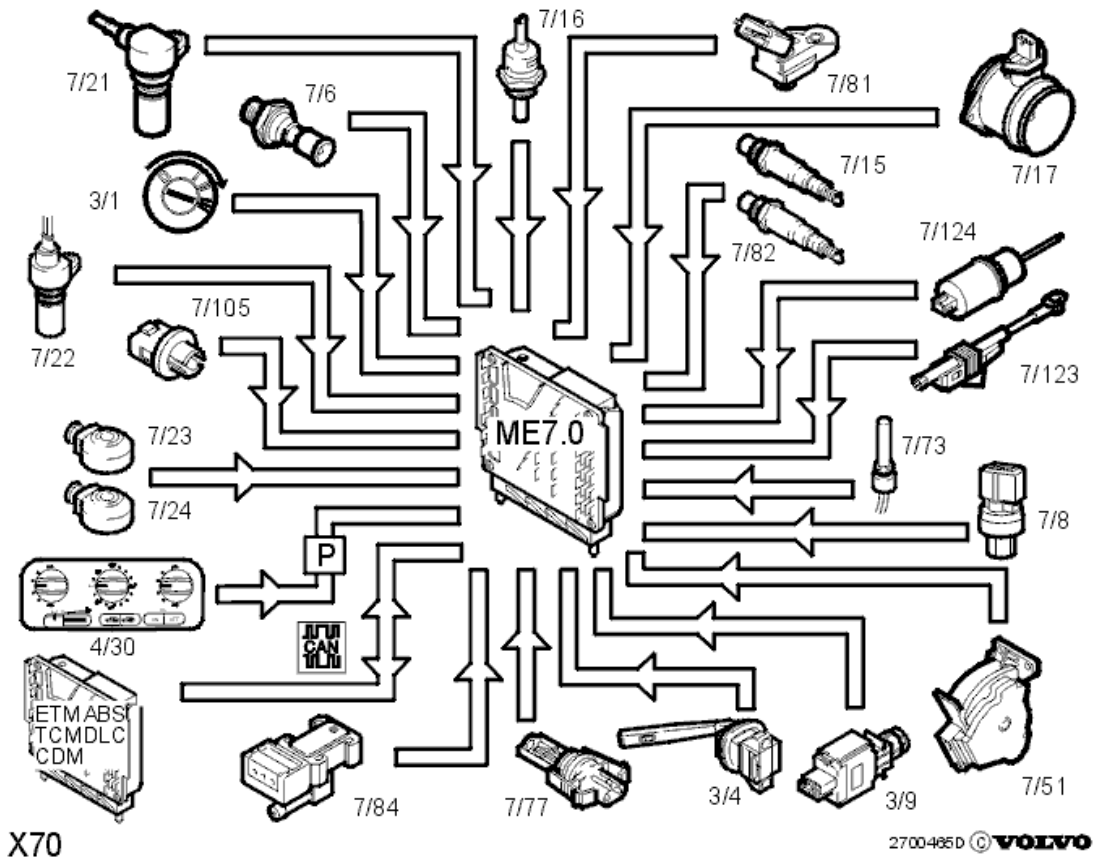


Input signals



Sensors and functions which are different to previous types are marked in **bold text**.

Number	Component	Information type/explanation
3/1	Ignition switch + 50 supply	Provides early information to the Engine Control Module (ECM) to prepare for start.
3/4	Cruise control lever	Gives information about selected speed to engine control module (ECM) via the electronic throttle module to control the throttle. The cruise control software is integrated into the engine control module (ECM).
3/9	Stop (brake) lamp switch	Informs engine control module (ECM) that the car is braking. The signal is a safety feature in addition to the brake pedal sensor. The engine control module (ECM) carries out a range test between the signals from both sources.
4/30 4/6	ECC MCC	Provides information if the air conditioning (A/C) is switched on or not. The engine control module (ECM) controls connection/disconnection of the compressor dependent on load, engine speed (RPM), engine coolant temperature, air conditioning (A/C) pressure.
7/6	Oil pressure switch	Provides information about engine oil pressure. The information is sent on to the Can and Driver information Module which lights the warning lamp.
7/8	air conditioning (A/C) pressure sensor (linear)	Provides information using a linear signal about any pressure changes on the high-pressure side. Depending on the pressure the engine control module (ECM) can activate the engine cooling fan (FC) at high/low speed and shut off

