The Phaeton W12
Engine Management System
Design and Function

Self-Study Program
Course Number 892303

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Always check Technical Bulletins and the Volkswagen Worldwide Repair Information System for information that may supersede any information included in this booklet.

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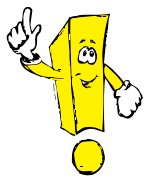

Important/Note!

The Self-Study Program provides you with information regarding designs and functions.

The Self-Study Program is not a Repair Manual.

For maintenance and repair work, always refer to the current technical literature.

The Motronic ME 7.1.1

The Motronic ME 7.1.1 engine management system for the W12 engine allows high engine performance with low fuel consumption by adapting to all operating conditions. At the heart of the Motronic ME 7.1.1 are two electronic engine control modules. This concept treats the two cylinder banks as two separate engines.

Each engine control module is assigned to one bank of the engine. Certain critical inputs, such as engine coolant temperature, report only to the primary Engine Control Module 1 J623. Engine Control Module 2 J624 obtains information only from Engine Control Module 1 J623 via the CAN data bus.

This internal CAN data bus serves exclusively to exchange information between the two engine control modules.

This Self-Study Program will familiarize you with the ME 7.1.1 engine management system, the interaction between the two control modules, the sensors, the actuators and individual subsystems.

For additional information on the W engine series, refer to *The W Engine Concept,* Self-Study Program Course Number 821203.

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Introduction

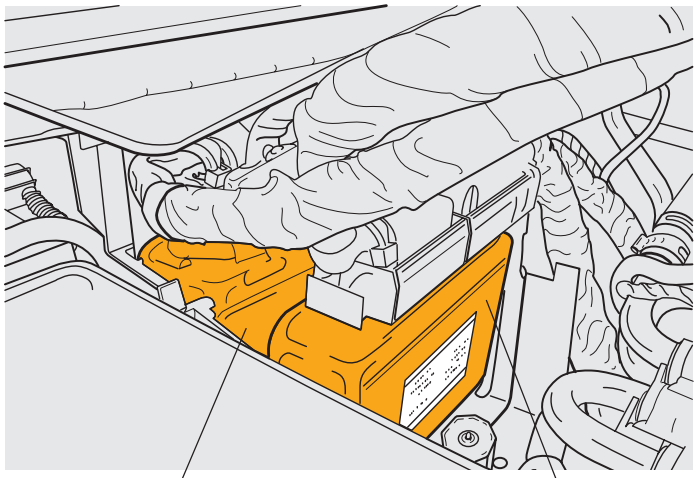
Because the two control modules are identical and engine control is fundamentally cylinder bank specific, each control module must be assigned to one of the cylinder banks.

The assignment of the engine control module is determined by the terminal configuration of its wiring harness connector.

For Engine Control Module 1 J623, terminal 49 is connected to power (+15). For Engine Control Module 2 J624, terminal 49 is connected to ground (31).

The wiring harnesses are color-coded to distinguish them.

Engine Control Module 1 J623 is also referred to as the “master“ and Engine Control Module 2 J624 as the “slave.”



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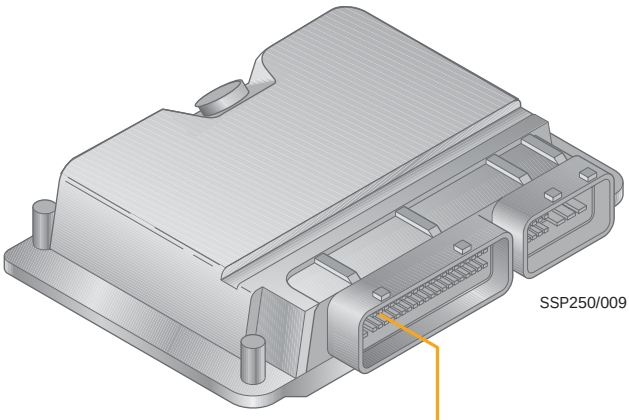
Engine Control Module 1 J623

Engine Control Module 2 J624



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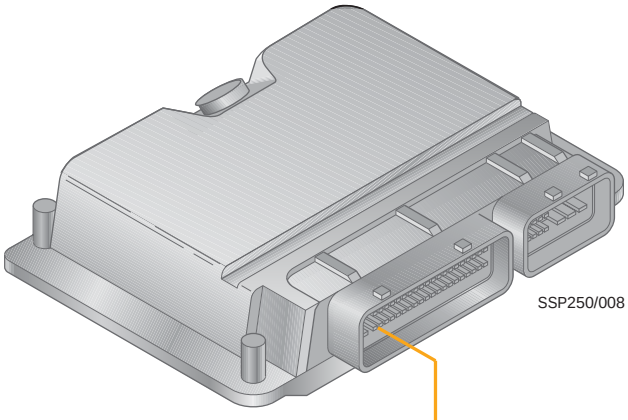
Terminal 49
to Power (+15)



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Terminal 49
to Ground (31)

Both of the engine control modules manage each bank separately to ensure that the following functions run smoothly:

- Injection control
- Ignition control (ignition system with single spark ignition coils)
- Idling speed control
- Heated oxygen sensor control of emission values
- Fuel tank breather system
- Electronic power control
- Cruise control system
- Secondary air system
- Knock control
- Continually variable intake and exhaust camshaft timing
- Engine mount control
- Coolant temperature control
- Self-diagnosis

The following subfunctions are assumed only by Engine Control Module 1 J623:

Incoming sensor signals from:

- Engine Coolant Temperature Sensor G62
- Throttle Position Sensor G79
- Brake Light Switch F
- Brake Pedal Switch F47
- Cruise Control Switch E45
- Kick-Down Switch F8
- Leak Detection Pump V144

Activated actuators:

- Motronic Engine Control Module Power Supply Relay J670
- Fuel Pump G6
- Transfer Fuel Pump G23
- After-Run Coolant Pump V51
- Map Controlled Engine Cooling Thermostat F265
- Right Electro-Hydraulic Engine Mount Solenoid Valve N145
- Coolant Fan V7
- Coolant Fan 2 V177

The input signals are processed by Engine Control Module 1 J623 and transmitted to Engine Control Module 2 J624 via the internal CAN data bus.

There is only one Engine Speed Sensor G28 in the system. It transmits the engine speed signal to both Engine Control Module 1 J623 and Engine Control Module 2 J624.

