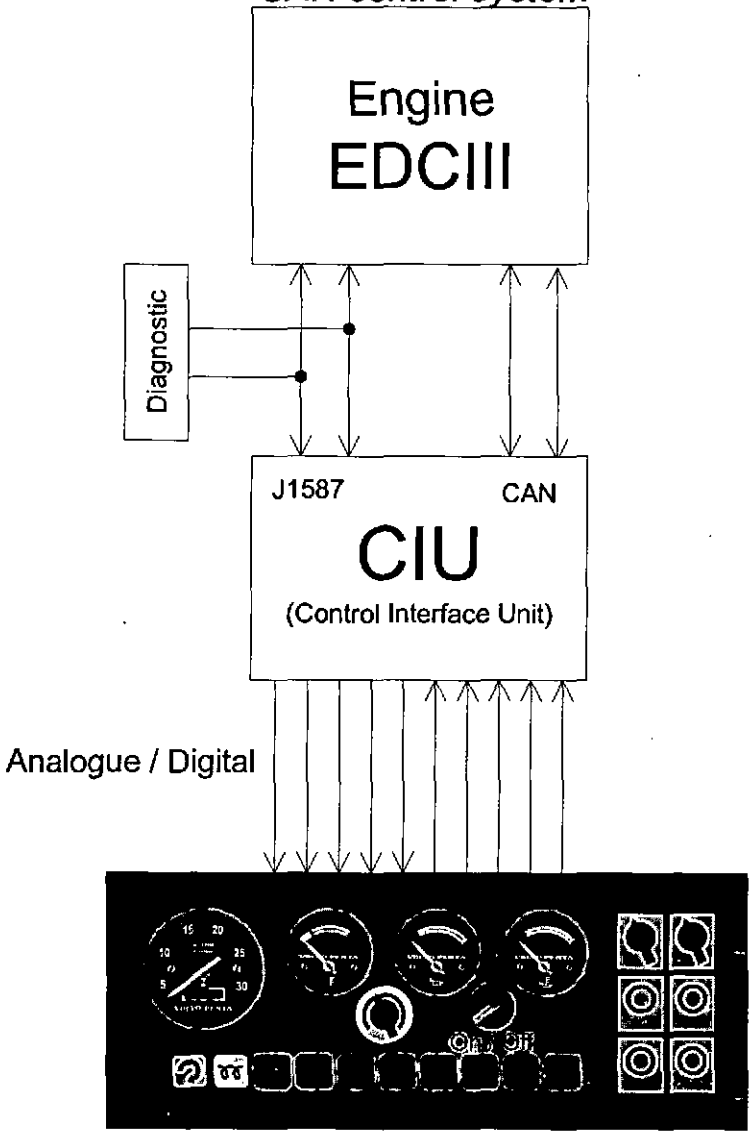
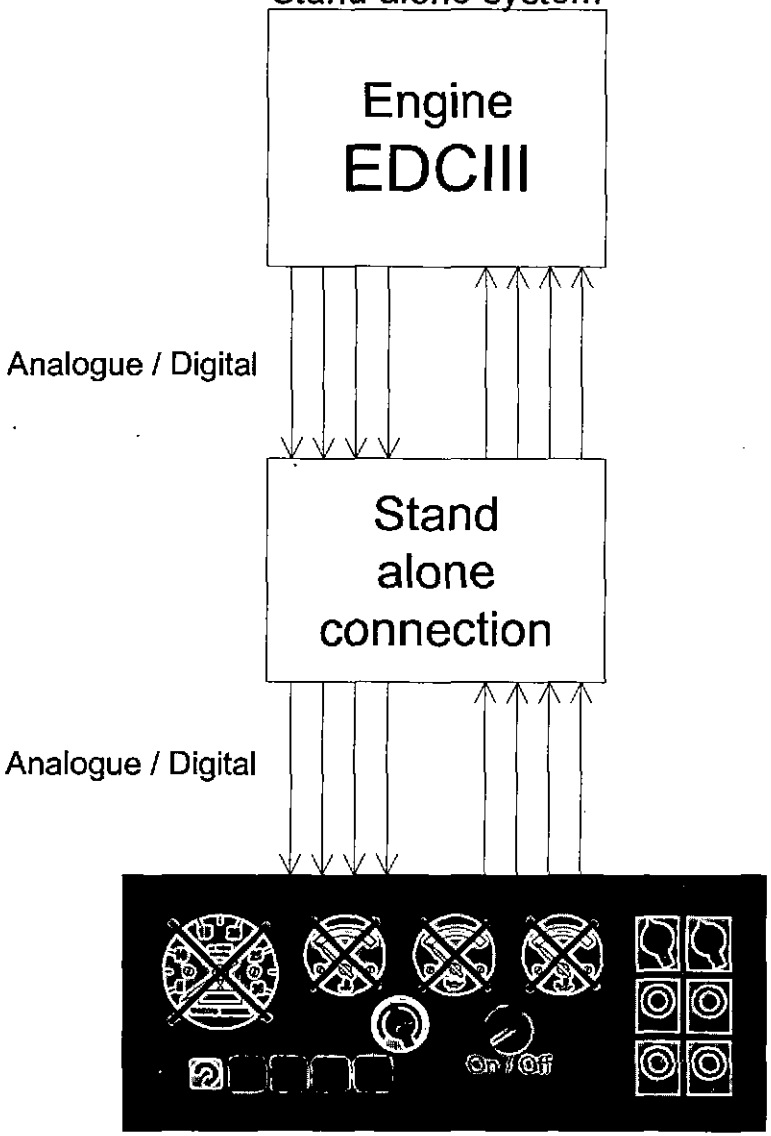
Industrial D12