		the air conditioning (A/C) compressor. The engine control module (ECM) can also provide information about low volume in the air conditioning (A/C) system.
7/15	Front heated oxygen sensor (HO2S) (linear signal)	New signal characteristics. Provides information about the oxygen level in the exhaust gases upstream of the catalytic converter.
7/16	Engine coolant temperature sensor	Provides information about engine coolant temperature (ECT). Located in the thermostat housing on the front edge of the engine.
7/17	Mass air flow (MAF) sensor (heated film principle)	Provides information about the intake air mass. Has no resistor for the intake air temperature is complemented instead by a separate sensor 7/77 downstream of the charge air cooler (CAC).
7/21	Camshaft position (CMP) sensor	New signal characteristics. Provides information about cylinder intake and compression phase. Gives shorter starting time, approximately 0.5 seconds.
7/23 7/24	Knock sensor (KS) 1 Knock sensor (KS) 2	Provides information if the engine knocks. The engine control module (ECM) always knows each cylinders exact position from the new camshaft position (CMP) sensor. A turbocharged engine can be subjected to greater pressure variations in combustion chamber and must therefore have signals from 2 knock sensors (KS).
7/25	Engine speed (RPM)/position sensor	Provides information about the crankshaft position and engine speed (RPM). Has flywheel adaptation for mechanical faults/damage. Like M 4.4
7/51	Accelerator pedal (AP) position sensor	Provides information about current throttle opening. The signal is sent via two separate cables at the same time, one analog signal and one digital signal.
7/53	Low pressure sensor AC	Provides information about pressure changes on the low pressure side.
7/73	Engine coolant level switch	Provides information about engine coolant level. The information is sent further to the Can and Driver information Module which lights the low engine coolant level warning lamp.
7/77	Manifold absolute pressure (MAP) sensor	Provides information about the intake air actual temperature after the charge air cooler (CAC). Used for boost pressure control. The sensor is used together with intake air pressure sensor 7/81.
7/81	Manifold absolute pressure (MAP) sensor	Provides information about the intake air actual pressure after charge air cooler (CAC). The most important sensor for boost pressure control. The sensor is used together with intake air temperature sensor 7/77.
7/82	Rear heated oxygen sensor (HO2S)	Provides information about the oxygen level downstream of the catalytic converter (TWC) front section. Compared to previous versions it operates faster and can also affect the fuel/air mix to a greater extent.
7/84	Fuel tank pressure	Provides information about pressure changes in the fuel

	sensor	tank system. Used for leak diagnostic.
7/95	Ambient air pressure sensor (located in engine control module (ECM))	Provides information about ambient air pressure. Affects injected fuel quantity at cold start at high altitude and leak diagnostic.
7/105	Ambient air temperature sensor	Provides information about ambient air temperature. The signal is used to switch off the leak diagnostic in cold weather.
7/123	Clutch pedal position sensor	Provides information that the clutch pedal is depressed and that the throttle should close. Used in certain markets to connect the so called Interlock function via VGLA which inhibits the starter motor. Also disconnects the cruise control.
7/124	Brake pedal sensor (located in the brake servo)	Provides information that the brake pedal is depressed and that the throttle should be closed in case of serious faults in the Electronic throttle system in order to move to idling speed when the brake pedal is depressed. The signal is used to disconnect the cruise control.
CAN	CAN communication	Exchange of information between the Engine Control Module (ECM) and the following units: ABS, TCM, CAN and driver module, electronic throttle module and DLC.

Fuel trim

Control of the fuel/air mixture occurs using known principles. However the signal from the front probe is now of a linear character. This means that the engine control module (ECM) notices small changes throughout the voltage range and can control the fuel/air mixture much faster and more precisely than before.

Both heated oxygen sensors (HO2S) contain as before a PTC resistor which is supplied with voltage from the engine control module (ECM) in order to reach operating temperature quickly.

If the engine control module (ECM) determines that the ambient air is very cold and damp it may delay starting to heat up the heated oxygen sensors (HO2S) a few minutes. This is to prevent the heated oxygen sensor (HO2S) warm ceramic being touched by cold drops of water and then cracking.

The oxygen sensitive ceramic which measures oxygen levels in the exhaust gases consists of Zirconium dioxide.

Front heated oxygen sensor (HO2S)

The output signal characteristic is between 0 - 4.7V.

The short-term fuel trim control lies between 0.75 and 1.25.

Signal characteristics:

- low voltage = rich mixture
- high voltage = lean mixture

Rear heated oxygen sensor (HO2S)

The rear heated oxygen sensor (HO2S) operates with the same signal characteristics as previously, but has gained more importance for controlling the fuel/air mixture. The rear heated oxygen sensor (HO2S) has been moved forward nearer to the front heated oxygen sensor (HO2S), just in front of the metal monolith in the catalytic converter.

Camshaft Position (CMP) Sensor

The camshaft position (CMP) sensor is a new version and operates using a different signal characteristic to previously.

- The sensor consists of an MRE (Magnetic Resistance Element). It is a permanent magnet with 2 special resistors which are connected in series with each other, where one end is voltage supplied and the other goes to ground. The output signal is an analog sine curve which passes through an analog/digital converter in the camshaft position (CMP) sensor before being sent on to the engine control module (ECM).
- When a tooth on the pulse wheel nears the sensor the magnetic field is bent and affects the resistor located nearest to the ground, resistance affects the voltage and the output signal to the Engine Control Module (ECM) is low. When the same tooth continues past the sensor the magnetic field follows and so affects the other resistor which is located nearest to the voltage supply, this resistor affects the voltage so that the output signal to the Engine Control Module (ECM) is high. The magnetic field swings backwards and forwards between the teeth on the pulse wheel and the engine control module (ECM) senses the signals between the teeth, partly before and partly after the sensor.
- The pulse wheel has 4 teeth. The engine control module (ECM) calculates the time interval from one tooth to the next and can decide exactly which cylinder must be supplied with fuel and spark respectively.