Workshop manual

EDC Fuel system

TWD740VE, TWD1231VE

7738217-4 English 06-2002

Report form

Do you have any complaints or other comments about this manual? Please make a copy of this page, write your comments down and post it to us. The address is at the bottom of the page. We would prefer you to write in English or Swedish.

From: .....

.....

.....

.....

Refers to publication: .....

Publication no.: ..... Issued: .....

Suggestion/reasons: .....

.....

.....

.....

.....

.....

.....

.....

.....

Date: .....

Name: .....

AB Volvo Penta
Customer Support
Dept. 42200
SE-405 08 Gothenburg
Sweden

Notes

Workshop manual

EDC Fuel system

TWD740VE, TWD1231VE

Contents

7738217-4 English 06-2002

Safety information

Introduction

The workshop manual contains technical data, descriptions and repair instructions for specified products or product versions supplied by Volvo Penta. Make sure you use the correct workshop literature.

Read the available safety information, “General information“ and “Repair instructions“ before you start to do any service work.

Important

The following special warning signs are found in the workshop manual and on the product.

WARNING! Warns for the risk of personal injury, major damage to product or property, or serious malfunctions if the instruction is ignored.

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

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

To give you a perspective on the risks which always need to be observed and precautions which always have to be taken, we have noted them below.

Make it impossible to start the engine by cutting system current with the main switch(es) and lock it (them) in the off position before starting service work. Fix a warning sign by the helmsman’s seat.

All service work should normally be done on a stationary engine. Some work, such as adjustments, need the engine to be running, however. Going close to a running engine is a safety risk. Remember that loose clothes, long hair etc. can catch on rotating components and cause severe injury.

If work is done adjacent to a running engine, a careless movement or a dropped tool can lead to personal injury in the worst case.

Be careful with hot surfaces (exhaust pipes, turbos, charge air pipes, starting heaters etc.) and hot fluids in pipes and hoses on an engine which is running or which has just stopped. Re-install all guards which have been removed during service work, before re-starting the engine.

Make sure that the warning or information labels on the product are always clearly visible.Replace labels which have been damaged or painted over.

Never start an engine without the air filter in place. The rotating compressor turbine in the turbocharger can cause severe injury. Foreign bodies in the inlet pipe can also cause severe mechanical damage.

Never use start spray or similar products as a starting aid. Explosions could occur in the inlet manifold. Danger of personal injury.

Only start the engine in a well-ventilated area. When operated in a confined space, exhaust fumes and crankcase gases must be ventilated from the engine bay or workshop area.

Avoid opening the coolant filling cap when the engine is hot. Steam or hot coolant can spray out at the same time as the pressure which has built up is lost. Open the filler cap carefully if necessary, and release the excess pressure in the cooling system. Be extremely careful if a tap, plug or coolant hose has to be removed from a hot engine. Steam or hot coolant can stream out in an unexpected direction.

Hot oil can cause burns. Avoid skin contact with hot oil. Make sure that the oil system is de-pressurised before doing any work on it. Never start or run the engine with the oil filler cap removed, because of the risk of oil spillage.

Stop the engine before doing any work on the cooling system.

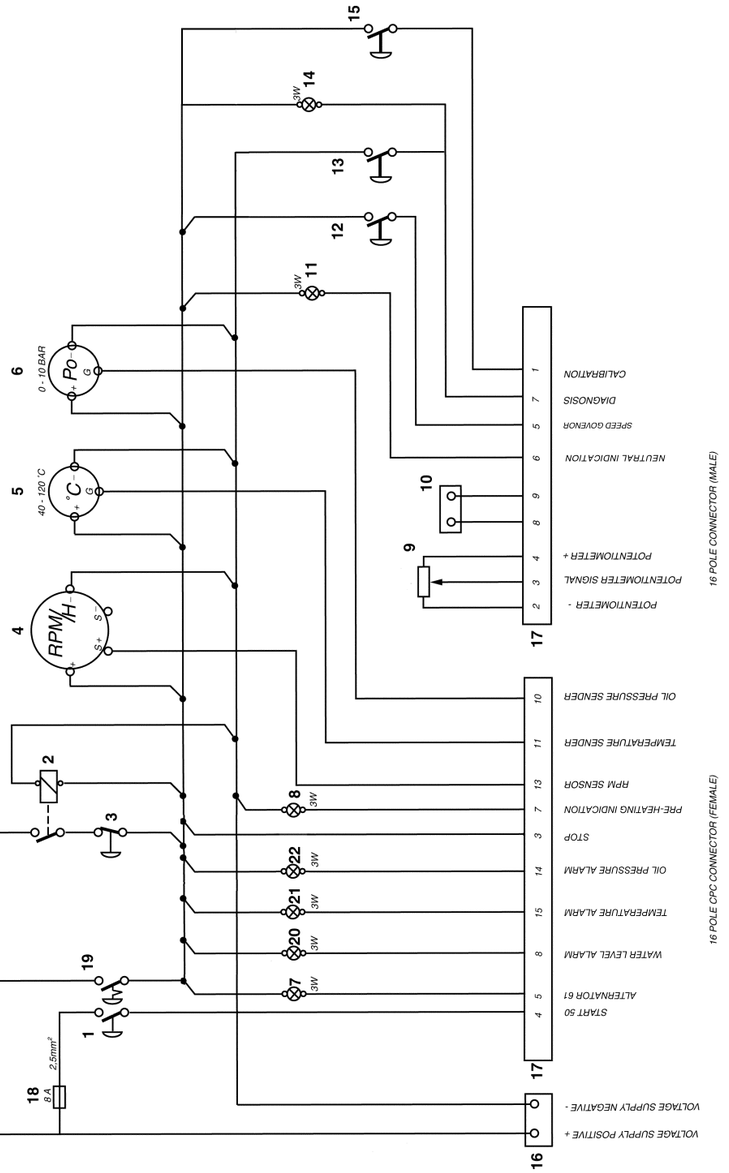
Main cables
(24 V system voltage)
Note. The components in the wiring diagram have the same numbers as in the perspective diagram on page 45.

1. Starter button
2. Latching relay
3. Stop button
4. Tachometer
5. Coolant temperature gauge
6. Oil pressure gauge
7. Charge warning lamp
8. Pre-heating indication
9. Engine speed potentiometer
10. Diagnostic connector
11. Regulator, position indicator
12. Regulator, position switch
13. Diagnostic button
14. Diagnostic lamp
15. Calibration button
16. Power supply
17. 16 pin connector
18. Fuse
19. Key switch
20. Warning lamp, coolant level
21. Warning lamp, coolant temperature
22. Warning lamp, oil pressure

NO= Normally open during operation.
Cables shown with broken lines are not supplied by Volvo Penta Cable areas not specified = 0.5 mm².

NOTE! The higher-level cable installation is a recommendation from Volvo Penta. Cable colours etc. are the customer’s responsibility.

Control panel layout

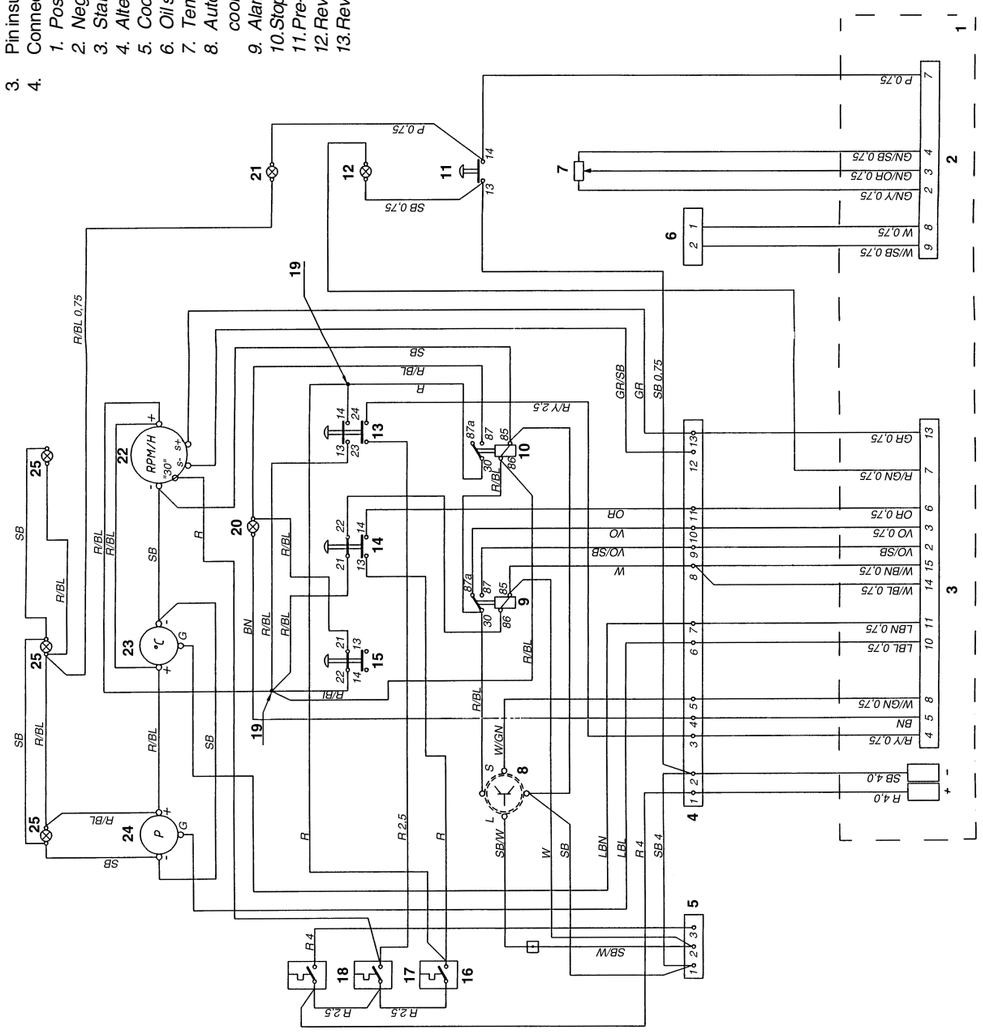


1. Junction box
2. Pin insulator, male
3. Pin insulator, female
4. Connector
   1. *Positive (+)*
   2. *Negative (-)*
   3. *Start 50*
   4. *Alternator 61*
   5. *Coolant level*
   6. *Oil sensor*
   7. *Temperature sensor*
   8. *Automatic stop oil pressure, coolant temperature*
   9. *Alarm*
   10. *Stop*
   11. *Pre-heating*
   12. *Rev S- sensor*
   13. *Rev S+ sensor*
5. Connector
   1. *Negative (-)*
   2. *Automatic stop*
   3. *Positive (+)*
   6. Serial output
   7. Accelerator linkage
   8. Level sensor
   9. Intermediate relay
   10. Latching current relay
   11. Diagnostic button
   12. Preheating indication
   13. Starter button
   14. Interlock button
   15. Stop button
   16. Circuit breaker 8 A
   17. Circuit breaker 8 A
   18. Circuit breaker 16 A
   19. Joint
   20. Charge indication lamp
   21. Diagnosis indication
   22. Tachometer
   23. Coolant temperature instrument
   24. Oil pressure instrument
   25. Instrument lighting

NO = Normally open during operation.
Cables shown with broken lines are not supplied by Volvo Penta Cable areas not specified = 0.5 mm^2.

Cable colours

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



⚠ Always use goggles when doing any work where there is any risk of splinters, grinding sparks, acid splash or other chemicals. Your eyes are extremely sensitive. Injury can cause blindness!

⚠ Avoid skin contact with oil! Long-term or repeated skin contact with oil can make your skin dry out. The consequence is irritation, dry skin, eczema and other skin disorders. Used oil is more hazardous to health than new oil. Use protective gloves and avoid oil-soaked clothes and rags. Wash regularly, especially before meals. Use special skin cream to avoid drying and facilitate skin cleaning.

⚠ Most chemicals intended for the product (e.g. engine and transmission oils, glycol, petrol (gasoline) and diesel oil) or chemicals for workshop use (e.g. degreasers, paints and solvents) are hazardous. Read the instruction on the packages carefully! Always observe the safety advice (e.g. use of breathing protection, goggles, gloves etc.). Make sure that other personnel are not inadvertently exposed to hazardous substances, such as via the air they breathe. Ensure good ventilation. Handle used and surplus chemicals in the prescribed manner.

⚠ Be very careful when searching for leaks in the fuel system and testing fuel injectors. Use goggles. The jet from a fuel injector is under very high pressure, and has considerable penetration ability; fuel can force its way deep into body tissues and cause serious damage. Risk of blood poisoning (septicaemia).

⚠ **WARNING!** Fuel delivery pipes must not be bent or straightened under any circumstances. Damaged pipes must be replaced.

⚠ All fuels, and many chemicals, are flammable. Make sure that open flames or sparks can not set them alight. Petrol (gasoline), some thinners and hydrogen gas from batteries are extremely flammable and explosive when mixed with air in the correct ratio. Do not smoke! Provide good ventilation and take the necessary precautions before you start welding or grinding in the vicinity. Always have a fire extinguisher easily available near the workplace.

⚠ Make sure that oil and fuel soaked rags, and used fuel and oil filters are stored in a safe place. Oil soaked rags can self-ignite in the right circumstances. Used fuel and oil filters are polluting waste and must be handed to an approved waste management facility for destruction, together with used lubrication oil, contaminated fuel, paint residue, solvents, degreasers and wash residue.

⚠ Batteries must never be exposed to open flames or electric sparks. Do not smoke close to the batteries. The batteries generate hydrogen gas when charged, which forms an explosive gas when mixed with air. This gas is very flammable and highly explosive. A spark, which can be formed if the batteries are wrongly connected, is enough to make a battery explode and cause damage. Do not move the connections when you attempt to start the engine (risk of arcing), and do not stand and lean over one of the batteries.

⚠ Never mix up the battery positive and negative poles when the batteries are installed. If the batteries are wrongly connected, this can cause severe damage to the electrical equipment. Please check the wiring diagram!

⚠ Always use goggles when charging and handling batteries. Battery electrolyte contains highly corrosive sulphuric acid. If this comes into contact with your skin, wash at once with soap and a lot of water. If you get battery acid in your eyes, flush at once with a lot of water, and get medical assistance at once.

⚠ Stop the engine and cut the system current with the main switch(es) before doing any work on the electrical system.

⚠ The clutch must be adjusted with the engine shut off.

