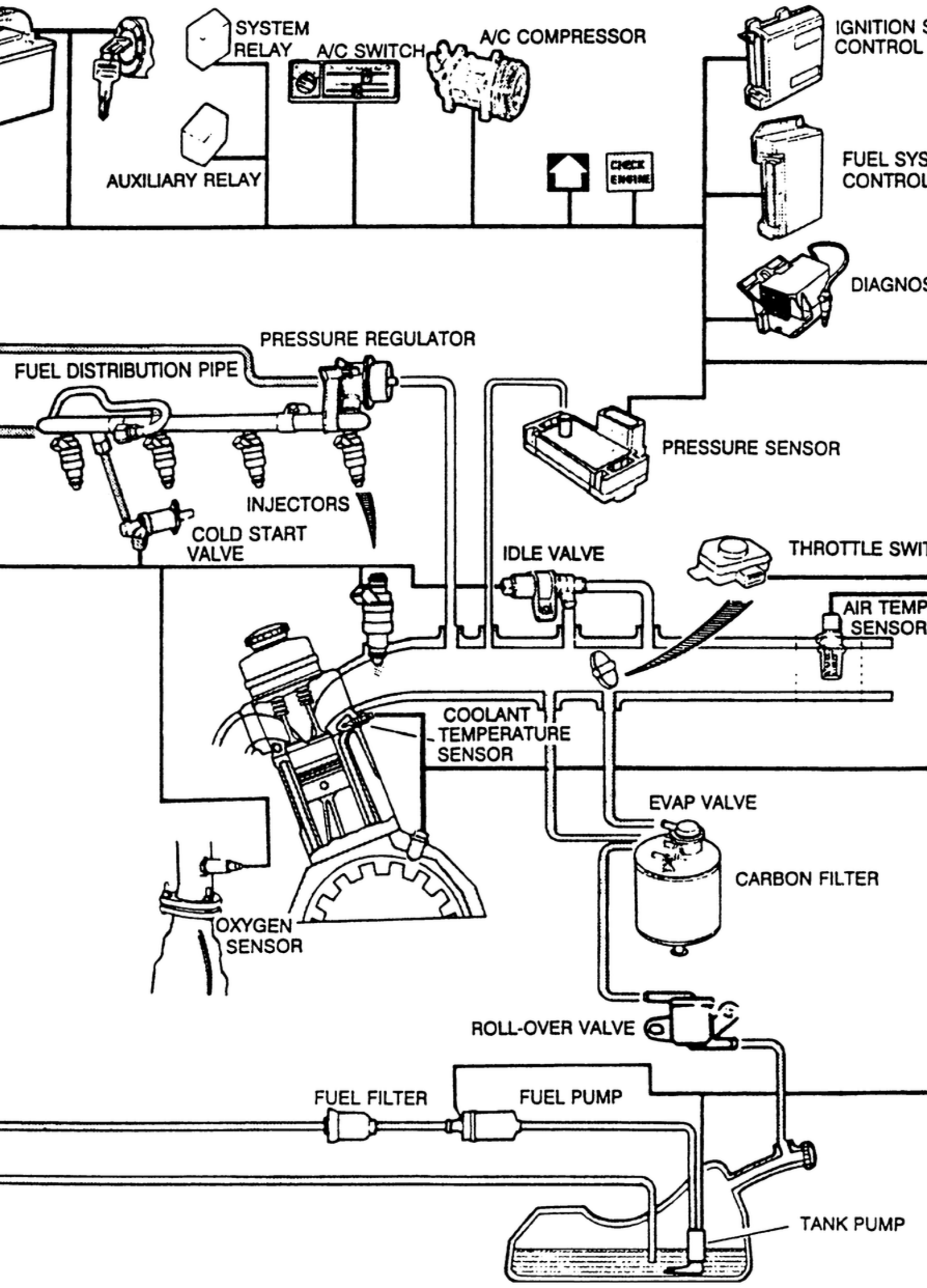
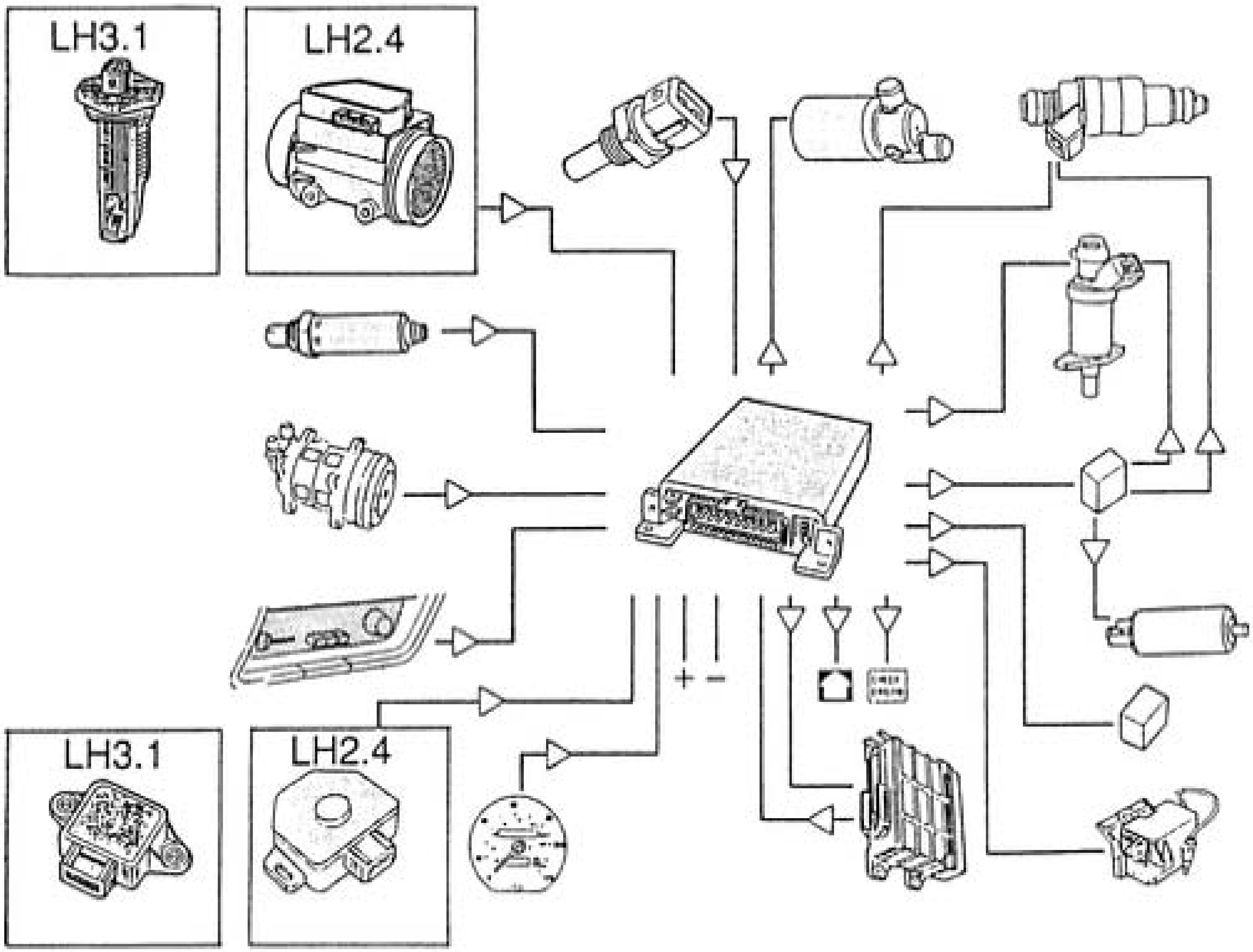
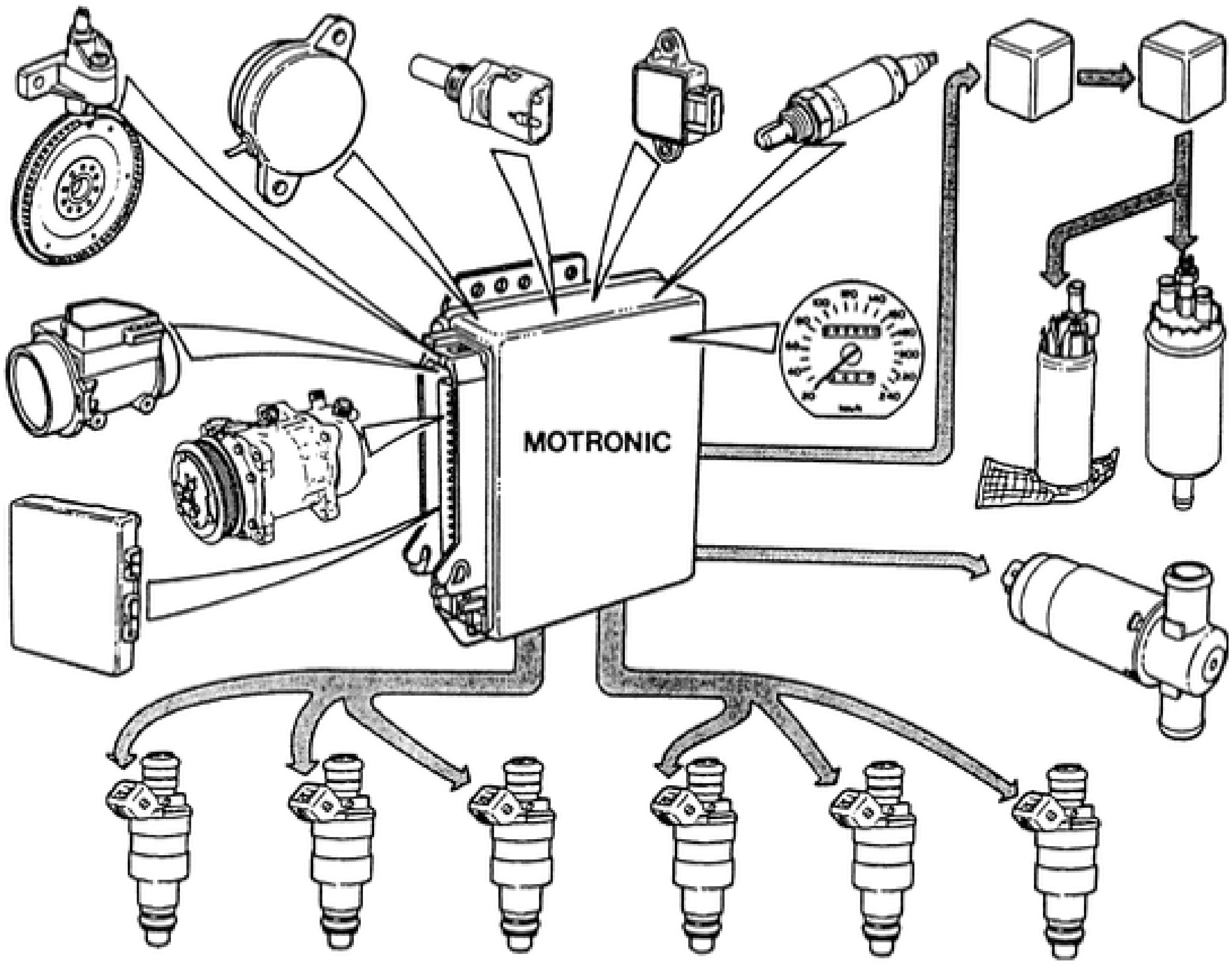
Regina Fuel Injection System



