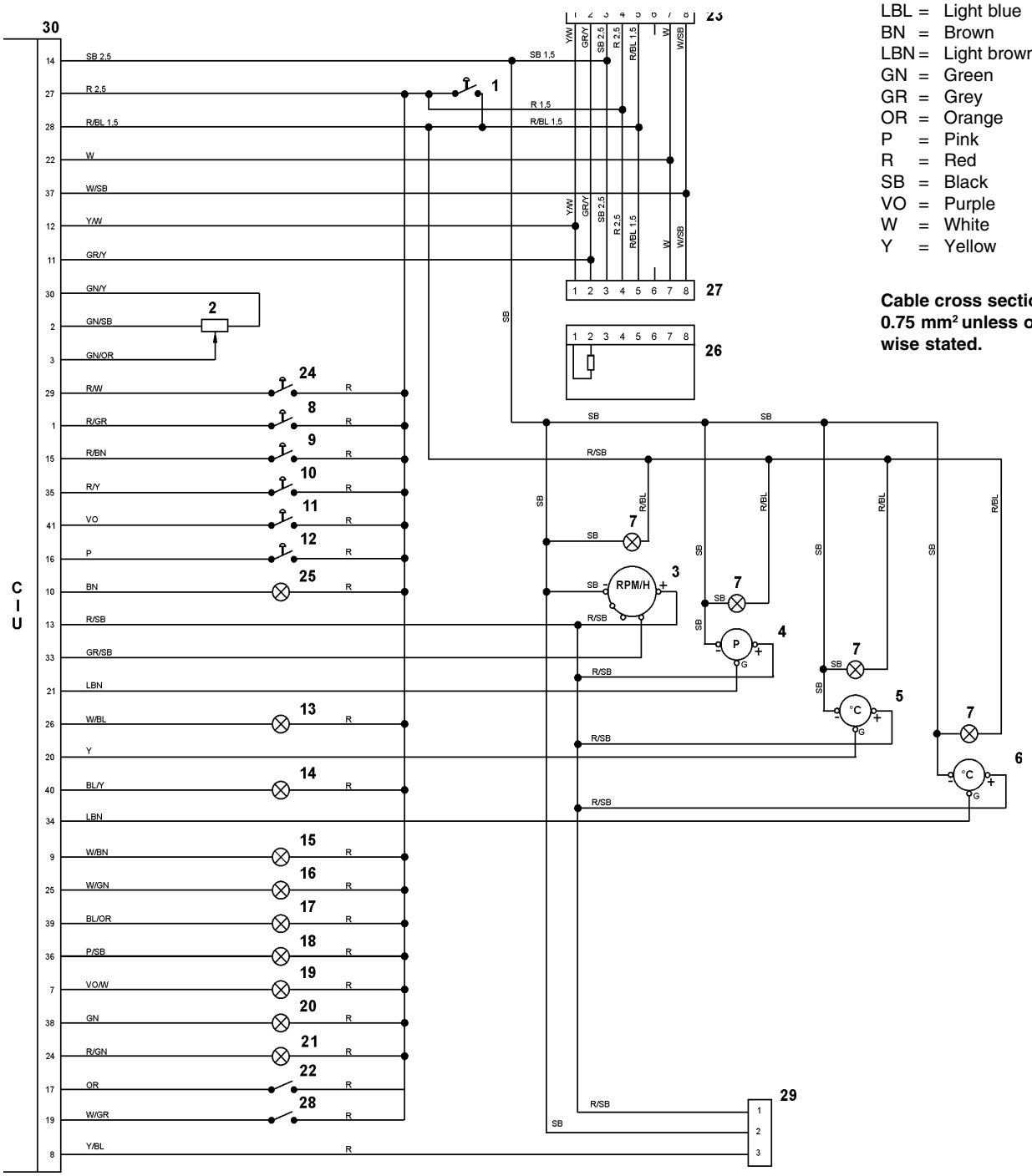
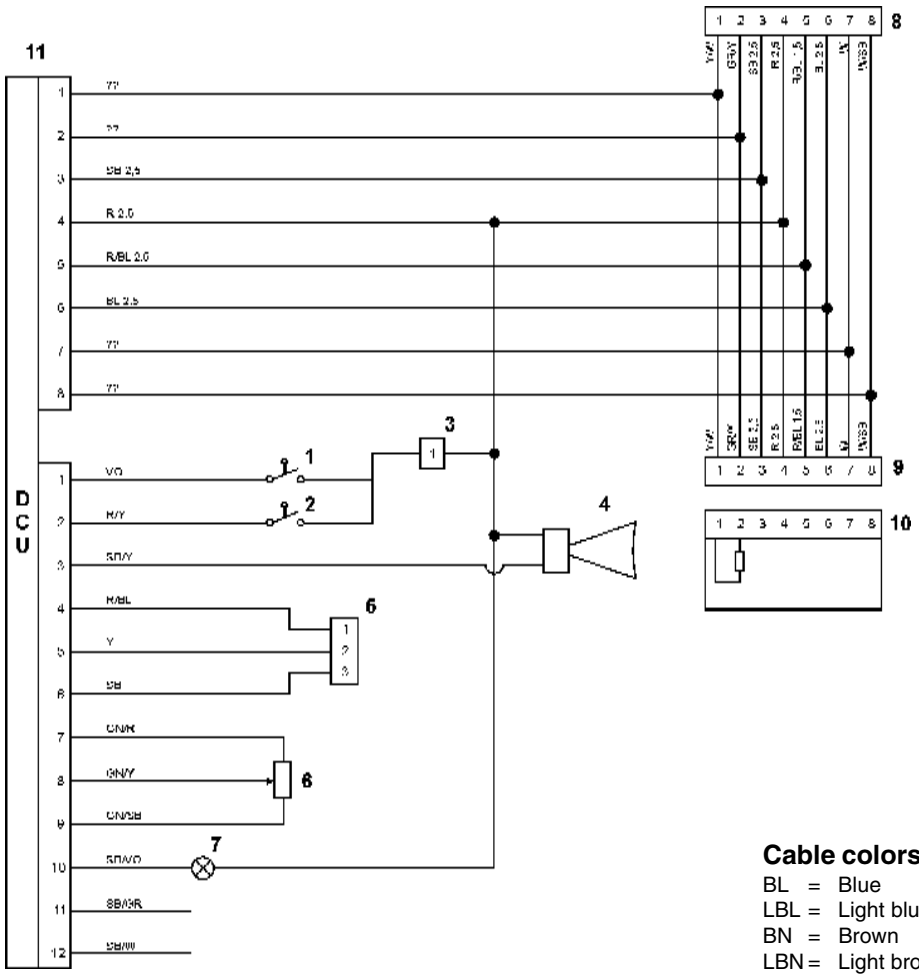


1. Key switch, operating current (15+)
2. RPM-potentiometer
3. Tachometer (code 14)
4. Oil pressure, instrument
5. Oil temperature, instrument
6. Coolant temperature, instrument
7. Instrument illumination
8. Idle contact, two position
9. 1500/1800 contact, two position
10. Start switch, spring return
11. Stop switch, spring return
12. Diagnosis contact, spring return
13. Alarm, low oil pressure
14. Alarm, high oil temperature
15. Alarm, high coolant temperature
16. Alarm, low coolant level
17. Fuel alarm
18. Diagnostic lamp
19. Overspeed indication (GE)
20. Operation indicator
21. Preheating indication
22. Preheating contact
23. 8-pin Deutsch connecting plug
24. Regulator contact
25. Battery voltage alarm
26. Termination resistance 120 Ohm
27. 8-pin Deutsch connecting socket
28. Contact, engine protector disconnect (not connected on GE engines)
29. Easy Link connector block
30. Control Interface Unit (CIU)

Electrical diagram DCU



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GR = Grey
OR = Orange
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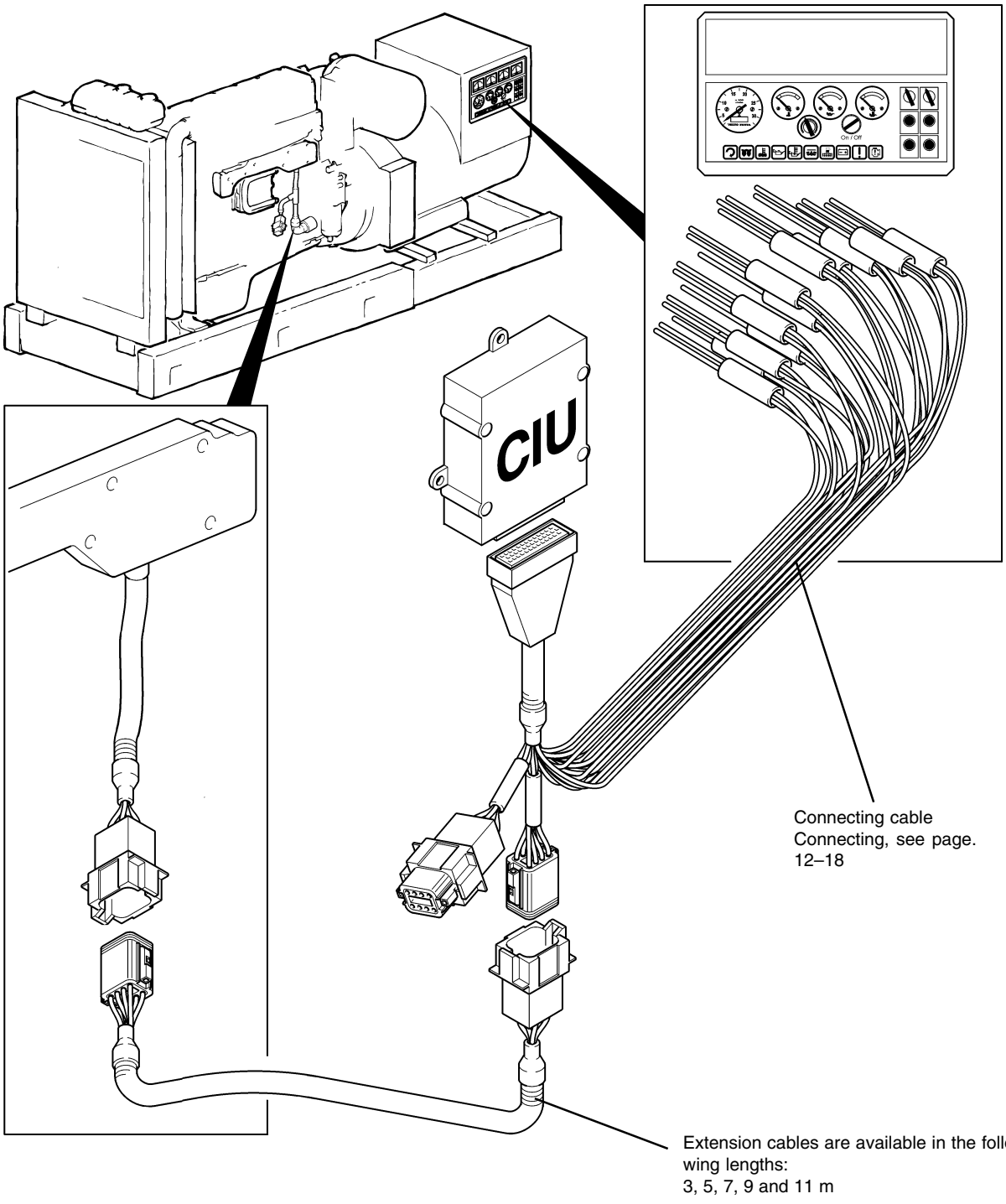
SB = Black
VO = Purple
W = White
Y = Yellow

Cable cross section = 0.75 mm² unless otherwise stated.