⚠ The existing lugs on the engine should be used for lifting. Always check that the lifting devices are in good condition and that they have the correct capacity for the lift (the weight of the engine plus the gearbox and extra equipment if installed). The engine should be lifted with a customised or adjustable lifting boom for safe handling and to avoid damaging components on top of the engine. All chains or cables should be parallel to each other and should be as square as possible to the top of the engine.

If other equipment connected to the engine has altered its centre of gravity, special lifting devices may be needed to obtain the correct balance and safe handling.

Never do any work on an engine which just hangs from a lifting device.

⚠ Never work alone when heavy components are to be dismantled, even when safe lifting devices such as lockable blocks & tackle are used. Even when lifting devices are used, two people are needed in most cases. One who operates the lifting device and other who makes sure that components move freely and are not damaged during lifting.

Always make sure that there is enough space for disassembly where you are working, with no risk for personal or material damage.

⚠ **WARNING!** Components in the electrical and fuel systems on Volvo Penta products have been designed to minimise the risks of explosion and fire. The engine must not be operated in environments with adjacent explosive media.

⚠ Only use the fuels recommended by Volvo Penta. Please refer to the instruction book. The use of fuel of inferior quality can damage the engine. In a diesel engine, poor fuel can cause the regulation rod to bind and the engine will over-rev, entailing a strong risk of personal injury and machinery damage. Poor fuel can also lead to higher maintenance costs.

⚠ Remember the following when washing with a high pressure washer: Never aim the water jet at seals, rubber hoses, electrical components or the radiator. Never use the high pressure water for engine cleaning.

Wiring diagram for TWD1231VE engine

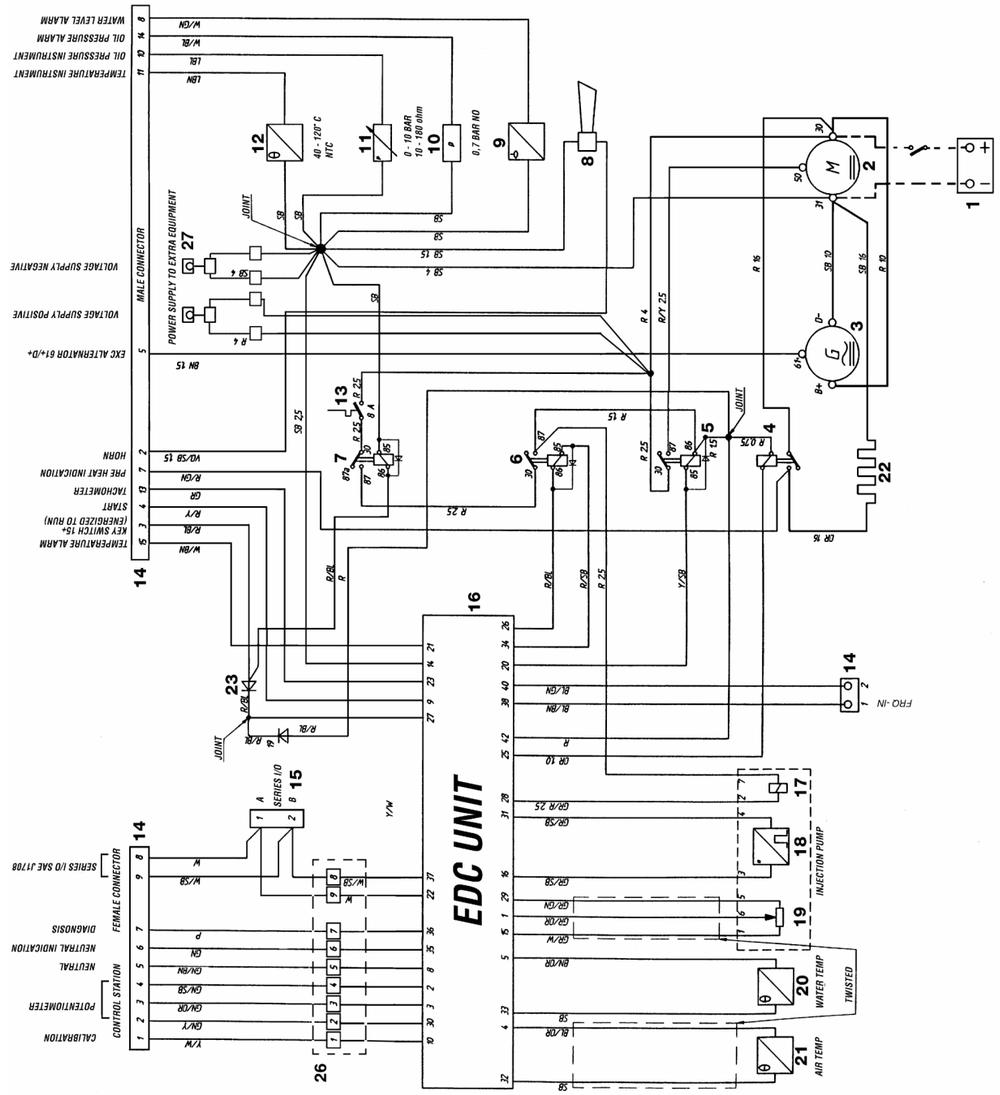
Engine (24 V system voltage)
Note. The components in the wiring diagram have the same numbers as in the perspective diagram on the previous page.

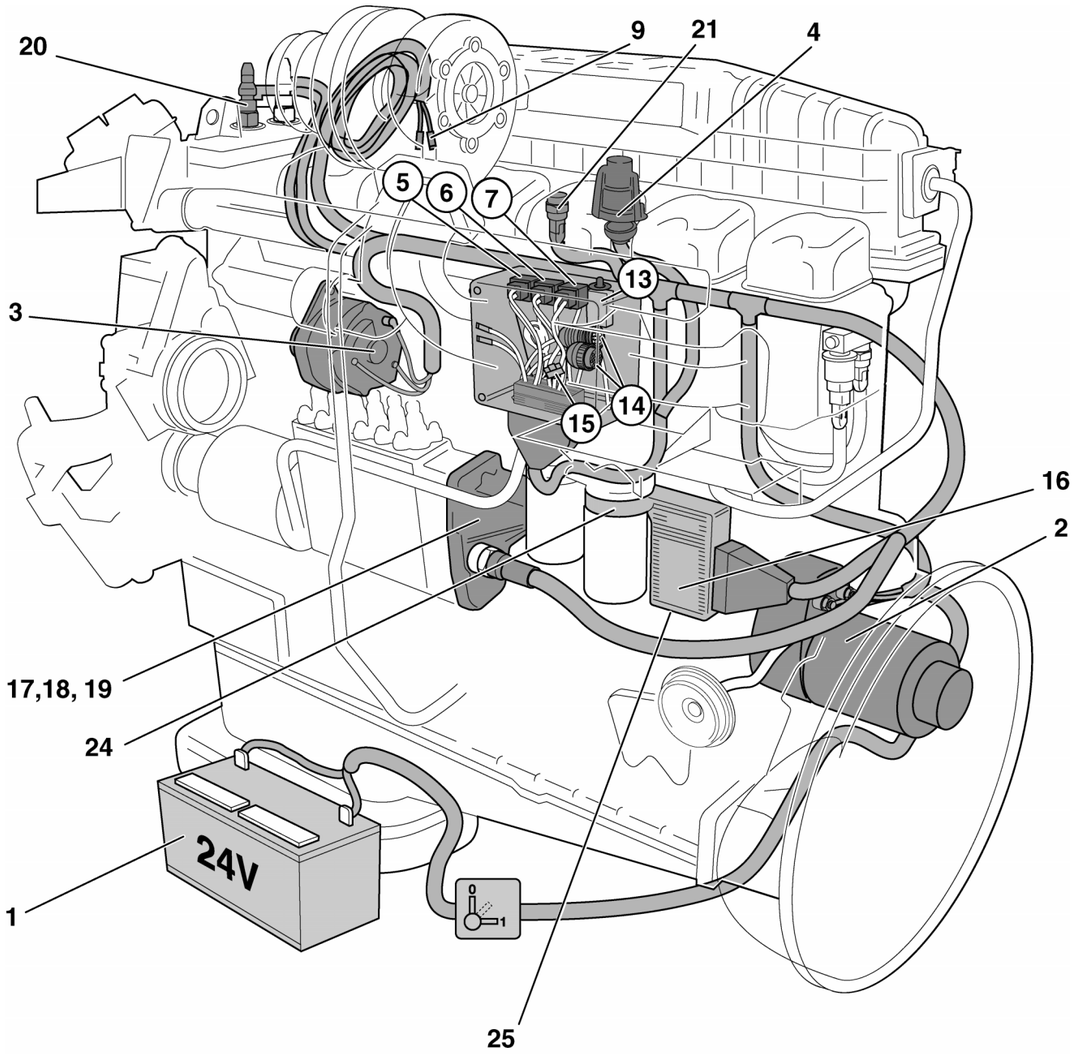
1. Battery (24 V).
2. Starter motor
3. Alternator
4. Pre-heating relay
5. Starter relay
6. Main relay
7. Stop relay
8. Horn
9. Sensor, coolant level
10. Oil pressure monitor
11. Oil pressure sensor
12. Coolant temperature sensor, instrument
13. Circuit breaker
14. Connector
15. Test connector
16. Control unit
17. Actuation solenoid, EDC
18. Engine speed sensor
19. Position sensor
20. Coolant temperature sensor, EDC
21. Charge air temperature sensor.
22. Starting heater
23. Diode
24. Fuel temperature sensor
25. Charge air pressure sensor
26. Connector, Only late models
27. Extra equipment

NO = Normally open during operation. Cables shown with broken lines are not supplied by Volvo Penta Cable areas not specified = 0.5 mm².

Cable colours

BL	= Blue	P	= Pink
LBL	= Lightblue	R	= Red
BN	= Brown	SB	= Black
LBN	= Lightbrown	VO	= Violet
GN	= Green	W	= White
GR	= Grey	Y	= Yellow
OR	= Orange		





The positions in the illustration of the EDC system are the same as the positions on the wiring diagram, and show where each component is located on the engine.

About the workshop manual

This workshop manual contains descriptions and repair instructions for the standard versions of the TWD740VE and TWD1231VE engines.

The engine designation and number are always given on the type plate (please refer to page 9). The engine designation and number must always be given in all correspondence about an engine.

The workshop manual has been primarily prepared for Volvo Penta service workshops and their qualified personnel. This assumes that people who use the manual have basic skills and can do the tasks of a mechanical or electrical nature associated with the trade.

Volvo Penta constantly improves its products, so we reserve the right to make modifications without prior notification. All information in this manual is based on product data which was available up to the date on which the manual was printed. Any material changes introduced into the product or service methods after this date are notified by means of Service Bulletins.

Spare parts

Spare parts for electrical and fuel systems are subject to various national safety requirements. Volvo Penta Original Spares comply with these requirements. No damage whatever, occasioned by use of non-original Volvo Penta spares for the product, will be compensated by the warranty offered by Volvo Penta.

Certified engines

When service or repairs are done to an emission certified engine, which is used in an area where exhaust emissions are regulated by law, it is important to be aware of the following:

Certification means that an engine type has been checked and approved by the relevant authority. The engine manufacturer guarantees that all engines made of the same type are equivalent to the certified engine.

This put special demands on service and repair work, as follows:

- Maintenance and service intervals recommended by Volvo Penta must be complied with.
- Only Volvo Penta original spares may be used.
- Service to injection pumps, pump settings and injectors must always be done by an authorised Volvo Penta workshop.
- The engine must not be converted or modified, except for the accessories and service kits which Volvo Penta has approved for the engine.
- Installation changes to the exhaust pipe and engine air inlet ducts must not be done.
- No seals may be broken by unauthorised personnel.

The general advice in the instruction book about operation, care and maintenance apply.

IMPORTANT! Delayed or inferior care/maintenance, and the use of non-original spares, mean that AB Volvo Penta can no longer be responsible for guaranteeing that the engine complies with the certified version.

Damage, injury and/or costs which arise from this will not be compensated by Volvo Penta.

Repair instructions

The work methods described in the workshop manual apply to work in a workshop environment. For this reason, the engine is lifted out and mounted on an engine support. Renovation work which does not need the engine to be lifted out can be done in situ, with the same work methods, unless otherwise specified.

The warning signs which occur in the workshop manual (please refer to “Safety information“ for their meanings)

WARNING!

IMPORTANT!

NOTE!

are not comprehensive in any way, since we can not of course foresee everything, since service work is done in highly varying circumstances. For this reason, all we can do is to point out the risks which we believe could occur due to incorrect work in a well-equipped workshop, using work methods and tools tested by us.

In the workshop manual, all tasks for which there are Volvo Penta special tools, are done using these tools. Special tools are specially prepared to permit the safest and most rational work methods possible. For this reason, it is the responsibility of the person who uses other tools or other work methods than those recommended by us, to ensure that there is no risk of personal injury or material damage, and that they can not cause any malfunctions.

In some cases, special safety regulations and user instructions are available for the tools and chemicals mentioned in the workshop manual. These rules must always be observed, so there are no special instructions about this in the workshop manual.

The majority of risks can be prevented by taking certain elementary precautions and using common sense. A clean workplace and a clean engine eliminate many risks of both personal injury and malfunction.

Above all, when work on fuel systems, lubrication systems, inlet systems, turbocharger, bearing caps and seals is done, it is extremely important that no dirt or other kinds of foreign particles are able to get in, since this would otherwise cause malfunctions or shortened repair life.

Our common responsibility

Each engine consists of a large number of collaborating systems and components. Any deviation of a component from its technical specification can dramatically increase the environmental impact of an otherwise good engine. For this reason, it is extremely important that specified wear tolerances are maintained, that systems with adjustment facilities are correctly adjusted and that Volvo Penta Original Spares are used for the engine. The times noted in the engine maintenance schedule must be observed.

Some systems, such as components in the fuel system, may require special competence and special test equipment. For environmental reasons etc., some components are sealed at the factory. It is only permissible to work on sealed components if you are authorised to do such work.

Remember that most chemical products, incorrectly used, damage the environment. Volvo Penta recommends the use of biodegradable degreasers whenever engine components are de-greased, unless otherwise specified in the workshop manual. Be careful to ensure that oils, wash residue letc. are processed for destruction, and are not inadvertently discharged to the environment.