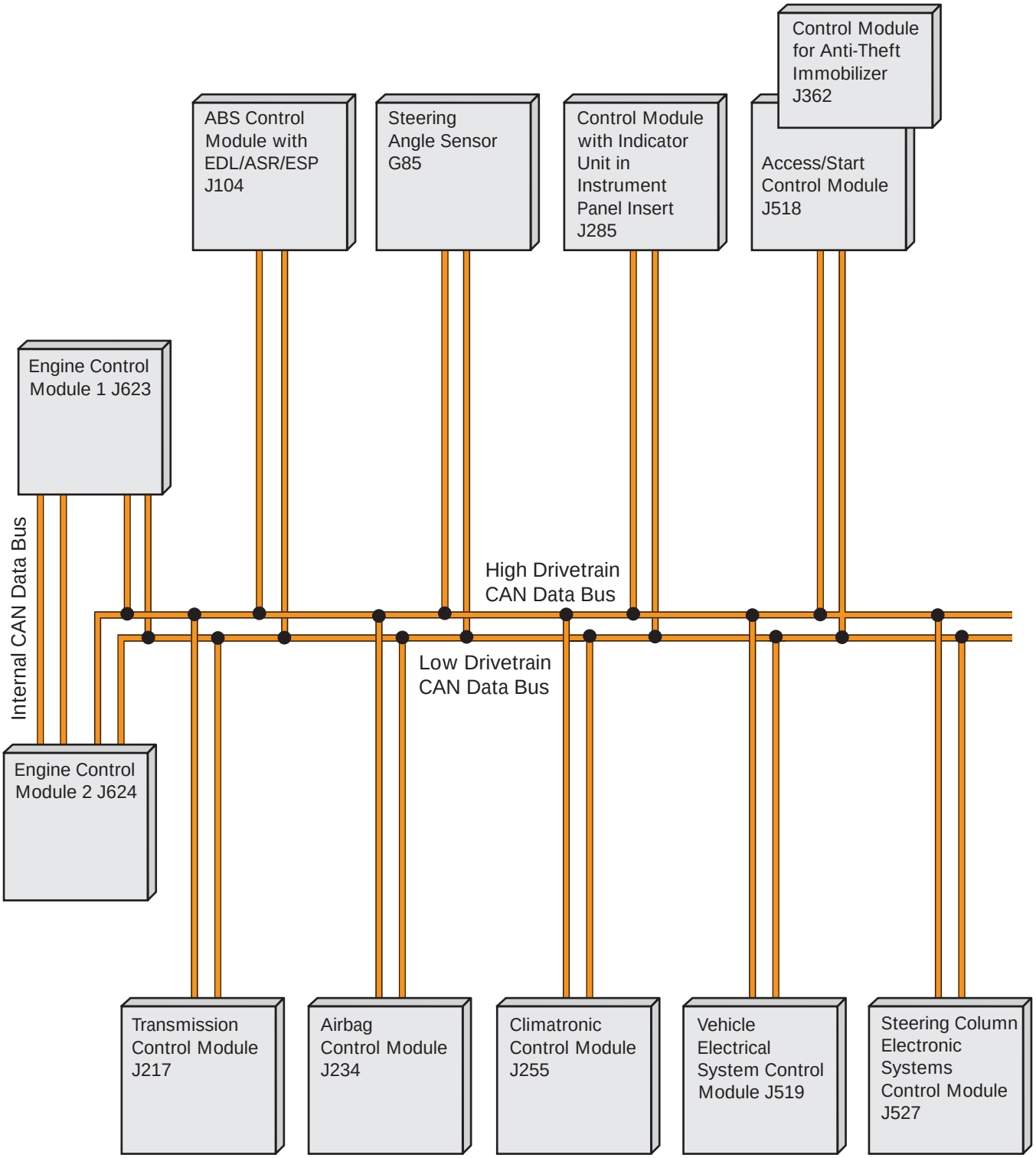
Engine Control Modules in the CAN Data Bus Drive

Engine Control Module 1 J623 and Engine Control Module 2 J624 communicate with the control modules of other vehicle systems.

This data is exchanged over the drivetrain CAN data bus which connects the individual control modules to an overall system.

The internal CAN data bus has been added for engine management in the W12 engine as a part of the two-control-module concept.

The internal CAN data bus only exchanges information between the two engine control modules.


Control Module for Anti-Theft Immobilizer J362
ABS Control Module with EDL/ASR/ESP J104
Steering Angle Sensor G85
Control Module with Indicator Unit in Instrument Panel Insert J285
Access/Start Control Module J518
Engine Control Module 1 J623
Internal CAN Data Bus
High Drivetrain CAN Data Bus
Low Drivetrain CAN Data Bus
Engine Control Module 2 J624
Transmission Control Module J217
Airbag Control Module J234
Climatronic Control Module J255
Vehicle Electrical System Control Module J519
Steering Column Electronic Systems Control Module J527

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System Overview

Engine Control Module 1 J623

Sensors

Mass Air Flow Sensor G70
Intake Air Temperature Sensor G42

Engine Speed Sensor G28

Engine Coolant Temperature Sensor G62

Engine Coolant Temperature Sensor (on Radiator) G83

Heated Oxygen Sensor G39

Heated Oxygen Sensor 2 G108

Oxygen Sensor Behind Three Way
Catalytic Converter G130
Oxygen Sensor 2 Behind Three Way
Catalytic Converter G131

Camshaft Position Sensor G40
Camshaft Position Sensor 3 G300

Knock Sensor 1 G61
Knock Sensor 2 G66

Throttle Valve Control Module J338
Angle Sensor 1 for Throttle Drive G187
Angle Sensor 2 for Throttle Drive G188

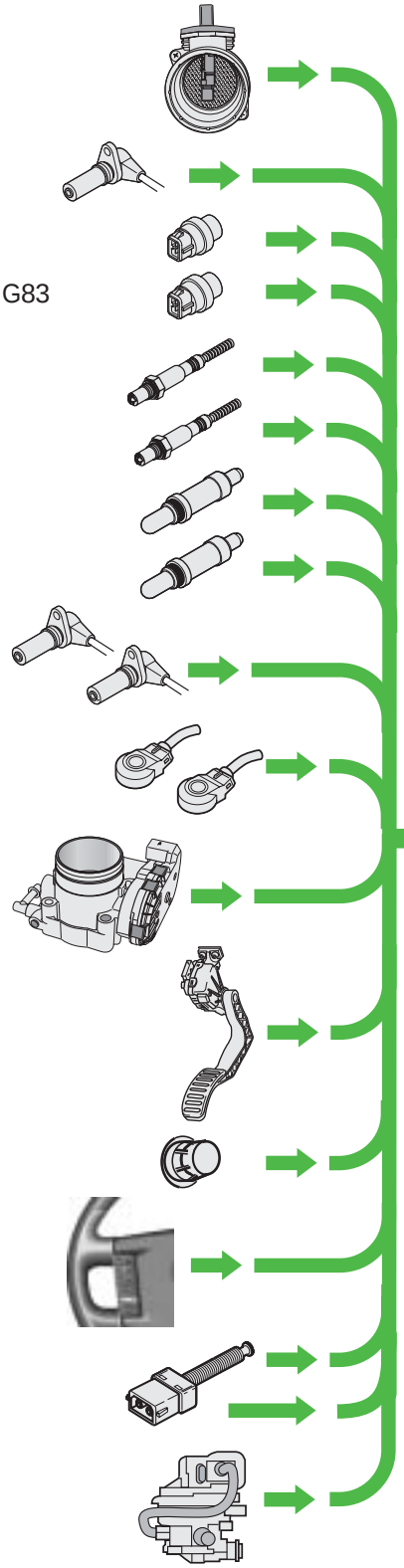
Accelerator Pedal Module with
Throttle Position Sensor G79
Sender 2 for Accelerator Pedal Position G185