1. Start contact
2. Stop contact
3. 1-pin connector block
4. Signal horn, buzzer alarm
5. Easy Link connector block
6. RPM-potentiometer
7. Indication, engine running
8. 8-pin Deutsch connecting plug
9. 8-pin Deutsch connecting socket
10. Termination resistance 120 Ohm
11. Display Control Unit (DCU)

TAD16401642GE (CIU)



General

The installation must be and performed with great care.

Secure the connecting cable between motor and instrument panel with clamps. Take into consideration that the connectors blocks must be mechanically secured so that they are not subjected to pulling forces.

Cables must not be run too close to hot components on the engine or close to any other source of heat. Make sure that it is protected from mechanical wear, sharp edges and water splashes. If necessary, run the cable through protective conduits.

Avoid making joints in the system as far as possible. Cables and any joints must be accessible for inspection and service

NOTE! The connectors must be installed “dry”, they must not be packed with Vaseline etc.

Connection

Engine control

(see wiring diagram, page. 11)

NO = Normally open

NC = Normally closed

Ignition key (system voltage OFF/ON)

NOTE! Start current for the engine's system voltage (the control module) is 10 A. Make sure that other components in the installation are dimensioned for this current.

Start contact

Contact type, closing (NO), spring biased.

Stop contact

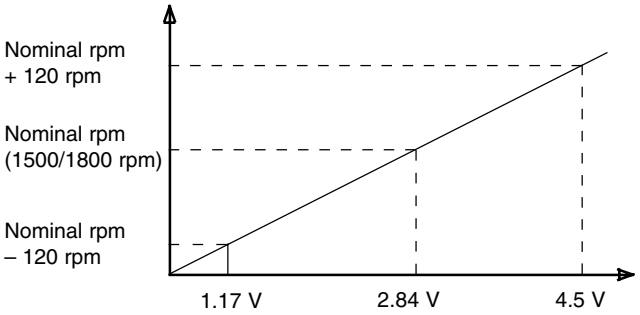
Contact type, closing (NO), spring biased.

Via parameter setting, they can become energized during operation. In that case, use contact type closed (NC).

RPM-potentiometer

Nominal rpm minus 120 rpm: 0.3 1.9 V (preset value 1.17 V)

Nominal rpm plus 120 rpm: 1.9 4.7 V (preset value 4.5 V)



1500 / 1800 rpm contact

This function allows a change of frequency from 50 to 60 Hz.

Contact type two position.

Idle button

Contact type two position.

Closed contact provides idling speed (900 rpm).

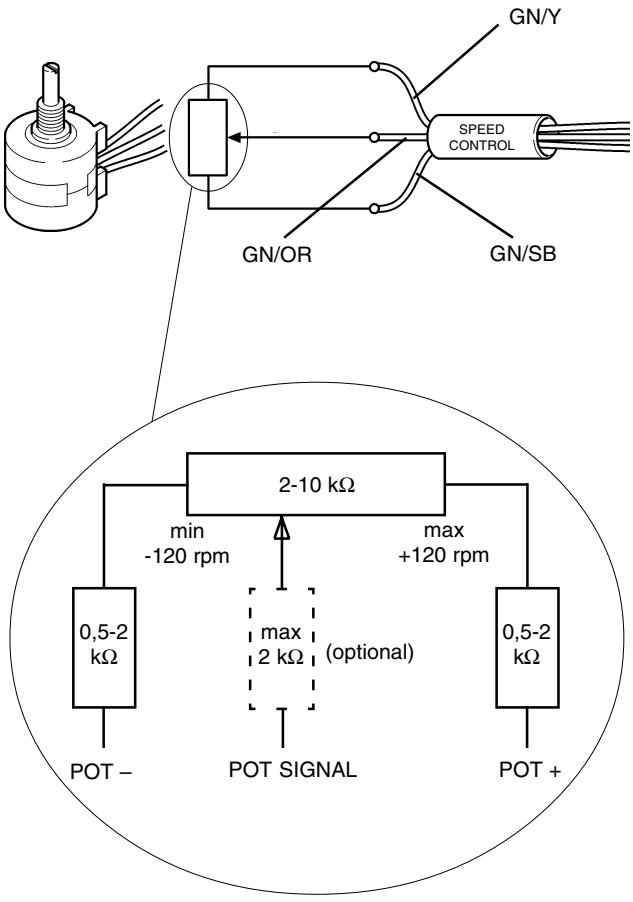
Speed drop contact

The contact must be closed to obtain speed drop.

Contact type two position.

Regulator contact

Contact type two position.



Warning and indication lamps

The warning and indication lamps listed below are available. Specs for all lamps:

Max. load 3 W
Voltage 24 V

(see wiring diagram, page. 11)

- Alarm, low oil pressure
- Alarm, high oil temperature
- Alarm, high coolant temperature
- Alarm, low coolant level
- Fuel alarm
- Charge indication
- Overspeed indication
- Operation indicator
- Diagnostic lamp
- Preheating indication

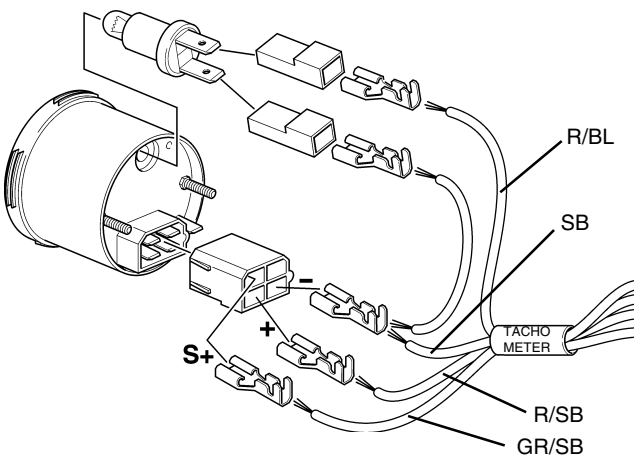
Instruments

(see wiring diagram, page. 11)

Tachometer

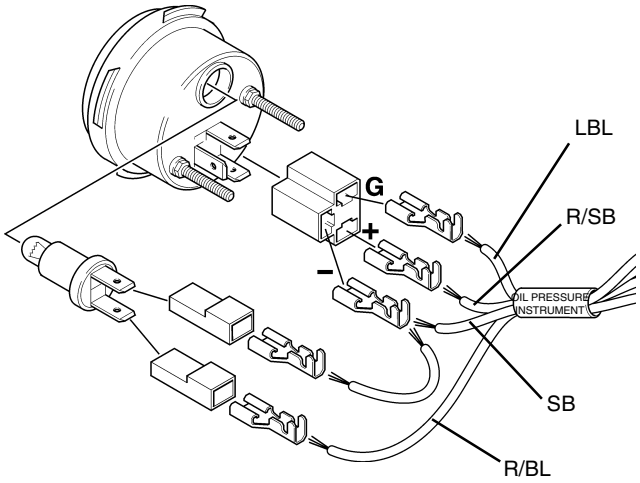
Use Volvo Penta universal tachometer, graduated 0–2600 rpm.

Set code 14, see installation instructions 7739513-5.



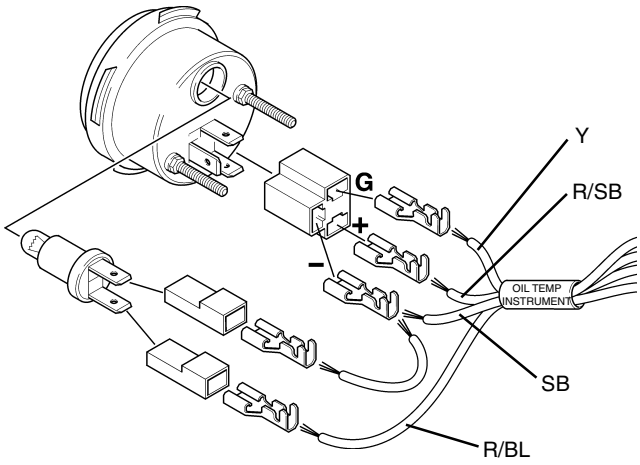
Oil pressure instrument

Use Volvo Penta oil pressure instrument, graduated 0–10 bar.



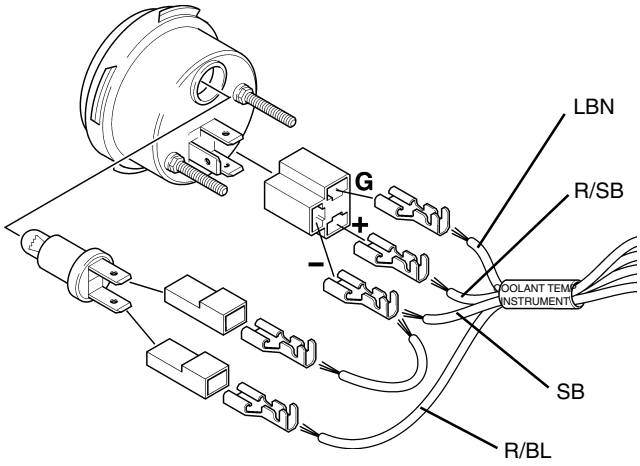
Oil temperature instrument

Use Volvo Penta oil temperature instrument, graduated 40–150°C.



Coolant temperature instrument

Use Volvo Penta oil temperature instrument, graduated 40–150°C.



Easy Link

For parallel connection of up to 20 extra VDO-instruments. The instruments automatically find their respective parameter group in the data bus. Max length of Easy-Link wiring is 3 m.

The following instruments are available:

- RPM
- Coolant temp
- Oil pressure
- Oil temp
- Battery voltage
- Operating hours

Other

(see wiring diagram, page. 11)

Diagnostic connector

Contact type, closing (NO), spring biased.

For reading of fault codes, see chap. “Fault tracing”.