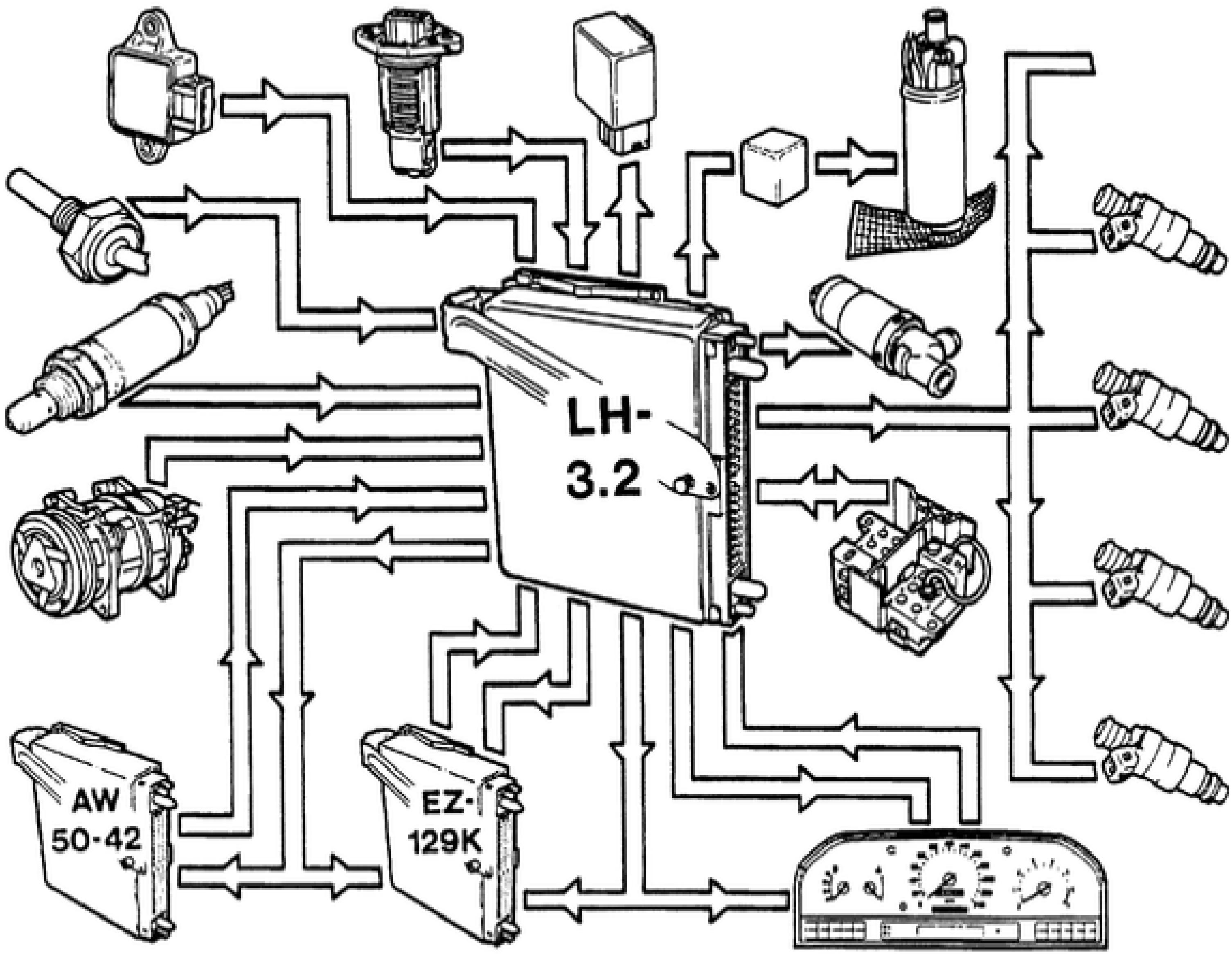
LH-Jetronic 2.4 and 3.1 Fuel Injection System



