

**284: Engine control module (ECM), B5244S2**

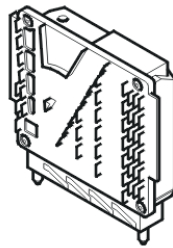
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Control module

Signals

**System overview****Control module**

The engine control module (ECM) controls the following functions:

- injectors
- ignition
- camshafts (CVVT)
- evaporative emission system (EVAP) valve
- throttle angle
- engine cooling fan (FC)
- Air conditioning (A/C) compressor
- fuel pump (only vehicles with demand controlled fuel pumps).

The engine control module (ECM) is supplied with battery voltage ( $U_{bat}$ ) via fuses in the central electronic module (CEM) and in the integrated relay/fusebox in the engine compartment. To prevent certain stored data from being

erased from the engine control module (ECM) when the ignition is switched off, the control module also has a 30-supply. This supply is from the integrated relay/fusebox in the engine compartment. The control module is grounded via the wiring which is connected at the right-hand suspension turret.

The engine control module (ECM) contains a voltage regulator which maintains a low voltage (5 V) in internal components in the control module such as:

- Analog/Digital converter
- Digital/Analog converter
- Micro-processor.

Functions which require battery power ( $U_{bat}$ ) and high output are controlled by external or internal power stages. For example ignition coils have external power stages (integrated into the ignition coils) while the power stages for the injectors are integrated in the engine control module (ECM).

The micro-processor in the engine control module (ECM) receives signals from the different sensors and control modules in the vehicle. The micro-

processor uses a program which interprets the signals from the different sensors and how the components and functions should be controlled.

The engine control module (ECM) has several self-learning (adaptive) functions. It continually adapts ongoing calculations to changing circumstances (such as wear, air leaks, differences between different fuels).

Emissions are kept low through efficient management of the injection period, ignition, evaporative emission system (EVAP) valve and camshafts etc. Faults which affect emissions can be detected by running diagnostics for functions and components.

The engine control module (ECM) is positioned in a box in the engine compartment. The transmission control module (TCM) is also in this box in vehicles with automatic transmissions. A temperature sensor and atmospheric pressure sensor are integrated in to the engine control module (ECM). The engine control module (ECM) uses the temperature

signal to control the internal cooling fan in the control module box. The pressure signal provides information about the atmospheric pressure. The engine control module (ECM) is then able to compare this signal with the pressure in the fuel rail during fuel pressure control.

The engine control module (ECM) communicates with other control modules using controller area network (CAN) communication.

The engine control module (ECM) checks activations, input and output signals and functions using an integrated diagnostic system. A diagnostic trouble code (DTC) is stored if, after validation, the control module detects a fault. In certain cases the faulty signal is also replaced with a substitute value or certain functions are limited.

For example, substitute values can be set for:

- engine coolant temperature (ECT) sensor
- mass air flow (MAF) sensor
- throttle position (TP) sensor
- air pressure

- fuel pressure.

Mathematical calculations and signals from certain components are used to calculate the substitute values. Other substitute values are fixed, predefined values in the engine control module (ECM).

The substitute value allows the vehicle to be driven and for the emissions to be kept at a reasonable level even though vital functions or components are malfunctioning.

Functions which may be limited are for example:

- camshaft control (CVVT)
- fuel trim
- throttle angle
- fuel pressure regulation.

The substitute values are used and functions restricted so that the system is still able to work whilst protecting components that are required for safety reasons (for example the throttle angle).

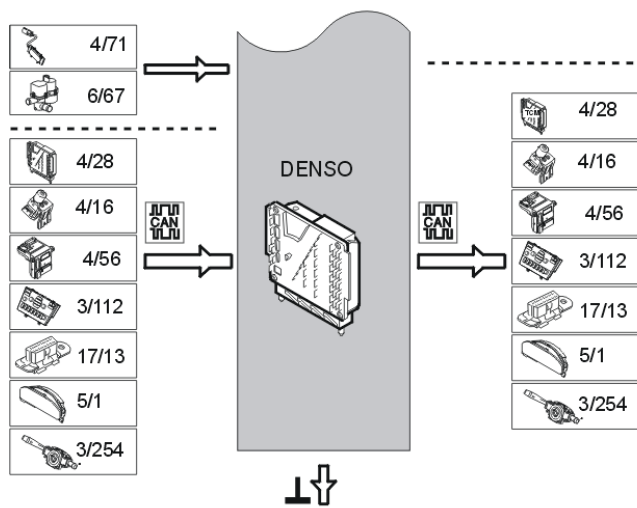
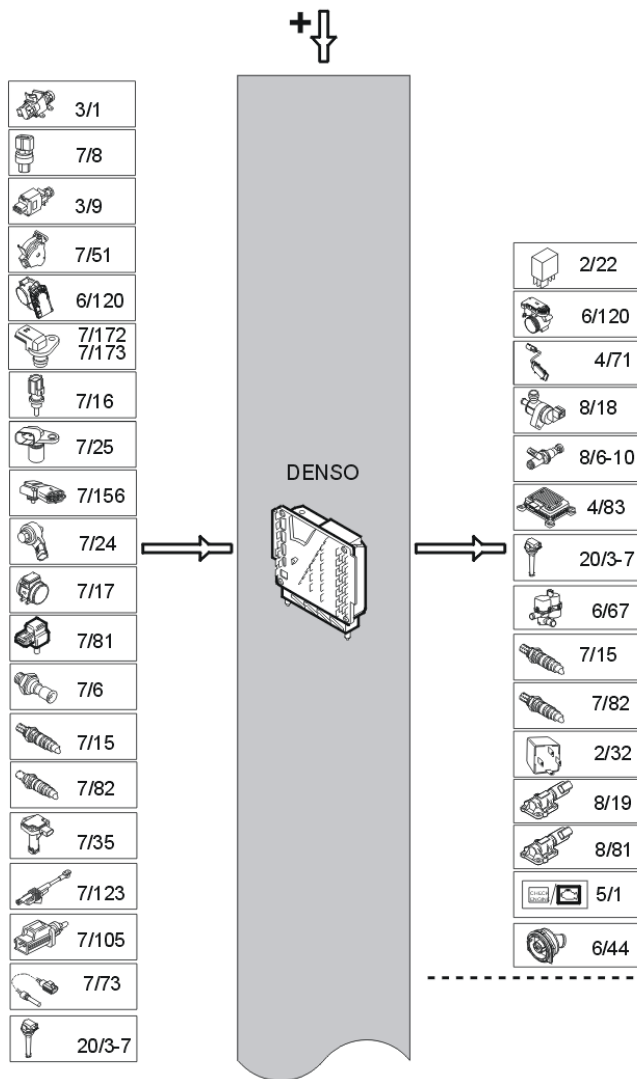
Any diagnostic trouble codes (DTCs) are stored in the internal memory of the engine control module (ECM). This information can be read off using VIDA via the data link connector (DLC) in the vehicle.