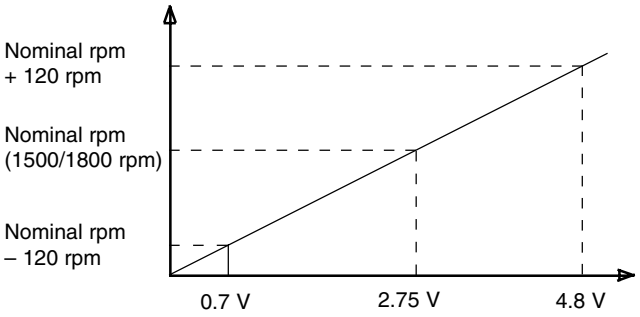
Preheating contact

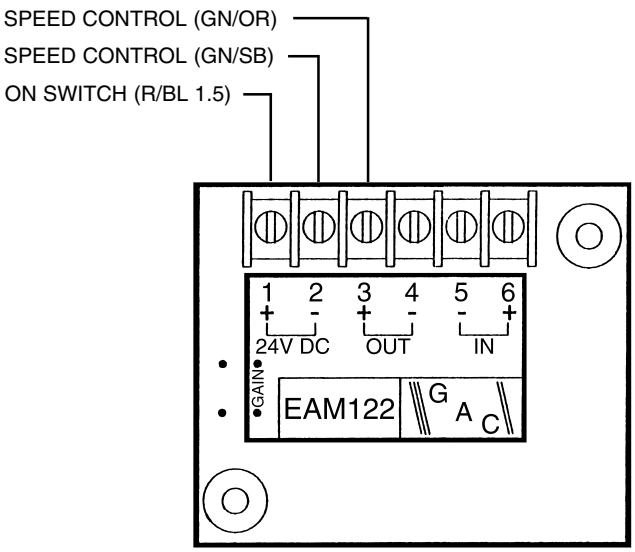
Contact type, closing (NO), spring biased.

This contact will activate the pre-heating.

Synchronization/load distribution

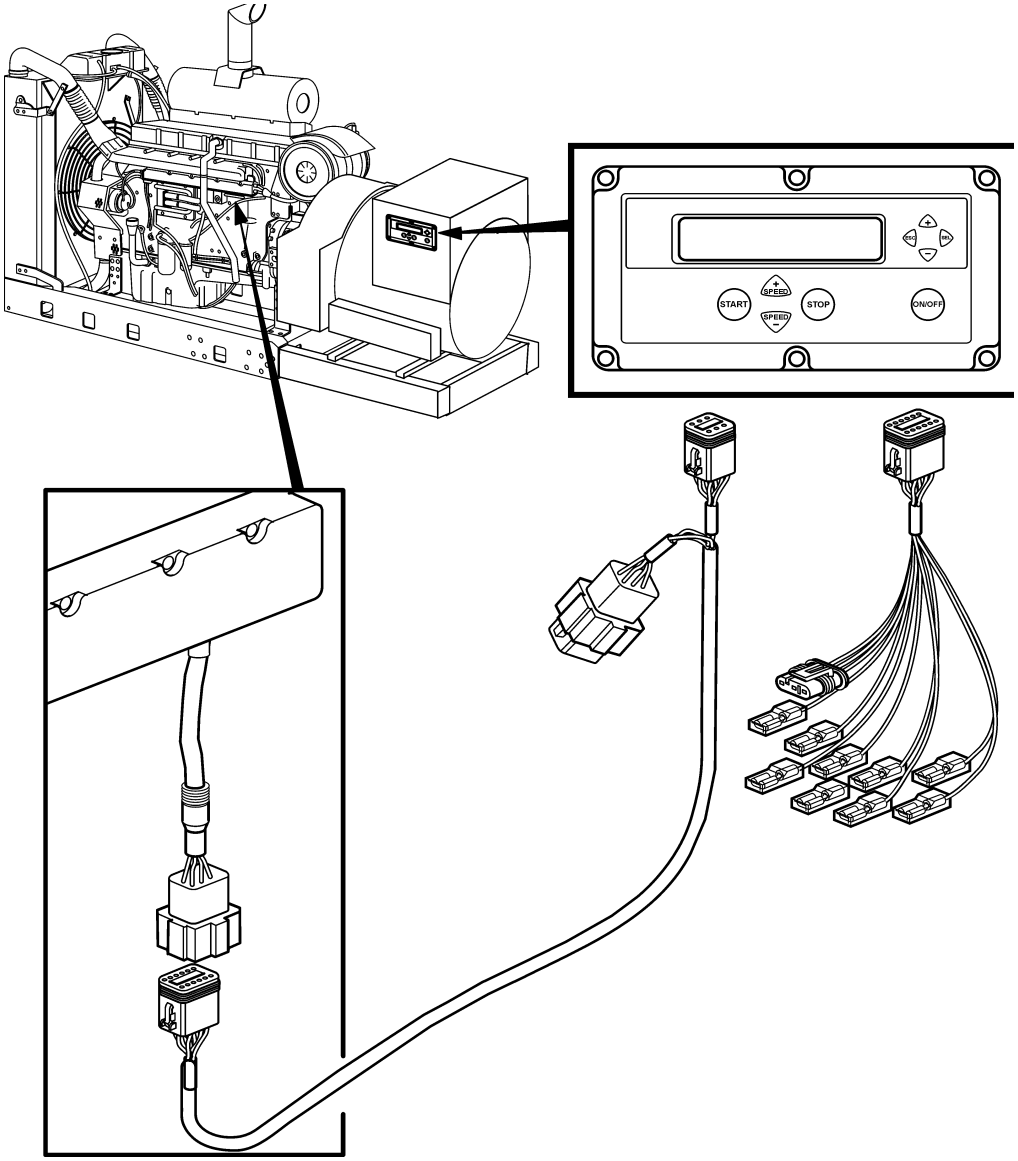
The system has been adapted to GAC synchronization and load distribution system. When connecting this system, use interface module EAM122 . The voltage levels must simultaneously be adjusted using the VODIA tool, as shown below, when this system is used.





NOTE! The interface module EAM122 is not sold by Volvo Penta. Contact the local representative for GAC (Governors of America Corporation).

TAD1640–1642GE (DCU)



General

The installation must be and performed with great care.

Secure the connecting cable between motor and instrument panel with clamps. Take into consideration that the connectors blocks must be mechanically secured so that they are not subjected to pulling forces.

Cables must not be run too close to hot components on the engine or close to any other source of heat. Make sure that it is protected from mechanical wear, sharp edges and water splashes. If necessary, run the cable through protective conduits.

Avoid making joints in the system as far as possible. Cables and any joints must be accessible for inspection and service

NOTE! The connectors must be installed “dry”, they must not be packed with Vaseline etc.

Connection

Display Control Unit (DCU)

The DCU is connected in via the 8-pin data bus connector, see Component location page. 8.

Start contact

Contact type, closing (NO), spring biased.

Stop contact

Contact type, closing (NO), spring biased.

Easy Link

For parallel connection of up to 20 extra VDO-instruments. The instruments automatically find their respective parameter group in the data bus. Max length of Easy-Link wiring is 3 m.

The following instruments are available:

- RPM
- Coolant temp
- Oil pressure
- Oil temp
- Battery voltage
- Operating hours

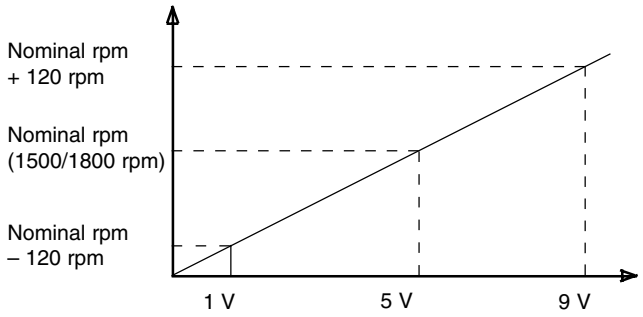
RPM potentiometer/load distribution system

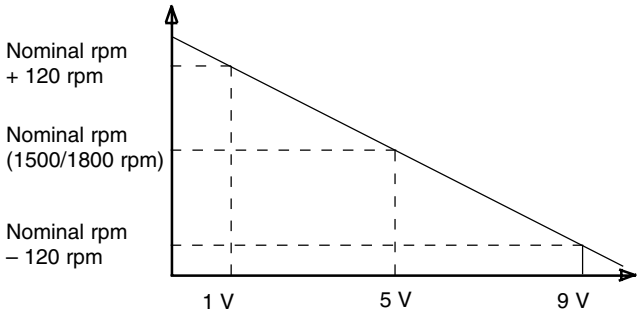
In the DCU the values of: the throttle potentiometer input or the voltage input from the connection to an external load distribution system can be set.

Nominal rpm minus 120 rpm: 0 -10 V (preset value 1 V)

Nominal rpm plus 120 rpm: 0 -10 V (preset value 9 V)

The signal is invertible, see diagram below.



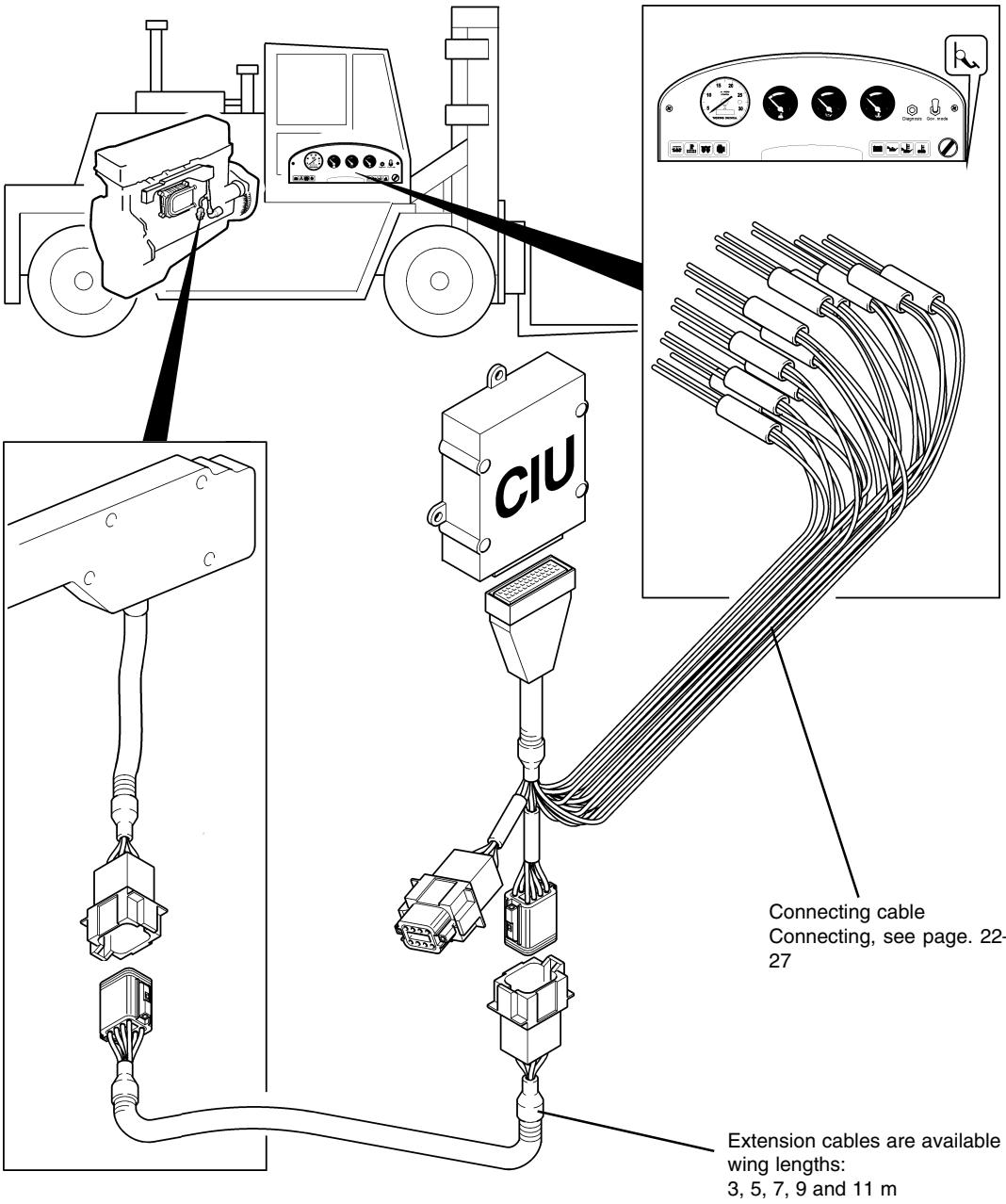


Warning and indication lamps

Indication engine running

Max. load 3 W
Voltage 24 V

TAD1641-1642VE (CIU)



General

The installation must be well prepared and performed with great care.