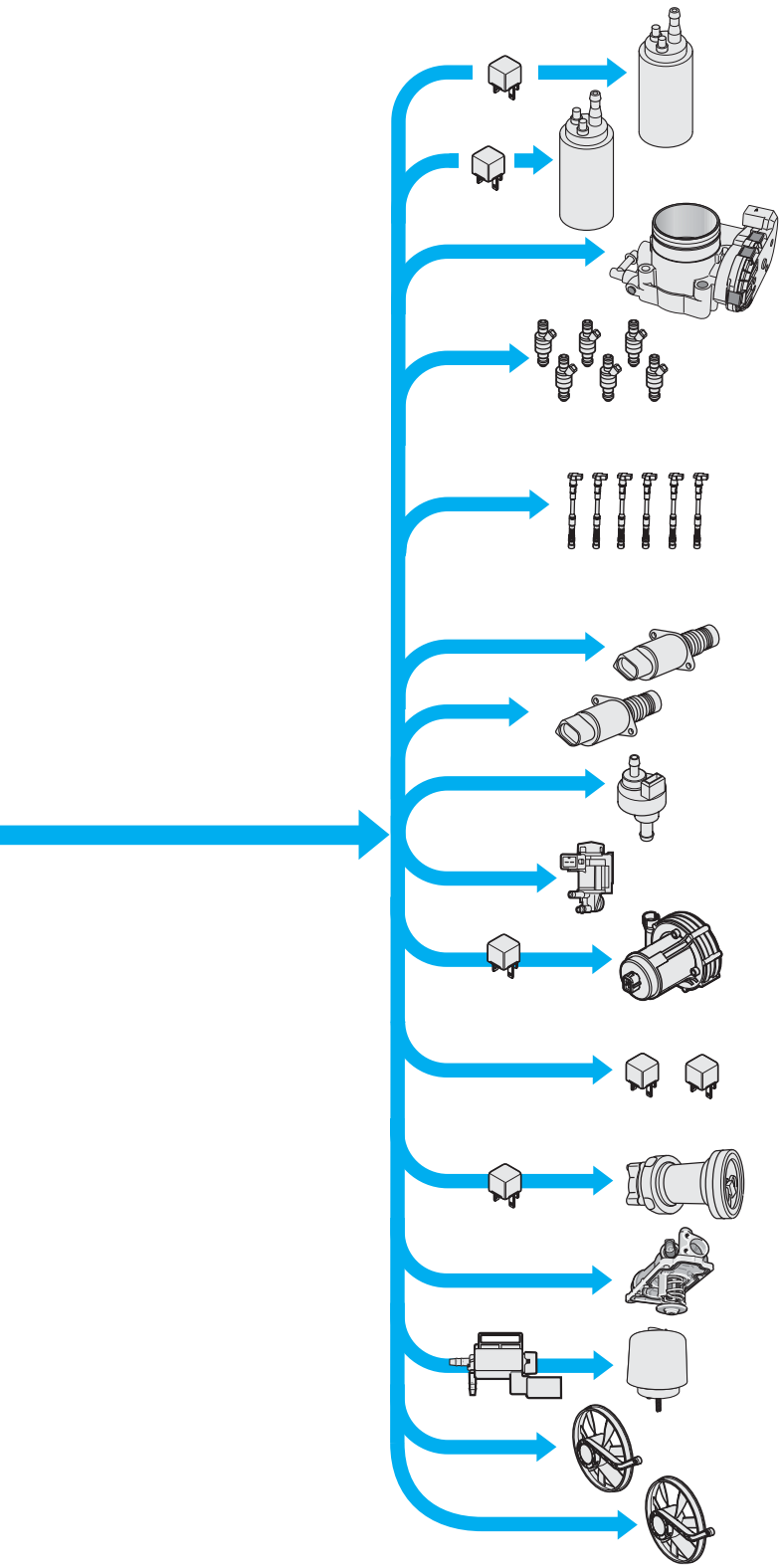
Kick-Down Switch F8

Cruise Control Switch E45
Button for Cruise Control E227

Brake Light Switch F
Brake Pedal Switch F47

Leak Detection Pump V144





Actuators

Fuel Pump Relay J17
Fuel Pump G6

Fuel Pump 2 Relay J49
Transfer Fuel Pump G23

Throttle Valve Control Module J338
Throttle Drive G186

Cylinder 1 Fuel Injector N30
Cylinder 2 Fuel Injector N31
Cylinder 3 Fuel Injector N32
Cylinder 4 Fuel Injector N33
Cylinder 5 Fuel Injector N83
Cylinder 6 Fuel Injector N84

Ignition Coil 1 with Power Output Stage N70
Ignition Coil 2 with Power Output Stage N127
Ignition Coil 3 with Power Output Stage N291
Ignition Coil 4 with Power Output Stage N292
Ignition Coil 5 with Power Output Stage N323
Ignition Coil 6 with Power Output Stage N324

Valve 1 for Camshaft Adjustment N205

Camshaft Adjustment Valve 1 (Exhaust) N318

Evaporative Emission Canister Purge Regulator Valve N80

Secondary Air Injection Solenoid Valve N112

Secondary Air Injection Pump Motor V101
Secondary Air Injection Pump Relay J299

Motronic Engine Control Module
Power Supply Relay J271
Motronic Engine Control Module
Power Supply Relay 2 J670