## Signals

The table below summarizes the input signals to and output signals from the Engine Control Module (ECM). The signal types are divided into directly connected signals and CAN communication. The illustration below displays the same information with the Volvo component designations.

Input signals	Output signals
<p><b>Directly connected:</b></p> <ul style="list-style-type: none"> <li>■ Ignition switch (3/1)</li> <li>■ Air conditioning (A/C) pressure sensor (7/8)</li> <li>■ Stop lamp switch (3/9)</li> <li>■ Accelerator pedal (AP) position sensor (7/51)</li> <li>■ Electronic throttle unit (6/120)</li> <li>■ Camshaft position sensor, intake (7/172)</li> <li>■ Camshaft position sensor, exhaust (7/173) (certain markets only)</li> <li>■ Engine coolant temperature (ECT) sensor (7/16)</li> <li>■ Engine speed (RPM) sensor (7/25)</li> <li>■ Fuel pressure sensor with integrated fuel temperature sensor (7/156) (vehicles with demand controlled fuel pumps only)</li> <li>■ Knock sensor (KS) (7/24)</li> <li>■ Mass air flow (MAF) sensor/temperature sensor (7/17)</li> <li>■ Manifold absolute pressure (MAP) sensor (7/81)</li> <li>■ Oil pressure switch (7/6)</li> <li>■ Front heated oxygen sensor (HO2S) (7/15)</li> <li>■ Rear heated oxygen sensor (HO2S) (7/82)</li> <li>■ Oil level sensor (7/35) (2005-, certain markets only)</li> <li>■ Clutch pedal sensor (7/123) (manual transmissions only)</li> <li>■ Outside temperature sensor (7/105)</li> </ul>	<p><b>Directly connected:</b></p> <ul style="list-style-type: none"> <li>■ Air conditioning (A/C) relay (2/22)</li> <li>■ Electronic throttle unit (6/120)</li> <li>■ Engine cooling fan (FC) control module (4/71)</li> <li>■ Evaporative emission system (EVAP) valve (8/18)</li> <li>■ Injectors (8/6-10)</li> <li>■ Fuel pump control module (4/83) (only vehicles with demand controlled fuel pumps)</li> <li>■ Ignition coils (20/3-7)</li> <li>■ Leak diagnostic unit (6/67), (certain markets only).</li> <li>■ Front heated oxygen sensor (HO2S), preheating (7/15)</li> <li>■ Rear heated oxygen sensor (HO2S), preheating (7/82)</li> <li>■ Main relay (system relay) (2/32)</li> <li>■ Camshaft reset valve (CVVT), intake (8/19)</li> <li>■ Camshaft reset valve (CVVT), exhaust (8/81) (certain markets only)</li> <li>■ Emissions warning lamp (5/1)</li> <li>■ Control module cooling fan (6/44).</li> </ul>

<ul style="list-style-type: none"> <li>■ Engine coolant level sensor (7/73)</li> <li>■ Ignition coils (20/3-7)</li> <li>■ Engine cooling fan (FC) control module (4/71)</li> <li>■ Leak diagnostic unit (6/67), (certain markets only).</li> </ul>	
<p><b>Via Controller Area Network (CAN) communication:</b></p> <ul style="list-style-type: none"> <li>■ Transmission Control Module (TCM) (4/28) (only cars with automatic transmissions)</li> <li>■ Brake control module (BCM) (4/16)</li> <li>■ Central electronic module (CEM) (4/56).</li> </ul> <p>Via central electronic module (CEM) (4/56):</p> <ul style="list-style-type: none"> <li>■ Climate Control Module (CCM) (3/112)</li> <li>■ Data link connector (DLC) (17/13)</li> <li>■ Driver information module (DIM) (5/1)</li> <li>■ Steering wheel module (SWM) (3/254).</li> </ul>	<p><b>Via Controller Area Network (CAN) communication:</b></p> <ul style="list-style-type: none"> <li>■ Transmission Control Module (TCM) (4/28) (only cars with automatic transmissions)</li> <li>■ Brake control module (BCM) (4/16)</li> <li>■ Central electronic module (CEM) (4/56).</li> </ul> <p>Via central electronic module (CEM) (4/56):</p> <ul style="list-style-type: none"> <li>■ Climate Control Module (CCM) (3/112)</li> <li>■ Data link connector (DLC) (17/13)</li> <li>■ Driver information module (DIM) (5/1)</li> <li>■ Steering wheel module (SWM) (3/254).</li> </ul>



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