Secure the connecting cable between motor and instrument panel with clamps. Take into consideration that the connectors blocks must be mechanically secured so that they are not subjected to pulling forces.

Cables must not be run too close to hot components on the engine or close to any other source of heat. Make sure that it is protected from mechanical wear, sharp edges and water splashes. If necessary, run the cable through protective conduits.

Avoid making joints in the system as far as possible. Cables and any joints must be accessible for inspection and service

NOTE! The connectors must be installed “dry”, they must not be packed with Vaseline etc.

Connection

Engine control

(see wiring diagram, page. 12)

NO = Normally open

NC = Normally closed

Ignition key

Ignition lock is used to wiring off system voltage, pre-heating function, start function and stop function.

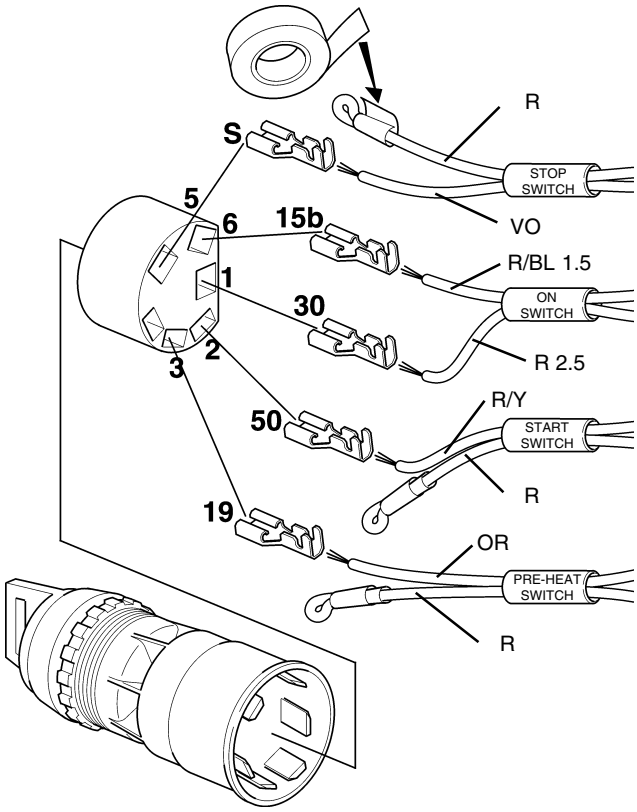
Position “0” = engine off

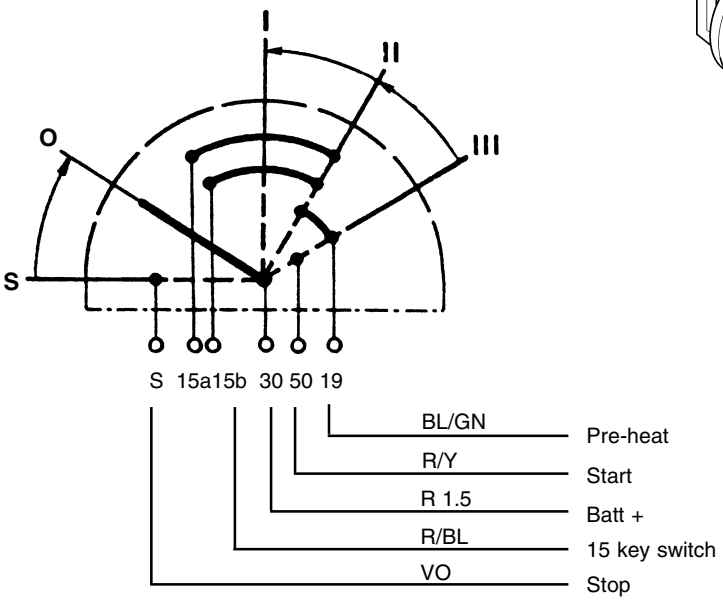
Position “I” = system voltage turned on

Position “II” = preheating on (spring return)

Position “III” = starter motor connected (spring return)

Position “S” = stop function on (spring return)





NOTE! Start current for the engine’s system voltage (the control module) is 10 A. Make sure that other components in the installation are dimensioned for this current.

Regulator contact

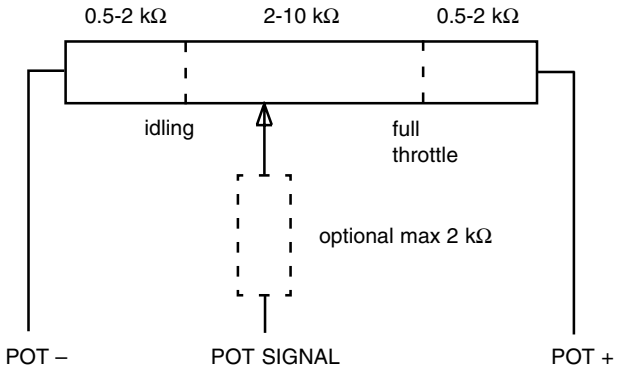
Contact type two position.

Accelerator

Idling: 0.3 1.9 V (preset value 1.17 V)

Full throttle: 1.9 4.7 V (preset value 4.5 V)

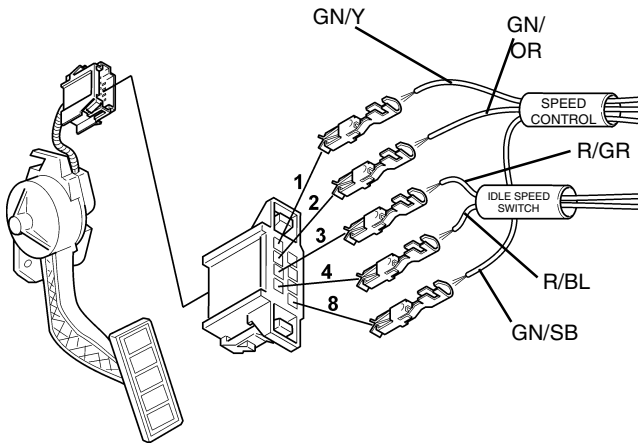
Where an accelerator with different resistance and voltage values is used, the control module must be re-calibrated using the parameter tool, see “Parameter setting”.



Idle contact

The accelerator features a built-in idle contact that works like a Limp home device if the accelerator potentiometer should break down.

Depressing the pedal will close the contact and the engine will gradually accelerate towards 80% of max. rpm.
Releasing the pedal will open the contact, and the engine will directly slow down to idle.



Warning and indication lamps

The warning and indication lamps listed below are available. Specs for all lamps:

Max. load 3 W
Voltage 24 V

(see wiring diagram, page 11)

- Alarm, low oil pressure
- Alarm, high oil temperature
- Alarm, high coolant temperature
- Alarm, low coolant level
- Fuel alarm
- Charge indication
- Diagnostic lamp
- Preheating indication

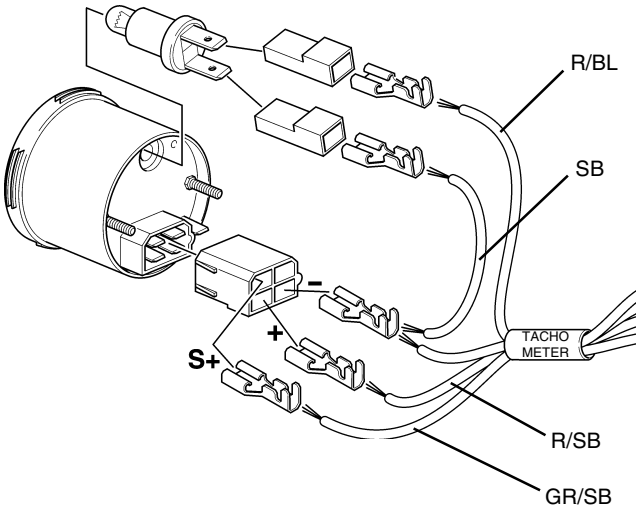
Instruments

(see wiring diagram, page. 11)

Tachometer

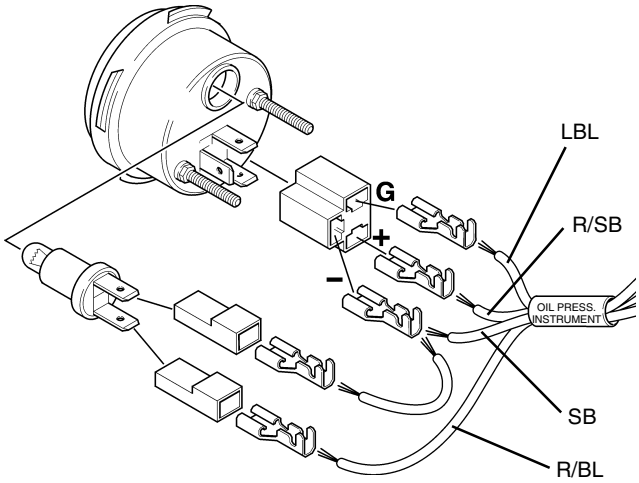
Use Volvo Penta universal tachometer, graduated 0–2600 rpm.

Set code 14, see installation instructions 7739513-5.