Engine Coolant Pump Relay J235
After-Run Coolant Pump V51

Map Controlled Engine Cooling Thermostat F265

Right Electro-Hydraulic Engine Mount Solenoid Valve N145

Coolant Fan V7

Coolant Fan 2 V177

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System Overview

Engine Control Module 2 J624

Sensors

Engine Speed Sensor G28

Mass Air Flow Sensor 2 G246
Intake Air Temperature Sensor 2 G299

Heated Oxygen Sensor 3 G285

Heated Oxygen Sensor 4 G286

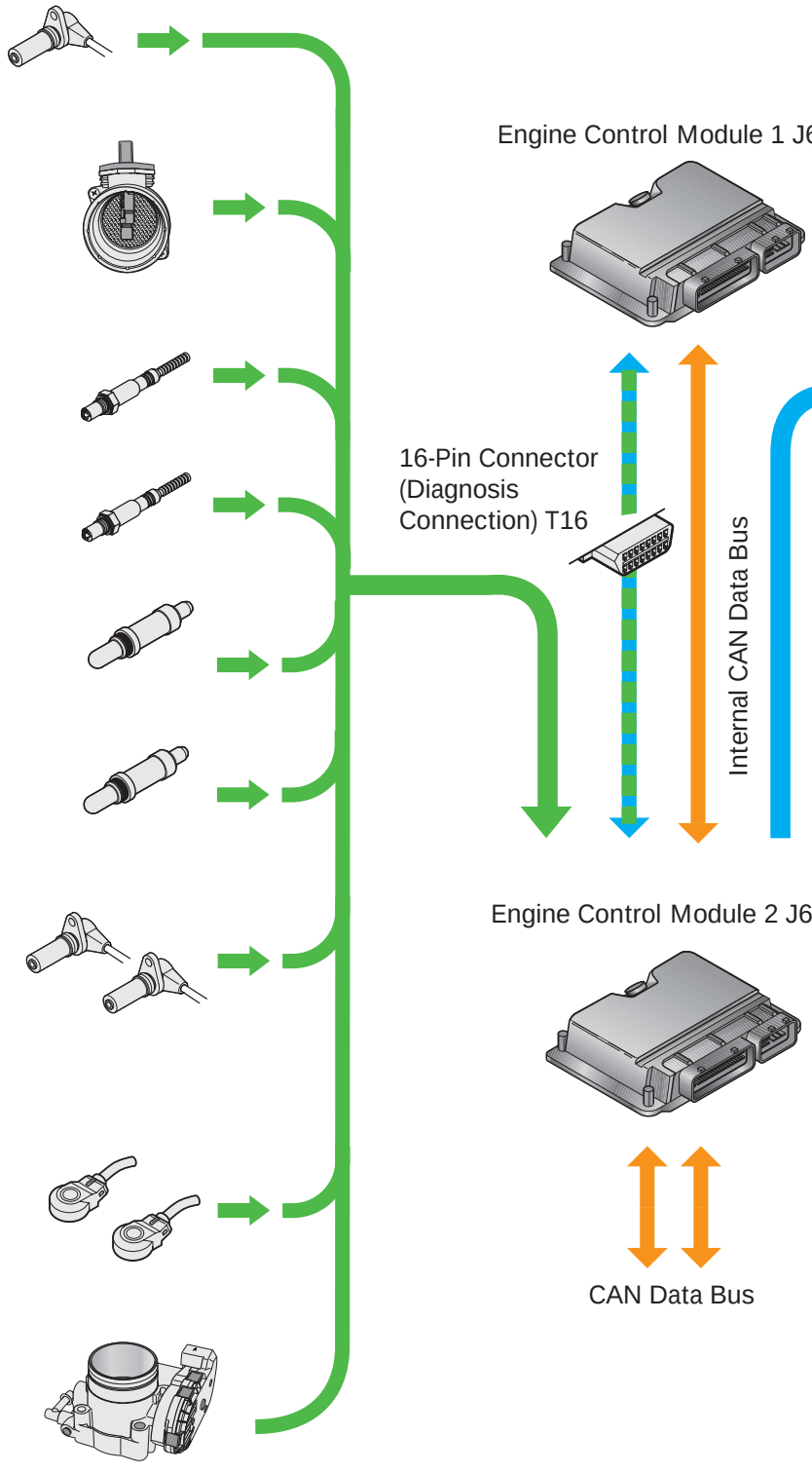
Oxygen Sensor 3 Behind Three-Way Catalytic Converter G287

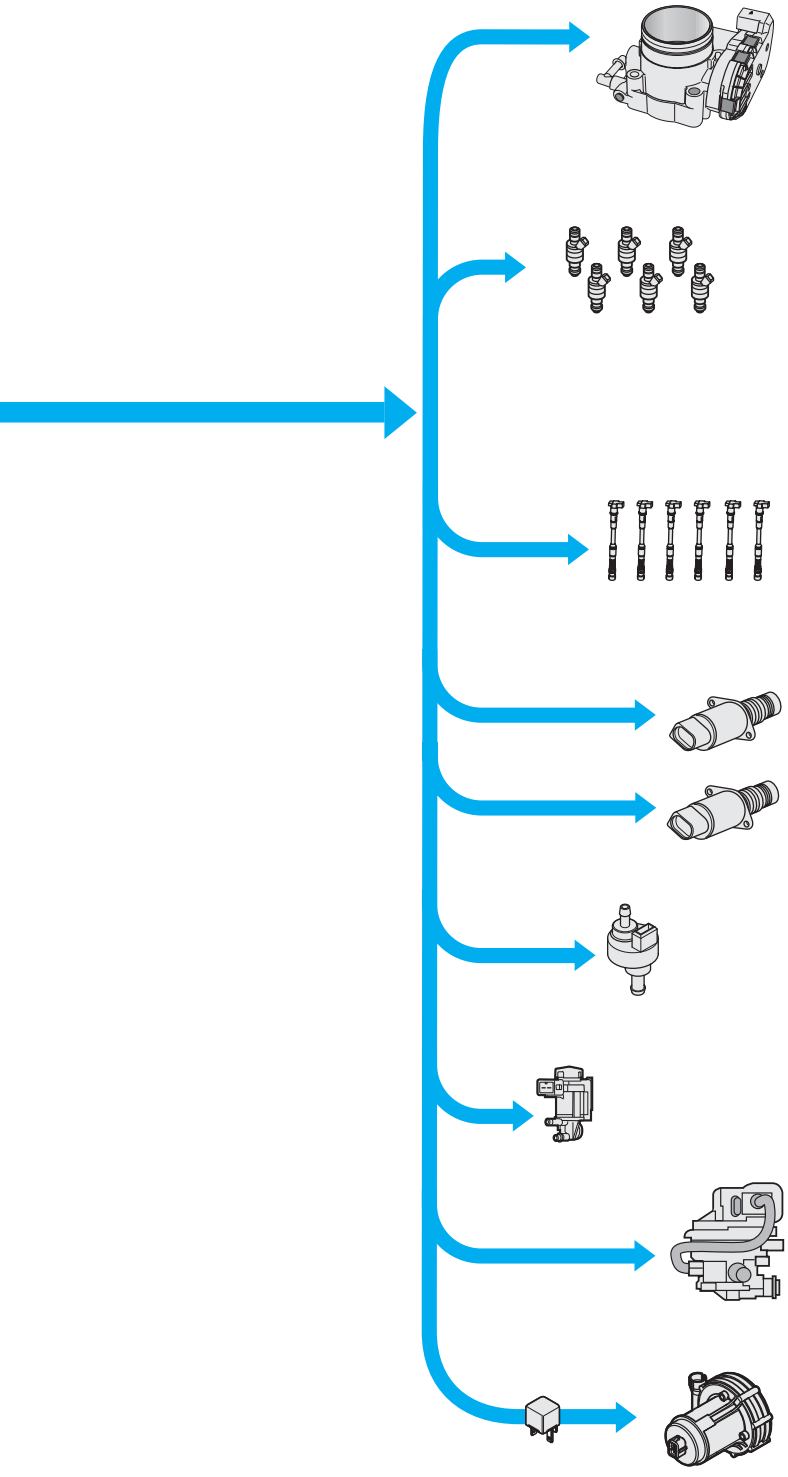
Oxygen Sensor 4 Behind Three-Way Catalytic Converter G288