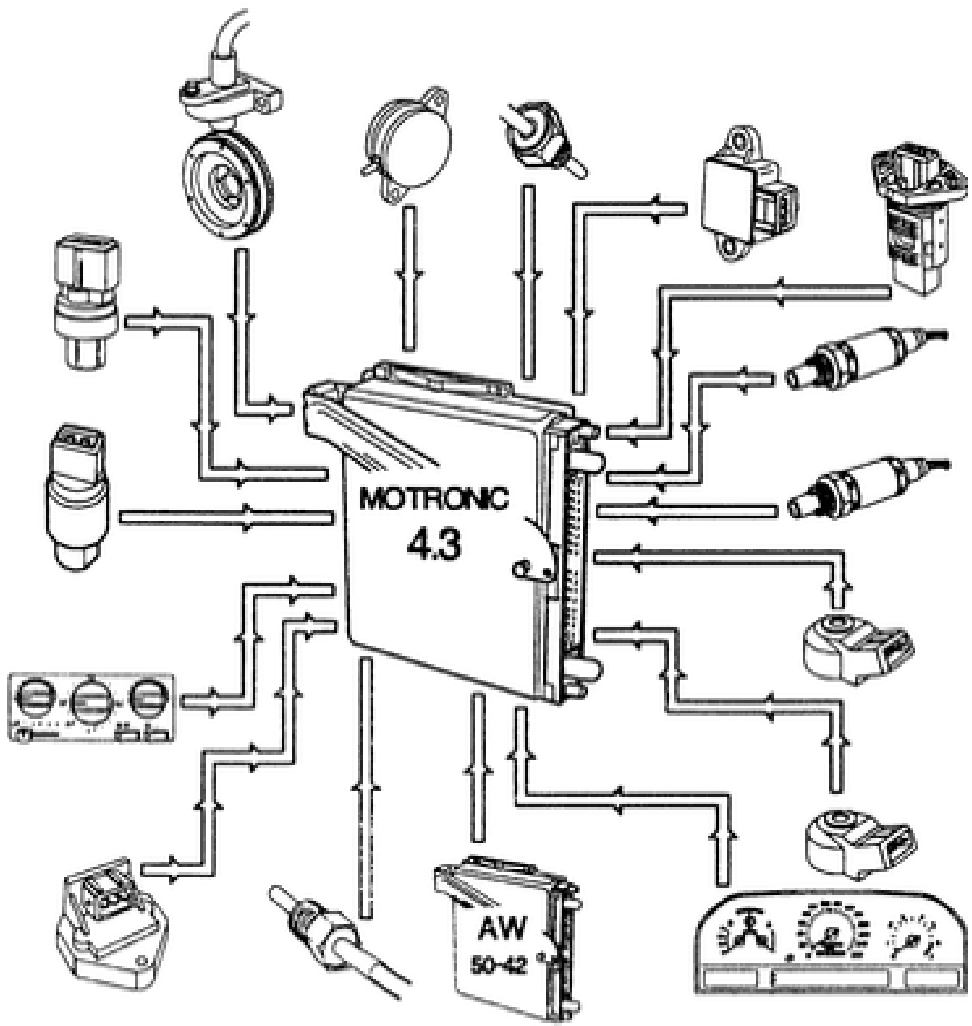
Motronic 1.8 Fuel Injection System



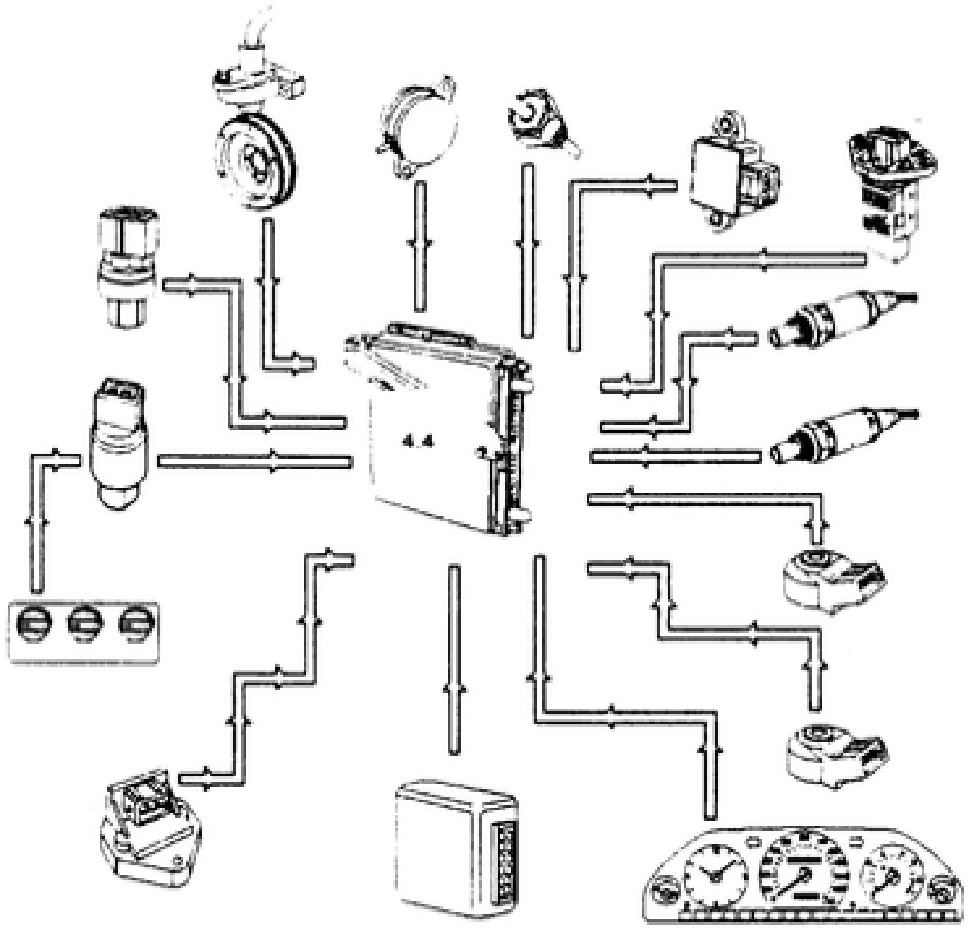
Bosch LH-Jetronic 3.2 Fuel Injection System



Motronic 4.3 Fuel Injection System



Motronic 4.4 Fuel Injection System



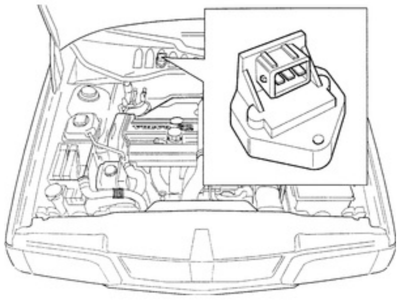
1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

The acceleration sensor measures the vertical acceleration of the vehicle, helping the ECM distinguish a bumpy road from a genuine engine "knock". The acceleration sensor works on the same principle as the KS. The acceleration sensor receives a steady voltage signal from the ECM and has a steady return signal. When the vehicle rides over a bumpy terrain, the return signal fluctuates, the fluctuation measuring the deviation of the terrain.

NOTE: This sensor is found only on 1995 and later 850 models, 1996 and later 960 models and all 1998 models.

Fig. 1: The location of the acceleration sensor — 850/C70/S70/V70 models



NOTE: The sensor is located under the cowl panel on 850/C70/S70/V70 models and adjacent to the driver's side strut tower on 960/S90/V90 models.

1. Disconnect the negative battery cable.
2. On 850/C70/S70/V70 models remove the wiper arms and the cowl panel, see Section 6 of this manual for more information.
3. Unplug the sensor.
4. Remove the sensor retaining bolts.
5. Remove the sensor from the vehicle.

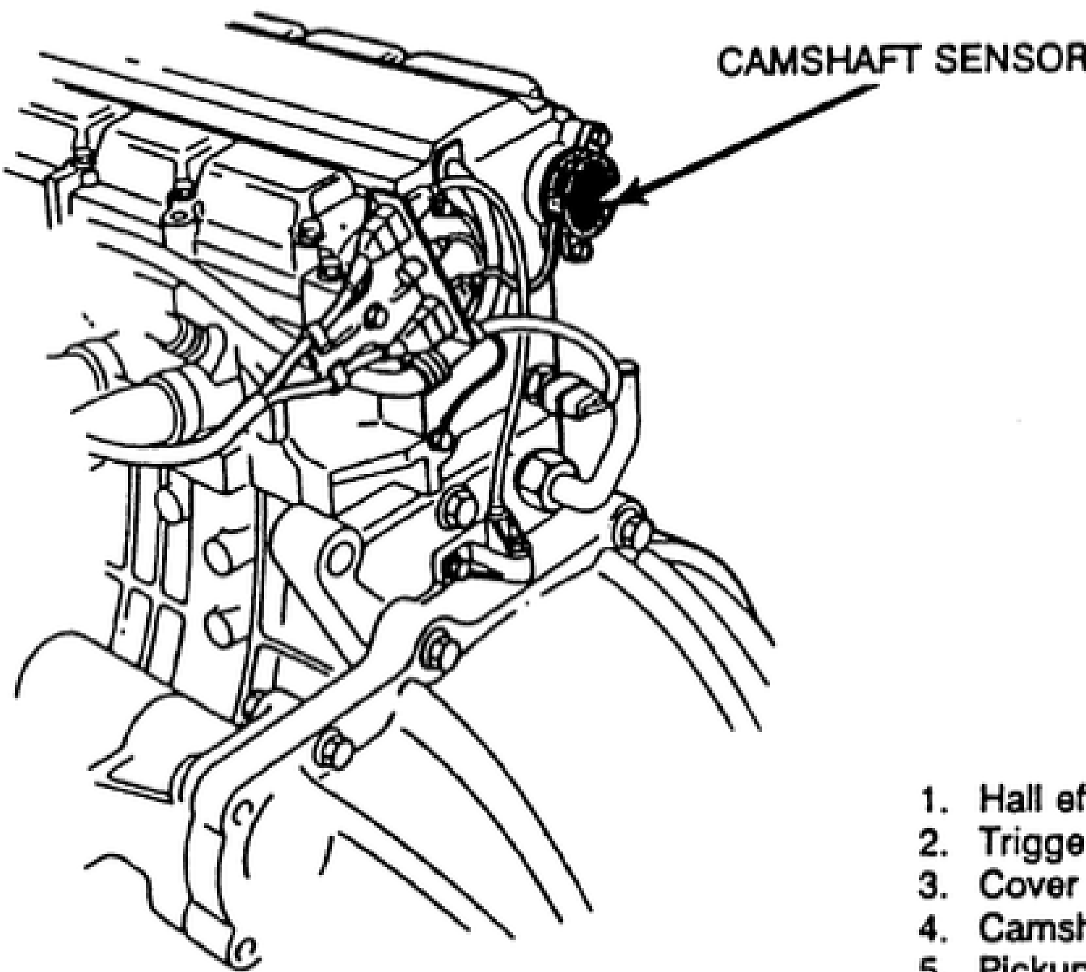
To install:

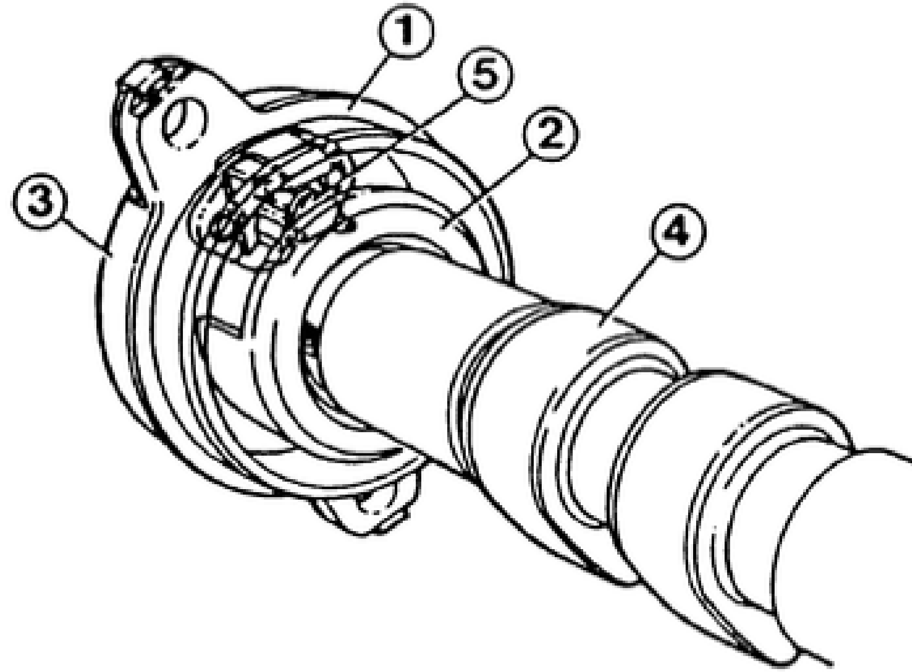
6. Place the sensor into position and tighten the retaining bolts.
7. Plug the sensor connector in.
8. On 850/C70/S70/V70 models install the cowl panel and wiper arms.
9. Connect the negative battery cable.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

1. On 850/C70/S70/V70 models, remove the wiper arms and the cowl panel. See Section 6 of this manual for additonal information to access the sensor.
2. Start the vehicle and, using a voltmeter, backprobe the connector's signal return circuit between the connector and ground. Use the wiring diagrams at the end of section 6 to help you.
3. Voltage should be 2.5v. If the there is no voltage, proceed to the next step. If the voltage reading is out of range, replace the sensor.
4. Turn the engine **OFF**, but leave the ignition **ON**.
5. Unplug the connector on the sensor and using a voltmeter, measure the signal from the ECM between the connector and ground. Use the wiring diagrams in the end of section 6 to help you.
6. Voltage should be 5.0v, if voltage is out of range or there is no voltage repair the circuit. If voltage is ok, proceed to the next step.
7. Turn the ignition **OFF**, using an ohmmeter measure the resistance between the sensor ground and ground. Use the wiring diagrams in the end of section 6 to help you.
8. Resistance should be 0 ohms, if resistance is out of range repair the circuit.
9. On 850/C70/S70/V70 models install the cowl panel and wiper arms.