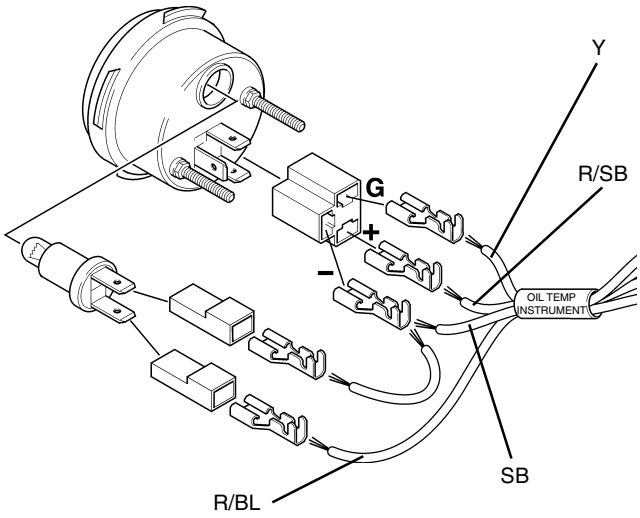
Oil pressure instrument

Use Volvo Penta oil pressure instrument, graduated 0–10 bar.



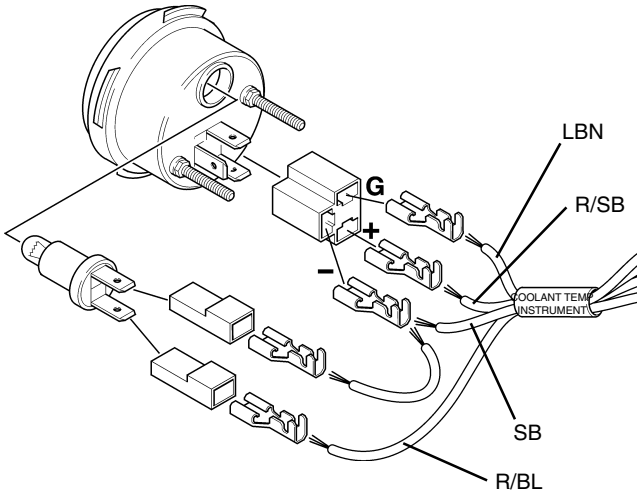
Oil temperature instrument

Use Volvo Penta oil temperature instrument, graduated 40–150°C.



Coolant temperature instrument

Use Volvo Penta oil temperature instrument, graduated 40–150°C.



Easy Link

For parallel connection of up to 20 extra VDO-instruments. The instruments automatically find their respective parameter group in the data bus. Max length of Easy-Link wiring is 3m.

The following instruments are available:

- RPM
- Coolant temp
- Oil pressure
- Oil temp
- Battery voltage
- Operating hours

Other

(see wiring diagram, page. 11)

Diagnostic connector

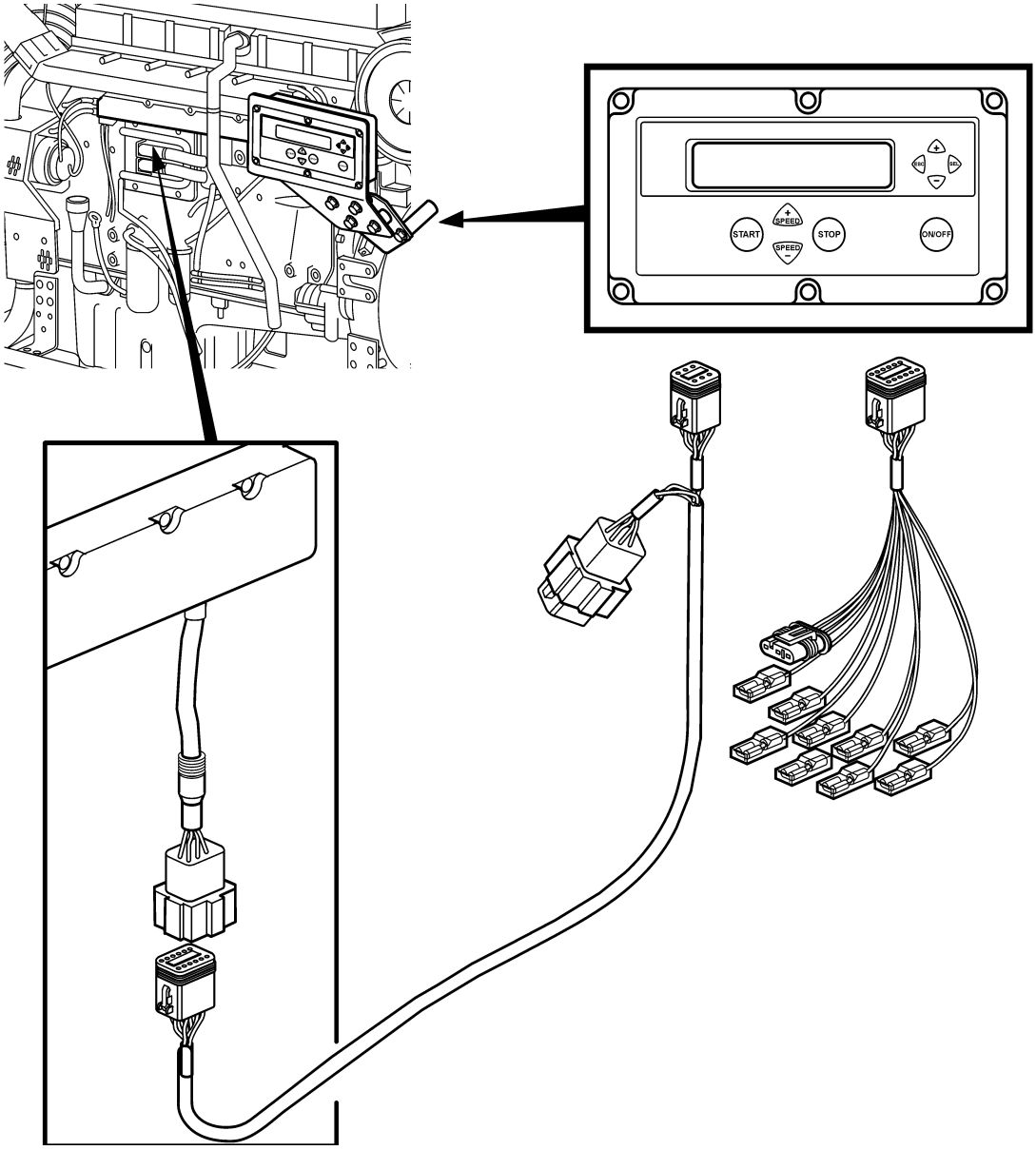
Contact type, closing (NO), spring biased.

For reading of fault codes, see chap. “Fault tracing”.

Contact, engine protector disconnect

Contact type, closing (NO), spring biased.

TAD1641-1642VE (DCU)



General

The installation must be well prepared and performed with great care.

Secure the connecting cable between motor and instrument panel with clamps. Take into consideration that the connectors blocks must be mechanically secured so that they are not subjected to pulling forces.

Cables must not be run too close to hot components on the engine or close to any other source of heat.

Make sure that it is protected from mechanical wear, sharp edges and water splashes. If necessary, run the cable through protective conduits.

Avoid making joints in the system as far as possible. Cables and any joints must be accessible for inspection and service

NOTE! The connectors must be installed “dry”, they must not be packed with Vaseline etc.

Connection

Display Control Unit (DCU)

The DCU is connected in via the 8-pin data bus connector, see Component location page. 8.

Start contact

Contact type, closing (NO), spring biased.

Stop contact

Contact type, closing (NO), spring biased.

Easy Link

For parallel connection of up to 20 extra VDO-instruments. The instruments automatically find their respective parameter group in the data bus. Max length of Easy-Link wiring is 3m.

The following instruments are available:

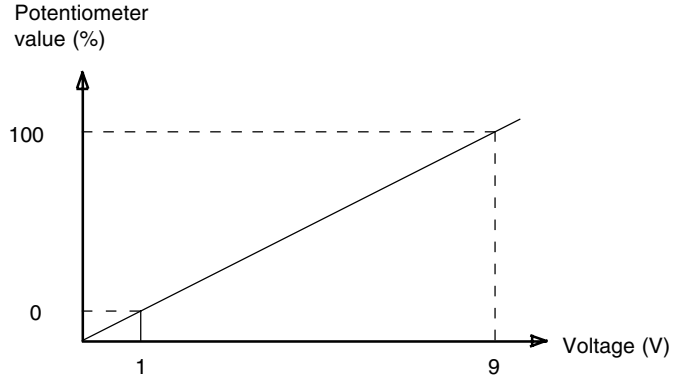
- RPM
- Coolant temp
- Oil pressure
- Oil temp
- Battery voltage
- Operating hours

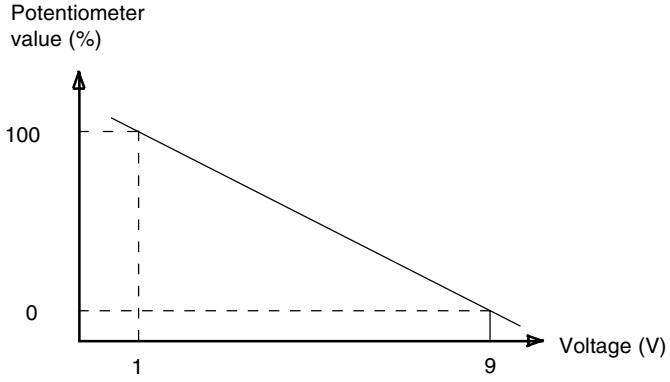
RPM-potentiometer

Max. potentiometer value: 0 -10 V (preset value 9 V)

Min. potentiometer value 0 -10 V (preset value 1 V)

The signal is invertible, see diagram below.





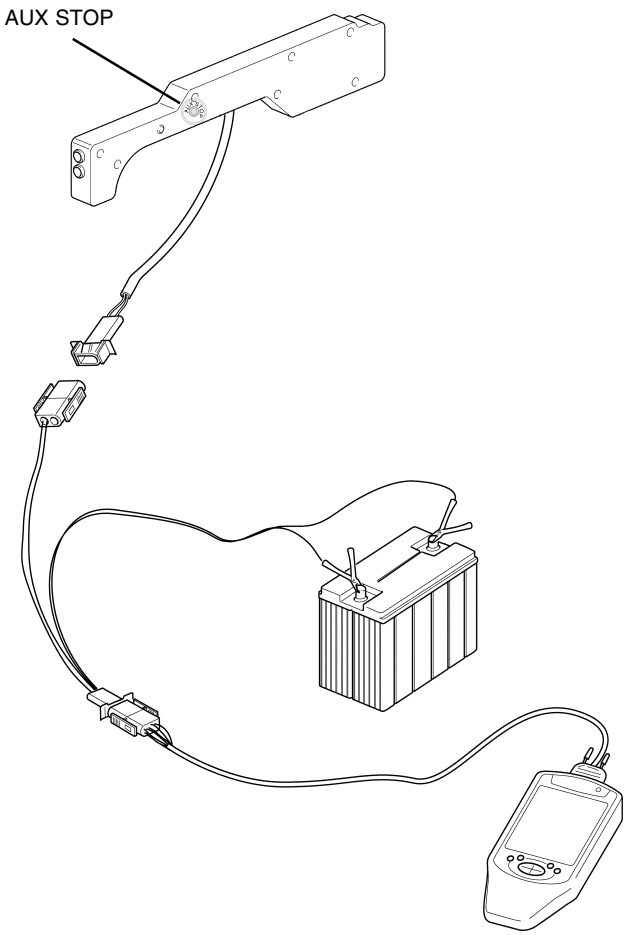
Warning and indication lamps

Indication engine running

Max. load 3 W
Voltage 24 V

Parameter setting

Connecting parameter tool VODIA



Operation

Using the VODIA-tool (3838619), in the position “Parameters, reprogramming” you can read and adjust the parameters listed below. The VODIA tool is connected into the diagnostic outlet (2-pole connector) under the cable cover on the left side of the engine, alternatively via the T-piece diagnostic outlet 874427. For instructions see VODIA Users Guide.