CAN control system



Stand alone system

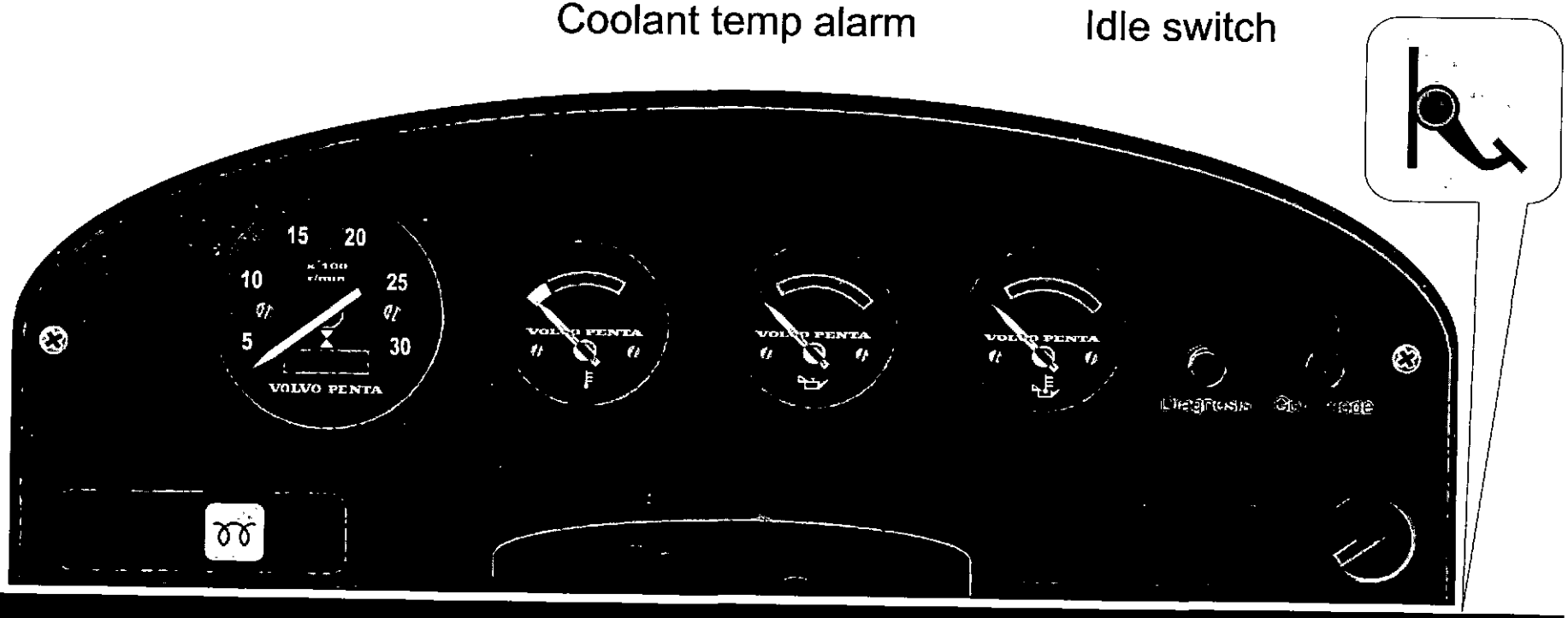


All Speed (TWD1240VE) - control system

Instruments:
Tachometer
Coolant temp.
Oil pressure
Oil temp.

Alarm / indications:
Coolant level alarm
Fuel alarm
Pre-heat indication
Diagnostic lamp
Charge lamp
Oil pressure lamp
Oil temp alarm
Coolant temp alarm

Buttons / speed control:
Diagnosis request
Pre-heat request
Start
Stop
Governor mode
Speed control
Idle switch