Tightening torque

The tightening torque for vital fasteners, which should be tightened with a torque wrench, are listed in “Technical Data“. “Tightening torque“ and are specified in the workshop manual job descriptions. All torque specifications apply to clean screws, screw heads and mating faces. The torque specifications apply to lightly oiled or clean screws. If lubricants, locking fluids or sealants are needed on a fastener, the type of preparation to be used will be noted in the job description and in “Tightening Torques“. Where a particular torque value is not specified for any fastener, the general tightening torques in the table below shall apply. The torque specification is a target value and the fastener does not need to be tightened with a torque wrench.

Dimension	Tightening torque
	Nm
M5	6
M6	10
M8	25
M10	50
M12	80
M14	140

Engine (24 V system voltage)
Note. The components in the wiring diagram have the same numbers as in the perspective diagram on the previous page.

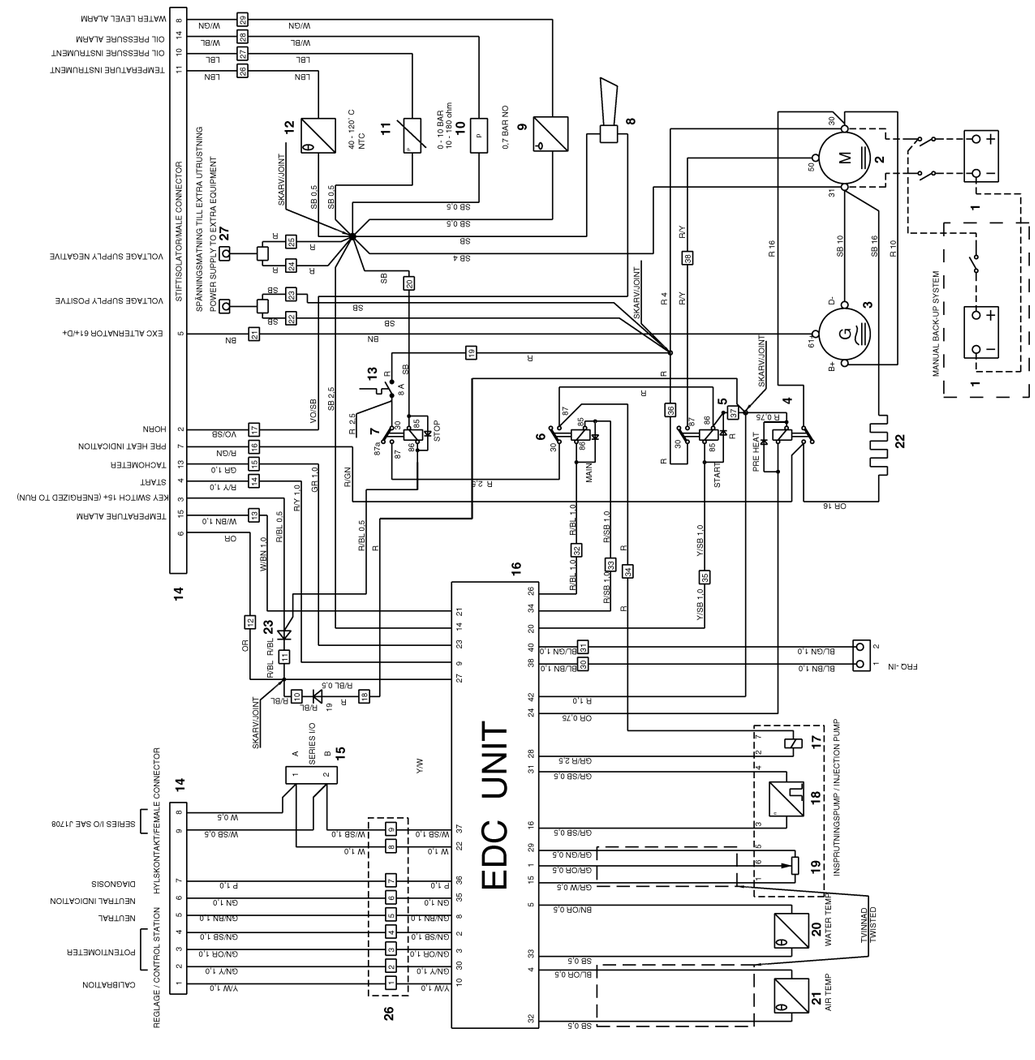
1. Battery (24 V).
2. Starter motor
3. Alternator
4. Pre-heating relay
5. Starter relay
6. Main relay
7. Stop relay
8. Horn
9. Sensor, coolant level
10. Oil pressure monitor
11. Oil pressure sensor
12. Coolant temperature sensor, instrument
13. Circuit breaker
14. Connector
15. Test connector
16. Control unit
17. Actuation solenoid, EDC
18. Engine speed sensor
19. Position sensor
20. Coolant temperature sensor, EDC
21. Charge air temperature sensor.
22. Starting heater
23. Diode
24. Fuel temperature sensor
25. Charge air pressure sensor
26. Connector
27. Extra equipment

NO = Normally open during operation. Cables shown with broken lines are not supplied by Volvo Penta Cable areas not specified = 0.5 mm².

Cable colours

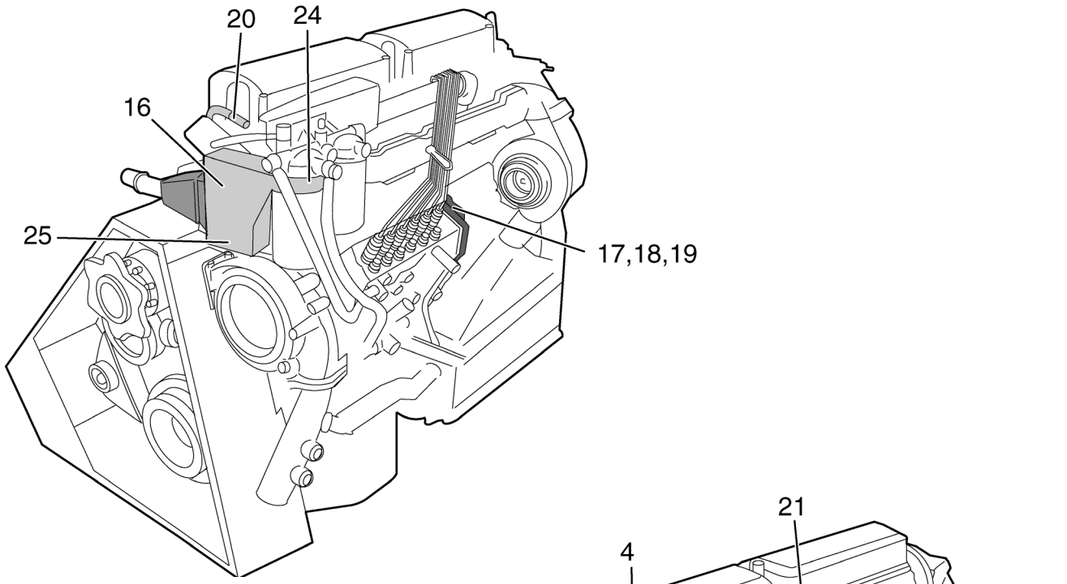
BL	= Blue	P	= Pink
LBL	= Light blue	R	= Red
BN	= Brown	SB	= Black
LBN	= Light brown	VO	= Violet
GN	= Green	W	= White
GR	= Grey	Y	= Yellow
OR	= Orange		

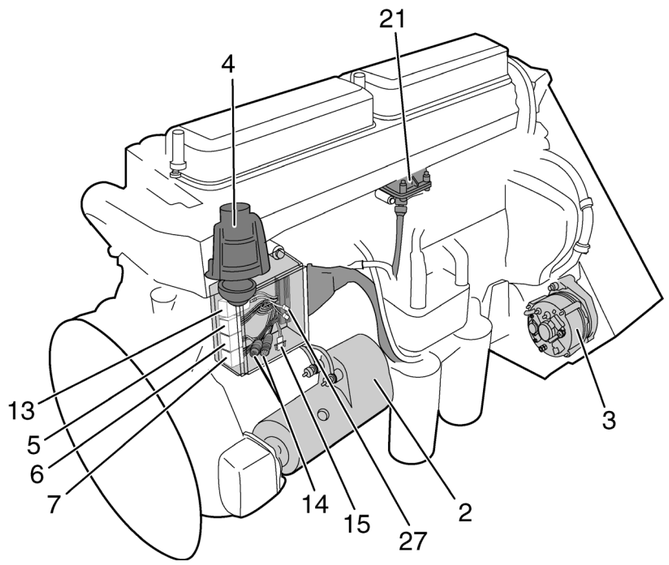
Wiring diagram for TWD740VE engine



Wiring diagrams

TWD740VE





The positions in the illustration of the EDC system are the same as the positions on the wiring diagram, and show where each component is located on the engine.

Torque/angle tightening

In torque/angle tightening, the fastener is tightened to the specified torque, and tightening then continues through a pre-determined angle. Example: for 90° angle tightening, the fastener is turned a further 1/4 turn in one sequence, after the specified tightening torque has been achieved.

Lock nuts

Dismantled locknuts shall not be re-used, they shall be replaced by new ones, since the locking properties are impaired or lost when the nut is used several times. On locknuts with plastic inserts, such as Nylock®, the tightening torque specified in the table must be reduced if the Nylock® nut has the same nut height as a standard fully metallic hexagonal nut. Reduce the tightening torque by 25% if the screw dimension is 8 mm or greater. On Nylock ® nuts with higher nut height, where the fully metallic thread is as high as on a standard hexagonal nut, use the tightening torques in the table.

Strength classes

Screws and nuts are sub-divided into different strength classes. Classification is indicated by markings on the screw head. Markings of a higher number indicate stronger material. For example, a screw marked 10-9 is stronger than one marked 8-8. For this reason, it is important when fasteners are dismantled, that the screws are put back in the correct places when they are re-installed. When you change screws, please check the spare parts catalogue to ensure that the correct versions are obtained.

Sealants

Several different types of sealant and locking fluids are used on the engine. The properties of the preparations differ, and they are intended for different strengths of fastener, temperature, resistance to oil and other chemicals, and for the different materials and gap thicknesses found in the engine.

It is therefore important that the correct types of sealant and locking fluids are used on the fasteners where needed, to give a fully acceptable service result.

In the workshop manual, the relevant chapters contain notes on the preparations used in our engine production.

In service work, the same preparations or preparations of corresponding properties, but of other makes, shall be used.

When sealants and locking fluids are used, it is important that the surfaces are free from oil, grease, paint and rust-protection, and that they are dry.

Always observe the manufacturer's instructions about temperatures of use, hardening times and other instructions for use of the product.

Two basic types of preparation are used on the engine, characteristics are as follows:

RTV preparations (Room Temperature Vulcanizing). These are mostly used together with gaskets, such as sealing gasket joints, or are brushed on gaskets. RTV preparations are fully visible when the component has been disassembled; old RTV compound must be removed before the joint is sealed again.

The following RTV preparations may be mentioned in the workshop manual: Loctite ® 574, Permatex ® No. 3, Permatex ® No 77. Remove old sealant with denatured alcohol in each case.

Anaerobic preparations. These preparations harden in the absence of air. These preparations are used when two solid components, such as two cast components, are fitted together without a gasket. Common uses are also to lock and seal plugs, stud threads, taps, oil pressure monitors etc. Hardened anaerobic preparations are glassy and for this reason, the preparations are coloured to make them visible. Hardened anaerobic preparations are highly resistant to degreasers, and old compound can not be removed. On re-installation, degrease carefully and then apply new sealant.

The following anaerobic preparations may be mentioned in the workshop manual: Loctite ® 572 (white), Loctite ® 241 (blue).

NOTE! Loctite® is a registered trademark belonging to the Loctite Corporation, Permatex® is a registered trademark belonging to the Permatex Corporation.

Safety rules for

Fluorocarbon rubber

Fluorocarbon rubbers are commonly used materials in seal rings on shafts, O-rings etc.

When flourocarbon rubber compounds are exposed to high temperatures (above 300° C), **hydrofluoric acid** can be formed, which is highly corrosive. Skin contact can cause severe chemical burns. If it splashes in your eyes, this can cause severe chemical burns. If you breathe the fumes, you can suffer lung and bronchial injury.

⚠ **WARNING!** Be very careful when working on engines which have been exposed to high temperatures, such as overheating caused by a seizure or fire. Seals must never be cut with a flame torch during disassembly, or burned in uncontrolled circumstances afterwards.

- Always use chloroprene rubber gloves (gloves for chemicals handling) and goggles.
- Handle the removed seal in the same way as corrosive acid. All residues, including ash, can be strongly corrosive. Never use compressed air to blow components clean.
- Put the remains in a plastic container, seal it and apply a warning label. Wash the gloves under running water before you take them off.

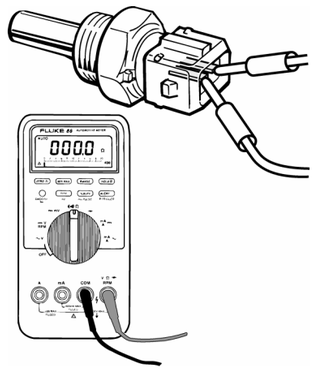
The following seals are most probably made from fluorocarbon rubber:

Seal rings for crankshafts, camshafts, countershafts.

O-rings, irrespective of where they are installed. O-rings for cylinder liner sealing are almost always made of fluorocarbon rubber.

Please note that seals which have not been exposed to high temperature can be handled normally.

Measurement of coolant temperature sensor



1. Undo the coolant temperature sensor connector.

2. Use the multimeter to measure across the two contact pins on the sensor. The multimeter should show the following values at:

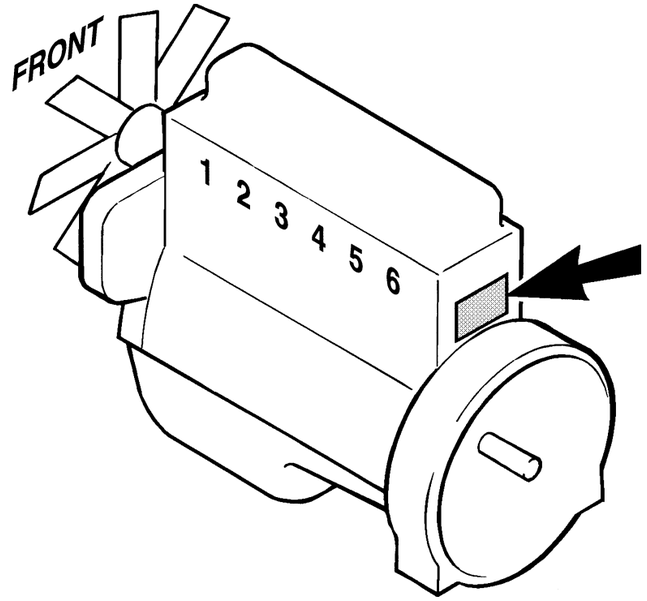
60° C	319 ± 37 Ω
90° C	128 ± 9 Ω
100° C	97 ± 6 Ω
120° C	57 ± 3 Ω

NOTE! The sensor is highly sensitive to temperature changes. It is enough to breathe on it, or hold it in your hand to get an incorrect measurement value.