Camshaft Position Sensor 2 G163
Camshaft Position Sensor 4 G301

Knock Sensor 3 G198
Knock Sensor 4 G199

Throttle Valve Control Module 2 J544
Angle Sensor 1 (on Throttle Drive 2 Power Accelerator Actuation) G297
Angle Sensor 2 (on Throttle Drive 2 Power Accelerator Actuation) G298





Actuators

Throttle Valve Control Module 2 J544
Throttle Drive 2 (Power Accelerator Actuation) G296

Cylinder 7 Fuel Injector N85
Cylinder 8 Fuel Injector N86
Cylinder 9 Fuel Injector N299
Cylinder 10 Fuel Injector N300
Cylinder 11 Fuel Injector N301
Cylinder 12 Fuel Injector N302

Ignition Coil 7 with Power Output Stage N325
Ignition Coil 8 with Power Output Stage N326
Ignition Coil 9 with Power Output Stage N327
Ignition Coil 10 with Power Output Stage N328
Ignition Coil 11 with Power Output Stage N329
Ignition Coil 12 with Power Output Stage N330

Valve 2 for Camshaft Adjustment N208

Camshaft Adjustment Valve 2 (Exhaust) N319

Evaporative Emission Canister Purge
Regulator Valve 2 N333

Secondary Air Injection Solenoid Valve 2 N320

Leak Detection Pump V144

Secondary Air Injection Pump Motor 2 V189
Secondary Air Injection Pump Relay 2 J545

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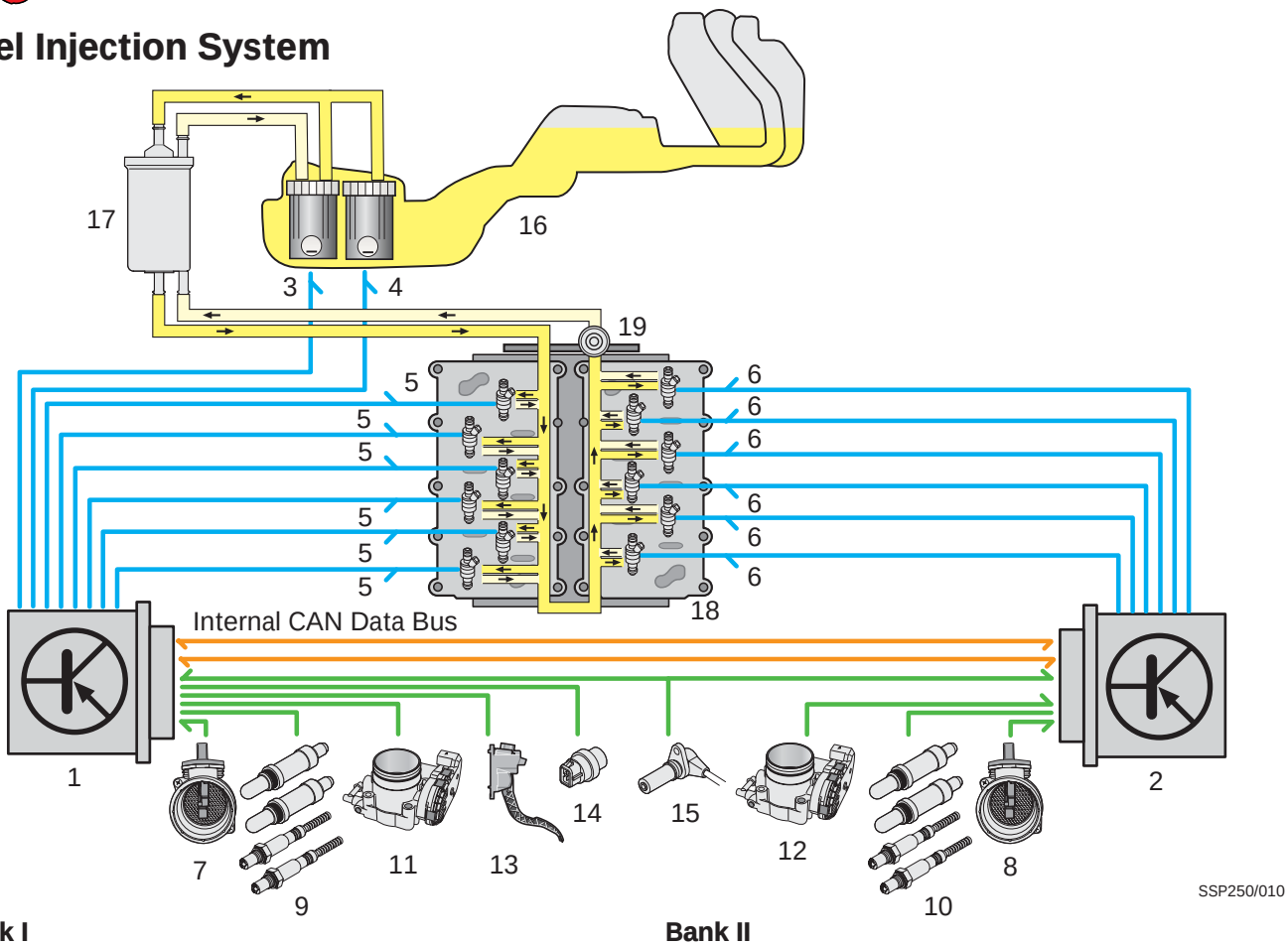
The positions of the actuators and sensors shown in the following subsystem diagrams are not identical to the physical layout in the engine compartment.