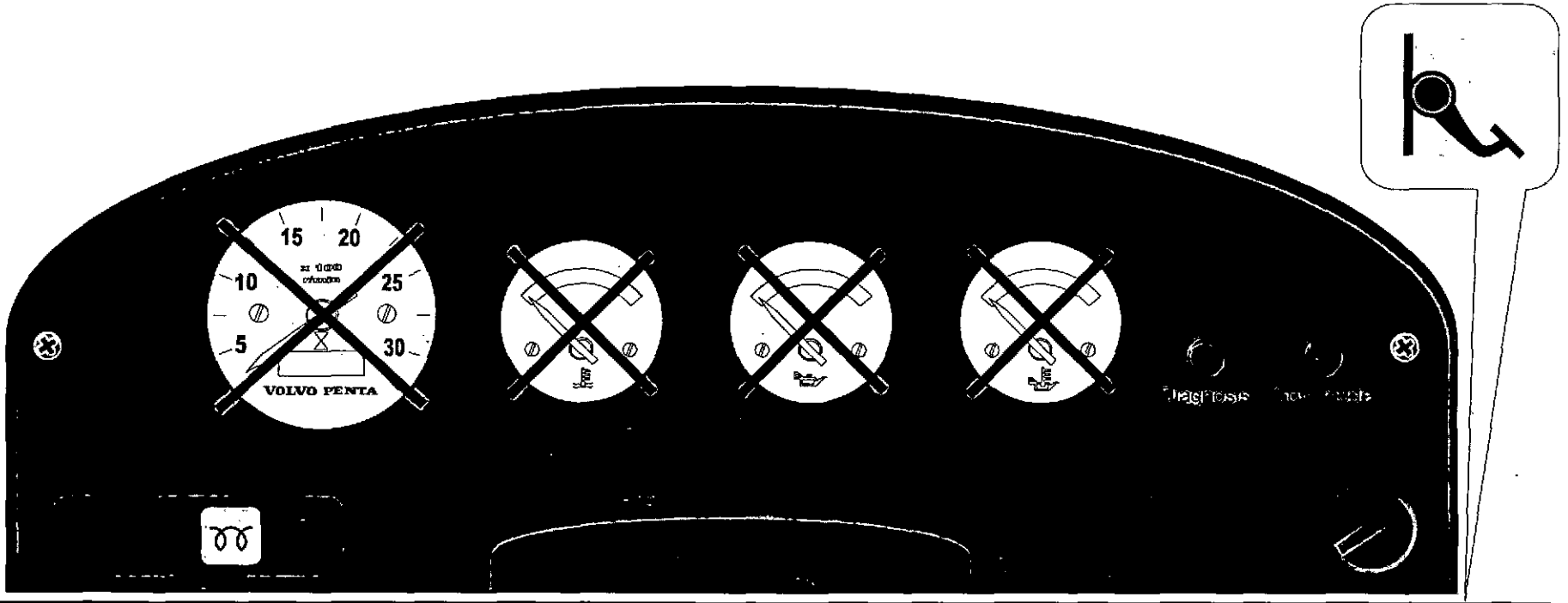


All Speed (TWD1240VE) - stand alone system

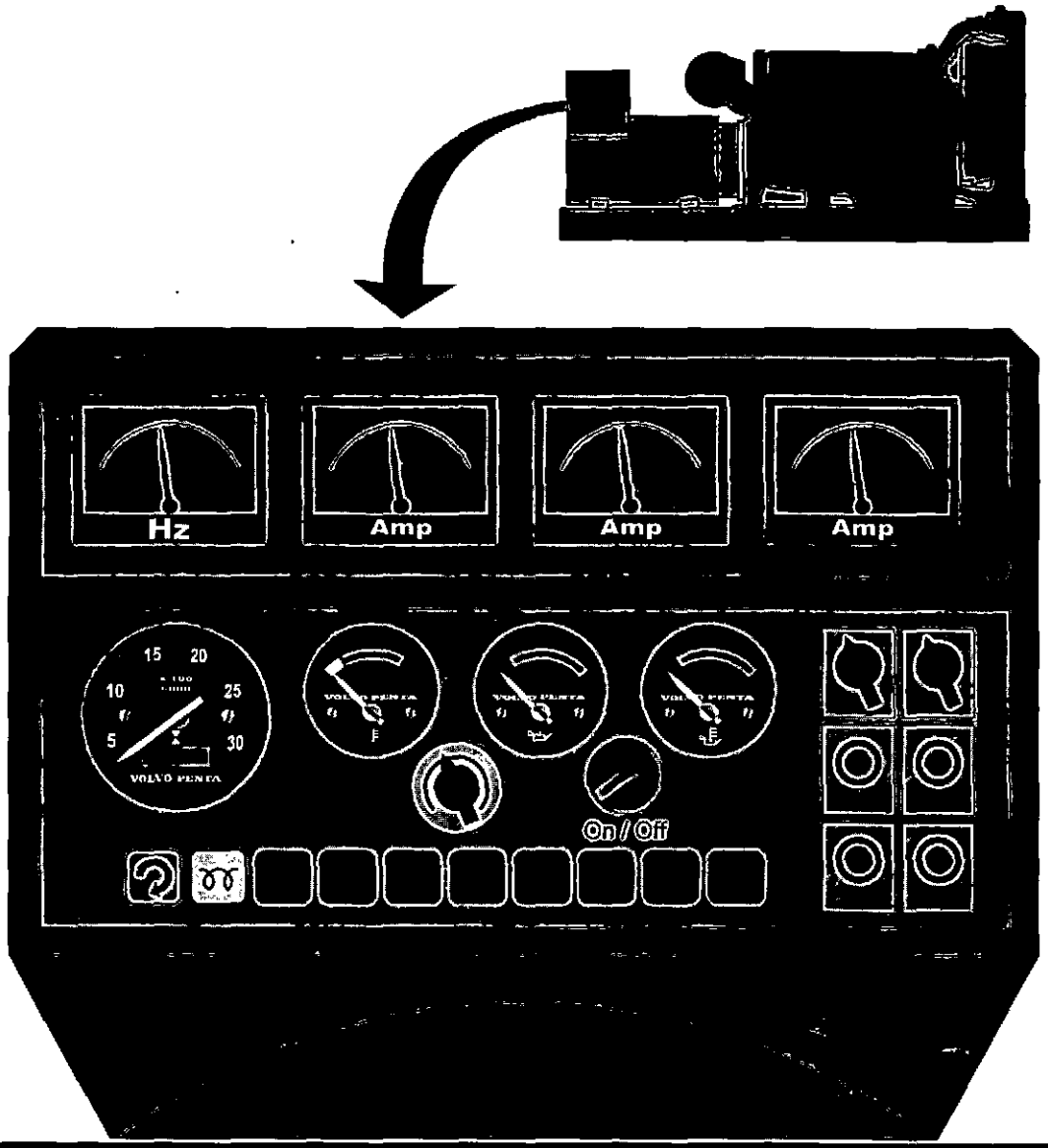
Instruments:
Not included in the "stand alone" interface

Alarm / indications:
Coolant level alarm
Pre-heat indication
Diagnostic lamp
Oil pressure lamp
Coolant temp alarm

Buttons / speed control:
Diagnosis request
Pre-heat /Start
Stop
Governor mode
Speed control
Idle switch



GenSet (TAD1240GE) - control system

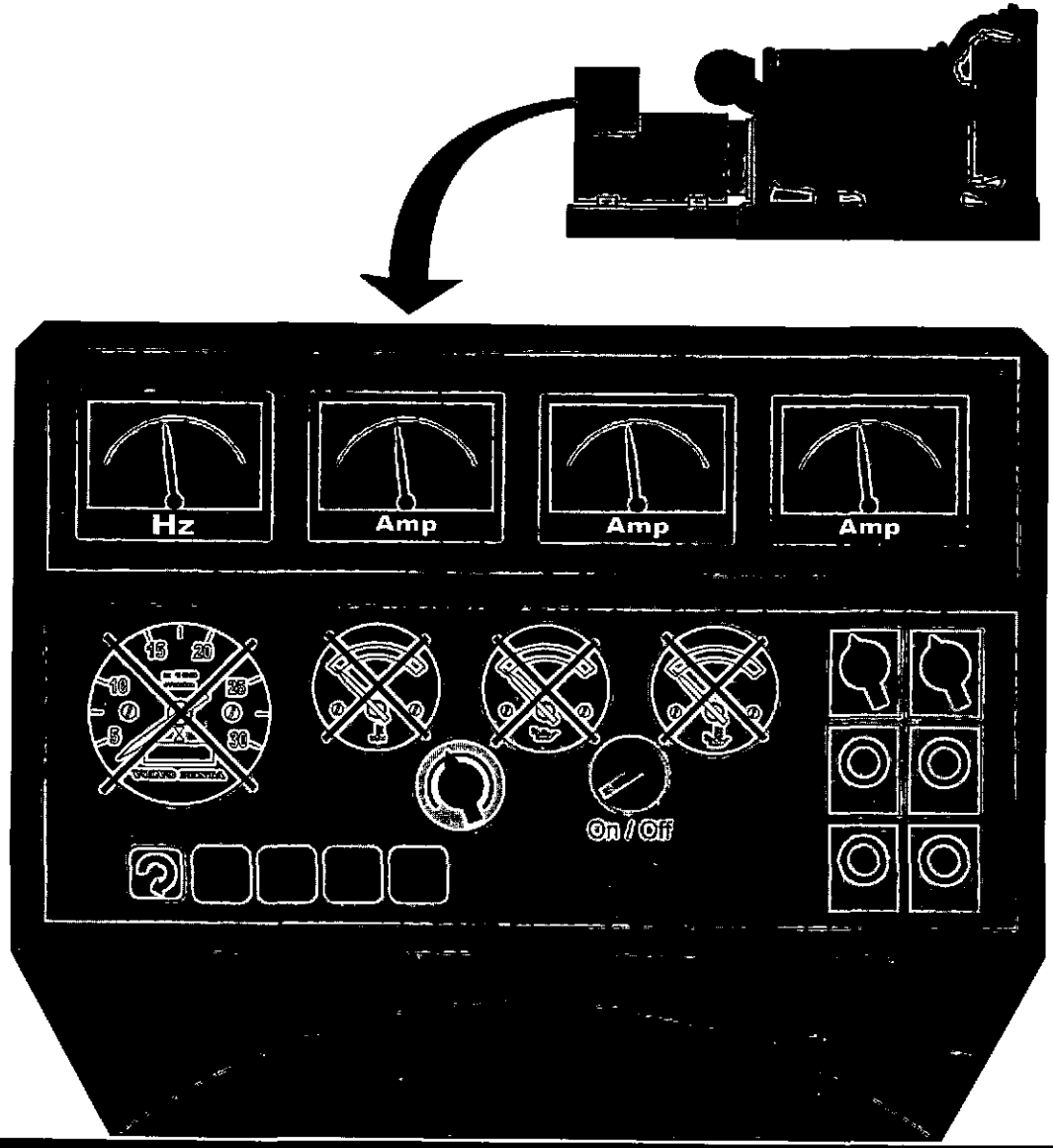


Instruments:
- Tachometer
- Coolant temp.
- Oil pressure
- Oil temp.