Location of engine signs

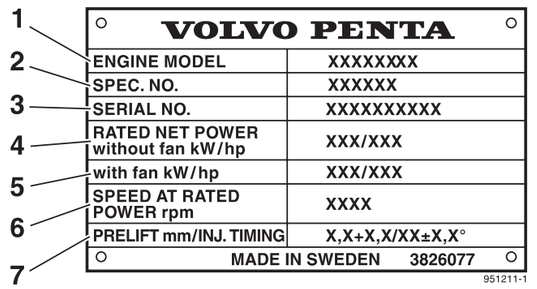
The engines are supplied with two engine signs, of which one is installed on the engine block, as in the illustration.

The other sign is supplied loose, for installation in a suitable location close to the engine.



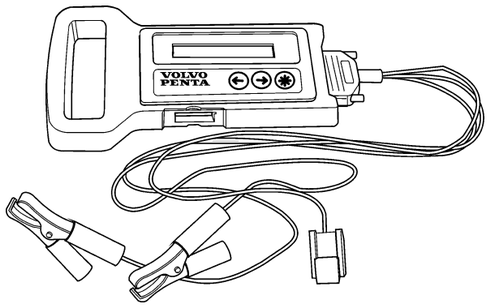
Explanation of engine designation:
E.g. TWD1231VE

T	–	Turbodiesel
W	–	Water to air, intercooler
D	–	Diesel engine
12	–	Displacement, litre
3	–	Generation
1	–	Version
V	–	Stationary and mobile operation
E	–	Emission control

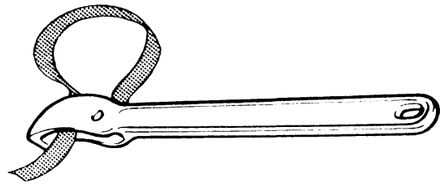


1. Engine designation
2. Product number
3. Serial number
4. Engine power, net, (without fan)
5. Engine power, net, (with fan)
6. Max. engine speed
7. Piston position/Injection advance (BTDC)

Special tools



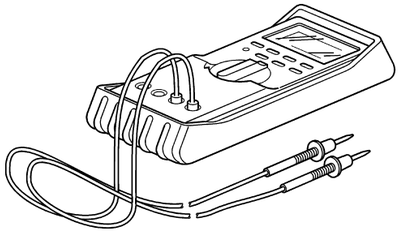
Diagnosis tool* with cable 885 2931



Tool for removing fuel and oil filter 999 91796.

* Order the cartridge separately, part number 885312

Data cable* for diagnostic program 885337

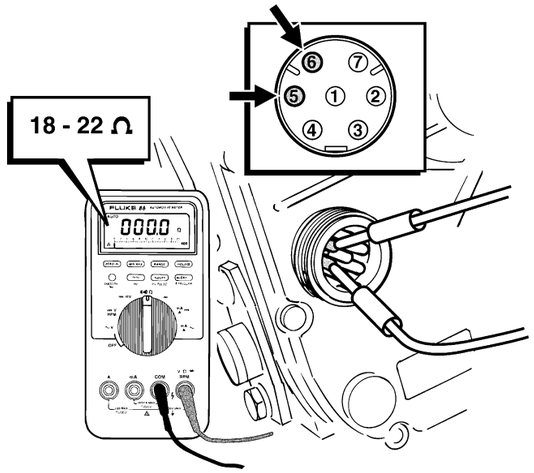


Multimeter 951 00608

* When you order the data cable, an order form is enclosed for software.

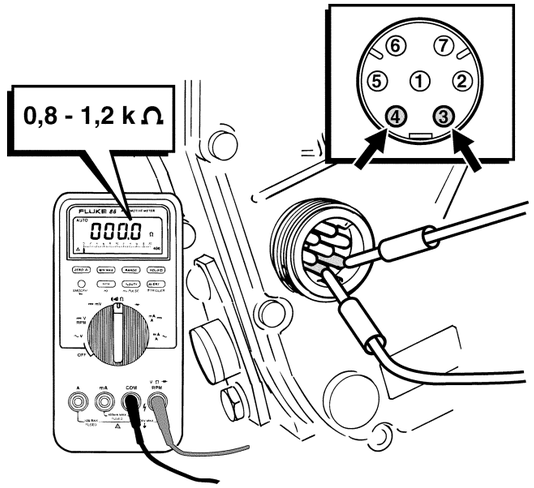
Tightening torque

Coolant temperature sensor	max. 30 Nm
Charge air temperature sensor	max. 30 Nm
Control unit gland in fuel fine filter bracket	38 ± 6 Nm



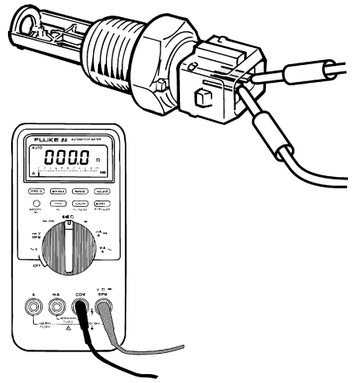
3b. Or use a multimeter to measure between pins 5 and 6. The multimeter should show 18 -22 Ω.

Measurement of engine speed sensor



4. Use a multimeter to measure between pins 3 and 4. The multimeter should show 0.8 – 1.2 kΩ.

Measurement of charge air temperature sensor



1. Undo the charge air temperature sensor connector.

2. Use the multimeter to measure across the two contact pins on the sensor. The multimeter should show the following values at:

60° C	1240 ± 42 Ω
90° C	458 ± 20 Ω
120° C	195 ± 10 Ω

NOTE! The sensor is highly sensitive to temperature changes. It is enough to breathe on it, or hold it in your hand to get an incorrect measurement value.

Electric fault tracing in EDC systems

General information

Before you start electric fault tracing, check the following:

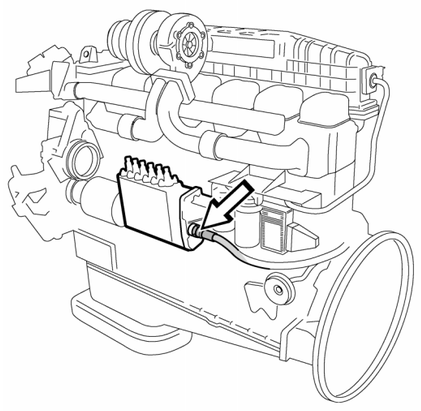
- Fault codes
- Fuel level and filter
- Air filter
- Battery
- Cables (visual)
- Main switch, fuses, connectors
- Relay connections

Electric fault finding can be done on the following components:

- Fuel pump control solenoid, engine speed sensor and position sensor.
- Coolant temperature sensor.
- Charge air temperature sensor.

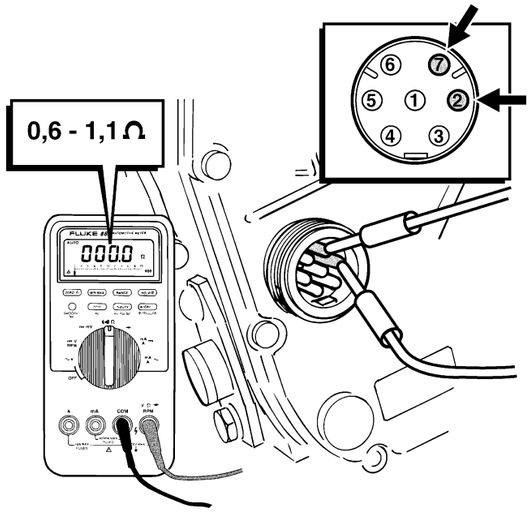
Do all measurements with a multimeter set for resistance measurement.

Measurement of components in the injection pump



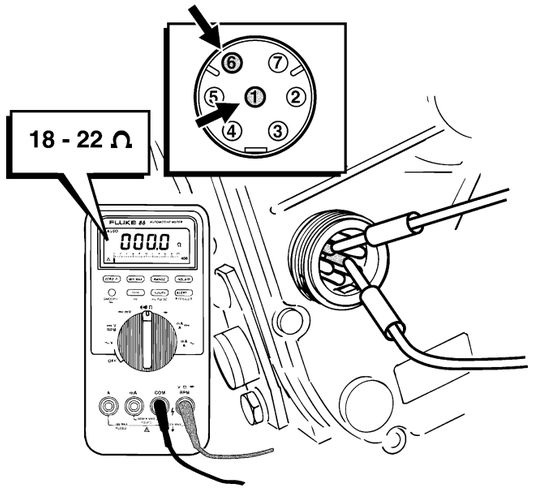
1. Undo the connector on the injection pump acutator.

Measurement of control solenoid



2. Use a multimeter to measure between pins 2 and 7. The multimeter should show 0.6 – 1.1 Ω.

Measurement of position sensor



3a. Use a multimeter to measure between pins 1 and 6. The multimeter should show 18 -22 Ω.

Specifications

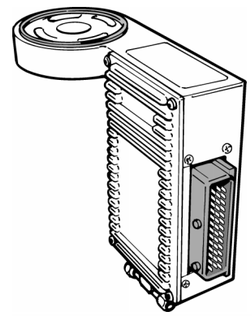
Technical data

The figures in brackets are also found in the “Wiring diagrams“ chapter at the back of this manual and in the “Component description“ chapter.

Control unit, (16)

Voltage ..... 9 – 32 V

Connector 42-poligt

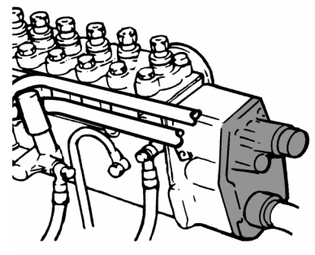


Components in injector pump actuator, (17, 18, 19)

Position sensor ..... inductive type

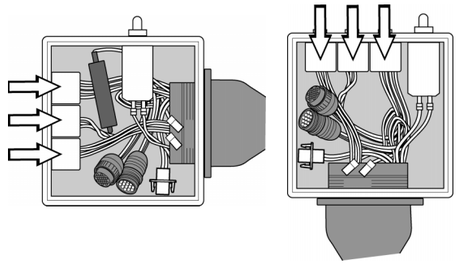
Speed sensor ..... inductive type

Control solenoid ..... inductive type



Relays, (5, 6, 7)

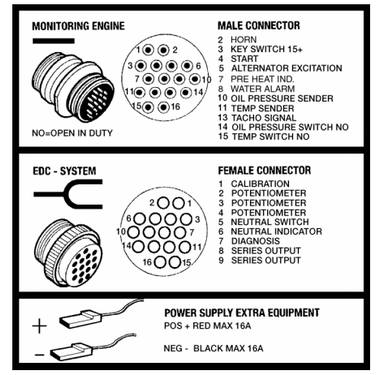
Type ..... Switching, 24 V, 10/20 A



TWD740VE TWD1231VE

Connector (14)

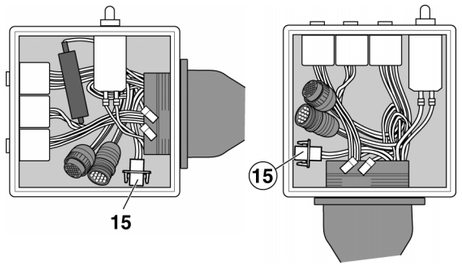
Connector ..... 2 pcs. 16 pin
(please refer to the label on the inside of the junction box)



Test connector, diagnosis (15)

Connector ..... 2 pin

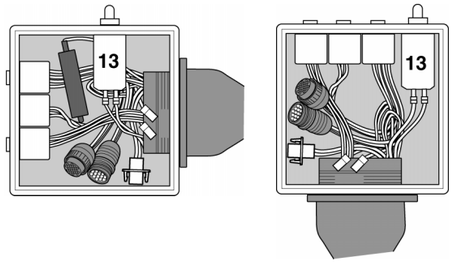
Located in junction box, centrally on one side of the engine.



TWD740VE TWD1231VE

Fuse (13)

Circuit breaker ..... 8 A

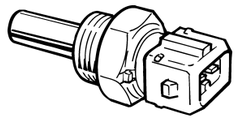


TWD740VE TWD1231VE

Coolant temperature sensor (12)

Type: Thermistor with negative temperature coefficient, so-called NTC resistor.

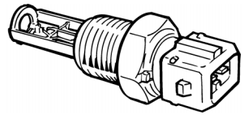
Measurement range ..... –30° C to +120° C



Charge air temperature sensor (21)

Type: Thermistor with negative temperature coefficient, so-called NTC resistor.