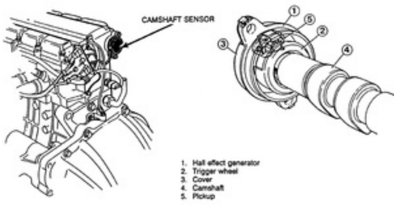


1. Hall effect generator
2. Trigger wheel
3. Cover
4. Camshaft
5. Pickup

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

Fig. 1: Camshaft sensor components and location — 960 models



The function of the Camshaft Position (CMP) sensor is to tell the ECM if the camshaft is on the first or second revolution of an engine cycle. The CMP sensor allows the engine to determine which pistons are approaching TDC. The CMP sensor, in conjunction with the crankshaft position sensor, determine which cylinder requires ignition.

The CMP sensor consists of a trigger rotor and a Hall effect switch. The trigger rotor turns at the same speed as the camshaft. The ECM sends a 5-volt supply to the Hall effect sensor, which is grounded when the rotor passes the Hall effect switch, giving a zero voltage signal. When the sensor is shielded, the sensor returns the 5-volt signal to the ECM.

1992 Volvo 940

Submodel: | Engine Type: L4 | Liters: 2.3
Fuel Delivery: FI | Fuel: GAS

1. Disconnect the negative battery cable.
2. Remove the air inlet hose from the air cleaner housing and the throttle body.
3. Unplug the sensor's connector.
4. Remove the two retaining screws and remove the sensor from the engine.

   To install:

5. Install the sensor into place and tighten the retaining bolts.
6. Plug in the connector.
7. Install the air inlet hose onto the throttle body and the air cleaner housing.
8. Connect the negative battery cable.

Fig. 1: Crankshaft position sensor (1) and camshaft position sensor (2)

Fig. 2: Removing the CMP sensor

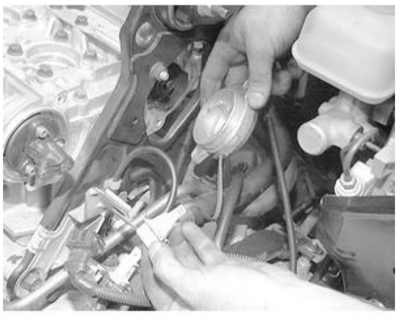


Fig. 3: Inspect the Hall effect switch inside the CMP sensor after removal

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

Fig. 1: CMP sensor connector terminals

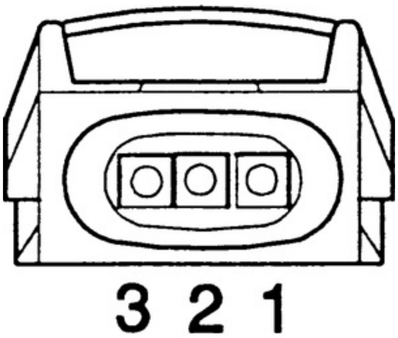


Fig. 2: Checking for battery voltage at terminal 3

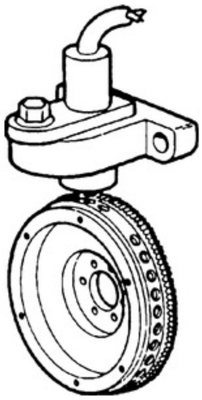
Fig. 3: Checking the signal return circuit of the CMP sensor

1. Disconnect the negative battery cable.
2. Unplug the sensor connector.
3. To test the voltage lead:
    A. Using an voltmeter, measure the voltage at terminal 3. Turn the ignition **ON**, and measure the voltage between terminal 3 and ground.
    B. Voltage should be battery voltage. If voltage is not present or out of range, repair the circuit. If voltage is ok, proceed to the next step.
4. To test the signal return:
    A. Using an voltmeter, measure the voltage at terminal 2. Turn the ignition **ON**, and measure the voltage between terminal 2 and ground.
    B. Voltage should be around 5v. If voltage is not present or out of range, repair the circuit. If voltage is ok, proceed to the next step.
5. To test the ground circuit:
    A. Using an ohmmeter, measure the resistance at terminal 1. Turn the ignition **ON**, and measure the resistance between terminal 1 and ground.
    B. Resistance should be 0 ohms. If continuity is not present or out of range, repair the circuit. If continuity is ok, replace the CMP sensor.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

Fig. 1: The CKP sensor and pulse wheel



The Crankshaft Position (CKP) sensor, sometimes called an RPM and/or impulse sensor, is used to determine engine speed and Top Dead Center (TDC). This ensures precise ignition timing. The sensor is located at the rear of the engine block, above the flywheel. Engine speed is transmitted to the fuel control unit. The engine will not start without this signal.

LH Jetronic and EZK Ignition System Vehicles

On the pulsewheel, there are 60 markings for the CKP sensor, 58 which are drilled holes to provide information to the ignition control unit. There are no holes at 2 of the markings. These are 90 degrees Before Top Dead Center (BTDC), for cylinders No. 1 and No. 4. Ignition timing is based on these markings and other information such as engine load and temperature. This means that ignition timing can be controlled and that there is no need for the ignition setting to be adjusted.

Regina Engine Control and REX-1 Ignition Systems

On the pulsewheel, there are 44 markings for the CKP sensor, 40 which are drilled holes to provide information to the ignition control unit. There are no holes at 2 of the markings. These are 90 degrees Before Top Dead Center (BTDC), for cylinders No. 1 and No. 4. Ignition timing is based on these markings and other information such as engine load and temperature. This means that ignition timing can be controlled and that there is no need for ignition setting to be adjusted.

Motronic Engine Control Systems

The flywheel has a series of holes located on the top surface. As the holes pass the CKP sensor, the holes induce a voltage in the coil of the sensor. The passage of several holes generates an A/C signal, the frequency of which is a function of the number of holes passing per second and the voltage of which can vary between 0.1 and 55 vdc, depending on engine speed and temperature.

At 90°TDC for cylinder 1 there is a longer hole. When the longer gap passes the sensor, the voltage stops, and the ECM can calculate camshaft position.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

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1. Disconnect the negative battery cable.
2. Remove any components necessary to access the sensor.
3. Unplug the sensor's connector.
4. Remove the two retaining screws and remove the sensor from the engine.

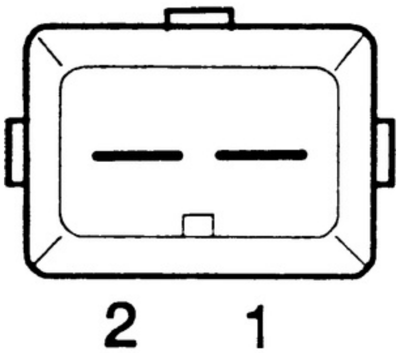
   To install:

5. Install the sensor into place and tighten the retaining bolts.
6. Plug in the connector.
7. Install any components removed to access the sensor.
8. Connect the negative battery cable.

1992 Volvo 940

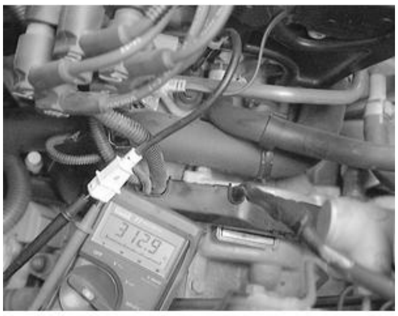
Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

Fig. 1: CKP sensor terminal identification



1. Disconnect the negative battery cable.
2. Unplug the sensor connector.
3. Using an ohmmeter, measure the resistance across the two sensor terminals.
4. Resistance should be between 200–500 ohms. If the resistance is out of range, replace the sensor.

Fig. 2: Testing the CMP sensor resistance



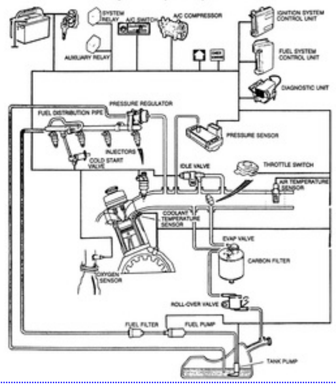
1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

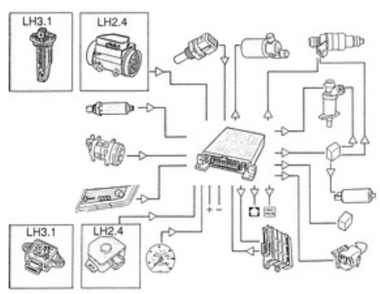
The Engine Control Module (ECM) performs many functions on your vehicle. The module accepts information from various engine sensors and computes the required fuel flow rate necessary to maintain the correct amount of air/fuel ratio throughout the entire engine operational range.

Based on the information that is received and programmed into the ECM's memory, the ECM generates output signals to control relays, actuators and solenoids. The ECM also sends out a command to the fuel injectors that meters the appropriate quantity of fuel. The module automatically senses and compensates for any changes in altitude when driving your vehicle.