Adjustable parameters TAD16411642VE (CIU/DCU)

NOTE! Certain parameters require special authorization.

Functions

Primary control mode

Selects which regulator is used when the regulation selector is used.

Alternative position "Isochronous" or "Speed drop"

Preset position "Isochronous"

Controls speed drop

Selects how much speed drop is to be used when speed drop is activated (percent).

Min. value	0 %
Preset value	4 %
Max. value	8 %

Stop (CIU)

The stop input on the CIU-unit receives voltage during "Run" or "Stop"

Preset position "Stop"

Lamp test (CIU)

This parameter selects whether lamp test shall be performed when the system is started.

Alternative positions "Off" or "On"
Preset position "On"

Idle speed

Setting idle speed.

Min. value	600 rpm
Preset value	900 rpm
Max. value	1200 rpm

Primary engine rpm

Selects which regulator is used when the regulation selector is used.

Alternative rpms	1500 rpm or 1800 rpm
Preset rpm	Depending on which spec. that has been ordered

Fine adjustment engine speed (CIU)

Voltage at the potentiometer input on the CIU-unit that corresponds to nominal rpm (1500/1800 rpm) minus120 rpm.

Min. value	0.3 V
Preset value	1.17 V
Max. value	1.9 V

Voltage at the potentiometer input on the CIU-unit that corresponds to nominal rpm (1500/1800 rpm) minus120 rpm.

Min. value	1.9 V
Preset value	4.5 V
Max. value	4.7 V

Preheating on ignition

Selects if preheating and after heating are to be activated directly when ignition is turned on.

The length of preheating/afterheating is dependant on coolant temperature.

If the "On" parameter is in the "Off" position, then preheating/afterheating must be activated manually via the ignition switch or the preheating button.

Alternative positions "Off" or "On"
Preset position "On"

Alarm limits

Alarm limit for oil temperature

At this temperature, a warning lamp is lit.

Min. value	120 °C (248 °F)
Preset value	125 °C (257 °F)
Max. value	130 °C (266 °F)

Alarm limit for coolant temperature

At this temperature, a warning lamp is lit.

Min. value	95 °C (203.00 °F)
Preset value	98 °C (208.40 °F)
Max. value	101 °C (213.80 °F)

Overspeed limit

Percentage above normal rpm at which the overspeed warning will be activated.

Min. value	0 %
Preset value	20 %
Max. value	20 %

Engine protector

Engine protector oil temperature

Selects whether engine protector should be activated, with regard to high oil temperature.

A fault code is indicated and the engine is shut down.

Alternative positions “Off” or “On”
Preset position “On”

Engine protector coolant temperature

Selects whether engine protector should be activated, with regard to high coolant temperature.

A fault code is indicated and the engine is shut down.

Alternative positions “Off” or “On”
Preset position “On”

Engine protector coolant level

Selects whether engine protector should be activated, with regard to low coolant level.

A fault code is indicated and the engine is shut down.

Alternative positions “Off” or “On”
Preset position “On”

Engine protector overspeed limit

Selects whether engine protector should be activated, with regard to overspeed.

A fault code is indicated and the engine is shut down.

Alternative positions “Off” or “On”
Preset position “On”

Engine protector charge air temperature

Selects whether engine protector should be activated, with regard to high charge air temperature.

A fault code is indicated and the engine is shut down.

Alternative positions “Off” or “On”
Preset position “On”

Engine protector charge air pressure

Selects whether engine protector should be activated, with regard to high charge air pressure.

A fault code is indicated and the engine is shut down.

Alternative positions “Off” or “On”
Preset position “On”

Engine protector oil pressure

Selects whether engine protector should be activated, with regard to low oil pressure.

A fault code is indicated and the engine is shut down.

Alternative positions “Off” or “On”
Preset position “On”

Engine protector piston cooling pressure

Selects whether engine protector should be activated, with regard to low piston cooling pressure.

A fault code is indicated and the engine is shut down.

Alternative positions “Off” or “On”
Preset position “On”

Engine protector crankcase pressure

Selects whether engine protector should be activated, with regard to high crankcase pressure.

A fault code is indicated and the engine is shut down.

Alternative positions “Off” or “On”
Preset position “On”

Adjustable parameters TAD16411642VE (CIU/DCU)

NOTE! Certain parameters require special authorization.

Functions

Primary control mode

Selects which regulator is used when the regulation selector is used.

Alternative position ”Isochronous” or “Speed drop”

Preset position ”Isochronous”

Regulation gradient

Selects how much speed drop to use (gradient)

Min. value	10 Nm/rpm
Preset value	25 Nm/rpm
Max. value	127 Nm/rpm

Stop, CIU

The stop input on the CIU-unit receives voltage during “Run” or “Stop”.

Preset position ”Stop”

Lamp test

This parameter selects whether lamp test shall be performed when the system is started.

Alternative positions “Off” or “On”
Preset position “On”

Idle speed

Setting idle speed.

Min. value	550 rpm
Preset value	600 rpm
Max. value	800 rpm

Idle voltage CIU

Voltage of throttle regulation input to the CIU unit that corresponds to idle.

Min. value	0.3 V
Preset value	1.17 V
Max. value	1.9 V

Max. rpm voltage CIU

Voltage of throttle regulation input to the CIU unit that corresponds to full throttle.

Min. value	1.9 V
Preset value	4.5 V
Max. value	4.7 V

Preheating on ignition

Selects whether pre-heating should be activated directly when ignition is turned on. If the On parameter is in the Off position, then preheating/afterheating must be activated manually via the ignition switch or the preheating button.

Alternative positions “Off” or “On”
Preset position “On”

Alarm limits

Alarm limit for oil temperature

At this temperature, a warning lamp is lit.

Min. value	120 °C (248 °F)
Preset value	125 °C (257 °F)
Max. value	130 °C (266 °F)

Alternative positions “Off” or “On”
Preset position “On”

Alarm limit for coolant temperature

At this temperature, a warning lamp is lit.

Min. value	95 °C (203.00 °F)
Preset value	98 °C (208.40 °F)
Max. value	101 °C (213.80 °F)

Engine protector

Engine protector oil temperature

Selects whether engine protector should be activated, with regard to high oil temperature.

A fault code is indicated and the engine is shut down.

Alternative positions “Off” or “On”
Preset position “On”

Engine protector coolant temperature

Selects whether engine protector should be activated, with regard to high coolant temperature.

A fault code is indicated and the engine is shut down.

Alternative positions “Off” or “On”
Preset position “On”

Engine protector coolant level

Selects whether engine protector should be activated, with regard to low coolant level.

A fault code is indicated and the engine is shut down.

Alternative positions “Off” or “On”
Preset position “On”

Engine protector charge air temperature

Selects whether engine protector should be activated, with regard to high charge air temperature.

A fault code is indicated and the engine is shut down.

Alternative positions “Off” or “On”
Preset position “On”

Engine protector charge air pressure

Selects whether engine protector should be activated, with regard to high charge air pressure.

A fault code is indicated and the engine is shut down.

Alternative positions “Off” or “On”
Preset position “On”

Engine protector oil pressure

Selects whether engine protector should be activated, with regard to low oil pressure.

A fault code is indicated and the engine is shut down.

Alternative positions “Off” or “On”
Preset position “On”

Engine protector piston cooling pressure

Selects whether engine protector should be activated, with regard to low piston cooling pressure.

A fault code is indicated and the engine is shut down.

Alternative positions “Off” or “On”
Preset position “On”

Engine protector crankcase pressure

Selects whether engine protector should be activated, with regard to high crankcase pressure.

A fault code is indicated and the engine is shut down.

Alternative positions “Off” or “On”
Preset position “On”

Fault tracing

A number of symptoms and possible causes of engine malfunctions are described in the table below. Always contact your Volvo Penta dealer if any problems occur which you can not solve by yourself.

⚠ **WARNING!** Read the safety instructions for handling and service in the chapter “Safetyinformation” before starting work.

Symptoms and possible causes

☼ The diagnostic indicator is blinking	Please refer to the “Diagnostic information” chapter
Engine cannot be stopped.	2, 5
Starter motor does not rotate	1, 2, 3, 4, 5, 6, 7, 24
Starter motor rotates slowly	1, 2
Starter motor rotates normally but engine does not start	8, 9, 10, 11,
Engine starts but stops again	8, 9, 10, 11, 13
Engine does not reach correct operating speed at full throttle	9, 10, 11, 12, 13, 21, 25, 26
Engine runs unevenly	10, 11
High fuel consumption	12, 13, 15, 25
Black exhaust smoke	12, 13
Blue or white exhaust smoke	15, 22
Oil pressure too low	16
Coolant temperature too high	17, 18, 19, 20
Coolant temperature too low	20
No, or poor charge	2, 23

1. Flat batteries
2. Poor contact/open circuit in electrical cable
3. Main breaker turned off
4. Main fuse blown
5. Faulty ignition lock
6. Faulty main relay
7. Faulty starter motor/solenoid
8. Fuel starvation:
   – fuel stopcock closed
   – fuel tank empty/faulty tank connected
9. Clogged fuel fine filter/prefilter (due to contamination, or stratification of fuel at low temperature)
10. Air in the fuel system
11. Water/contamination in fuel
12. Faulty unit injector
13. Insufficient air flow to engine:
    – blocked air filter
    – air leak between turbo and the engine’s inlet pipe
    – dirty compressor part in turbo charger
    – faulty turbo charger
    – poor engine room ventilation
14. Coolant temperature too high
15. Coolant temperature too low
16. Oil level too low
17. Coolant temperature too low
18. Air in the coolant system
19. Faulty circulation pump
20. Defective thermostat
21. Blocked intercooler
22. Oil level too high
23. Alternator drive belt slips
24. Water entry into engine
25. High back pressure in the exhaust system
26. Break in “Pot+“ cable to pedal

Diagnosis function

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

The diagnosis function has the following tasks:

- To detect and localize malfunctions
- To inform that a malfunction has been detected
- Give advice in fault tracing

Message regarding disturbance

If the diagnosis function detects a malfunction in the EMS 2 system, this is informed by means of fault codes in the instrumentation Dependant on which equipment is in use, this can be done in different ways (fault codes can also be read via VODIA):

From the DCU - (Display Control Unit):

- the text “!! ENGINE WARNING !!” is shown in the display. **NOTE!** the language in which the DCU presents the information is selectable.