Measurement range ..... -40° C to +150° C



Code	Meaning	Reason	Reaction	Action
8.1	Control unit	Faulty internal voltages in the control unit.	–	**Erase fault code.**
8.2	Control unit - internal sensors	Unreasonable values of fuel temperature, charge air pressure or the positive supply voltage inside the control unit is too low.	If the charge air pressure is unreasonable, the system will assume a charge air pressure as a function of engine speed. This can lead to reduced performance and increased exhaust smoke. If the fuel temperature is unreasonable, the system will assume that the fuel temperature is 40°C. If the true temperature is lower, there is a risk of excessive power delivery. Higher true temperature causes somewhat reduced performance.	**Erase fault code.**
8.3	Read/write fault in control calibration.	Internal fault in control unit.	–	**Erase fault code.** Re-calibrate linkage.
8.4 **8.5** **8.6**	Control unit – Storage memory	The control unit suffers read/write faults when reading from/writing to the internal memory.	–	**Erase fault code.**
9.9	Control unit – Program memory	Internal fault in program memory.	–	**Erasing fault code.** Disconnect the EDC system from system voltage for 5 minutes.
Other alarms	Warning lamp on instrument panel for high coolant temperature.	Excessive coolant temperature	If the coolant temperature is too high, the system will reduce the amount of fuel injected until the temperature is normalised	Check the cooling system

Code	Meaning	Reason	Reaction	Action
3.3	Coolant temperature sensor	System receives unreasonable values from coolant temperature sensor	System assumes that engine temperature is 10°C. Can give increased exhaust smoke on starting. **NOTE! Alarm for high coolant temperature does not function.**	Check cables and sensor connector. Check sensor. **Erase fault code.**
3.6	DIAGNOSIS" button (EDC control panel)	Button has been depressed > 2 minutes	–	Check cables and button connections. Check button. Check cables and connections up to control panel. **Erase fault code.**
4.6	Starter motor relay	Short circuit or open circuit in cables / starter relay.	–	Check cables and connections to starter relay in distribution box. Check starter relay. **Erase fault code.**
5.1	Main relay	Short circuit or open circuit in cables / main relay.	–	Check cables and connections to main relay in distribution box. Check main relay.**Erase fault code.**
5.4	Pre-heating relay	Short circuit or open circuit in cables / pre-heating relay.	–	Check cables and connections to pre-heating relay in distribution box. Check main relay. **Erase fault code.**
5.6	Charge air pressure	System receives too high or too low value for charge air pressure.	If the pressure is too high, the system will reduce the amount of fuel injected until the pressure is normalised (turbo protection).	Check the air filter. Check the pressure pipe from the inlet pipe to the control unit. Check the Waste gate valve.**Erase fault code.**
6.1	Fuel temperature	Fuel temperature is too high.	Mass compensation ceases - engine power is reduced.	Reduce fuel temperature. **Erase fault code.** Check the installation.
6.2	Charge air temperature	Charge air temperature is too high.	If the air temperature is too high, the system will reduce the amount of fuel injected until the temperature is normalised (engine protection.)	Check the intercoolers and the engine bay temperature. **Erase fault code.** Check the installation if the engine bay temperature is too high.
6.3	Engine temperature	Engine temperature is too high.	If the engine temperature is too high, the system will reduce the amount of fuel injected until the temperature is normalised (engine protection.)	Check sensor cables. **Erase fault code**. Start the engine.

Design and function

General information

EDC (Electronic Diesel Control) is a system in which the amount of fuel injected is controlled electronically, as distinct from the systems where the injected fuel volume is mechanically controlled.

The main components of an EDC system are a microprocessor based control unit, and electromagnetic actuator and a number of sensors which continually provide the control unit with information.

The EDC system

The injection pump on the TWD740VE and TWD1231VE engines has an electromagnetic actuator. The actuator contains a solenoid which acts on the injection pump control rod, and thus influences the amount of fuel injected.

The EDC system has a built-in smoke limiting function. The system measures charge air pressure and manifold temperature, and thus calculates the amount of air available. The amount of air available determines the maximum permissible amount of fuel injected, in its turn.

In order to achieve the minimum amount of emissions, the system measures the coolant temperature and uses this to determine the amount of preheating and post heating in the engine (please refer to the "Component description" chapter). Curves, Preheating and Post Heating, and correct fuel volume. The system also decides the maximum amount of fuel which can be injected at each engine speed.

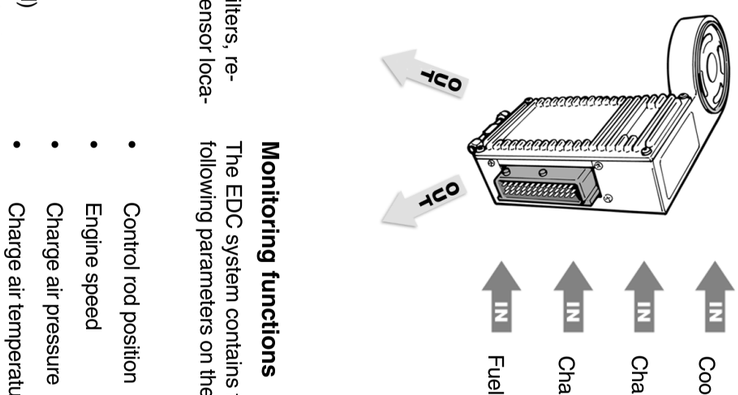
Difference between mechanical and electronic regulator

In an injection pump with a centrifugal regulator, the injection volume is controlled mechanically. The centrifugal regulator is influenced by accelerator position, and compares it with the injector pump speed. The amount of fuel injected is increased or reduced, to make the injection pump turn at the speed corresponding to the accelerator position.

In the EDC system, the centrifugal regulator in the injection pump is replaced by an electromagnetic actuator. The actuator is controlled by the control unit, which takes its information from a number of sensors located on the engine and controls, in its turn.

Injection pumps with a centrifugal regulator are equipped with a smoke limiter, in the form of a pressure-dependent full load stop.

Engines with the EDC system do not have a mechanical smoke limiter. The corresponding function is integrated in the EDC system instead.



EDC system control unit

The control unit, which is built into the fuel filters, receives signals from the following sensors (sensor location is noted in brackets).

- Control rod position (injection pump)
- Engine speed (injection pump)
- Charge air pressure (control unit)
- Charge air temperature (inlet manifold)
- Coolant temperature (thermostat housing)
- Fuel temperature (control unit)
- Accelerator position (driver's foot pedal)

Using these signals, the control unit directs the injection pump to provide the engine with the correct amount of fuel under every loading.

if the above-mentioned sensors give unreasonable values, the system takes various measures to protect the engine and its auxiliaries (e.g. the turbocharger).

To protect the engine if there is excessive charge temperature, coolant temperature, charge air pressure, engine speed, the EDC system reduces the amount of fuel injected (and thus reduces power) until the relevant values return to the permissible interval. The engine must be re-started to get normal power back.

In addition, there are Limp-home values (emergency control parameters) stored in the control unit. These come into action if there are any technical faults in the system or its auxiliaries, sensors etc. Limp-home values are activated to allow the engine to continue in operation, but at reduced performance.

The control unit also contains a diagnosis function, which can help the user/service personnel to quickly find any faults in the system, by using a diagnosis lamp, diagnosis instrument or PC based diagnosis program.

Monitoring functions

The EDC system contains functions for monitoring the following parameters on the engine:

- Control rod position
- Engine speed
- Charge air pressure
- Charge air temperature
- Coolant temperature
- Fuel temperature
- Excess current, (control unit)

If anything abnormal occurs, the control unit generates and stores a code. The diagnosis lamp on the EDC control panel then begins to flash.

The number of flashes given by the diagnosis lamp corresponds to the relevant fault code, which is obtained by pressing the diagnosis button.

Please refer to the "Function checking with diagnosis button" chapter for function checking with the diagnosis button, and fault codes.

EDC fault codes

Code	Meaning	Reason	Reaction	Action
1.1	No fault	Diagnostic function activated	—	—
1.2	Calibration erased	—	Accelerator position does not coincide with engine speed.	If it is the accelerator potentiometer: refer to "Calibrating accelerator linkage", or re-start
1.3	Fault in accelerator linkage during calibration	Too small difference between min and full throttle resistance values.	—	Check fixing of potentiometer in accelerator linkage. **Erase fault code.** Re-calibrate linkage.
2.2	Control rod sensor	Control rod position sensor gives unreasonable values to control unit. Engine stopped by system	Check connections oninjection pump and control unit	**Erase fault code.** Start the engine.
2.3	Control rod actuator	Control rod actuator pulls too much or not enough current. Open circuit in control unit connector (pin 42)	Main relay opens (engine stopped)	Check connections on injection pump and control unit. **Erase fault code.** Start the engine.
2.4	Engine speed sensor or starter relay	Control unit does not receive a signal from the engine speed sensor	Engine does not start.	Check connections on sensor, control unit and starter relay. **Erase fault code.** Start the engine.
2.5	Engine speed sensor	Engine speed sensor gives unreasonable values	Engine stopped by system	Check connections on pump and control unit. **Erase fault code.** Start the engine.
2.6	Accelerator position sensor	System does not receive any information from control potentiometer	Engine runs at a constant 1000 rpm.	Check cables/connections on control potentiometer, and cables and connections up to control panel. **Erase fault code.** Start the engine.
2.7	Accelerator position sensor	Accelerator position sensor gives unreasonable values to control unit	Engine stopped by system	Check connections on sensor and control unit. **Erase fault code.** Start the engine.
3.1	Incorrect frequency	Accelerator position sensor gives unreasonable values to control unit	Engine idles	Check higher-level system on sensor and control unit. **Erase fault code.** Start the engine.
3.2	Charge air temperature sensor	System receives unreasonable values from charge air temperature sensor	System assumes that charge air temperature is 55°C. Can give marginally impaired performance/ increased exhaust smoke.	Check cables and sensor connector. Check sensor. **Erase fault code.**

Function check with diagnosis button

General information

The EDC system has a diagnosis function which indicates whether the system is functioning normally, via a combined button and indication lamp marked DIAGNOSIS.

The EDC system control unit constantly checks system functions. If a technical problem occurs with the EDC system, or if the system gives unreasonable signals, the indication lamp will start to flash.

Reading fault codes

If a fault code occurs, the lamp will start to flash. To read the codes, press the DIAGNOSIS button and keep it depressed for at lesst 1 second.

A two digit fault code will now be given. First a number of flashes to indicate the first figure, then a short pause, and then a number of flashes which indicate the second figure.

Example:
2 flashes – pause – 4 flashes = fault code 2.4, i.e. a fault in the engine speed sensor or starter relay. Please refer to “EDC fault codes“ on the pages below.

When the fault code has stopped flashing, the lamp will go out. Next time the button is pressed, the next fault code will be flashed out. The first fault code will be flashed out again once all fault codes have been read off.

NOTE! If the diagnosis has triggered any action (e.g. stopped the engine), the fault code must be erased before the engine can be started again. Please refer to “Erasing fault codes“ below.

DIAGNOSTIC BUTTON

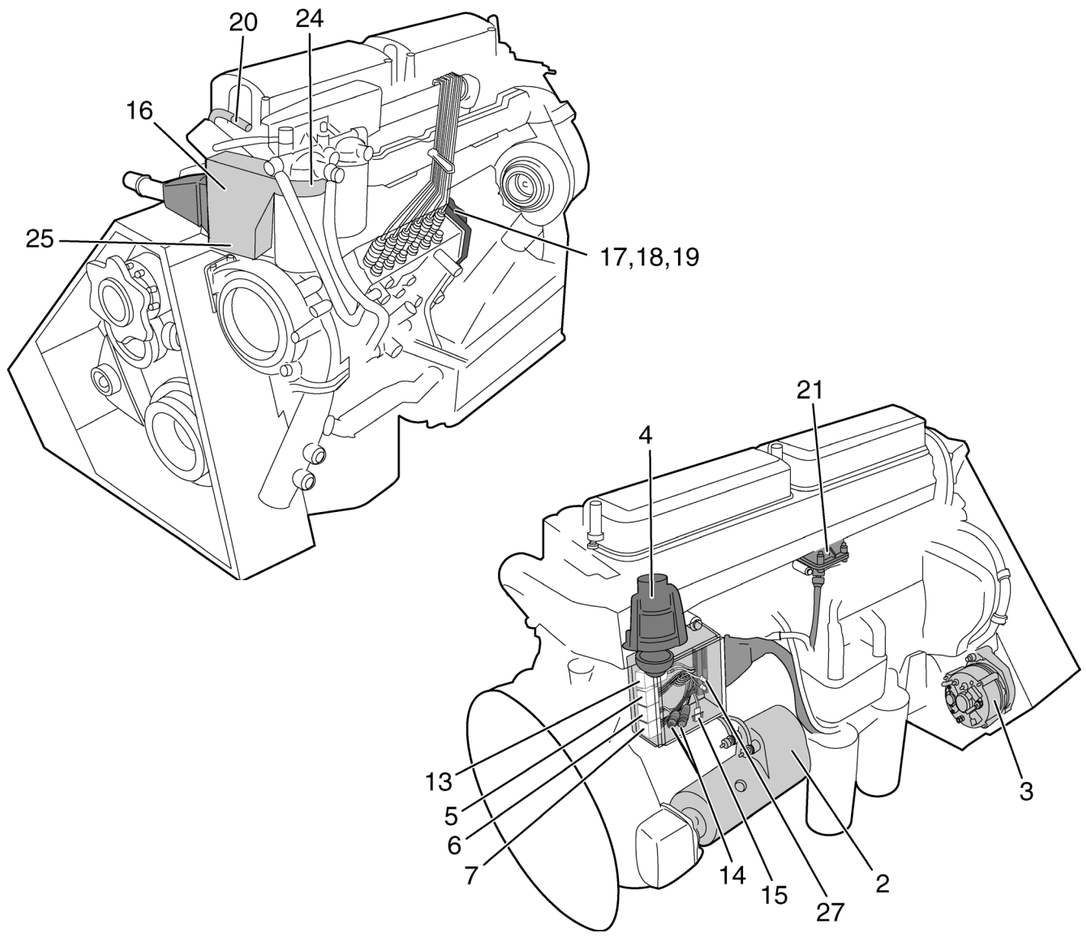
Erasing stored fault codes

1. Turn off the system voltage with the ignition switch.

2. Press the DIAGNOSIS button and keep it depressed at the same time as you switch the system voltage on again with the ignition key. Then keep the switch depressed for a further 3 seconds. The fault codes are now erased.