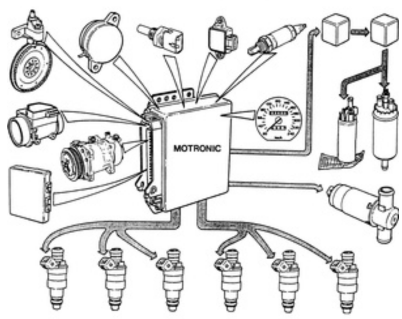
Regina Fuel Injection System



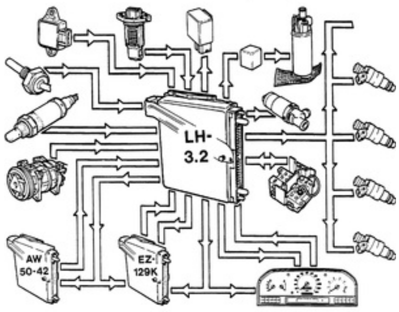
LH-Jetronic 2.4 and 3.1 Fuel Injection System



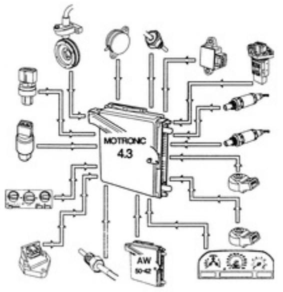
Motronic 1.8 Fuel Injection System



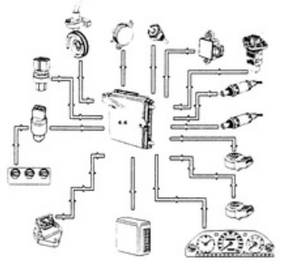
Bosch LH-Jetronic 3.2 Fuel Injection System



Motronic 4.3 Fuel Injection System



Motronic 4.4 Fuel Injection System



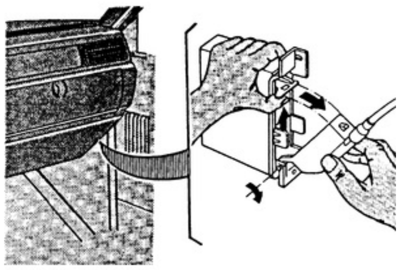
1992 Volvo 940

Submodel: | Engine Type: L4 | Liters: 2.3
Fuel Delivery: FI | Fuel: GAS

NOTE: If the battery cable(s) is disconnected for longer than 5 minutes, the adaptive fuel factor will be lost. After repair it will be necessary to drive the vehicle at least 10 miles, and as many as 250, to allow the processor to relearn the correct factors. The driving period should include steady-throttle open road driving if possible. During the drive, the vehicle may exhibit driveability symptoms not noticed before. These symptoms should clear as the control module computes the correction factor.

Coupe, 240, 700 and 940 Series

Fig. 1: Location of the ECM on Coupe, 240, 700 and 940 series models. Be sure to lift the retaining clip before detaching the connector



NOTE: The ECM is located on the passenger side footwell under the kickpanel.

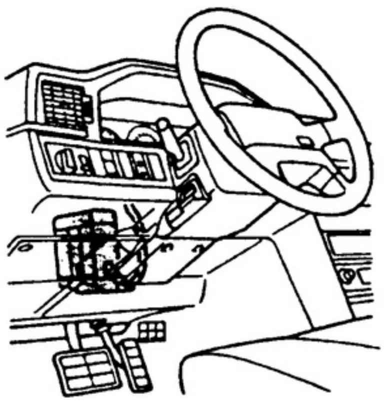
1. Disconnect the negative battery cable.
2. Remove the kickpanel to access the ECM.
3. Remove the retaining bolts on the ECM bracket.
4. Carefully lower the ECM and unlatch the harness connector from the ECM.
5. Remove the ECM.

To install:

6. Attach the connector to the ECM and carefully place it into position.
7. Tighten the bracket retaining bolts.
8. Install the kickpanel.
9. Connect the negative battery cable.
10. Start the vehicle and check to make sure the "check engine" light on the instrument cluster is operative.

960/S90/V90 Series

Fig. 2: On 960/S90/V90 series vehicles, the ECM is located behind the driver's side dash panel



NOTE: The ECM is located behind the driver's side of the dash panel, just beneath the steering column.

1. Disconnect the negative battery cable.
2. Remove the knee bolster panel under the steering column.
3. Remove the retaining bolts on the ECM bracket.
4. Carefully lower the ECM and unlatch the harness connector from the ECM.
5. Remove the ECM.

To install:

6. Attach the connector to the ECM and carefully place it into position.
7. Tighten the bracket retaining bolts.

8. Install the knee bolster panel.
9. Connect the negative battery cable.
10. Start the vehicle and check to make sure the "check engine" light on the instrument cluster is operative.

850/C70/S70/V70 Series

NOTE: The ECM on these models is in the engine compartment in a box similar to the air cleaner box. Air is brought through a pick-up tube from under the car and used to cool the modules as the vehicle drives along. There are sometimes three modules located in this box: an Ignition Control Module (ICM), ECM and, on automatic transaxle vehicles only, a Transmission Control Module (TCM). The ECM is usually the center one.

1. Disconnect the negative battery cable.
2. Remove the lid on the module box behind the passenger side headlamp.
3. Reach down and unsnap the harness connector and remove the ECM from the box.

To install:

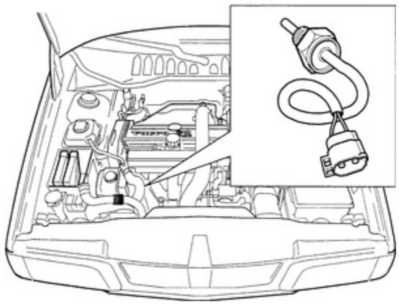
4. Place the ECM into the box and attach the harness connector to it.
5. Install the lid onto the module box.
6. Connect the negative battery cable.
7. Start the vehicle and check to make sure the "check engine" light on the instrument cluster is operative.

Fig. 3: The ECM and transmission module as located in the module box (with the lid removed)

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

Fig. 1: Location of the ECT sensor — 850/C70/S70/V70 models



The Engine Coolant Temperature (ECT) sensor resistance changes in response to engine coolant temperature. The sensor resistance decreases as the coolant temperature increases, and increases as the coolant temperature decreases. This provides a reference signal to the ECM, which indicates engine coolant temperature. The signal sent to the ECM by the ECT sensor helps the ECM to determine spark advance, EGR flow rate, air/fuel ratio, and engine temperature. The ECT also is used for temperature gauge operation by sending it's signal to the instrument cluster.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

1. Disconnect the negative battery cable.

   CAUTION
   Never open, service or drain the radiator or cooling system when hot; serious burns can occur from the steam and hot coolant. Also, when draining engine coolant, keep in mind that cats and dogs are attracted to ethylene glycol antifreeze and could drink any that is left in an uncovered container or in puddles on the ground. This will prove fatal in sufficient quantities. Always drain coolant into a sealable container. Coolant should be reused unless it is contaminated or is several years old.

2. Drain and recycle the engine coolant.
3. Remove any components necessary to access the sensor.
4. Remove the connector from the sensor.
5. Using the proper size socket, unscrew the sensor from its mounting location.

   To install:

6. Install the sensor in its mounting location and tighten it.
7. Install the connector on the sensor.
8. Install any components removed to access the sensor.
9. Refill and bleed the engine cooling system.
10. Connect the negative battery cable.
11. Inspect for leaks.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

1. Turn the key to the **ON** position, with the engine **OFF**.
2. Test the resistance of the sensor across the two terminals of the sensor.
3. Using the chart in this section for a cross reference, check the resistance in relationship to the temperature of the engine.
4. If the sensor is not within specifications, replace it.

Fig. 1: ECT sensor terminal identification

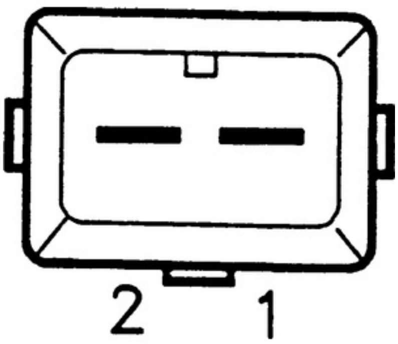


Fig. 2: Unplug the connector from the ECT sensor to test the sensor

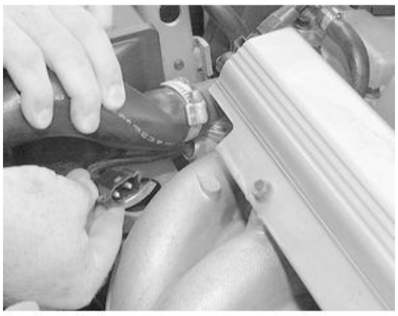
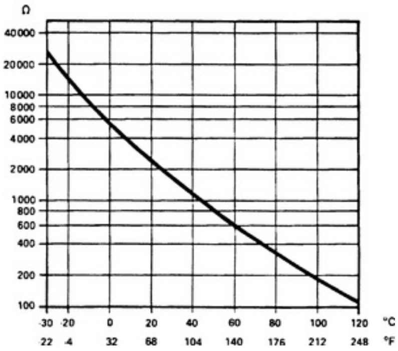


Fig. 3: Use an ohmmeter and check the sensor's resistance based on the temperature of the engine

Fig. 4: Engine temperature-to-resistance conversion chart



Ω
40000
20000
10000
8000
6000
4000
2000
1000
800
600
400
200
100
-30 -20 0 20 40 60 80 100 120 °C
22 -4 32 68 104 140 176 212 248 °F

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

The Oxygen Sensor (O2S) is a device which produces an electrical voltage when exposed to the oxygen present in the exhaust gases. The sensor is mounted in the exhaust manifold. Some oxygen sensors are electrically heated internally for faster switching when the engine is running. The oxygen sensor produces a voltage within 0 and 1 volt. When there is a large amount of oxygen present (lean mixture), the sensor produces a low voltage (less than 0.4v). When there is a lesser amount present (rich mixture) it produces a higher voltage (0.6 –1.0v).The stoichiometric or correct fuel to air ratio will read between 0.4 and 0.6v. By monitoring the oxygen content and converting it to electrical voltage, the sensor acts as a rich-lean switch. The voltage is transmitted to the engine controller. The controller signals the power module to trigger the fuel injector.