Alarm / indications:
- Run indication
- Pre-heat indication
- Coolant temp alarm
- Oil pressure lamp
- Oil temp alarm
- Coolant level alarm
- Water in fuel alarm
- Charge lamp
- Overspeed indication
- Diagnostic lamp

Buttons / : speed control
- Diagnosis request
- Pre-heat request
- 1500 / 1800 RPM
- Idle speed select
- Start / Stop
- Speed adjust

GenSet (TAD1240GE) - stand alone system

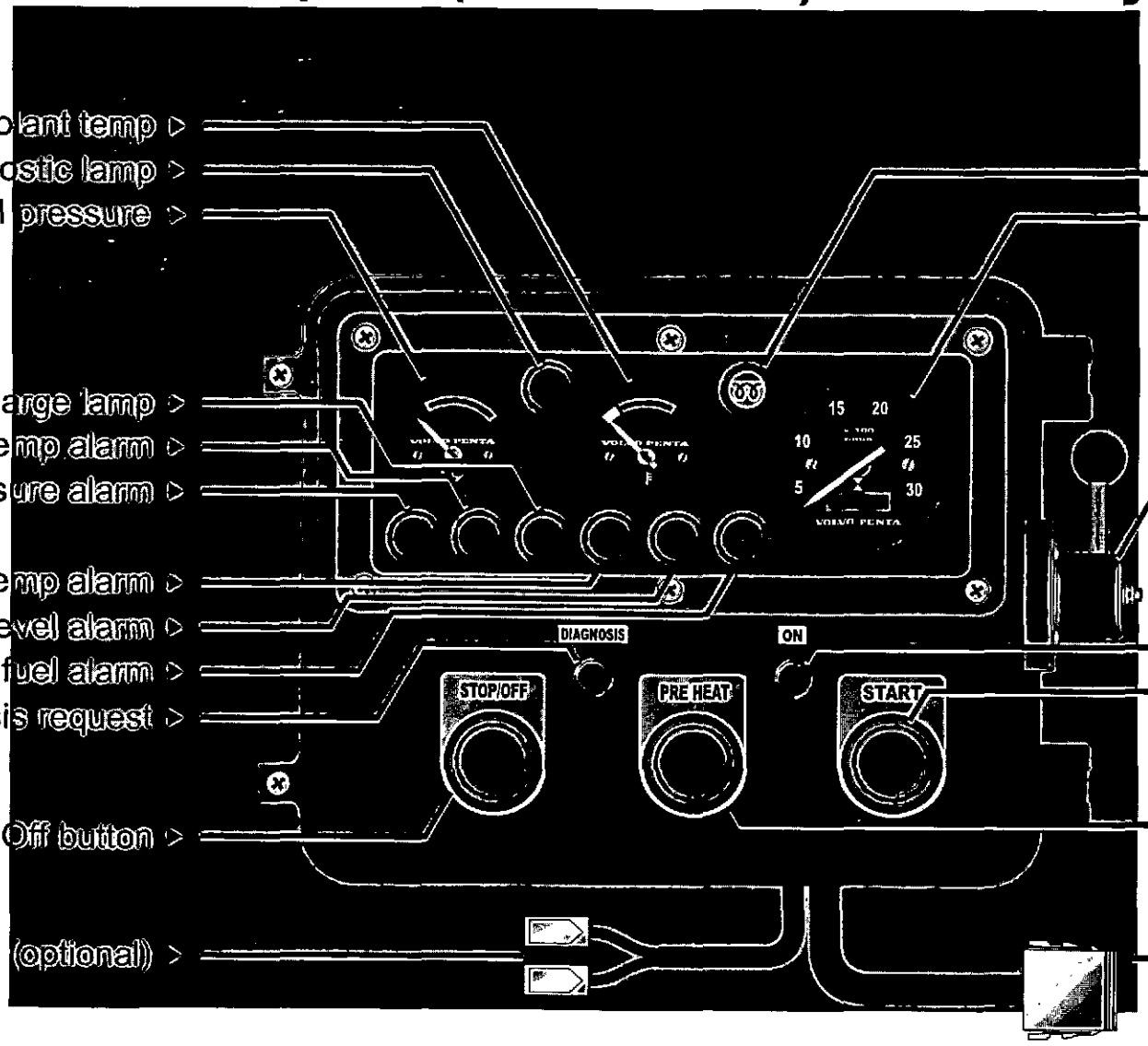


Instruments: Not included in the "stand alone" interface

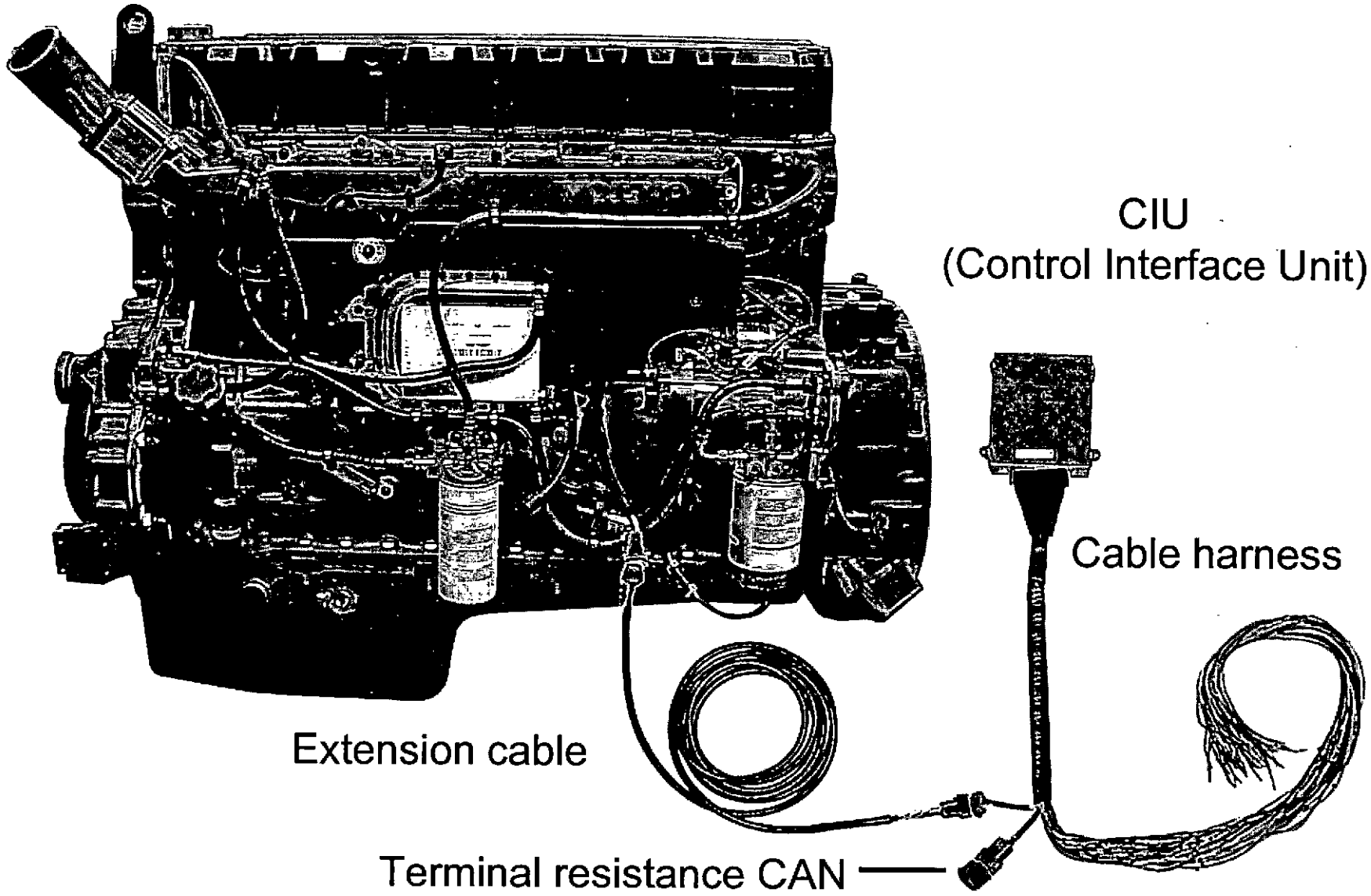
Alarm / indications:
- Run indication
- Coolant temp alarm
- Oil pressure lamp
- Overspeed indication
- Diagnostic lamp