Fuel Injection System



Bank I

1 Engine Control Module 1 J623
3 Fuel Pump G6
4 Transfer Fuel Pump G23
5 Fuel Injectors N30, N31, N32, N33, N83, N84
7 Mass Air Flow Sensor G70 with Intake Air Temperature Sensor G42
9 Oxygen Sensors G39, G108, G130, G131
11 Throttle Valve Control Module J338
13 Accelerator Pedal Module with Throttle Position Sensor G79 Sender 2 for Accelerator Pedal Position G185
14 Engine Coolant Temperature Sensor G62
15 Engine Speed Sensor G28
16 Fuel Tank
17 Filter
18 Fuel Rail
19 Fuel Pressure Regulator

Bank II

2 Engine Control Module 2 J624
6 Fuel Injectors N85, N86, N299, N300, N301, N302
8 Mass Air Flow Sensor 2 G246 with Intake Air Temperature Sensor 2 G299
10 Oxygen Sensors G285, G286, G287, G288
12 Throttle Valve Control Module 2 J544
15 Evaporator Air Inlet Ambient Temperature Sensor G57

Input Signals for Calculating Injection Period

- Mass air flow engine load signals
- Intake air temperatures
- Throttle valve control module signals
- Engine speed sensor signal
- Coolant temperature
- Oxygen sensor signals
- Accelerator pedal module signal

The fuel pumps located in the fuel tank move the fuel through the fuel filter to the injectors. Transfer Fuel Pump G23 is turned on if needed, depending on the amount of fuel required. The injectors are interconnected by a fuel rail. Injection is sequential. Using the input signals, the engine control modules calculate the required fuel quantity and the corresponding injection period for each bank.

The length of time that the injector remains open (the injection period) is the only variable that determines the fuel quantity injected. The pressure regulator regulates the injection pressure in the fuel rail and regulates the return of unused fuel to the fuel tank.

Combined Mass Air Flow and Intake Air Temperature Sensors

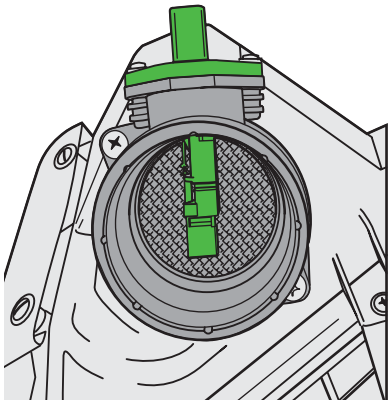
There are two combined mass air flow and intake air temperature sensors used on the W12 engine, one for each cylinder bank.

Mass Air Flow Sensor G70 determines the air mass and Intake Air Temperature Sensor G42 determines the temperature of the intake air for cylinder bank I.

Mass Air Flow Sensor 2 G246 and Intake Air Temperature Sensor 2 G299 determine the mass and temperature of the intake air for cylinder bank II.

Mass Air Flow Sensor 2 G246 and Intake Air Temperature Sensor 2 G299 for cylinder bank II are attached above cylinder bank I. Their signals are transmitted to Engine Control Module 2 J624.

Mass Air Flow Sensor G70 and Intake Air Temperature Sensor G42 for cylinder bank I are attached above cylinder bank II. Their signals are transmitted to Engine Control Module 1 J623.



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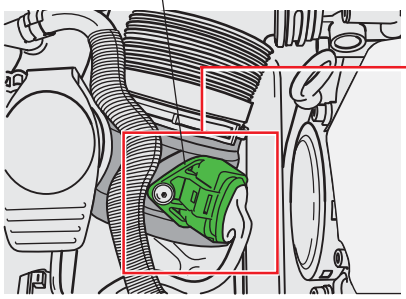
Mass Air Flow Sensor G70
Intake Air Temperature
Sensor G42



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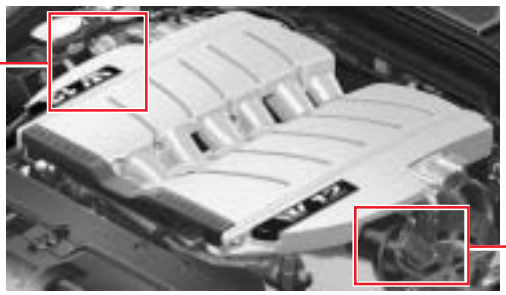

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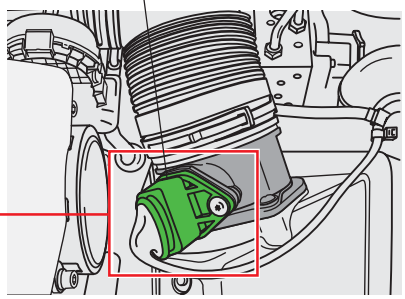
Mass Air Flow Sensor 2 G246
Intake Air Temperature
Sensor 2 G299



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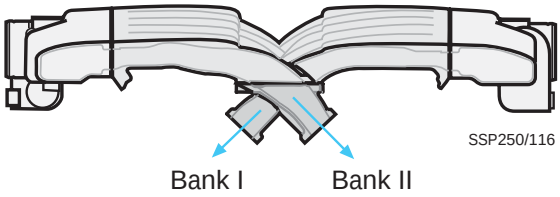
Mass Air Flow Sensor 2 G246
Intake Air Temperature
Sensor 2 G299 for Bank II



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Mass Air Flow Sensor G70
Intake Air Temperature
Sensor G42 for Bank I

Effects of failure

If Mass Air Flow Sensor G70 or Mass Air Flow Sensor 2 G246 fails, the air mass is calculated using the throttle valve position. The Malfunction Indicator Lamp K83 lights up.

If Intake Air Temperature Sensor G42 or Intake Air Temperature Sensor 2 G299 fails, an alternative temperature is calculated using the air conditioning system Evaporator Air Inlet Ambient Temperature Sensor G57.

Engine Speed Sensor G28

Engine Speed Sensor G28 provides an important input signal. It is located in the transmission housing.

The sensor used is a Hall-effect sensor. The engine speed and position of the crankshaft are detected by scanning the teeth of the converter plate with integrated sender wheel. The gap on the sender wheel acts as a reference mark for the engine control modules.