From CIU - Control Interface Unit:

- the diagnostic lamp starts to flash

Simultaneously, the fault will be stored in the control module memory. As soon as the fault has been corrected and the ignition has been turned off and on, the fault code will no longer be active.

- The DCU - fault code is shown as passive
- CIU - diagnostic lamp goes out

Both corrected (passive) and uncorrected (active) faults are stored in the control unit.

To read off fault codes, see chapter Operation, page. 36.

All fault codes are found in the fault code list, with information about the reason, reaction and measures to be taken, see chapter on “Fault codes.”

NOTE! The flashing codes noted only apply when a Volvo Penta CIU is used.

Effect on engine

The engine is affected in different ways, depending on the seriousness of the fault detected by the diagnosis function.

A fault message in the form of a fault code is always generated when the diagnosis function discovers a fault.

The engine is affected by different degrees (see below) depending on the seriousness of the fault:

- The engine is not affected
- Engine goes to idle speed (VE engines)
- Engine torque is limited to different levels (VE engine)
- Engine is shut off

Operation

When a malfunction has occurred and the diagnostic system has generated one or more fault codes, these can be read off either via:

- Plain text on the instrument panel (DCU - Display Control Unit).
- Diagnostic lamp on the instrument panel (CIU - Control Interface Unit).
- VODIA tool. For instructions, see “VODIA User´s Guide.”

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

1. Reduce engine speed to idle/shut down engine.
2. For DCU: Read off fault code shown via instrument panel, see Reading fault codes via Display Control Unit (DCU).

or

   For CIU: press in diagnostic button and read off fault code via flashes of diagnostic lamp, see Reading fault codes via diagnostic lamp on instrument panel (CIU).

3. Look up the fault code in the fault code list and take the necessary measures.

Reading fault codes via Display Control Unit (DCU)

When a fault code is set is shown as the text ”!! ENGINE WARNING !!” alternating with ”Press SEL for information.”

NOTE! the language in which the DCU presents the information is selectable.

The fault list is selected by pressing the SEL-button. The fault list shows:

- Operating hours
- Fault
- Cause
- Active/inactive

To leave the fault list, press ESC.

To enter the fault list when a fault code is not set, press the SEL-button and select menu alternative Diagnostics.

Erasing fault codes (DCU)

Fault codes cannot be erased with DCU - they must be erased by using VODIA.

Reading fault codes via the diagnostic lamp on the instrument panel (CIU)

If the diagnosis button is depressed and then released, a fault code will flash.

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 list.

Read 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.

NOTE! When the first fault code returns, all fault codes have been read.

Erasing fault codes (CIU)

The diagnosis function fault code memory is set to zero when the voltage to the engine is disconnected.

NOTE! Voltage must be fully disconnected.

When voltage is turned on again, the diagnosis function will check if there are any disturbances in the EMS 2 system. If this is the case, new fault codes will be set.

This means that:

1. Fault codes for malfunctions that have been rectified or disappeared are set as inactive (the inactive fault code can then be erased with the VODIA tool).
2. Fault codes from malfunctions that have not been corrected must be acknowledged and read off every time the voltage is reconnected.

If the diagnosis button is depressed after the faults have been corrected, and stored fault codes have been deleted, code 1.1 (“No fault”) will flash, see chapter on “Fault codes”.

Fault codes

⚠ **WARNING!** Read the safety instructions for handling and service in the chapter “Safety Information” before starting work.

NOTE: Reading the fault codes below, such as **PID 97, Code 2.1** means that **PID 97** is read using the diagnostic tool VODIA. **2.1** is the flashing code that is displayed by the instrument box diagnosis lamp. See Reading fault codes.

NOTE: When there is a reference to sockets in the cable harness gloves to the engine control module, see wiring diagram page 10.

Code 1.1 No faults

No active faults exist.

PID 97, Code 2.1 Water in fuel

Reason:

- Water in fuel

Reaction:

- Warning indication.

Action:

- Empty fuel prefilter.

PID 111, Code 2.2 Coolant level

Reason:

- Low coolant level

Reaction:

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

  GE engines: The engine is shut down (unless protection has been turned off with the diagnosis tool VODIA).

Action:

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

PID 111, Code 2.3 Coolant level sensor

Reason:

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

Reaction:

- None.

Action:

- Check that the cable harness to the unit injectors has not been damaged.
- Check the thermostat function.
- Check contact pressure in socket 23 and 10 in the upper cable connector (A) to the engine control module.

SID21, Code 2.4 Speed sensor, flywheel

Reason:

- 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.

Action:

- Check that the sensor connector is correctly installed.
- Check that the cable harness to the speed sensor has not been damaged.
- Check that the engine speed sensor is correctly installed in the flywheel housing.
- Check engine speed sensor function.
- Check contact pressure in socket 37 and 38 in the upper cable connector (A) to the engine control module.

SID22, Code 2.5 Speed sensor, camshaft wheel

Reason:

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

Reaction:

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

Action:

- Check that the sensor connector is correctly installed.
- Check that the cable harness to the speed sensor has not been damaged.
- Check that the engine speed sensor is correctly installed in the upper timing gear cover.
- Check engine speed sensor function.
- Check contact pressure in socket 45 and 46 in the upper cable connector (A) to the engine control module.

PID 190, Code 2.6 Engine rpm

Reason:

- Rpm too high.

Reaction:

- VE engines: None.
- VE engines: Engine is shut off (unless the protection has been shut off with the parameter setting tool).

Action:

- When the engine stops, look for the cause of high rpm.

PPID 132, Code 2.8 RPM-potentiometer connected to CIU

Reason:

- Short circuit to positive (+) or negative (-).
- Faulty potentiometer.

Reaction:

- VE engines: Engine goes to idle.

  If the accelerator is first released and then depressed, the engine can be emergency operated by means of the idle contact.

  GE engines: Engine speed is maintained.

Action:

- Check that the potentiometer is correctly connected.
- Check that the potentiometer cable is not damaged.
- Check potentiometer function.

PID 97, Code 2.9 Indicator for water in fuel

Reason:

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

Reaction:

- None.

Action:

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

PID 100, Code 3.1 Oil pressure sensor

Reason:

- Short circuit to positive (+) or negative (-).
- Open circuit.

Reaction:

- None.

Action:

- Check that the cable harness to the oil pressure sensor has not been damaged.
- Check that the oil pressure sensor is correctly connected.
- Check contact pressure in socket 11 in the lower cable connector (B) to the engine control module.

PID 105, Code 3.2 Charge air temperature sensor

Reason:

- Short circuit to positive (+) or negative (-).
- Open circuit.

Reaction:

- None.

Action:

- Check that the charge air temperature sensor connector is correctly installed.
- Check that the cable harness to the charge air temperature sensor has not been damaged.
- Check that the charge air temperature sensor is correctly installed.
- Check charge air temperature sensor function.
- Check contact pressure in socket 47 in the upper cable connector (A) to the engine control module.

PID 110, Code 3.3 Coolant temperature sensor

Reason:

- Short circuit to positive (+) or negative (-).
- Open circuit.

Reaction:

- Preheating is activated even when the engine is hot.

Action:

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

PID106/102, Code 3.4 Boost pressure sensor

Reason:

- Short circuit to positive (+) or negative (-).
- Open circuit.

Reaction:

- Engine smokes more than normally during acceleration/load increase.

Action:

- Check that the charge air temperature sensor connector is correctly installed.
- Check that the cable harness to the charge air temperature sensor has not been damaged.
- Check that the charge air temperature sensor is correctly installed.
- Check charge pressure sensor function.
- Check contact pressure in socket 22 in the upper cable connector (A) to the engine control module.

PID106/102, Code 3.5 Boost pressure

Reason:

- Boost pressure too high

Reaction:

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

  GE engines: The engine is shut down (unless protection has been turned off with the diagnosis tool VODIA).

Action:

- Check turbocharger compressor function.
- Check charge pressure sensor function.
- Check fuel volume/unit injector.

PID 94, Code 3.6 Fuel pressure sensor

Reason:

- Short circuit to positive (+) or negative (-).
- Open circuit.

Reaction:

- None.

Action:

- Check that the fuel pressure sensor connector is correctly installed.
- Check that the cable harness to the fuel pressure sensor has not been damaged.
- Check that the fuel pressure sensor is correctly installed.
- Check the fuel pressure sensor function.
- Check contact pressure insocket 16 in the lower cable connector (B) to the engine control module.

PID175, Code 3.7 Oil temperature sensor

Reason:

- Short circuit to positive (+) or negative (-).
- Open circuit.

Reaction:

- None.

Action:

- Check that the cable harness to the oil temperature sensor has not been damaged.
- Check that the oil temperature sensor is correctly connected.
- Check contact pressure in socket 31 in the upper cable connector (A) to the engine control module.

PID 94, Code 3.8 Fuel pressure

Reason:

- Low supply pressure.

Reaction:

- Warning indication.

Action:

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

PID 158, Code 3.9 Battery voltage

Reason:

- Alternator fault.
- Faulty battery, battery cables.

Reaction:

- Warning indication.

Action:

- Check supply voltage from control unit.

PPID 5, Code 5.1 Main relay

Reason:

- Short circuit to positive (+).

Reaction:

- Instrument panel is without power when key is turned to start position. Engine cannot be started.

Action:

- Check that the cable harness to the relay has not been damaged.
- Check the relay function.

PPID 4, Code 5.2 Start input, CIU

Reason:

- Short circuit to negative (-).
- Activated too long.

Reaction:

- Engine can not be started.
- Engine starts immediately ignition is switched on.

Action:

- Check that the starter switch connections are not damaged.
- Check that the cable harness to the start switch has not been damaged.

PPID 6, Code 5.3 Stop input, CIU

Reason:

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

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 the fault code is active, the engine can be started but not stopped.

Action:

- Check that the starter switch connections are not damaged.
- Check that the cable harness to the start switch has not been damaged.

PID 45, Code 5.4 Preheating relay

Reason:

- Short circuit to positive (+) or negative (-).
- Open circuit.

Reaction:

- Pre-heating cannot be activated.
- Pre-heating is constantly connected.

Action:

- Check that the cable harness to the relay input has not been damaged.
- Check the relay function.
- Check contact pressure insocket 25 in the lower cable connector (B) to the engine control module.

PID 107, Code 5.5 Pressure drop, air filter

Reason:

- Blocked air filter.

Reaction:

- Warning indication.

Action:

- Check the air filter.