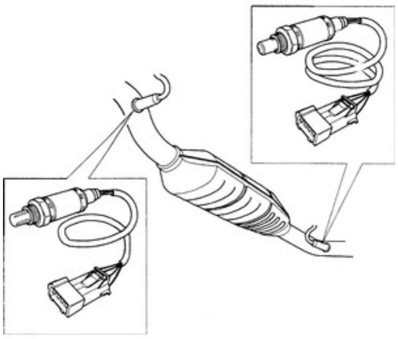
Later models have two sensors, one before the catalytic converter and one after. This is done for a catalyst efficiency monitor that is a part of the OBD-II engine controls that are on these year vehicles. The one before the catalyst measures the exhaust emissions right out of the engine, and sends the signal to the ECM about the state of the mixture as previously talked about. The second sensor reports the difference in the emissions after the exhaust gases have gone through the catalyst. This sensor reports to the ECM the amount of emissions reduction the catalyst is performing.

The oxygen sensor will not work until a predetermined temperature is reached, until this time the engine controller is running in what as known as OPEN LOOP operation. OPEN LOOP means that the engine controller has not yet begun to correct the air-to-fuel ratio by reading the oxygen sensor. After the engine comes to operating temperature, the engine controller will monitor the oxygen sensor and correct the air/fuel ratio from the sensor's readings. This is what is known as CLOSED LOOP operation.

A Heated Oxygen Sensor (HO2S) has a heating element that keeps the sensor at proper operating temperature during all operating modes. Maintaining correct sensor temperature at all times allows the system to enter into CLOSED LOOP operation sooner.

In CLOSED LOOP operation, the engine controller monitors the sensor input (along with other inputs) and adjusts the injector pulse width accordingly. During OPEN LOOP operation, the engine controller ignores the sensor input and adjusts the injector pulse to a preprogrammed value based on other inputs.

Fig. 1: OBD-II equipped vehicles have two HO2 sensors,
one before and one after the catalyst



1992 Volvo 940

Submodel: | Engine Type: L4 | Liters: 2.3
Fuel Delivery: FI | Fuel: GAS

1. Disconnect the negative battery cable.
2. Raise and support the vehicle safely.
3. Label and disconnect the HO2S from the engine control wiring harness.

   NOTE: Lubricate the sensor with penetrating oil prior to removal.

4. Remove the sensor using an appropriate tool. Special oxygen sensor sockets are available to remove the sensor and can be purchased at many parts stores or where automotive tools are sold. The proper size wrench can be used, most sensors are $^7/_8$ inch or 22mm sizes.

   To install:

5. Before installing, apply "Never Seez" paste (P/N 1 161 035-9) or equivalent anti-seize compound to the threaded section of the sensor.
6. Install the sensor in the mounting boss and tighten to 40 ft. lbs. (55 Nm).
7. Connect the engine control wiring harness to the sensor.
8. Lower the vehicle.
9. Connect the negative battery cable.
10. Remove the oxygen sensor, using a suitable wrench.

Fig. 1: Location of the front HO2S on an OBD-II equipped 850 model

Fig. 2: The catalyst efficiency monitor HO2S is located under this shield on 850 models

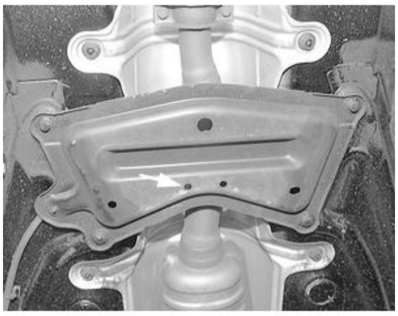


Fig. 3: The sensor can be seen from the side, but the panel must first be removed if the sensor is to be removed

Fig. 4: Unplug the HO2S connectors

Fig. 5: Remove the clip retaining the harness for the HO2S

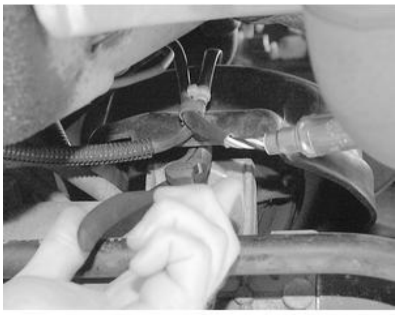


Fig. 6: The rear HO2S has an additional clip retaining the harness

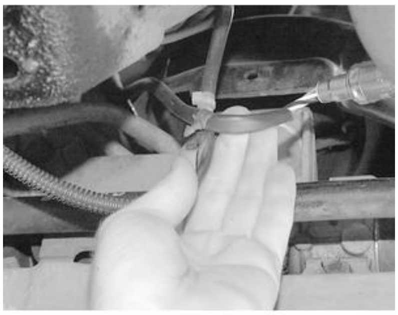


Fig. 7: A proper size open end wrench can be used to remove the HO2S

Fig. 8: Remove the HO2S from the exhaust pipe

Fig. 9: Inspect the oxygen sensor tip for abnormal deposits

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

WARNING
Do not pierce the wires when testing this sensor; this can lead to wiring harness damage. Backprobe the connector to properly read the voltage of the HO2S.

1. Disconnect the HO2S.
2. Check for supply voltage to the heating element by checking the power and ground circuits using the wiring diagrams located in Section 6. Check the heating element by:
   A. Turn the ignition to **RUN** position, with the engine **OFF**.
   B. Using a DVOM, probe the proper circuits connecting the positive lead of the DVOM to the power circuit and the negative lead to the ground circuit.
   C. Battery voltage should be present, if voltage is present but less than 8 volts, perform the following step. If there is no voltage skip the next step.
   D. Remove the connector on the ECM and check the resistance of the HO2S heater's power and ground circuits, if more than 5 ohms, repair the circuit(s). If resistance is less than 5 ohms, replace the ECM.
   E. If no voltage is present check for continuity of the HO2S heater's power and ground circuits. If continuity is present and resistance is less than 5 ohms, replace the ECM, if the circuit is open or resistance exceeds 5 ohms repair the circuit(s).
3. Start the vehicle and let it reach operating temperature. With the HO2S connected and engine running, measure the voltage with a Digital Volt-Ohmmeter (DVOM) between terminals **HO2S** and **SIG RTN** (GND) of the oxygen sensor connector. Voltage should fluctuate between 0.01–1.1 volts. If voltage fluctuation is slow or voltage is not within specification, the sensor may be faulty.

Fig. 1: Location of the HO2S connector — 700 series

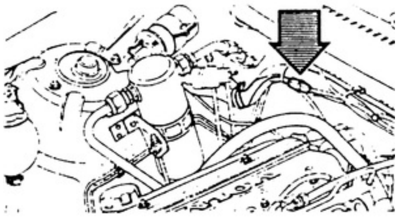
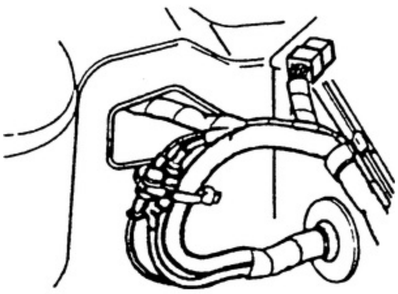


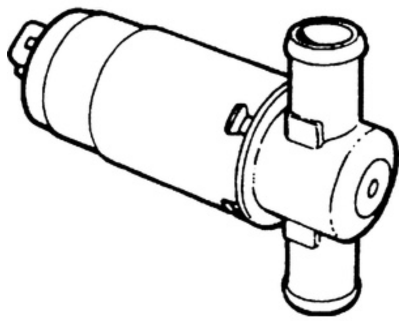
Fig. 2: Location of the HO2S connector — 240 series



1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

Fig. 1: A typical IAC valve assembly



An Idle Air Control (IAC) valve is incorporated into the system to set the correct air valve opening and constant idle speed. The valve consists of a stepper motor with twin coils, one for opening and one for closing. The ECM delivers pulsed ground signals to both IAC coils. Depending on the signals from the ECM, the motor operates a rotary valve which controls the air flow through the outlet port.

In the event of an electrical fault, a spring maintains the rotary valve in a fixed position and the idling speed is increased to approximately 1200 RPM. The ECM incorporates a self-learning system which enables it to learn the ideal idling speed. Because of this feature, the IAC valve is not adjustable.

1. Disconnect the negative battery cable.
2. Remove the throttle pulley cover (if equipped).
3. Remove the connector from the IAC.
4. Remove the hoses from the IAC valve.
5. Remove the IAC valve from the mounting hardware.

To install:

6. Place the IAC valve in the mounting hardware and secure it.
7. Install the hoses to the IAC.
8. Install the connector on the IAC.
9. Install the throttle pulley cover (if removed).
10. Connect the negative battery cable.

Fig. 1: Location of the IAC valve — 850 models

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

1. Disconnect the negative battery cable.
2. Unplug the IAC connector.
3. To test the coil driver circuits in the IAC valve:
    A. Using an ohmmeter, measure the resistance between pins 3 and 2 on the IAC valve.
    B. Resistance should be 10–14 ohms. If resistance is ok, proceed to the next step. If resistance is out of range, replace the IAC and retest.
    C. Using an ohmmeter, measure the resistance between pins 1 and 2 on the IAC valve.
    D. Resistance should be 10–14 ohms. If resistance is ok, proceed to the next step. If resistance is out of range, replace the IAC and retest.
4. To test the voltage lead:
    A. Using an voltmeter, measure the voltage at terminal 2. Turn the ignition **ON**, and measure the voltage between terminal 2 and ground.
    B. Voltage should be battery voltage. If voltage is not present or out of range, repair the circuit. If voltage is ok, proceed to the next step.
5. To test the signal return:
    A. Using an voltmeter, measure the voltage at terminal 1. Turn the ignition **ON**, and measure the voltage between terminal 1 and ground.
    B. Voltage should be around 6.0–8.5v. If voltage is not present or out of range, repair the circuit. If voltage is ok, proceed to the next step.
6. To test the ground circuit:
    A. Using an ohmmeter, measure the resistance at terminal 3. Turn the ignition **ON**, and measure the resistance between terminal 1 and ground.
    B. Resistance should be 0 ohms. If continuity is not present or out of range, repair the circuit. If continuity is ok, replace the CMP sensor and retest.

