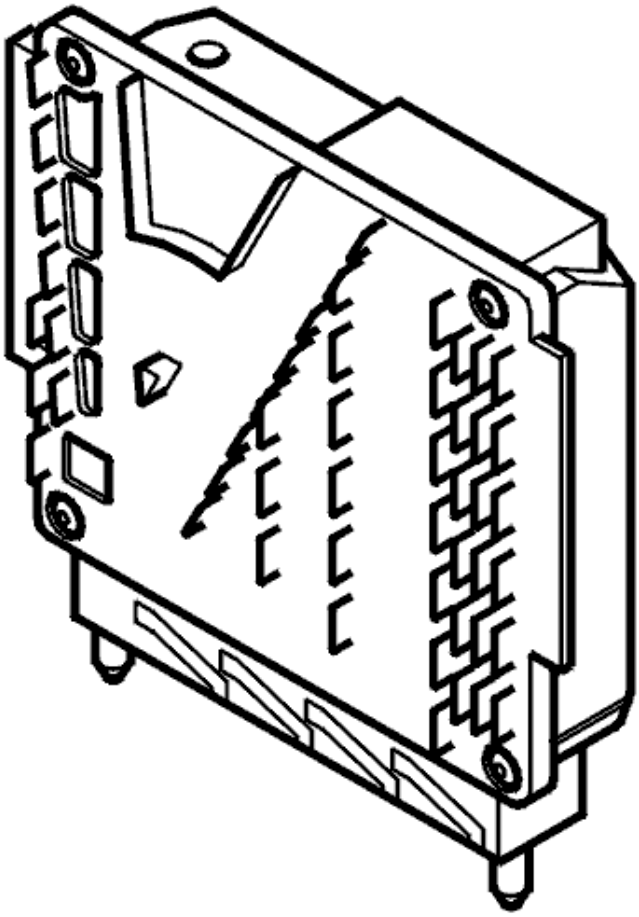
System overview
Control module



The Engine Control Module (ECM) controls the following functions:

* injectors
* ignition
* camshafts (CVVT)
* Evaporative emission system (EVAP) valve
* turbocharger (TC) control
* throttle angle
* engine cooling fan (FC)
* air conditioning (A/C) compressor
* fuel pump (only vehicles with demand controlled fuel pumps).

There is a micro-processor in the control module which receives signals from the different sensors in the car. The micro-processor uses a program which interprets the signals from the different sensors and how the components / functions should be controlled.

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

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 control module is in a box in the engine

compartment.

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 replaced with a substitute value or certain functions are limited.

Substitute values can be set for e.g.:

* engine coolant temperature (ECT)
* mass air flow
* throttle position
* atmospheric pressure
* etc.

Mathematical calculations and signals from certain components are used to calculate the substitute values. Other substitute values are fixed, predefined values in the control module.
The substitute value allows the car to be driven and for the emissions to be kept at a reasonable level even though vital functions / components are faults.

Functions which are limited may be for example:

* turbocharger (TC) control
* camshaft control (CVVT)
* fuel trim
* throttle angle
* etc.

A function is limited so that the system still functions, to protect components or for safety reasons (for example the throttle angle).