Buttons / : speed control
- Diagnosis request
- Pre-heat / start
- 1500 / 1800 RPM
- Idle speed select
- Stop
- Speed adjust

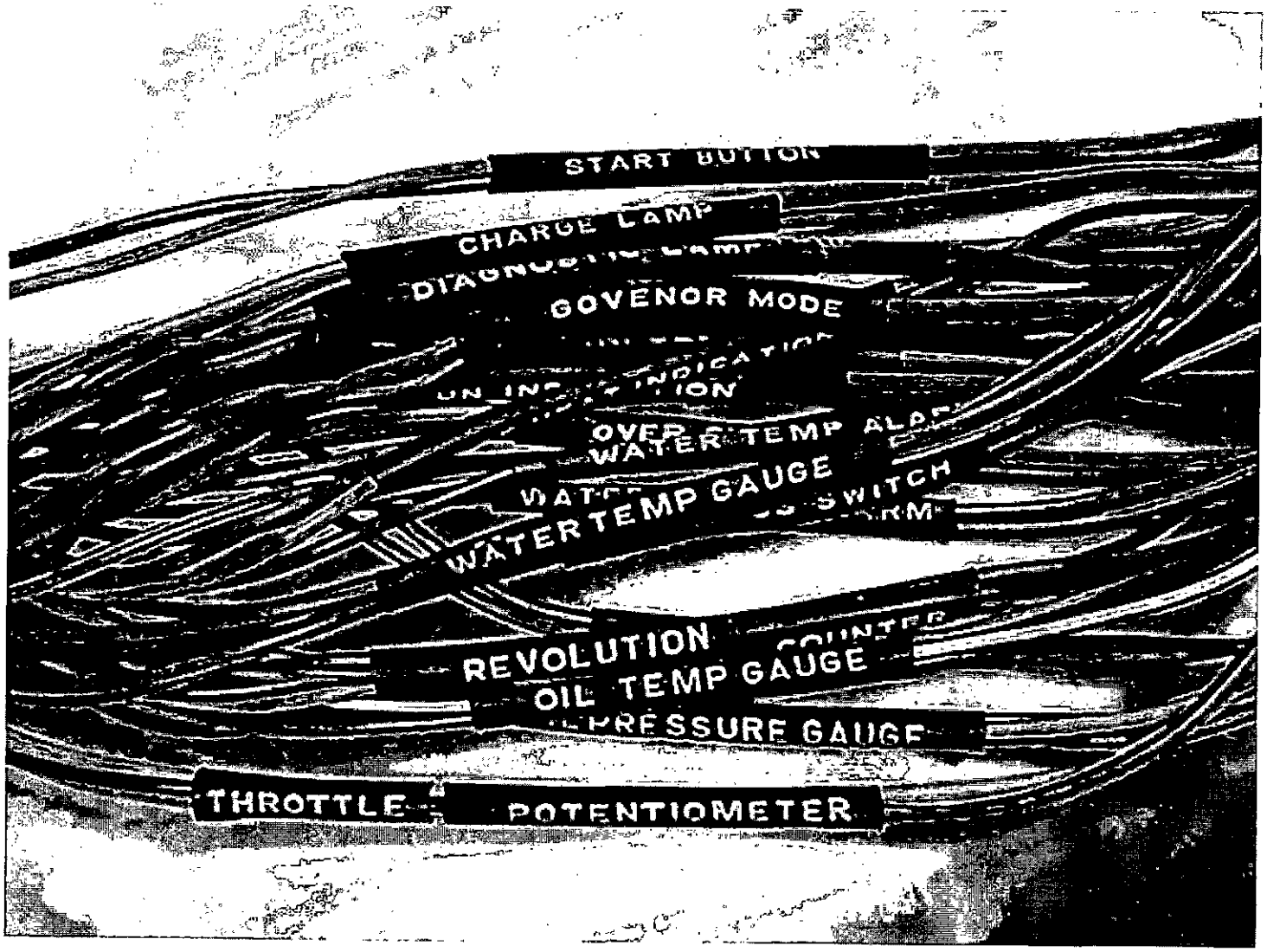
Powerpack (TAD1240VE) - control system



Control system



Customer interface



Utgåva Issue	Bildkort Micro v. card	Denna ritning är Volvo Pentas egendom, skyddad enligt gällande lag. This drawing is the property of Volvo Penta, protected in accordance with prevailing law.					
		Ändringsorder Engineering Change Notice	Datum Date	Blad Sheet	Ändring Engineering Change	Sign Sign	Granskad Checked
01			2000-12-04		Initial issue.	AJ	

VOLVO PENTA

TEKNISK BESTÄMMELSE/ TECHNICAL REGULATION

Benämning/Name

Interface specification for TAD124xGE

Prins id

Avdelning/Department		Model/Project		Grupp/Group			
47410		1057		3800			
Sign Date	Ritad/Drawn AJ 2000-12-04	Godk/Approved	Granskad/Checked	Godk/Appr prod	Blad/Sheet 1(20)	Ritning nr/Drawing No 874423	Utgåva/Issue 1

WPTR-01

CONTENTS

1. Overview

Volvo Penta has developed a new family of engines that are a bit different electrically than previous engines from Volvo Penta. These engines are equipped with a CAN-interface and a stand-alone interface. It is up to the customer to decide which way of interfacing that suite his application best. The engine will identify which interface that is used automatically.

This document contains the needed information of how to interface electrically to an engine in the Volvo Penta TAD124xGE-family.

2. Terminology

System reset
A system reset is used get rid of error codes due to installation problems. For example a warninglamp that has been connected wrongly to the stand-alone interface will cause an error code if it is removed when the power supply is on. This error code will be reset using a system reset and the lamp will be identified in its right function.
The identification of the system configuration is reset when a system reset is done and a new configuration is saved.

A system reset is carried out by activating the diagnosis switch before the ignition is turned on and keeping it active a couple of second after the ignition have been turned on. The engine is now in system reset mode. To end the system reset the key shall then be turned to stop position.

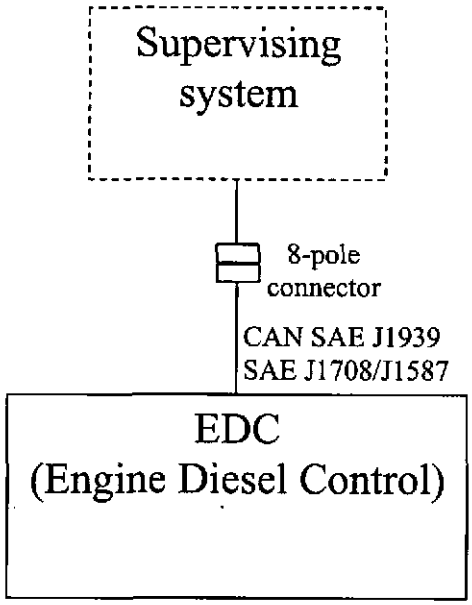
3. System configuration

There are 3 different ways to interface to the engine.