Component description

TWD740VE

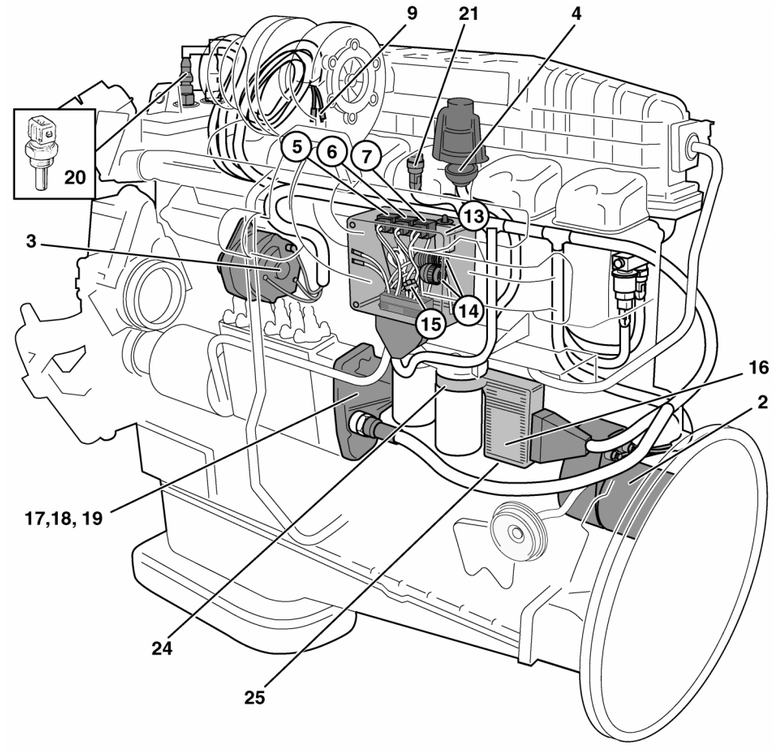


Component list* (Only EDC system)

1. –
2. Starter motor
3. Alternator
4. Pre-heating relay
5. Starter relay
6. Main relay
7. Stop relay
8. –
9. –
10. –
11. –
12. –
13. Circuit breaker
14. 2 pcs. 16 pin connectors
15. Test connector
16. Control unit
17. Control solenoid (located inside actuator)
18. Engine speed sensor (located inside actuator)
19. Control rod position sensor (located inside actuator)
20. Coolant temperature sensor (EDC)
21. Charge air temperature sensor
22. –
23. –
24. Fuel temperature sensor, located in control unit
25. Charge air temperature sensor, located in control unit

* *The positions in the illustration of the EDC system are the same as the positions in the wiring diagram and show where on the engine each component is located.*

TWD1231VE



Component list* (Only EDC system)

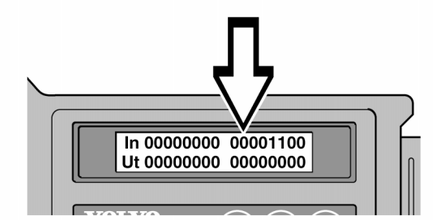
1. –
2. Starter motor
3. Alternator
4. Pre-heating relay
5. Starter relay
6. Main relay
7. Stop relay
8. –
9. Switch for sensor, coolant level
10. –
11. –
12. –
13. Circuit breaker
14. 2 pcs. 16 pin connectors
15. Test connector
16. Control unit
17. Control solenoid (located inside actuator)
18. Engine speed sensor (located inside actuator)
19. Control rod position sensor (located inside actuator)
20. Coolant temperature sensor (EDC)
21. Charge air temperature sensor
22. –
23. –
24. Fuel temperature sensor, located in control unit
25. Charge air temperature sensor, located in control unit

** The positions in the illustration of the EDC system are the same as the positions in the wiring diagram and show where on the engine each component is located.*

A figure one or zero on the **IN** line informs about whether the component has contact with the control unit or not.

Figure 0 = No contact
Figure 1 = Contact

Example 1. If the seventh figure from the right in the upper line is a zero, the preheating function button is disabled.

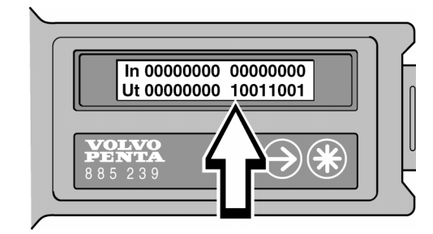


Example 1

A figure one or zero on the **OUT** line informs about whether the component is enabled or not.

Figure 0 = Disabled
Figure 1 = Enabled

Example 2. If the eighth figure from the right in the upper line is a one, the preheating relay is enabled. (Please refer to the illustration, “Example 2“)



Example 2

Engine history, pre-programmed extreme values

Please refer to the “Component description, Control unit“ chapter.

Basic data, engine

- Shows engine specifications, engine number, “data set“ (parameter file) part number, time when it was installed and where, and by whom, it was programmed.

Explanation of Input and Output menu

The Input and Output menu shows the components which supply signals to the control unit and their status, by means of ones and zeroes. Using this menu, faults in the internal function of components or their cables, connected to the control unit, can be identified.

When the Input and Output sub-menu is selected, by pressing the execute button ⊛, two lines of ones and zeroes are displayed, sub-divided into two groups of eight, one line for inputs and one line for outputs.

The figures represent the following components, starting from the right. (Please refer to the “Sub-menus for Inputs and Outputs“ illustration).

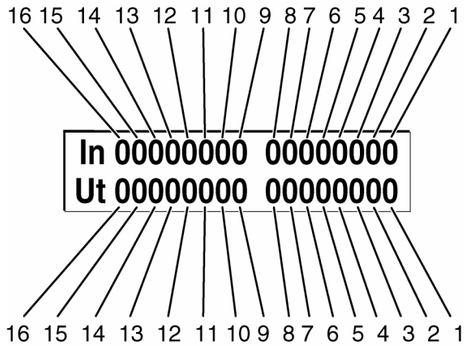
Inputs:

1. Function button, “Calibration“
2. Function button, “Start“
3. Choice of “Regulator mode”
4. Not active
5. Not active (red)
6. Not active (blue)
7. Function button, pre-heating
8. Not active

9–16. Not used.

Outputs:

1. Main relay
2. Starter relay
3. Actuation solenoid, control rod (=1 at working cycle > 0%)
4. Not active
5. Not active
6. Not active
7. Not active
8. Pre-heating relay
9. Lamp for function button, “Regulator mode” (green)
10. Temperature warning – OUT
11. Lamp for function button, “Diagnosis“ (green)
12. Not active (red)
13. Not active (blue)
14. Not active
15. Not active
16. Not active



Sub-menus for Inputs and Outputs

Control unit

Control unit, (16)

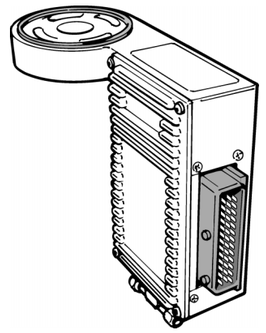
The control unit is located by the fuel filter.

There is a 42 pin sealed connector at the rear of the control unit for connecting the cable harness. The control unit cables are protected by flexible plastic hoses.

A hose connection for measuring the charge pressure is located underneath the control unit.

The control unit, which is the central section of the EDC system, receives continual information from sensors located on the engine and controls. The information is processed by the control unit, which sends signals to the electromagnetic acutator. The actuator then controls the amount of fuel supplied under each loading.

The control unit also has the task of monitoring the system and generating fault codes when any faults occur.



EDC system control unit

Limits for the TWD740VE

Alarm values
Highest permissible values of charge air temperature, coolant temperature etc. If the alarm values are exceeded, the system reduces the fuel value until the value falls within the permissible value again. The engine must be re-started to get normal power back.

The following alarm limits are pre-programmed into the control unit:

Highest permissible charge air temperature ..... 120° C

Highest permissible fuel temperature ..... 85° C

Highest permissible coolant temperature on/off: ..... 101/98° C

Highest permissible engine speed:
175 kW ..... 2800 rpm
203 kW ..... 2600 rpm

Highest permissible frequency ..... 1875 Hz

Lowest permissible frequency ..... 30 Hz

Highest permissible charge pressure, please refer to the **Max** curve in the diagram.

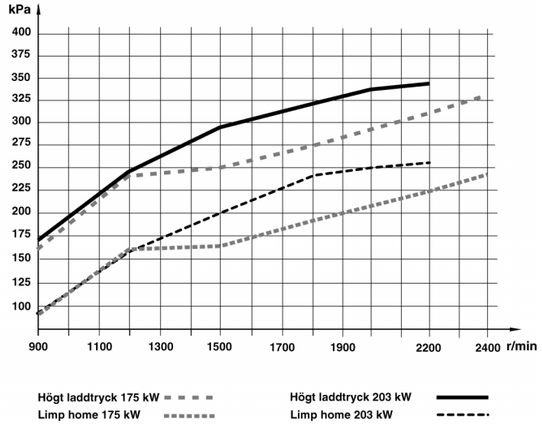


Diagram for charge pressure, TWD740VE
NOTE! Pressure is measured as absolute pressure.

Limp home values (emergency control values)
The basic values are used by the control unit to allow the engine to keep going if there is a technical fault in the system or its auxiliary equipment, sensors etc.

The following values (Limp home values) are stored in the control unit:

Charge air temperature ..... 55° C

Fuel temperature ..... 40° C

Coolant temperature ..... 10° C

Charge air pressure ..... Please refer to the diagram on the previous page

Engine speed ..... 1000 rpm

Extreme values
Highest and lowest values, and the time that an extreme value has been exceeded are stored in the control unit. These values can be read by means of a diagnosis program (please refer to the “Function check with diagnostic program“ chapter)

The following extreme values are pre-programmed into the control unit:

Charge air temperature ..... 110° C

Low charge air temperature ..... 0° C

High fuel temperature ..... 60° C

Low fuel temperature ..... 0° C

High coolant temperature ..... 95° C

Low coolant temperature ..... 5° C

High charge pressure:
175 kW ..... 310 kPa
203 kW ..... 325 kPa

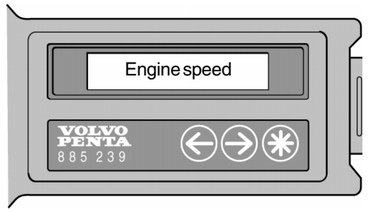
High engine speed:
175 kW ..... 2530 rpm
203 kW ..... 2320 rpm

Menus with sub-menus

- Engine speed (rpm)
  - Engine speed
  - Nominal engine speed
- Control rod
  - Control rod travel (mm)
  - Relative control travel (%)
- Absolute pressure (kPa)
- Temperatures
  - Coolant (°C)
  - Fuel (°C)
  - Charge air (°C)
- Fuel consumption
- nputs/Outputs (Please refer to explanation on next page)
  - In 00000000 00000000
  - Out 00000000 00000000
- Engine history
- Operation time (hours:min:sec)
- Basic data
  - VShows engine specifications, engine number, “data set“ (parameter file) part number, time when it was installed and where, and by whom, it was programmed.
- Relative loading (0–100%)
  - Power developed as a percentage of available power
- Battery voltage (V)
- Pre-heating
  - Pre-heating time
  - Post-heating time
- Accelerator
  - Voltage, engine speed control, input (V)
  - Relative engine speed control, input (%)
  - Frequency (Hz)

Main menu

There are 16 sub-menus to choose from the main menu:



- Engine speed
- Control rod
- Absolute pressure
- Temperatures
- Fuel consumption
- Inputs/Outputs
- Engine history
- Operation time
- Basic data
- Charge pressure
- Relative loading
- Battery voltage
- Pre-heating
- Accelerator
- Fault codes
- Nominal engine speed

Menus are selected with the arrow keys.

Choice of menu and sub-menu

- **Scroll to relevant menu:**
  For next language, press the arrow ⊕
  For previous language, press the arrow ⊕

Each menu has one or several sub-menus. To reach them, press the execute button. ⊕

- **Choice of sub-menu:**
  Press the execute ⊕ button when the correct menu is shown on the display.

When you have selected the engine speed menu, for example, and have pressed the execute button ⊕, the display shows the sub-menu, which is the current engine speed. If the menu contains several sub-menus, these are reached by pressing the arrow keys.

- **Scroll to relevant sub-menu:**
  For next sub-menu, press the arrow key ⊕
- **Display sub-menu:**
  Press the execute button ⊕ and the measurement value is shown constantly on the display.
- **Return to main menu:**
  Press the execute button ⊕ and the next menu is displayed.

Limits for the TWD1231VE

Alarm values

Highest permissible values of charge air temperature, coolant temperature etc. If the alarm values are exceeded, the system reduces the fuel value until the value falls within the permissible value again. The engine must be re-started to get normal power back.

The following alarm limits are pre-programmed into the control unit:

Highest permissible charge air temperature* ..... 150° C

Highest permissible fuel temperature ..... 85° C

Highest permissible coolant temperature on/off ..... 103/96° C

Highest permissible engine speed ..... 2500 rpm

Highest permissible charge pressure, please refer to the **Max** curve in the diagram.

** Agri Boost; 120° C*

Limp home values (emergency control values)

The basic values are used by the control unit to allow the engine to be driven if there is a technical fault in the system or its auxiliary equipment, sensors etc.

The following values (Limp home values) are stored in the control unit:

Charge air temperature ..... 55° C

Fuel temperature ..... 40° C

Coolant temperature ..... 10° C

Charge air pressure .... Please refer to the diagram

Engine speed ..... 1000 rpm

Extreme values

Highest and lowest values, and the time that an extreme value has been exceeded are stored in the control unit. These values can be read by means of a diagnosis program (please refer to the “Function check with diagnostic program“ chapter)

The following extreme values are pre-programmed into the control unit:

Charge air temperature ..... 110° C

Low charge air temperature ..... 0° C

High fuel temperature* ..... 55° C

Low fuel temperature ..... 0° C

High coolant temperature ..... 95° C

Low coolant temperature ..... 5° C

High charge air pressure .... Please refer to the table

High engine speed ..... Please refer to the table

** Agri Boost; 60° C*

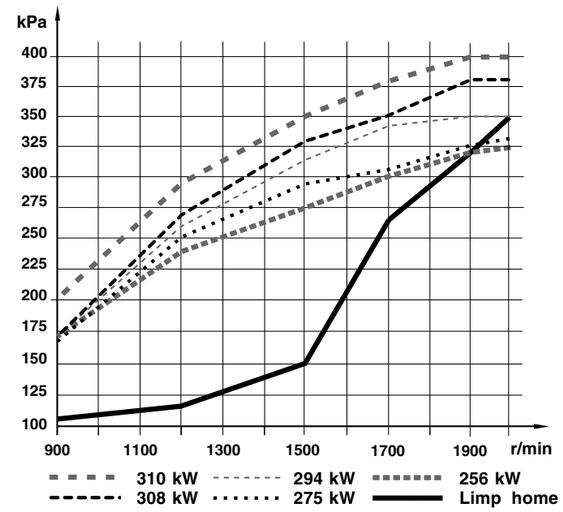


Diagram for charge pressure, TWD1231VE
NOTE! Pressure is measured as absolute pressure.