Engine Speed Sensor G28 is directly linked to both engine control modules, transmitting the engine speed signal to both Engine Control Module 1 J623 and Engine Control Module 2 J624.

Effects of failure

Continued travel is possible if the sender fails. However, at the next attempt to restart, the engine will not start.

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Fuel Pumps

The two chambers of the fuel tank each contain both an electric fuel pump and a suction jet pump (entrainment pump).

Electric Fuel Pump G6 and Transfer Fuel Pump G23 are activated by Engine Control Module 1 J623. With the aid of the pressure regulator, they generate a fuel system pressure of 58 psi (400 kPa, 4 bar).

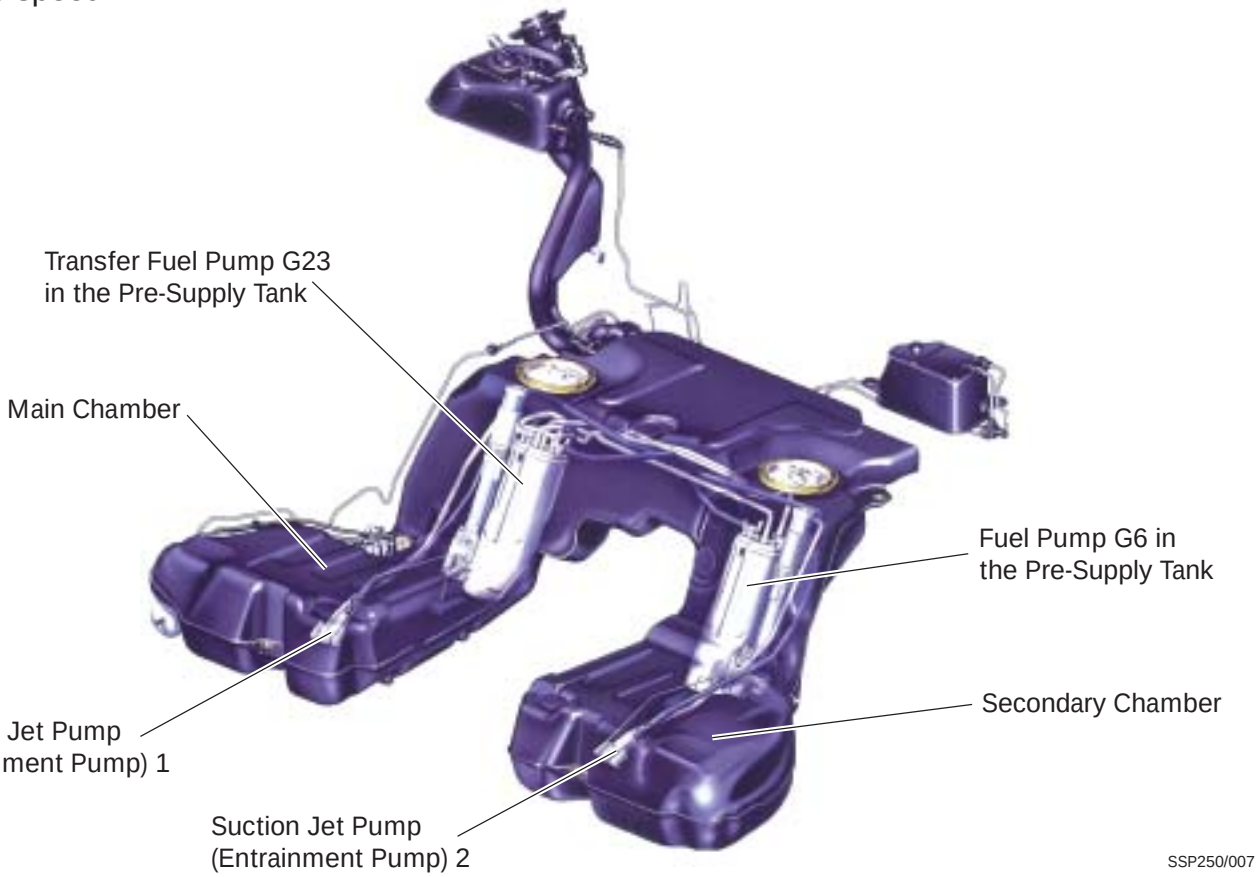
Transfer Fuel Pump G23 is the main pump. It delivers a continuous supply of fuel to the engine while the engine is running. The secondary pump, Fuel Pump G6, is turned on either when starting the engine, to achieve a quicker pressure build-up if the fuel tank has less than 5.3 gallons (20 liters), or if there is a high engine load and engine speed.

Suction jet pump (entrainment pump) 1 delivers the fuel from the main chamber into the pre-supply tank of Fuel Pump G6, and suction jet pump (entrainment pump) 2 pumps fuel out of the secondary chamber into the pre-supply tank of Transfer Fuel Pump G23.

Effects of failure

If one of the fuel pumps fails, engine performance is reduced as the result of a lack of fuel.

It is no longer possible to achieve top speed. At high engine speeds the engine runs unevenly.



Fuel Injectors

The fuel injectors are activated by the two engine control modules according to the firing order.

- Engine Control Module 1 J623 activates the fuel injectors for cylinder bank I: N30, N31, N32, N33, N83, N84.
- Engine Control Module 2 J624 activates the fuel injectors for cylinder bank II: N85, N86, N299, N300, N301, N302.

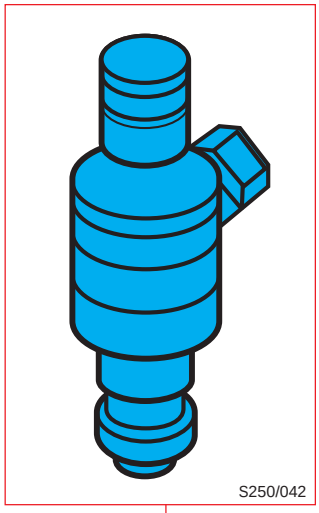
The fuel injectors are attached to a common fuel rail with securing clips. They inject finely atomized fuel directly in front of their respective intake valves.