- The engine is connected directly to an existing CAN SAE J1939 network.
- The interface unit called Control Interface Unit (CIU) is used.
- Controls and monitoring devices are connected directly to the engine using hard wiring (stand-alone).

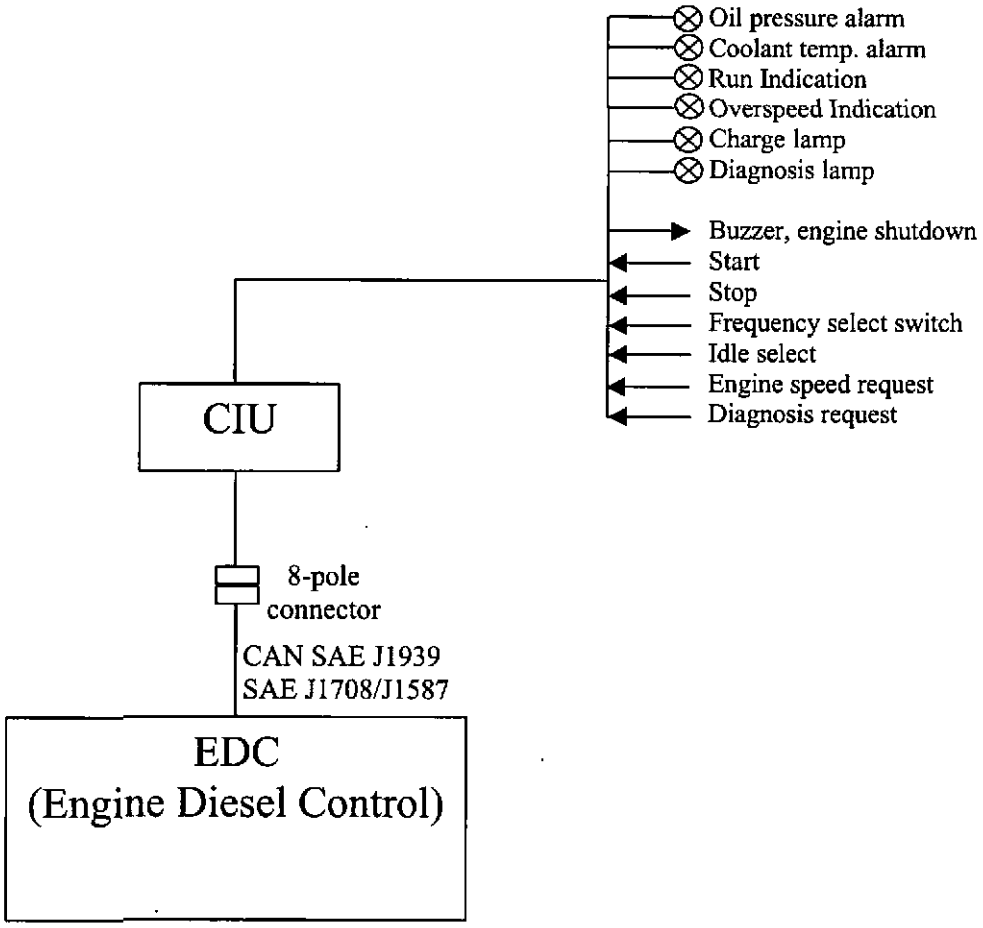
The engine performs an automatic configuration to decide which system that is used.

Existing CAN-network:



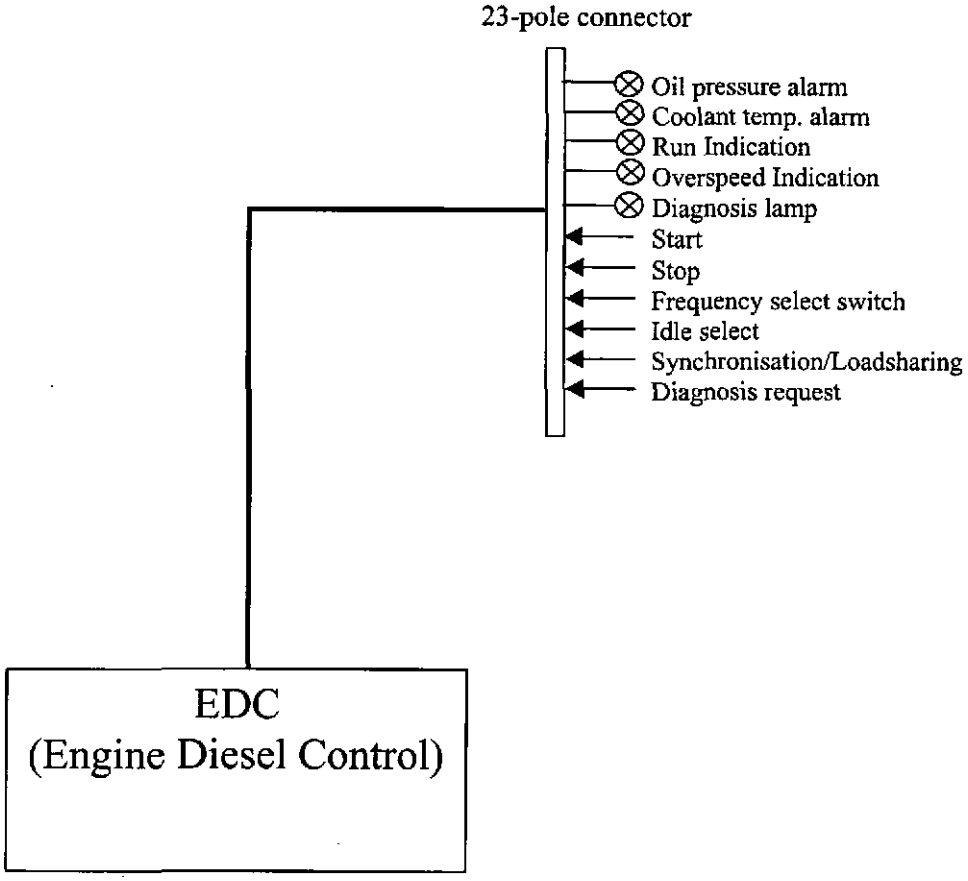
Signalling on the network is described in chapter 5 "Communication".

Interfacing using a CIU:



Signal requirements are specified in chapter 4 "Engine functionality".

Interfacing to the stand-alone connection:



Signal requirements are specified in chapter 4 "Engine functionality".

4. Engine functionality

In this chapter a brief description of how the signals are to be used for controlling the engine.
There are also some possibilities to configure the system to better match a specific installation. This is done using the Volvo Penta Parameter Tool and which parameter to change is described under "Configuration".

4.1. Start

A startrequest is addressed by the startsignal. The engine will then start to crank and it will continue to do so until one of the following conditions becomes true.