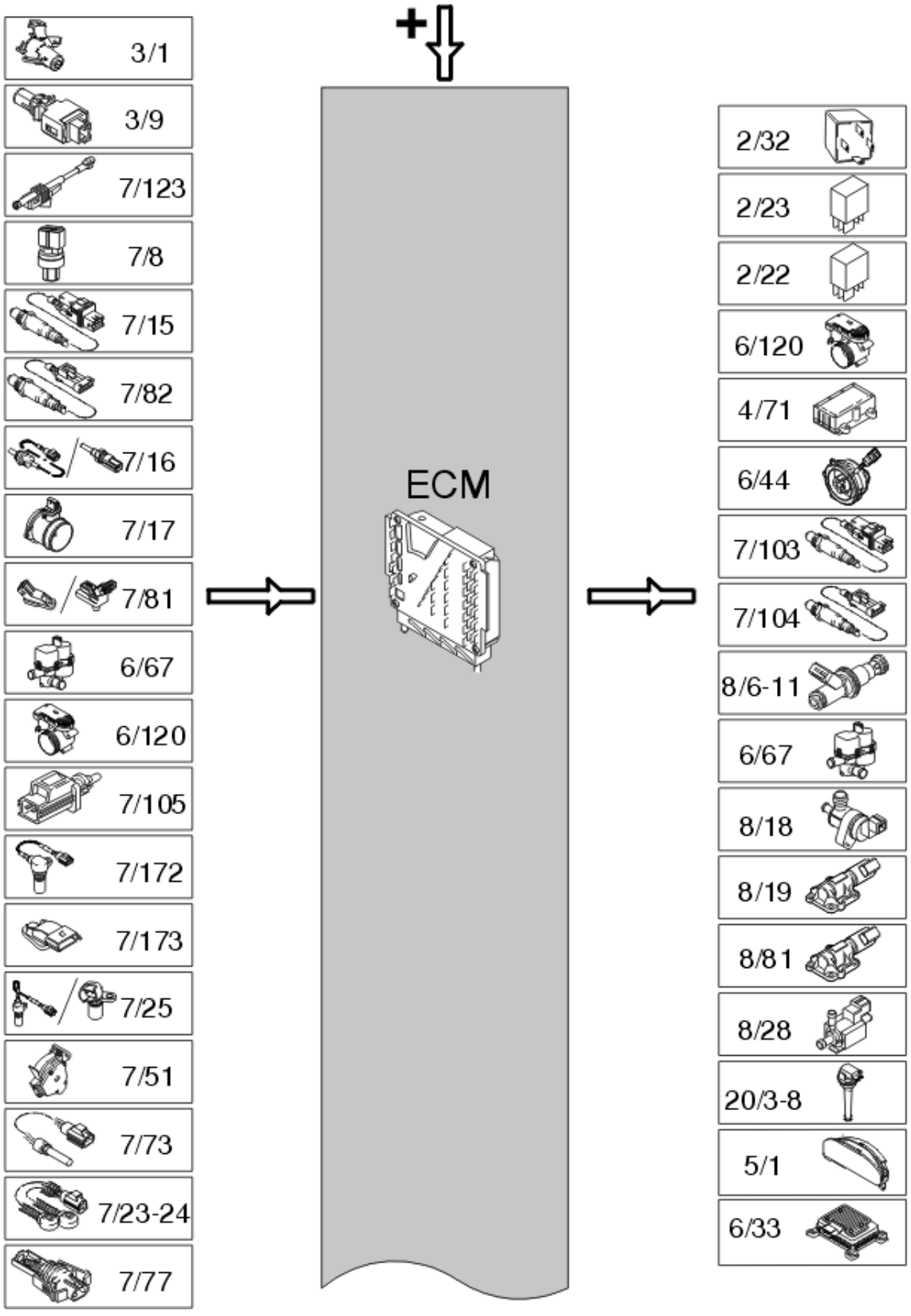
Any diagnostic trouble codes (DTCs) are stored in the control module memory. The data can be read off using VADIS.

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, serial communication and Controller area network (CAN) communication. The illustration below displays the same information with the Volvo component designations.

Input signals	Output signals
Directly connected: * Ignition switch (3/1) * Stop lamp switch (3/9) * Clutch pedal sensor (7/123) * Air conditioning (A/C) pressure sensor (7/8) * Front heated oxygen sensor (HO2S) (7/15) * Rear heated oxygen sensor (HO2S) (7/82) * Engine coolant temperature (ECT) sensor (7/16) * Mass air flow (MAF) sensor (7/17)	**Directly connected:** * Main relay (system relay) (2/32) * Fuel pump (FP) relay (2/23) * Air conditioning (A/C) relay (2/22) * Electronic throttle unit (6/120) * Engine cooling fan (FC) control module (4/71) * Engine cooling fan (FC) control module box (6/44) (turbocharger (TC) only and certain markets) * Front heated oxygen sensor (HO2S), preheating