Engine power (kW)	**256**	**275**	**294**	**308**	**310**
High charge air pressure** (kPa)	295	295	320	325	325
High engine speed (rpm)	2100	2000*	2000	1900	2000*

** Agri Boost; 275/310; 2200 rpm*
*** Absolute pressure*

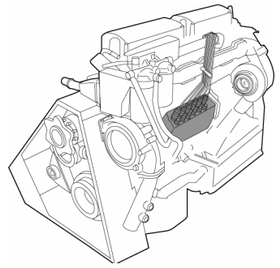
Injection pump, actuator, relay

Injection pump

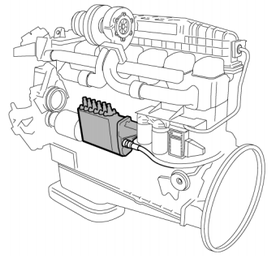
The injection pump is a piston-type unit, located on the left of the engine. It is driven from the timing gear.

TWD740VE and TWD1231VE have an electromagnetic actuator controlled by the control unit.

The engines do not have mechanical smoke limiters. The corresponding function is integrated in the EDC system instead.



Location of injection pump, TWD740VE

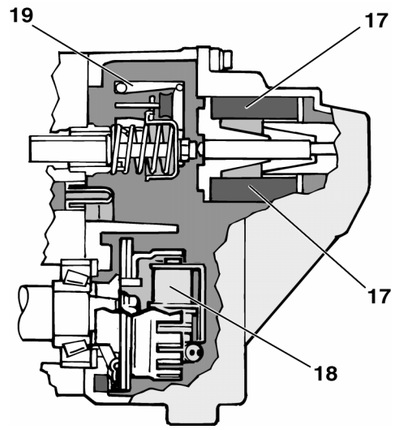


Location of injection pump, TWD1231VE

Actuator, (17, 18, 19)

The acutator is electromagnetic and is controlled by the control unit. It contains the following components:

- **Control solenoid (17)**
  The control magnet is a solenoid, and governs the movement of the control rod.
- **Engine speed sensor (18)**
  The engine speed sensor informs the control unit about engine speed.
- **Position sensor (19)**
  The position sensor informs the control unit about control rod position. This allows the control unit to control the movement of the control rod, and to decide at every instant whether to increase or reduce the control solenoid current.

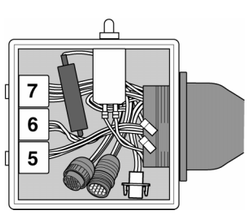


Electromagnetic actuator, EDC

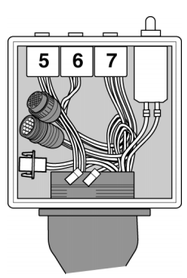
Relays, (5, 6, 7)

The three relays, starter relay (5), main relay (6), and stop relay (7) are located in the junction box. This is located on one side of the engine.

The start and stop functions are controlled by a switching relay each. The three relays are identical, and mutually interchangeable.



TWD740VE



TWD1231VE

Instrument menu functions

The instrument has a number of menus stored in its program section.

The software contains two main sections, *choice of language* and *choice of menu*. The main menu is found under the *choice of menu* section, where the user can get information about current engine speed, coolant temperature, fuel temperature and fuel consumption.

Under the main menu, there are also menu functions which allow you to read about the components connected to the control unit, and their status, for example if the engine has exceeded its pre-set limit values, basic data about the engine and a diagnostic function where the fault codes are explained in plain language.

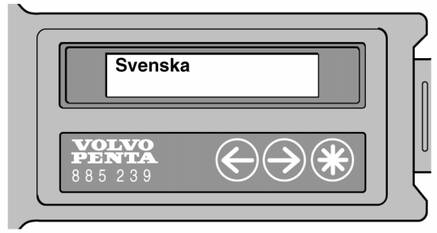
The following instruction summarises all the functions in the instrument.

Menu operation on the instrument

Choice of language

When the instrument is started, choose language:

- **Scroll to relevant language:**
  For next language, press the arrow ⊕
  For previous language, press the arrow ⊖
- **Select relevant language:**
  Press the execute button ✳ when the correct language is shown on the display.



NOTE! When the language has been chosen, the instrument has to be re-started to initialise the new choice of language

When the language has been chose, the next menu is displayed automatically. This is the main menu. The display then shows the first menu underneath the main menu, which is engine speed.

Function check with diagnosis instrument

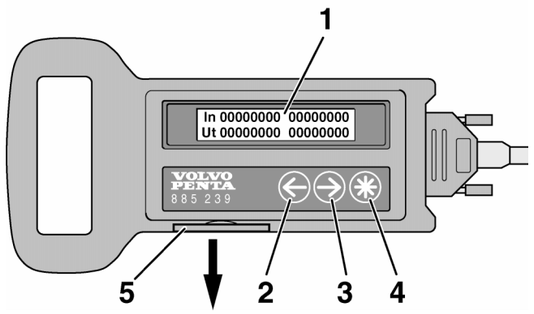
General information

When the control unit receives system voltage, the control unit checks the system. There is a service/diagnostic instrument for the EDC system, to read the results of checks for diagnosis and function checking. The instrument makes it easier to quickly localise and fix any faults in the EDC system.

Diagnosis instrument

The instrument has a window (1) where menus for displaying fault codes, sensor values and input/output signals are displayed. The menus can be supplemented and modified, such as other languages in the menus, by just changing the cassette (5) which contains the instrument software.

There are three buttons under the instrument display, two arrows ⊖ (2) and ⊕ (3) and an Execute button ✳ (4) which corresponds to “Enter“ on a computer.



Service/diagnostic instrument

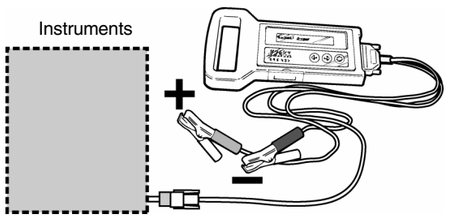
1. Display
2. Arrow key, left
3. Arrow key, right
4. Execute button (“Enter” on a computer)
5. Program cassette (change to change language)

Connection

The instrument is connected to a connector on the instrument panel.

The installer is responsible for ensuring that this connector is wired in.

Connect the red and black clamps on the diagnostic instrument cables to the positive (+) and negative (-) terminals on the engine electrical system, or another power supply (24 V).

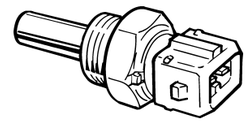


Connection of diagnostic instrument

Sensor, coolant, charge air, fuel temperature and charge air pressure

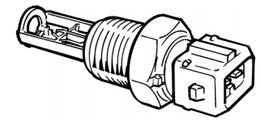
Coolant temperature sensor (12)

The sensor, which is located in the thermostat housing, gives the control unit information about engine coolant temperature. This consists of a non-linear resistor, whose resistance is highly dependent on the temperature of the resistor body. The resistance falls as the temperature rises.



Charge air temperature sensor (20)

The sensor is located underneath the intercooler on the right side of the engine. This consists of a non-linear resistor, whose resistance is highly dependent on the temperature of the resistor body. The resistance falls as the temperature rises.



Fuel temperature sensor (21)

The sensor is located inside the fixing lug on the control unit for the fine fuel filter.

The fuel flows from the filter head, via the fixing lug and on through the filter, back into the system. When the fuel passes the fixing lug, the sensor provides information about current fuel temperature to the control unit. The fuel also cools the control unit to a certain extent.

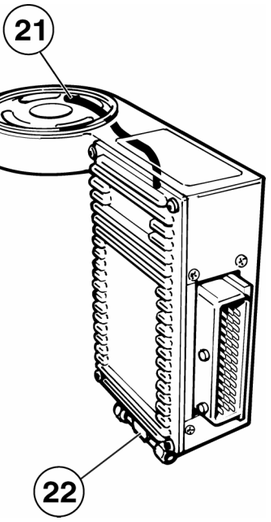
The sensor consists of a non-linear resistor, whose resistance is highly dependent on the temperature of the resistor body. The resistance falls as the temperature rises.

Since the sensor is integrated into the control unit, it can not be replaced separately, the entire control unit must be changed if necessary.

Charge air pressure sensor (22)

The sensor, which is integrated into the control unit, senses the charge air pressure via an air pressure pipe, which is connected between the inlet manifold and the T-nipple underneath the control unit. The sensor measures absolute pressure, which is the sum of charge pressure plus atmospheric pressure.

Since the sensor is integrated into the control unit, it can not be replaced separately, the entire control unit must be changed if necessary.



Diagnostic button, test connection

Diagnostic button

An EDC panel, containing a diagnostic button (yellow), is provided to monitor the EDC system functions. This starts to flash if the EDC system receives abnormal signals or if any technical problem occurs with the system.

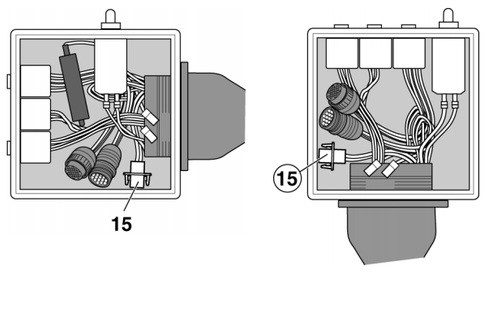
If the engine is to be installed in a vehicle, it is the responsibility of the vehicle constructor to connect a diagnostic button in a suitable location, such as the instrument panel.

NOTE! If the button is depressed when the lamp flashes, the lamp will flash out a two-digit fault code, please refer to the “Function check with diagnostic button“ chapter.

DIAGNOSTIC BUTTON

Test/diagnostic connector (15)

A test/diagnostic connector is available in the junction box. If the engine is installed in a vehicle, a diagnostic button should be installed on the instrument panel etc.



TWD740VE TWD1231VE

Alternator (3)

An alternator with built-in zener diodes **must** be used to protect the electronics. Please contact Volvo Penta when selecting the alternator.

Function check with diagnosis program

The program can read fault codes which have been stored in the engine control unit, check input and output signals, read off current values from engine sensors, store and print out test results.

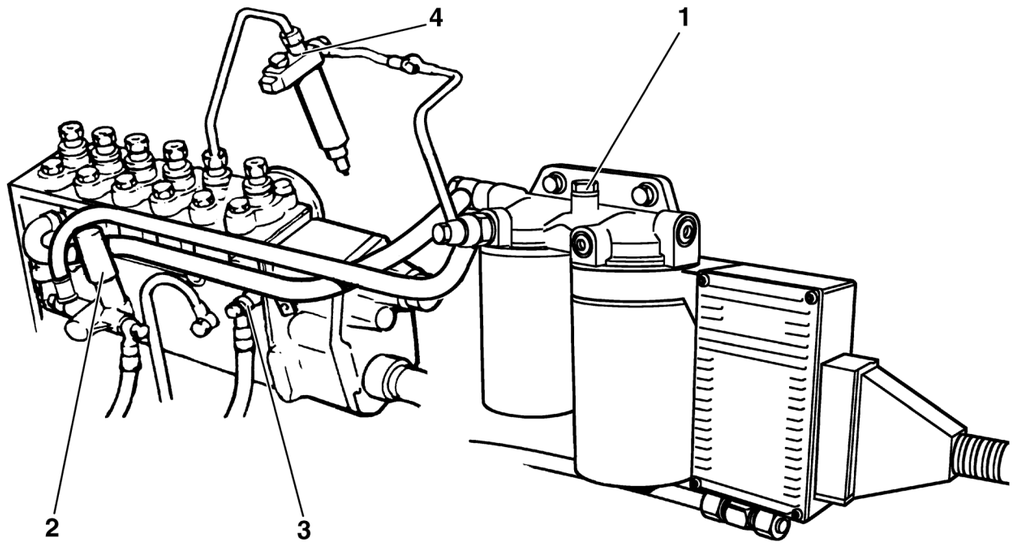
The program allows service and workshop personnel to quickly localise and attend to faults in the EDC system.

It is connected to the engine control unit via a diagnostic connector.

User information is included with the program.

Please refer to “Special tools“ to order the software.

Venting the fuel system



1. Vent screw on filter bracket
2. Hand pump
3. By-pass valve
4. Injector union

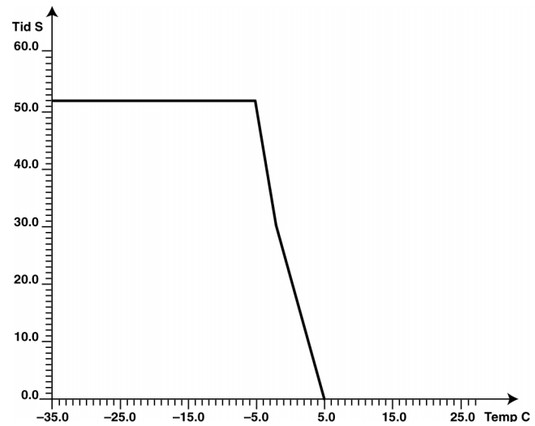
NOTE! The fuel system must be vented after the fuel filter is changed, or after filling the fuel tank when it has been run dry.

1. Put a suitable vessel underneath the fuel filter. Open the vent screw (1) on the filter bracket.
2. Pump up fuel with the hand pump on the supply pump (2) until fuel flows out, free from bubbles. Tighten the vent screw while fuel is flowing out.
3. Pump another 10 to 20 strokes with the vent screw closed, to build up a suitable supply pressure. Further venting is not normally needed.
4. If the injection pump still needs to be vented, loosen the connection for the by-pass valve (3) at the pump (the pump can also be vented by loosening the unions at the injectors (4)) until air-free fuel flows out. Tighten the unions while fuel is flowing out. Pump another 10 to 20 strokes, to build up a suitable supply pressure.
5. Start the engine and check carefully that no leakage occurs.

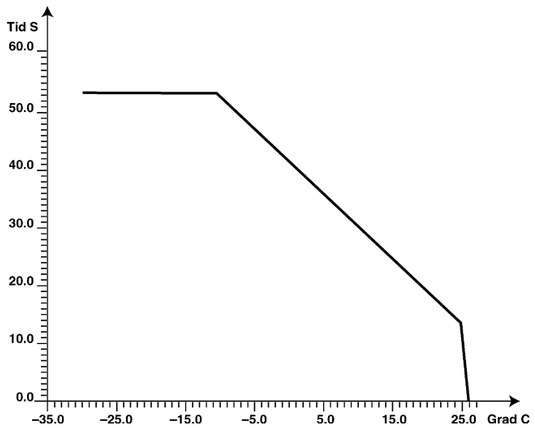
Signals to engine

Pre-heating and post heating time

The EDC system is equipped with software to control pre-heating of the engine before starting, and subsequent warming up of the engine after starting. Please refer to the “Operating an engine with EDC system, starting and stopping“ chapter.