PID 107, Code 5.6 Air filter sensor

Reason:

- Short circuit to positive (+) or negative (-).
- Open circuit.

Reaction:

- None.

Action:

- Check that the air filter sensor connector is correctly installed.
- Check that the cable harness to the air filter sensor has not been damaged.
- Check that the air filter sensor is correctly installed.
- Check the air filter sensor function.
- Check contact pressure insocket 31 in the lower cable connector (B) to the engine control module.

PID 98, Code 5.7 Oil level

Reason:

- Oil level too low.

Reaction:

- Warning indication.

Action:

- Check the oil level.

PID 175, Code 5.8 Oil temperature

Reason:

- Oil temperature too high

Reaction:

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

  GE engines: The engine is shut down (unless protection has been turned off with the diagnosis tool VODIA).

Action:

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

PID 98, Code 5.9 Oil level sensor

Reason:

- Short circuit to positive (+) or negative (-).
- Open circuit.

Reaction:

- None.

Action:

- Check that the wiring to the oil level sensor has not been damaged.
- Check the oil level sensor function.
- Check contact pressure in sockets 3 and 4 of the lower cable connector (B) to the engine control module.

PID 110, Code 6.1 Coolant temperature

Reason:

- Coolant temperature too high.

Reaction:

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

  GE engines: The engine is shut down (unless protection has been turned off with the diagnosis tool VODIA).

Action:

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

PID 105, Code 6.2 Charge air temperature

Reason:

- Charge air temperature too high.

Reaction:

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

  GE engines: The engine is shut down (unless protection has been turned off with the diagnosis tool VODIA).

Action:

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

PPID 3, Code 6.3 Start output EMS 2

Reason:

- Short circuit to positive (+) or negative (-).
- Activated too long.

Reaction:

- Engine can not be started.
- Engine starts immediately ignition is switched on.

Action:

- Check that the starter switch connections are not damaged.
- Check that the cable harness to the start switch has not
  been damaged.

SID 231, Code 6.4 Data link (CAN), CIU

Reason:

- Faulty data link (CAN), CIU.

Reaction:

- Instruments and warning lamps stop working.

Action:

- 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.
- Check that sockets 11 and 12 in the connector on the CIU are not damaged.
- Check contact pressure insockets 51 and 55 in the lower cable connector (B) to the engine control module.

SID 231, Code 6.5 Data link (CAN), EMS 2

Reason:

- Internal fault in control module.

Reaction:

- Engine not in operation: engine can not be started.
  Engine running: engine idles and can only be stopped with the emergency stop.

Action:

- 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.
- Check that sockets 11 and 12 in the connector on the CIU are not damaged.
- Check contact pressure insockets 51 and 55 in the lower cable connector (B) to the engine control module.

PID 100, Code 6.6 Oil pressure

Reason:

- Oil pressure too low.

Reaction:

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

  GE engines: The engine is shut down (unless protection has been turned off with the diagnosis tool VODIA).

Action:

- Check the oil level.
- Check that the oil filter is not blocked.
- Check system pressure valves and safety valves in the oil system.
- Check oil pressure sensor function.

PPID 8, Code 6.7 Piston cooling pressure

Reason:

- Piston cooling pressure too low.

Reaction:

- The engine is shut down (unless protection has been turned off with the diagnosis tool VODIA), applies to both GE and VE engines. The fault code is de-activated at engine speeds below 1000 rpm.

Action:

- Check that the oil pressure in the engine exceeds 175 kPa.

PPID 8, Code 6.8 Piston cooling pressure sensor

Reason:

- Short circuit to positive (+) or negative (-).
- Open circuit.

Reaction:

- None.

Action:

- Check that the piston cooling pressure sensor connector is correctly installed.
- Check that the cable harness to the piston cooling pressure sensor has not been damaged.
- Check that the piston cooling pressure sensor is correctly installed.
- Check piston cooling pressure sensor function.
- Check contact pressure insockets 10 and 14 in the lower cable connector (B) to the engine control module.

PID 158, Code 6.9 Battery voltage, CIU

Reason:

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

Reaction:

- Warning indication.
- Problems in engine starting.

Action:

- Check supply voltage from control unit.
- Check that battery.
- Check the alternator.

SID 1, Code 7.1 Unit injector cylinder #1

Reason:

- Electrical fault.
- Faulty compression or unit injector.

Reaction:

- Engine runs on 5 cylinders.
- Abnormal sound.
- Reduced performance.
- Cylinder balancing interrupted -> Uneven operation at low rpms and low load.

Action:

- Check contact pressure in socket 24 in the upper cable connector (A) to the engine control module.
- Check that the cable harness to the unit injectors has not been damaged.
- Check that the cable harness to the unit injectors has not been damaged.
- Check the oil fuel supply pressure.
- Check the valve clearance.
- Run a compression test and check cylinder #1.

SID 2, Code 7.2 Unit injector cylinder #2

Reason:

- Electrical fault.
- Faulty compression or unit injector.

Reaction:

- Engine runs on 5 cylinders.
- Abnormal sound.
- Reduced performance.
- Cylinder balancing interrupted -> Uneven operation at low rpms and low load.

Action:

- Check contact pressure in socket 16 in the upper cable connector (A) to the engine control module.
- Check that the cable harness to the unit injectors has not been damaged.
- Check that the cable harness to the unit injectors has not been damaged.
- Check the oil fuel supply pressure.
- Check the valve clearance.
- Run a compression test and check cylinder #2.

SID 1, Code 7.1 Unit injector cylinder #3

Reason:

- Electrical fault.
- Faulty compression or unit injector.

Reaction:

- Engine runs on 5 cylinders.
- Abnormal sound.
- Reduced performance.
- Cylinder balancing interrupted -> Uneven operation at low rpms and low load.

Action:

- Check contact pressure in socket 32 in the upper cable connector (A) to the engine control module.
- Check that the cable harness to the unit injectors has not been damaged.
- Check that the cable harness to the unit injectors has not been damaged.
- Check the oil fuel supply pressure.
- Check the valve clearance.
- Run a compression test and check cylinder #3.

SID 1, Code 7.1 Unit injector cylinder #4

Reason:

- Electrical fault.
- Faulty compression or unit injector.

Reaction:

- Engine runs on 5 cylinders.
- Abnormal sound.
- Reduced performance.
- Cylinder balancing interrupted -> Uneven operation at low rpms and low load.

Action:

- Check contact pressure in socket 56 in the upper cable connector (A) to the engine control module.
- Check that the cable harness to the unit injectors has not been damaged.
- Check that the cable harness to the unit injectors has not been damaged.
- Check the oil fuel supply pressure.
- Check the valve clearance.
- Run a compression test and check cylinder #4.

SID 5, Code 7.5 Unit injector cylinder #5

Reason:

- Electrical fault.
- Faulty compression or unit injector.

Reaction:

- Engine runs on 5 cylinders.
- Abnormal sound.
- Reduced performance.
- Cylinder balancing interrupted -> Uneven operation at low rpms and low load.

Action:

- Check contact pressure in socket 48 in the upper cable connector (A) to the engine control module.
- Check that the cable harness to the unit injectors has not been damaged.
- Check that the cable harness to the unit injectors has not been damaged.
- Check the oil fuel supply pressure.
- Check the valve clearance.
- Run a compression test and check cylinder #5.

SID 6, Code 7.6 Unit injector cylinder #6

Reason:

- Electrical fault.
- Faulty compression or unit injector.

Reaction:

- Engine runs on 5 cylinders.
- Abnormal sound.
- Reduced performance.
- Cylinder balancing interrupted -> Uneven operation at low rpms and low load.

Action:

- Check contact pressure in socket 40 in the upper cable connector (A) to the engine control module.
- Check that the cable harness to the unit injectors has not been damaged.
- Check that the cable harness to the unit injectors has not been damaged.
- Check the oil fuel supply pressure.
- Check the valve clearance.
- Run a compression test and check cylinder #6.

PID 153, Code 7.7 Crankcase ventilation pressure

Reason:

- Crankcase ventilation pressure too high.

Reaction:

- Warning indication.
- Engine is shut off.

Action:

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

PID 153, Code 7.8 Crankcase ventilation pressure sensor

Reason:

- Short circuit to positive (+) or negative (-).
- Open circuit.

Reaction:

- None.

Action:

- Check that the crankcase ventilation pressure sensor connector is correctly installed.
- Check that the cable harness to the crankcase ventilation pressure sensor has not been damaged.
- Check that the crankcase ventilation pressure sensor is correctly installed.
- Check crankcase ventilation pressure sensor function.
- Check contact pressure insocket 28 in the lower cable connector (B) to the engine control module.

PID 172, Code 7.9 Air temperature sensor, inlet

Reason:

- Short circuit to positive (+) or negative (-).
- Open circuit.

Reaction:

- None.

Action:

- Check that the charge air temperature sensor connector is correctly installed.
- Check that the cable harness to the charge air temperature sensor has not been damaged.
- Check that the charge air temperature sensor is correctly installed.
- Check air temperature sensor function.
- Check contact pressure in socket 29 in the upper cable connector (A) to the engine control module.

SID250, Code 9.2 Data link faulty (J1708/J1587)

Reason:

- Data link fault.

Reaction:

- Warning indication.

Action:

- 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.
- Check that sockets 22 and 37 in the connector on the CIU are not damaged.
- Check contact pressure in socket 33 and 34 in the upper cable connector (A) to the engine control module.

SID232, Code 9.3 Voltage feed to sensor

Reason:

- Short circuit.
- Fault in oil pressure sensor and/or charge air pressure sensor.

Reaction:

- Fault in oil pressure sensor and/or charge air pressure sensor.
- Fault code for oil pressure and charge air pressure sensors.
- Low engine power.
- Oil pressure and oil temperature instruments show 0.

Action:

- Check that the cable harness to oil pressure and charge air pressure sensor has not been damaged.
- Check contact pressure in socket 7 in the upper cable connector (A) to the engine control module.
- Check the oil pressure sensor and charge air pressure sensor.

SID 254, Code 9.8 Control module fault, CIU

Reason:

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

Reaction:

- CIU retakes factory settings.
- Engine goes to idle.
- Engine can not be started.

Action:

- Change CIU unit.

SID 240, Code 9.9 Memory fault in EMS

Reason:

- Memory fault in engine management system.

Reaction:

- Engine might not start.

Action:

- Change engine control unit.

SID 253, Code 9.9 Data set memory EEPROM

Reason:

- Internal fault in control module.
- Faulty programming.

Reaction:

- Engine does not start.

Action:

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

SID 254, Code 9.9 Control module EMS

Reason:

- Internal fault in control module.

Reaction:

- Engine misfires.
- Engine does not start.

Action:

- Change engine control unit.

Notes

Notes

Notes

Reference to Service bulletins

Group No Date Concerning

Report form

Do you have any comments or complaints about this manual? Please take a copy of this page, write your comments on it and send it to us. The address is at the bottom. We would appreciate it if you were to write in English or Swedish.

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