1. The startsignal goes inactive.
2. The engine speed exceeds 550 rpm.
3. The cranking time exceeds 20 s.

Signal requirements

CAN:	According to CAN-specification
Stand-Alone/CIU:	Active signal – shorted to Vbat
	Inactive signal – disconnected

4.2. Stop

A stoprequest is addressed by the stopsignal and will stop the engine.

Signal requirements

CAN:	According to CAN-specification
Stand-Alone/CIU:	Active signal – disconnected
	Inactive signal – shorted to Vbat

Configuration

Signal logic can be changed when Stand-Alone/CIU is used to:

	Active signal – shorted to Vbat
	Inactive signal – disconnected
Parameter:	Stop function CIU (when CIU is used) and Stop function EMS (when Stand Alone is used)

4.3. Synchronising/Loadsharing

The input is used for controlling the engine speed in order to synchronise and to perform loadsharing.

Signal requirements

CAN:	According to CAN-specification	
Stand-Alone/CIU:	Nominal speed (1500/1800):	2,9 V
	(Nominal speed - 120 rpm):	1,0 V
	(Nominal speed + 120 rpm):	4,8 V

4.4. Frequency select

The frequency switch is used for changing the nominal engine speed (i.e. switching between 1500 and 1800 rpm). For safety reasons the frequency can only be changed after a system reset (chapter 2). It is also possible to change the frequency using the Volvo Penta Parameter Tool.

Signal requirements

CAN:	According to CAN-specification
Stand-Alone/CIU:	Active signal – disconnected
	Inactive signal – shorted to bat -.
	Use Volvo Penta switch supply.

Configuration

The frequency can be changed by using the Volvo Penta Parameter Tool.

Parameter:	Primary engine speed

4.5. Idle switch

The idle switch is used for requesting idle speed. For safety reasons, it is only possible changing to idle speed if the engineload is under 500 Nm.

Signal requirements

CAN:	According to CAN-specification
Stand-Alone/CIU:	Active signal – shorted to Vbat
	Inactive signal – disconnected

4.6. Diagnosis switch

The diagnosis switch signal is used to address a diagnosis request. When doing that the engine will respond with a fault code on the diagnostic lamp. When the engine is controlled by a supervising system diagnosis information is fetched on the SAE J1708/J1587 datalink by sending a PPID 200 request (chapter 5). The engine will then respond with a PPID 200 response. Coarse diagnosis information is sent on the CAN-bus telling the supervising system if there is a minor fault on the engine ("Yellow lamp" in VP Engine Industry) or if there is a serious fault on the engine ("Red lamp" in VP Engine Industry).
The diagnosis switch signal is also used for doing system reset (chapter 2).

Signal requirements

CAN:	According to CAN-specification
Stand-Alone/CIU:	Active signal – shorted to Vbat
	Inactive signal – disconnected

4.7. Oil pressure alarm

The signal is activated by the engine if the oil pressure is too low. The alarm will be active until next start-up of the engine. The engine will be derated (this protection can be disabled by the Volvo Penta Parameter Tool).

Signal specification

CAN:	According to CAN-specification
Stand-Alone/CIU:	Load not to exceed 10 W. Output from Volvo Penta is active low, meaning that customer side of lamp is to be connected to Vbat.

Configuration

The engine protection can be disabled.

Parameter:	Oil pressure derate

4.8. Oil temperature alarm

The signal is activated by the engine if the oil temperature is too high. The alarm will go inactive if the temperature decreases under alarm temperature. The engine will be derated (this protection can be disabled by the Volvo Penta Parameter Tool). This signal is not available in the stand-alone connection.

Signal specification

CAN:	According to CAN-specification
CIU:	Load not to exceed 10 W. Output from Volvo Penta is active low, meaning that customer side of lamp is to be connected to Vbat.

4.9. Coolant temperature alarm

The signal is activated by the engine if the coolant temperature is too high. The alarm will go inactive if the temperature decreases under alarm temperature. The engine will be derated (this protection can be disabled by the Volvo Penta Parameter Tool).

Signal specification

CAN:	According to CAN-specification
Stand-Alone/CIU:	Load not to exceed 10 W. Output from Volvo Penta is active low, meaning that customer side of lamp is to be connected to Vbat.

Configuration

The engine protection can be disabled.

Parameter:	Coolant temperature derate

4.10. Coolant level alarm

The signal is activated by the engine if the coolant level is too low. The alarm will be active until next start-up of the engine. The engine will be derated (this protection can be disabled by the Volvo Penta Parameter Tool). This signal is not available in the stand-alone connection.

Signal specification

CAN:	According to CAN-specification
CIU:	Load not to exceed 10 W. Output from Volvo Penta is active low, meaning that customer side of lamp is to be connected to Vbat.

Configuration

The engine protection can be disabled.

Parameter:	Coolant level derate

4.11. Charge lamp

The signal is activated by the engine if the system voltage goes below 24,3 V when the engine is running. This signal is not available in the stand-alone connection.

Signal specification

CAN:	According to CAN-specification
CIU:	Load not to exceed 10 W. Output from Volvo Penta is active low, meaning that customer side of lamp is to be connected to Vbat.

4.12. Overspeed

The signal is activated by the engine when the engine speed exceeds the nominal engine speed with more than 20 %. The overspeed limit can be changed using the the Volvo Penta Parameter Tool.

Signal specification

CAN:	According to CAN-specification
Stand-Alone/CIU:	Load not to exceed 10 W. Output from Volvo Penta is active low, meaning that customer side of lamp is to be connected to Vbat.

Configuration

The trigg-level for the overspeed alarm can be set: It is also possible to configure the engine to perform a shutdown if the engine is overspeeding.

Parameter:	Overspeed limit (percent) Overspeed shutdown

4.13. Run Indication

The engine will activate a signal when the nominal rpm is achieved. The signal can be used as an indication of that the engine is prepared to take load.

Signal specification

CAN:	According to CAN-specification
Stand-Alone/CIU:	Load not to exceed 10 W. Output from Volvo Penta is active low, meaning that customer side of lamp is to be connected to Vbat.

5. Communication

There are 2 datalinks in the system, one CAN SAE J1939 datalink and one SAE J1708/J1587 datalink. The J1939 datalink is used for control and monitoring data and the J1708/J1587 datalink is used for diagnosis, control redundancy (start, stop and throttle) and service tools.

5.1. SAE J1939 Standard frames

There are a number of CAN-frames according to the J1939 protocol that are supported by the EDC. Only the signals which are specified below is supported.