Fig. 1: IAC valve terminal (pin) identification

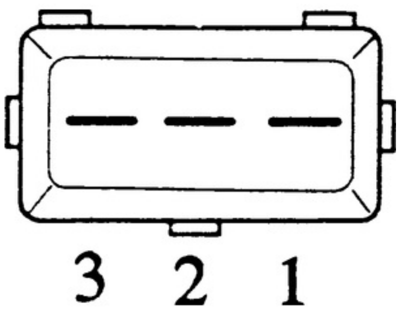


Fig. 2: IAC valve connector terminal identification

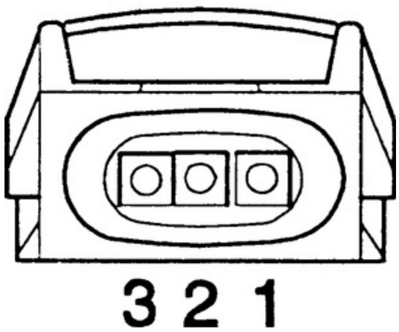


Fig. 3: Testing the coil driver circuit between pins 2 and 3

Fig. 4: Testing the coil driver circuit between pins 2 and 1

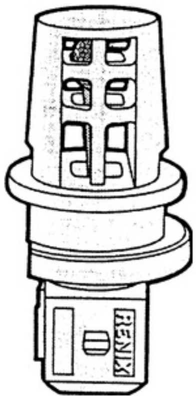
Fig. 5: Testing the IAC valve circuit at terminal 2 of the harness connector

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

The Intake Air Temperature (IAT) sensor determines the air temperature inside the intake manifold. Resistance changes in response to the ambient air temperature. The sensor has a negative temperature coefficient. As the temperature of the sensor rises the resistance across the sensor decreases. This provides a signal to the ECM indicating the temperature of the incoming air charge. This sensor helps the ECM to determine spark timing and air/fuel ratio. Information from this sensor is added to the pressure sensor information to calculate the air mass being sent to the cylinders.

Fig. 1: Typical intake air temperature sensor



1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

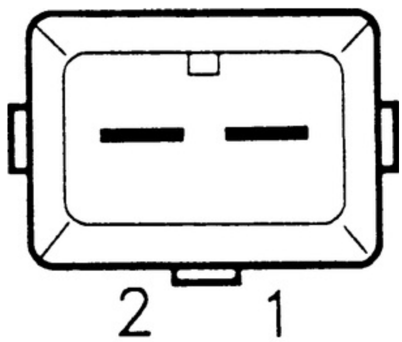
1. Disconnect the negative battery cable.
2. Unplug the connector from the sensor.
3. The sensor is removed by carefully twisting it out of the intake hose.

   To install:

4. Twist the sensor into the intake hose.
5. Plug in the connector.
6. Connect the negative battery cable.

1. Turn the key to the **ON** position, with the engine **OFF**.
2. Test the voltage of the sensor across the two terminals of the sensor.
3. Using the chart in this section for a cross reference, check the voltage in relationship to the temperature of the engine.
4. If the sensor is not within specifications, replace it.

Fig. 1: IAT sensor terminal identification



1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

The operation of the Knock Sensor (KS) is to monitor preignition or "engine knocks" and send the signal to the ECM. The ECM responds by adjusting ignition timing until the "knocks" stop. The sensor works by generating a signal produced by the frequency of the knock as recorded by the piezoelectric ceramic disc inside the KS. The disc absorbs the shock waves from the knocks and exerts a pressure on the metal diaphragm inside the KS. This compresses the crystals inside the disc and the disc generates a voltage signal proportional to the frequency of the knocks ranging from zero to 1 volt.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

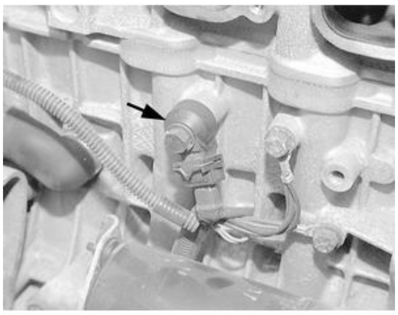
NOTE: The knock sensors are usually inaccessible without the removal of several components. It is best to locate the knock sensors and figure out what is required to be removed, then proceed to the appropriate section for removal of that component.

1. Disconnect the negative battery cable.
2. Remove any components necessary to access the sensor(s).
3. Unplug the sensor(s).
4. Remove the sensor-to-engine block retaining bolt.
5. Remove the knock sensor(s).

To install:

6. Place the sensor(s) into position and tighten the retaining bolt(s).
7. Plug the sensor(s) connector in.
8. Install any components removed for access.
9. Connect the negative battery cable.

Fig. 1: Knock sensors are located on the engine block under the intake manifold



1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

There is real no tests for this sensor, the sensor produces it's own signal based on information gathered while the engine is running. The sensors also are usually inaccessible without major component removal. The sensors can be monitored with an appropriate scan tool using a data display or other data stream information. Follow the instructions included with the scan tool for information on accessing the data. The only test available is to test the continuity of the harness from the ECM to the sensor.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

The most important information for measuring engine fuel requirements comes from the pressure sensor. Using the pressure and temperature data, the ECM calculates the intake air mass. It is connected to the engine intake manifold through a hose and takes readings of the absolute pressure. A piezoelectric crystal changes a voltage input to an electrical output which reflects the pressure in the intake manifold.

Atmospheric pressure is measured both when the engine is started and when driving fully loaded, then the pressure sensor information is adjusted accordingly.

The pressure sensor terminal has 3 connectors A, B and C. A is ground, B carries the output signal to the control unit and C provides the pressure sensor with 5 volts of current from the control unit. The output varies between 0.5–5.0 volts depending on intake manifold pressure. When the engine is not running, atmospheric pressure will register at full potential. The sensor is sensitive to electrical disturbances, therefore it is protected by a metal cover. The signal strength should be about 4.4 volts at atmospheric pressure.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

1. Disconnect the negative battery cable.
2. Remove the bolts securing the bracket to the firewall.
3. Remove the vacuum hose from the sensor.
4. Unplug the connector and remove the sensor.

To install:

5. Plug in the sensor connector.
6. Install the vacuum hose.
7. Install the sensor into place and tighten the bracket retaining bolts.
8. Connect the negative battery cable.

1. Turn the key to the **ON** position, with the engine **OFF**.
2. Test the voltage of the sensor across terminals **A** and **B** of the sensor by backprobing the connector.
3. Adding controlled pressure to the vacuum port on the sensor will help to verify the sensor's operation. A hand-held pump with a gauge (not a vacuum pump) or regulated air pressure can be used.
4. Using the chart in this section for a cross reference, check the voltage in relationship to the pressure.
5. If the sensor is not within specifications, replace it.
6. The sensor may also be checked with the engine running; at idle, the sensor should read 1.2–1.6v.

Fig. 1: Pressure-to-voltage conversion chart for the MAP sensor

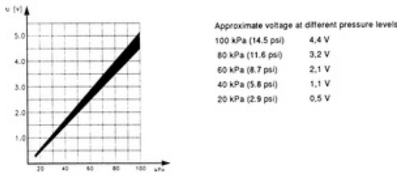


Fig. 2: MAP sensor connector terminal identification

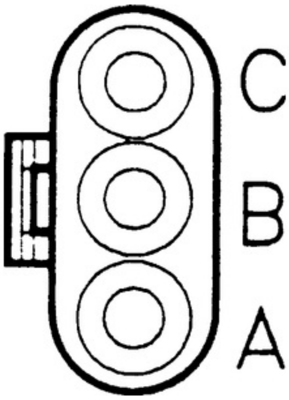


Fig. 3: Typical MAP sensor and terminal (pin) identification

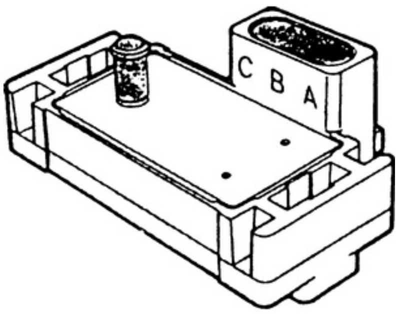


Fig. 1: Mass airflow sensor internal components

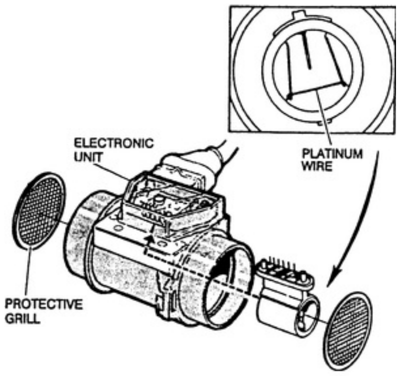
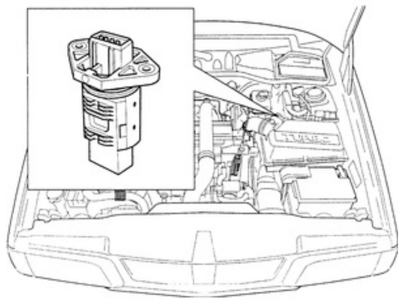


Fig. 2: MAF sensor location — 850/C70/S70/V70 models



The sensor inside the air mass meter consists of a wire which is maintained at 250°F (120°C), above the ambient air temperature of the air entering the engine. As the air mass passing over the wire increases, more current is required to maintain the correct temperature. The amount of current required is used to calculate the air mass taken in.