TWD740VE

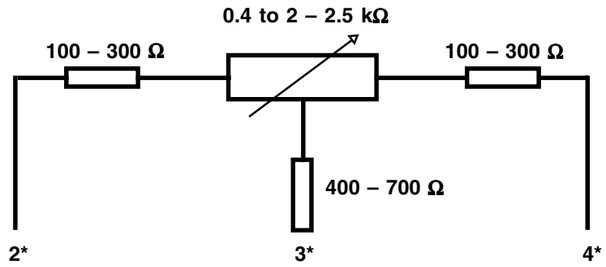


TWD1231VE

Input signals

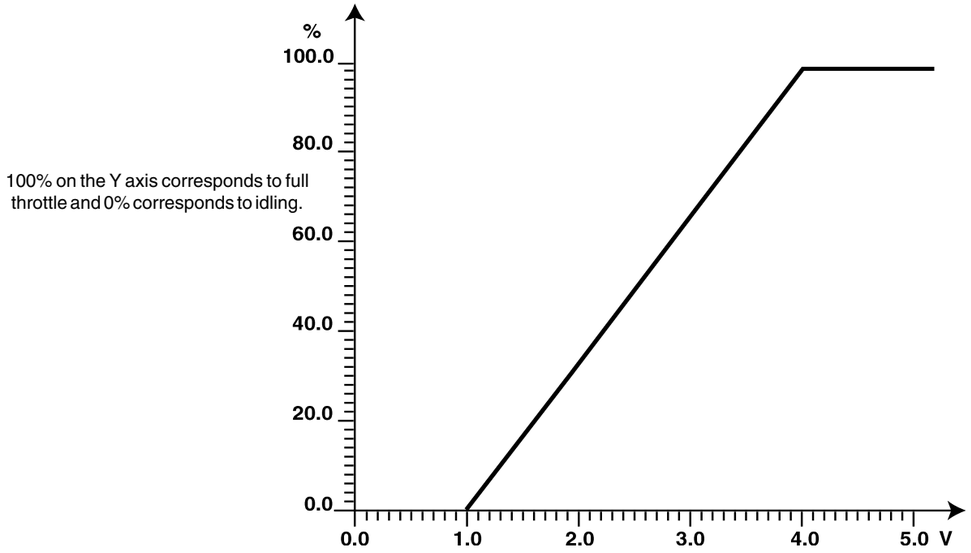
There are three ways to control engine speed:

- Accelerator potentiometer: 0.4 to 2–2.5 kΩ (The potentiometer must not go below 400 Ω). Must be calibrated, please refer to the “Calibrating the accelerator“ chapter.



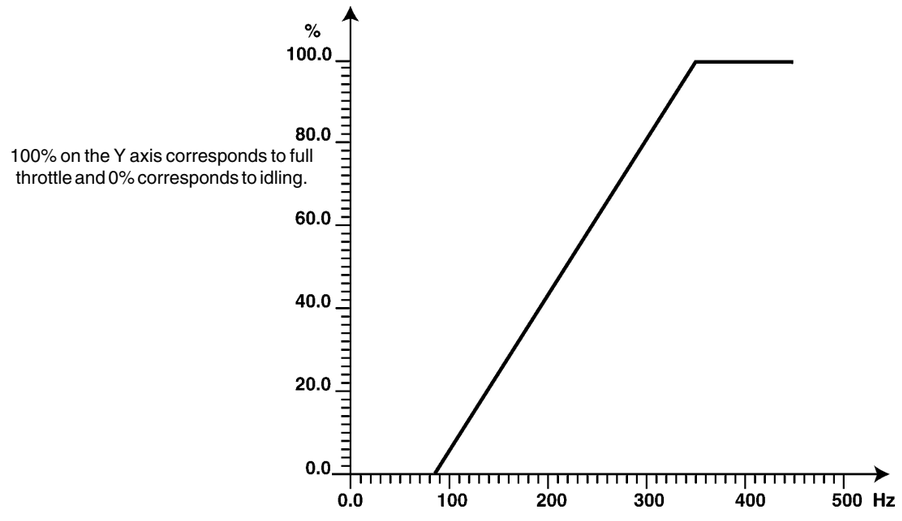
** According to the engine connector on the higher-level cable electrical system, please refer to the “Wiring diagrams“ chapter.*

- Voltage. Pins 3 and 4 on the connector (item 17) in the higher-level cable electrical system, please refer to the “Wiring diagrams“ chapter

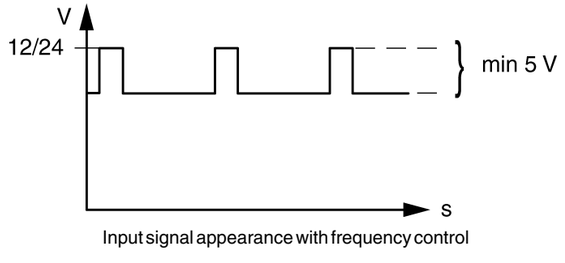


Voltage control. 0.8 V corresponds to idling and 2.8 V corresponds to full throttle.

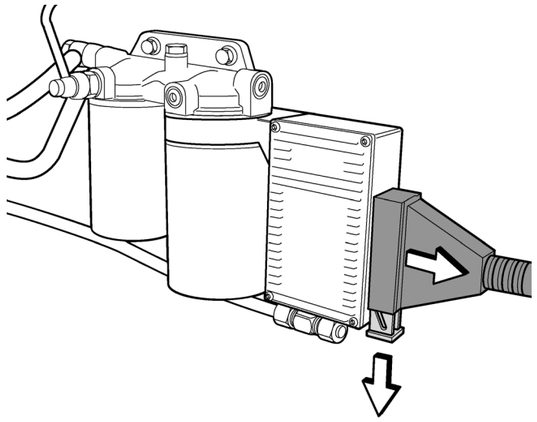
- Frequency. “PWMIN” on the engine wiring diagram, please refer to the “Wiring diagram” chapter.

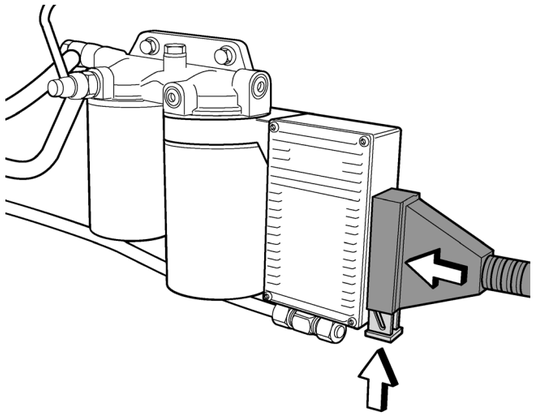


Frequency control. 85 Hz corresponds to idling and 350 Hz corresponds to full throttle.

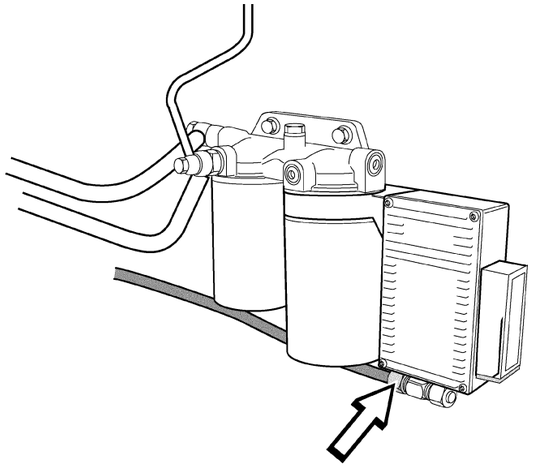


Input signal appearance with frequency control





3. Pull the catch arm down at the same time as you pull the connector back.



4. Undo the charge air pipe from the T-nipple underneath the control unit.
   NOTE! Do **not** unto the T-nipple from the control unit.

5. Unscrew the rear fuel filter. Use special tool 999 91796 for removal if necessary.
   NOTE! Be careful not to spill fuel.

6. Remove the control unit gland underneath the fixing lug, use a 27 mm spanner.

7. Remove the control unit.

8. Install the new control unit.
   Tightening torque: 38 ± 6 Nm

9. Connect the connector and charge air pipe. Check that the control unit and connector are clean before assembly. This is to avoid contact problems.
   NOTE! When you connect the connector, press it forwards towards the control unit at the same time as you press the red catch arm upwards. This is important, to avoid damaging the contact pins.

10. Check that the filter is absolutely clean and that the filter gasket is undamaged. Moisten the fuel filter gasket with oil.

11. Screw down the fuel filter by hand, until the gasket just touches the bracket. Then turn it another **half turn** by hand

12. Vent the fuel system, please refer to the “Venting the fuel system“ chapter.

13. Start the engine, check functioning, and check that no leakage occurs.

Repair instructions

General advice on working with EDC

NOTE! The figures in the repair instructions below apply to the TWD1231VE, but the principles are the same for the TWD740VE.

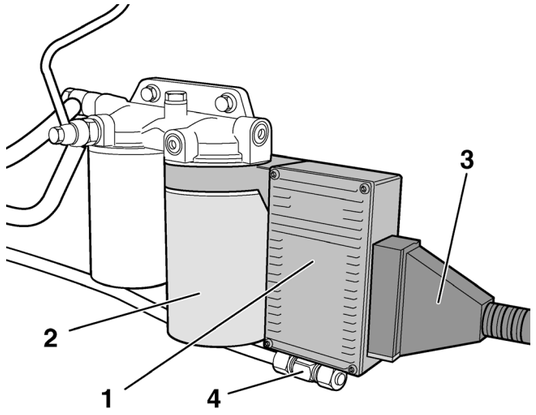
Follow the instructions below, to avoid damage to the EDC system control unit.

- Never turn off the main switch when the engine is running.
- Never undo the battery cables when the engine is running.
- When the batteries are quick charged, turn the main switch off or undo the battery cables. During normal maintenance charging, the main switch does not need to be turned off.
- Only batteries may be used for start help. Quick starting units can give excess voltages and damage the control unit.
- Disconnect the main switch before undoing the 42 pin connector on the control unit.
- If you discover any damage on the cable harnesses, undo the connector on the control unit.

⚠ **IMPORTANT!** Always undo the connector on the control unit before doing any welding.

- When a connector is undone from a sensor, be careful to ensure that the connector pins are not exposed to oil or other fluids. This can cause contact problems.

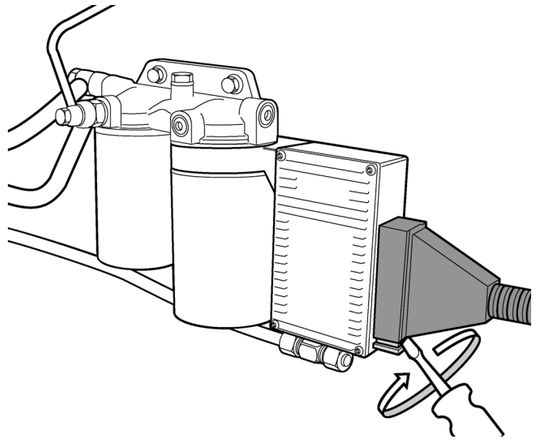
Changing the control unit



1. Control unit
2. Fuel fine filter
3. Connector
4. Hose connector, charge pressure

Control unit with connectors

1. Clean the filter bracket carefully.



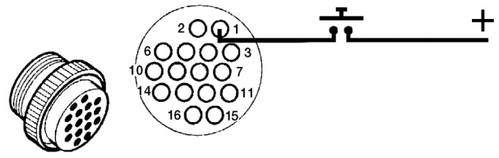
2. Remove the control unit connector, by inserting a screwdriver **between** the red catch arm and the connector. Turn the screwdriver to partly pull the catch arm out of the connector.

Calibration of accelerator linkage

Calibration of EDC unit

The engine must be calibrated when controlled by the accelerator potentiometer.

When calibrating, it is a good idea to install a switch (1) between pin 2 in the “Female Connector“ in the junction box, and the positive battery terminal, as in the adjacent sketch. The voltage can also be taken from the positive (+) terminal in the junction box, or from the battery. The switch should be spring biased and “normally open“.



Female Connector

Calibration

1. Set the accelerator to idling.
2. Erase any fault codes (please refer to the “Function checking with diagnosis button“ chapter).
3. Switch off system voltage.
4. Press switch (1). Keep the switch depressed and switch the current on. Then keep the switch depressed for a further 3 seconds.
5. Release the switch. The diagnosis lamp should now flash, as a confirmation that the EDC system is in calibration mode.
6. Move the accelerator to full throttle position. Keep the control in this position. Acknowledge by pressing the switch for at least 3 seconds.
7. Move the accelerator to idling position. Keep the control in this position. Acknowledge by pressing switch (1) for at least three seconds.
8. Finish calibrating by pressing the switch again. The diagnosis lamp will stop flashing and calibration is completed.

DIAGNOSTIC BUTTON

Idling adjustment

Idling speed is adjusted to 600 rpm when the engine is delivered. If necessary, the idling speed can be adjusted in the range from 550-1000 rpm (TWD740VE) and 550-900 rpm (TWD1231VE).

NOTE! Adjustment must be done on a warm engine.

1. Enter calibration mode as in items 1-5.

2. Start the engine. You can now adjust the idling speed with the accelerator, within the engine speed range as above. (This area is equal to the working range of the control.)

3. Set the desired engine speed and press the switch.
   Idling speed is now stored in the control unit memory.

Operation of engines with the EDC system

Starting the engine

The EDC system is equipped with software for controlling the way the engine is warmed up before starting, and for continued warming after starting, in accordance with the diagram in the “Signals to engine“ chapter.

When the start button is pressed, pre-heating of the engine starts, and then a start attempt is done for up to 30 seconds. When the engine has started, post-heating starts, in accordance with the diagram in the “Signals to engine“ chapter.

To start the engine at once (i.e. without pre-heating) press the start button twice, then keep it depressed during the start attempt.

The amount of fuel supplied during starting is determined by the coolant temperature.

NOTE! Engines with EDC need to be cranked longer by the start motor than equivalent engines with mechanical injection. This is because the EDC system pre-heats the combustion chambers during starting, to reduce exhaust emissions.

Stopping the engine

Engines with the EDC system are provided with electronic engine shut-off. To stop the engine, press the stop button, and the current will be cut and the engine will be stopped by the stop relay.

Do not use the main switch, since transients can be generated by the alternator.
This could permanently damage the alternator and control unit.