* Mass air flow (MAF) sensor (7/17) * Manifold absolute pressure (MAP) sensor, intake (7/81) (not turbocharged engines 2003-) * Manifold absolute pressure (MAP) sensor, with built-in intake air temperature (IAT) sensor, intake (7/81) (turbocharged engines 2003-) * Leak diagnostic unit (6/67), (certain markets only) * Electronic throttle unit (6/120) * Outside temperature sensor (7/105) * Camshaft position (CMP) sensor (7/172) * Camshaft position (CMP) sensor (7/173) * Engine speed (RPM) sensor (7/25) * Accelerator pedal (AP) position sensor (7/51) * Engine coolant level sensor (7/73) * Knock sensor (KS) (7/23-7/24) * Manifold absolute pressure (MAP) sensor, intake (7/77) (not turbocharged engines 2003-) * Oil level sensor (7/35) (2004-, R models only) * Fuel pressure sensor with integrated fuel temperature sensor (7/156) (vehicles with demand controlled fuel pumps only).	* Front heated oxygen sensor (HO2S), preheating (7/103) * Rear heated oxygen sensor (HO2S), preheating (7/104) * Injectors (8/6-8/11) * Leak diagnostic unit (6/67), (certain markets only) * Evaporative emission system (EVAP) valve (8/18) * Reset valve camshaft continuous variable valve timing (CVVT) (8/19) * Camshaft reset valve (CVVT) (8/81) (model year 2003- and B6XXXT model year 2002) * Turbocharger (TC) control valve (8/28) * Ignition coils (20/3-20/8) * Driver information module (DIM) (5/1), emissions warning lamp * Fuel pump control module (6/33) (only vehicles with demand controlled fuel pumps).
Via Controller Area Network (CAN) communication: * Transmission Control Module (TCM) (4/28) (only cars with automatic transmissions) * Brake control module (BCM) (4/16) * Central electronic module (CEM) (4/56) * Suspension module (SUM) (4/84) (vehicle with Four-C (Continuously Controlled Chassis Concept) only). Via central electronic module (CEM) (4/56): * Climate Control Module (CCM) (3/112) * Data link connector (DLC) (17/13) * Driver information module (DIM) (5/1) * Steering wheel module (SWM) (3/130).	**Via Controller Area Network (CAN) communication:** * Transmission Control Module (TCM) (4/28) (only cars with automatic transmissions) * Brake control module (BCM) (4/16) * Central electronic module (CEM) (4/56) * Differential electronic module (DEM) (4/82) (AWD only) * Suspension module (SUM) (4/84) (vehicle with Four-C (Continuously Controlled Chassis Concept) only). Via central electronic module (CEM) (4/56): * Climate Control Module (CCM) (3/112) * Data link connector (DLC) (17/13) * Driver information module (DIM) (5/1) * Steering wheel module (SWM) (3/130).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ECM
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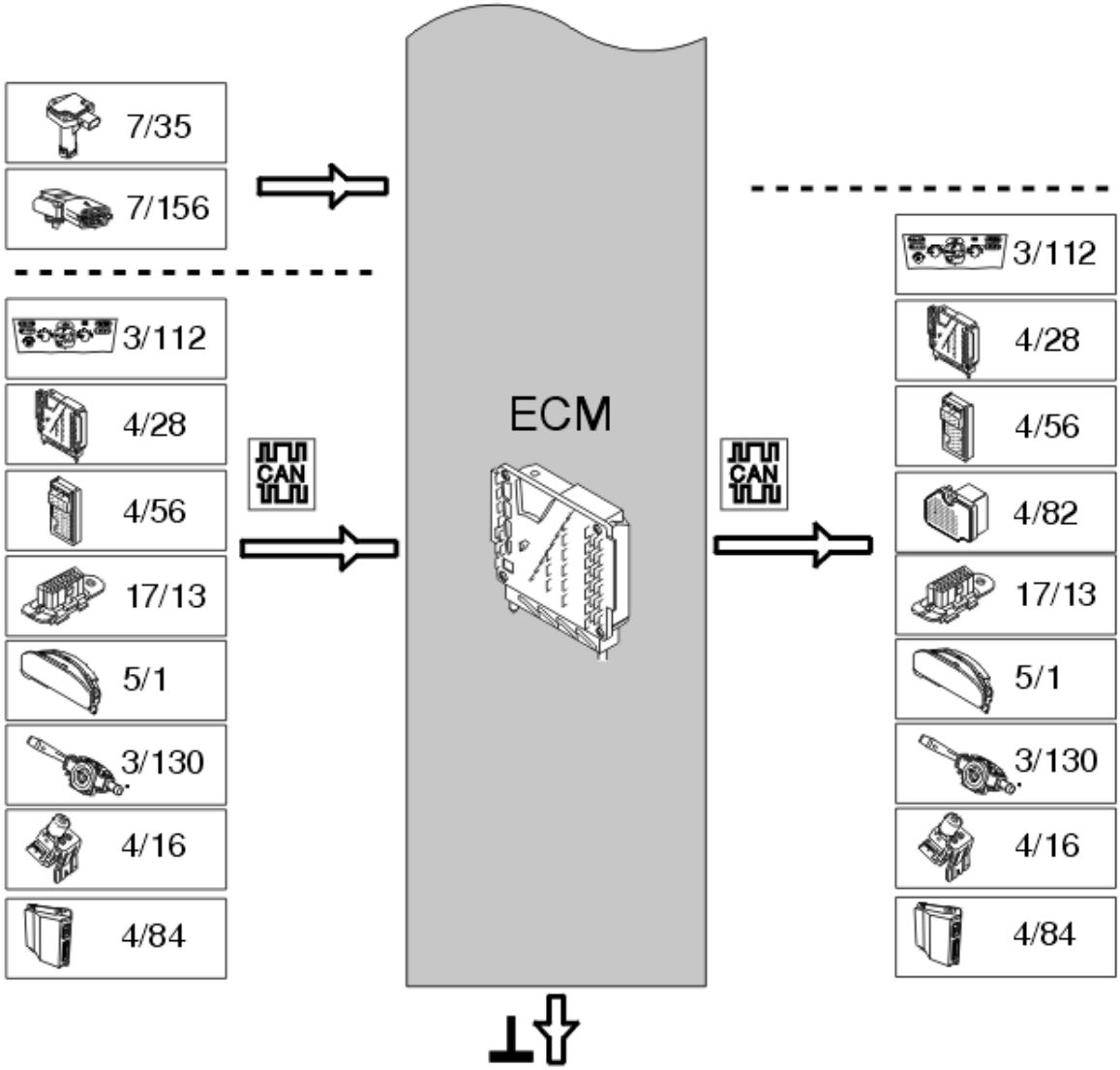
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ECM
CAN
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