When the engine is turned off, any dirt on the wire is burned off electrically as the element is heated to a temperature of 1832°F (1000°C) for 1 second. Any dirt remaining on the wire would cause it to send incorrect signals to the control unit and result in an incorrect air/fuel mixture.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

1. Disconnect the negative battery cable.
2. Unplug the sensor connector.
3. Remove the two retaining screws for the sensor and remove the sensor.

To install:

4. Place the sensor into the air inlet hose.
5. Tighten the retaining screws.
6. Plug in the connector.
7. Connect the negative battery cable.

Fig. 1: Location of the MAF sensor in the air inlet hose

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

1. Unplug the connector for the MAF sensor.
2. Using the wiring diagrams found in Section 6, find the signal ground wire. Using a DVOM, connect the leads between the signal ground circuit and a ground. Resistance should be 0 ohms. If the specification is out of spec, repair the wire harness and retest.
3. Using the diagrams, find the signal circuit. Turn the ignition to the **ON** position with the engine **OFF**. Measure the voltage between the signal circuit and ground, voltage should be battery voltage. If voltage is out of spec, repair the open in the wiring and retest.
4. Plug the MAF sensor connector in. Using a DVOM backprobe the signal return and signal ground. With the key in the **ON** position and the engine **OFF**, voltage should be 0.1 –0.2v. If voltage is Ok, check all connections to make sure that they have good contact. If voltage is out of specification, replace the MAF sensor.

Fig. 1: MAF sensor connector terminal identification

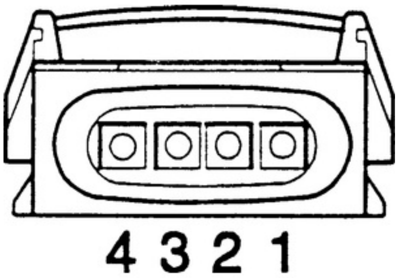


Fig. 2: Checking the ground circuit of the MAF sensor

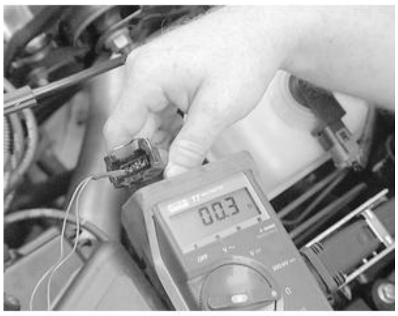
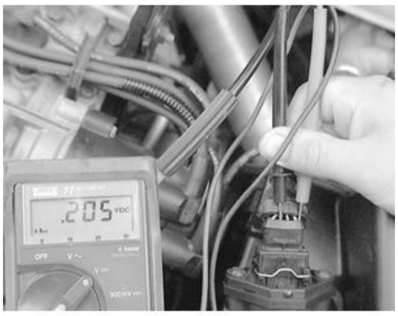
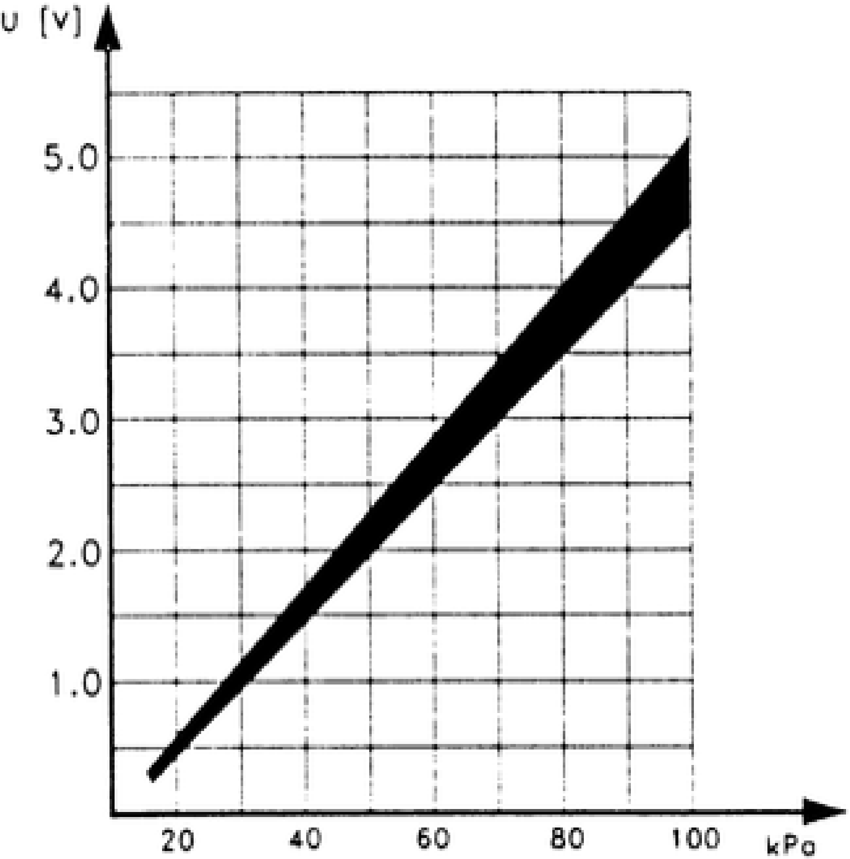


Fig. 3: Checking the signal circuit of the MAF sensor

Fig. 4: Checking the signal return circuit of the MAF sensor



.205 VDC
OFF



Approximate voltage at different pressure levels

100 kPa (14.5 psi)	4,4 V
80 kPa (11.6 psi)	3,2 V
60 kPa (8.7 psi)	2,1 V
40 kPa (5.8 psi)	1,1 V
20 kPa (2.9 psi)	0,5 V

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

The Throttle Position (TP) sensor is a potentiometer that provides a signal to the ECM that is directly proportional to the throttle plate position. The TP sensor is mounted on the side of the throttle body and is connected to the throttle plate shaft. The TP sensor monitors throttle plate movement and position, and transmits an appropriate electrical signal to the ECM. These signals are used by the ECM to adjust the air/fuel mixture, spark timing and EGR operation according to engine load at idle, part throttle, or full throttle. The TP sensor is not adjustable.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

1. Disconnect the negative battery cable.
2. Remove any components necessary to access the sensor.
3. Remove the connector from the sensor.
4. Remove the mounting screws from the sensor and remove the sensor.

To install:

5. Install the sensor onto the throttle plate shaft.

NOTE: The throttle plate shaft is designed to fit a specific way on the sensor, note the position of the shaft before tightening the bolts.

6. Tighten the mounting screws.
7. Install the sensor connector.
8. Install any components removed to access the sensor.
9. Connect the negative battery cable.

Fig. 1: Location of the TP sensor on the throttle body

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

1. With the engine **OFF** and the ignition **ON**, check the voltage at the signal return circuit of the TP sensor by carefully backprobing the connector using a DVOM.
2. Voltage should be between 0.2 and 1.4 volts at idle.
3. Slowly move the throttle pulley to the wide open throttle (WOT) position and watch the voltage on the DVOM. The voltage should slowly rise to slightly less than 4.8v at Wide Open Throttle (WOT).
4. If no voltage is present, check the wiring harness for supply voltage (5.0v) and ground (0.3v or less), by referring to your corresponding wiring guide. If supply voltage and ground are present, but no output voltage from TP, replace the TP sensor. If supply voltage and ground do not meet specifications, make necessary repairs to the harness or ECM.

Fig. 1: Checking the signal return of the TP sensor

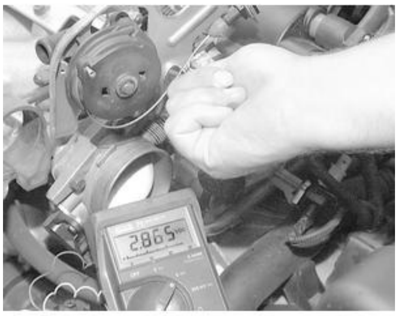


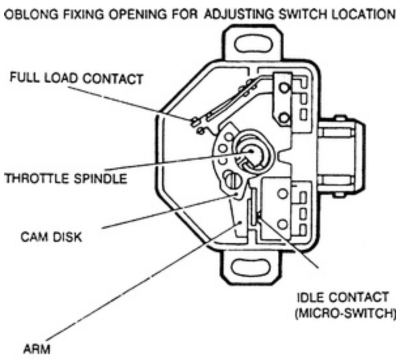
Fig. 2: Checking the signal circuit of the TP sensor

Fig. 3: Checking the ground circuit of the TP sensor

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

Fig. 1: Internal components of the throttle switch



The throttle switch informs the fuel system and ignition system control units whether the throttle valve is closed or fully opened. The throttle switch is equipped with micro-switches for idling and full load running.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

1. Disconnect the negative battery cable.
2. Remove any components necessary to access the sensor.
3. Remove the connector from the switch.
4. Remove the mounting screws from the sensor and remove the switch.

   To install:

5. Install the switch onto the throttle plate shaft.

   NOTE: The throttle plate shaft is designed to fit a specific way on the switch, note the position of the shaft before tightening the bolts.

6. Tighten the mounting screws.
7. Install the switch connector.
8. Install any components removed to access the switch.
9. Connect the negative battery cable.

1992 Volvo 940

Submodel: | Engine Type: L4 | Liters: 2.3
Fuel Delivery: FI | Fuel: GAS

1. Unplug the switch connector and connect an ohmmeter to the switch terminals. The center terminal is common, terminal No. 1 is the idle switch, terminal No. 3 is the full load switch.
2. The idle switch should be closed when the throttle is closed. Any movement of the throttle lever will open the switch just before the throttle plate actually opens. Operate the switch by hand, if necessary, to determine a faulty switch or faulty adjustment.
3. Connect the ohmmeter to the full load switch. The switch should close when the throttle lever is 70 degrees off idle, about $^1/_3$ of full stroke.
4. If the switches are good but do not operate at the proper throttle angles, check the throttle cable adjustment.

Fig. 1: Throttle switch connector terminal identification