5.1.1. Transmitted from EDC

ENGINE TEMPERATURE
- Oil temperature
- Coolant temperature

INLET / EXAUST CONDITIONS
- Boost pressure

- Oil pressure

EEC1
- Drivers demand, engine % torque
- Actual engine, % torque
- Engine speed

EEC2
- Accelerator pedal position
- Percent load at current speed

EEC3
- Nominal friction - percent torque

FUEL ECONOMY
- Fuel rate

ENGINE HOURS/REVOLUTIONS
- Total Engine Hours

WATER IN FUEL INDICATOR
- Water in fuel alarm

5.1.2. Received and supported by EDC

TSC1
- Requested engine speed /speed limit
- Requested torque / torque limit

5.2. J1939 Proprietary frames

5.2.1. Transmitted by the EDC

VP Engine Industry

Data Length	8
Transmission update period	50 ms
Data page	0
PDU format	255
PDU specific	71
Priority	3
Source address	0
PGN Number (calculated)	65351
Identifier (calculated)	218056448
Description	Engine information

Byte	Bit	Signal
1	1-2	Not used
1	3-4	Running indication
1	5-6	Overspeed alarm
1	7-8	Oil pressure alarm
2	1-2	Oil temperature alarm
2	3-4	Coolant temperature alarm
2	5-6	Coolant level alarm
2	7-8	Charge alarm
3	1-2	Buzzer
3	3-8	Not used
4	1-2	General lamptest
4	3-4	Buzzertest / Lamptest
4	5-8	Not used
5	1-2	EMS Diagnose Yellow lamp
5	3-4	EMS Diagnose Red lamp
5	5-8	Not used
6	1-24	Not used

Running indication
The running status of the engine

Value	Description
0	Stopped
1	Running
2	Reserved
3	Not available

Type: Measured
Format: Numeric

Overspeed alarm
The status of the (virtual) overspeed alarm switch

Value	Description
0	Inactive
1	Active
2	Switch error
3	Not available

Type: Measured
Format: Numeric

Oil pressure alarm
The status of the (virtual) oil pressure alarm switch

Value	Description
0	Inactive
1	Active
2	Switch error
3	Not available

Type: Measured
Format: Numeric

Oil temperature alarm
The status of the (virtual) oil temperature alarm switch

Value	Description
0	Inactive
1	Active
2	Switch error
3	Not available

Type: Measured
Format: Numeric

Coolant temperature alarm
The status of the (virtual) coolant temperature alarm switch

Value	Description
0	Inactive
1	Active
2	Switch error
3	Not available

Type: Measured
Format: Numeric

Coolant level alarm
The status of the coolant level alarm switch

Value	Description
0	Inactive
1	Active
2	Switch error
3	Not available

Type: Measured
Format: Numeric

Charge alarm
The status of the (virtual) charge alarm switch

Value	Description
0	Inactive
1	Active
2	Switch error
3	Not available

Type: Measured
Format: Numeric

Buzzer
Controls the buzzer

Value	Description
0	Inactive
1	Active
2	Reserved
3	Not available

Type: Status
Format: Numeric

General lamptest
Controls the general lamptest

Value	Description
0	Inactive
1	Active
2	Reserved
3	Not available

Type: Status
Format: Numeric

Buzzertest / Lamptest
Controls the buzzertest / lamptest

Value	Description
0	Inactive
1	Active
2	Reserved
3	Not available

Type: Status
Format: Numeric

EMS Diagnose Yellow lamp
The status of the yellow diagnose lamp of the EMS (Mirror of PID 44, J1587)

Value	Description
0	Inactive
1	Active
2	Error condition
3	Not available

Type: Status
Format: Numeric

EMS Diagnose Red lamp
The status of the red diagnose lamp of the EMS (Mirror of PID 44, J1587)

Value	Description
0	Inactive
1	Active
2	Error condition
3	Not available

Type: Status
Format: Numeric

5.2.2. Received and supported by the EDC

VP Status

Data Length	8
Transmission update period	20 ms
Data page	0
PDU format	255
PDU specific	70
Priority	3
Source address	17
PGN Number (calculated)	65350
Identifier (calculated)	218056209
Description	CIU status information

Byte	Bit	Signal
1	1-2	Start request
1	3-4	Stop request
1	5-6	Not used
1	7-8	Idle speed select
2	1-2	Frequency select
2	3-4	Diagnosis switch
2	5-6	Preheat request, not used in genset spec.
2	7-8	Not used
3	1-16	Accelerator pedal position
5	1-32	Not used

Start request
Start request

Value	Description
0	Inactive
1	Active
2	Error indication
3	Not availible

Type: Status
Format: Numeric

Stop request
Stop request

Value	Description
0	Inactive
1	Active
2	Error indication
3	Not available

Type: Status
Format: Numeric

Idle speed select
Indicates if the engine shall operate at idle speed or at running speed.

Value	Description
0	Normal running speed request
1	Idle speed request
2	Error indication
3	Not available

Type: Status
Format: Numeric

Frequency select
Indicates if the engine shall operate at primary engine speed or secondary engine speed rpm.

Value	Description
0	Primary engine speed request
1	Secondary engine speed request
2	Error indication
3	Not available

Type: Status
Format: Numeric

Diagnosis switch
Status of the Diagnosis switch

Value	Description
0	Inactive
1	Active
2	Error indication
3	Not available

Type: Status
Format: Numeric

Accelerator pedal position
The accelerator pedal position

Resolution: 0.097752 %/bit (1/1023)
Offset: 0
Size: 2 bytes, bit 0-9
Data range: 0 to 100
Unit: %
Error indication: FEFF

Type: Measured
Format: Numeric

5.3. SAE J1708/J1587

5.3.1. Transmitted by the EDC

PID 44

Data	Description
240	No errors
241	Serious error indication (red lamp)
244	Error indication (yellow lamp)
245	New error

Transmission update period: 500 ms

When a new error occurs PID 44 will contain data 245 twice.

5.3.2. Received by the EDC

PPID 98
Bit coded message used for redundant values of start and stop. They are used if the CAN-bus is malfunctioning.

7	6	5	4	3	2	1	0
DC	DC	DC	DC	Start	Stop	DC	DC

0 - Inactive
1 - Active
DC – Don't care

PPID 132

PPID 132 is used for a redundant value of accelerator pedal position. It is used if the CAN-bus is malfunctioning.

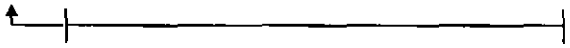
Transmission update period:	100 ms
Resolution:	0.097752 %/bit (1/1023)
Offset:	0
Size:	2 bytes, bit 0-9
Data range:	0 to 100
Unit:	%
Error indication:	FEFF

PPID 200

PPID 200 is used for fetching diagnosis information from the engine. When the EDC receive a PPID 200 request it will respond with one fault. When another request is received the EDC will respond with next fault. When there is no more fault to report the EDC will respond with faultnumber 0 and faultcode 0 on a request.

Request

MID	PID	Receiver	No of bytes	CMD	Subsystem specific	PPID	From whom	CS
144	254	128	4	212	128	200	128	CS



Response:

MID	PID	Receiver	No of bytes	CMD	PPID	No of bytes	PPID	Diag code char	Fault code	Flash code	CS
128	254	144	7	212	200	4	1	XXX	XXX	XXX	CS

Where

Diag code char is one byte data that consist of

Bit 0-3: FMI (Failure Mode Identifier, according to SAE J1587)

Bit 5: Low character identifier
1=low character is subsystem identifier (SID)
0=low character is parameter (PID)

Bit 6: Type of diagnostic code,
1 = standard code
0 = reserved

Bit 7: 1= Fault is inactive.
0: Fault is active.

Bit 8: 1= Occurrence Count included.
0= Occurrence Count not included.

Faultcode is one byte of data which consist of the specific faultnumber. These are specified in manuals from Volvo Penta.

Flash code is one byte of data that consist of the first and the second digit in the flash code. For example will 54 mean that the first digit in the flashcode is 5 and the second digit is 4.