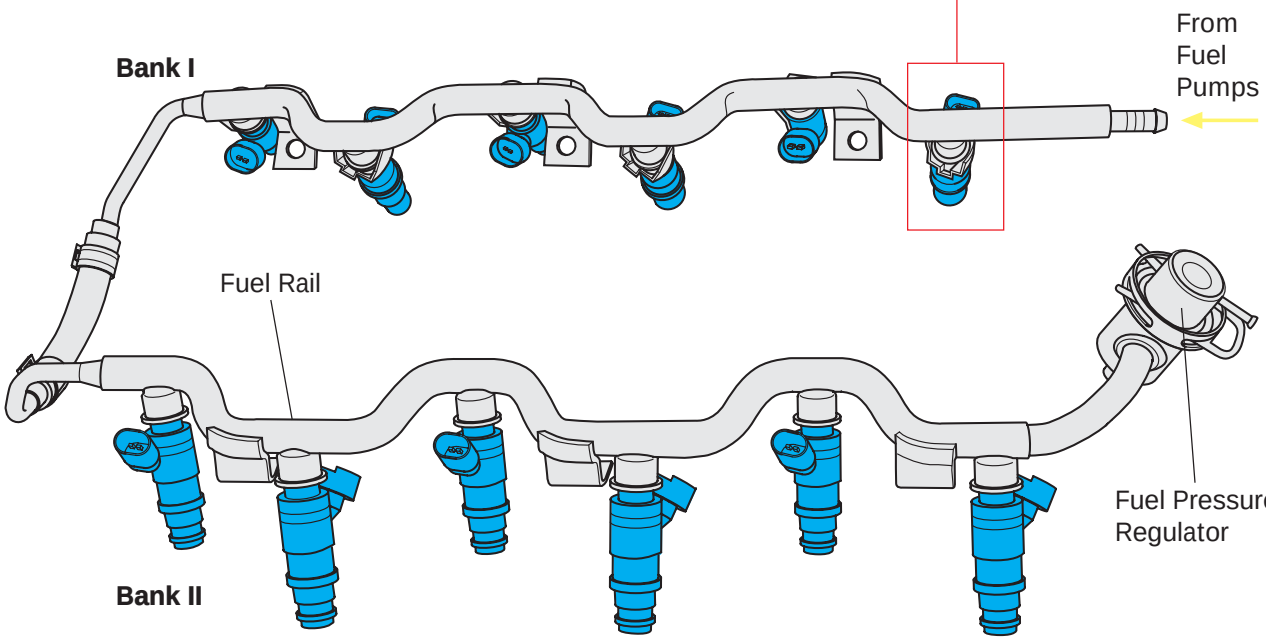
Effects of failure

If a fuel injector is blocked, a mixture deviation is detected by the diagnosis system.

The supply of fuel is interrupted, which means the engine runs with reduced power output.

A fault is recorded in the appropriate engine control module.



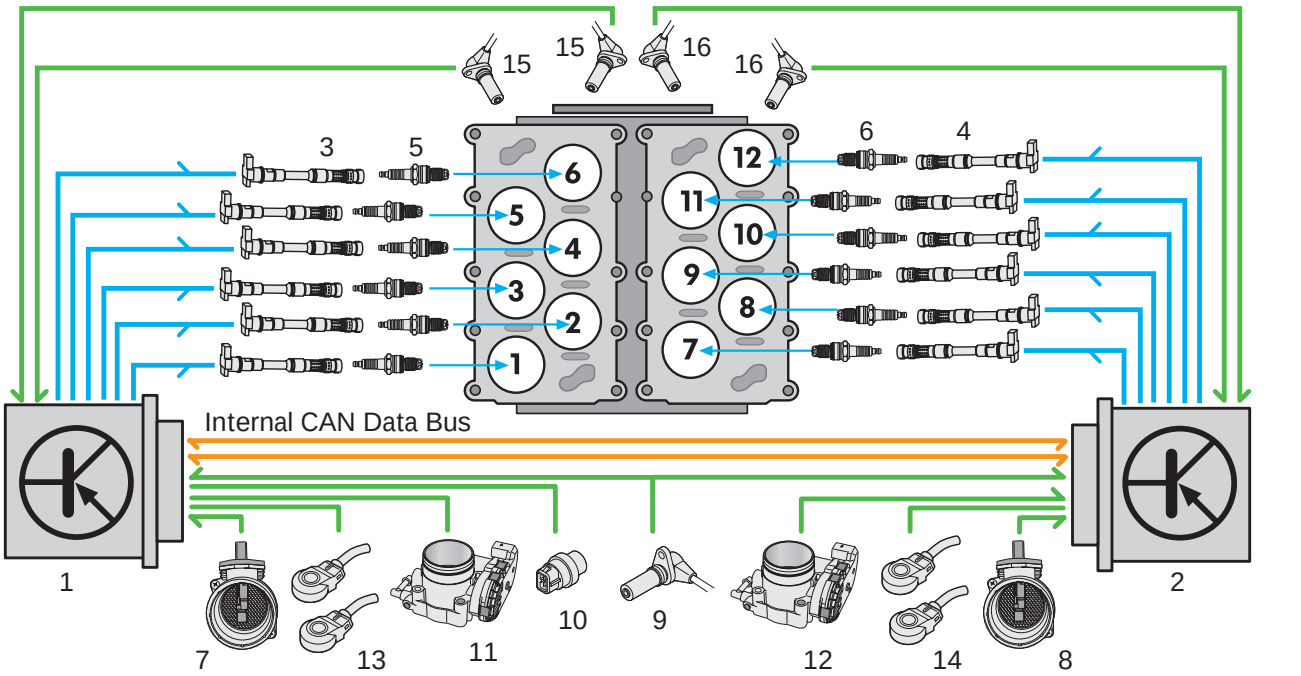


Ignition System

Input Signals for Calculating the Firing Point

- Engine speed sensor signal
- Mass air flow engine load signals
- Throttle valve control module signals
- Coolant temperature
- Knock sensor signals
- Camshaft position sensor signals

The firing point is calculated from a map stored in the memory of the appropriate engine control module. Each engine control module also makes allowance for the input signals.



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Bank I

1 Engine Control Module 1 J623
3 Ignition Coils with Power Output Stage N70, N127, N291, N292, N323, N324
5 Spark Plugs Q
7 Mass Air Flow Sensor G70 with Intake Air Temperature Sensor G42
9 Engine Speed Sensor G28
10 Engine Coolant Temperature Sensor G62
11 Throttle Valve Control Module J338
13 Knock Sensors 1 and 2 G61, G66
15 Camshaft Position Sensors 1 and 3 G40, G300

Bank II

2 Engine Control Module 2 J624
4 Ignition Coils with Power Output Stage N325, N326, N327, N328, N329, N330
6 Spark Plugs Q
8 Mass Air Flow Sensor 2 G246 with Intake Air Temperature Sensor 2 G299
9 Engine Speed Sensor G28
12 Throttle Valve Control Module 2 J544
14 Knock Sensors 3 and 4 G198, G199
16 Camshaft Position Sensors 2 and 4 G163, G301

Ignition Coils with Power Output Stage

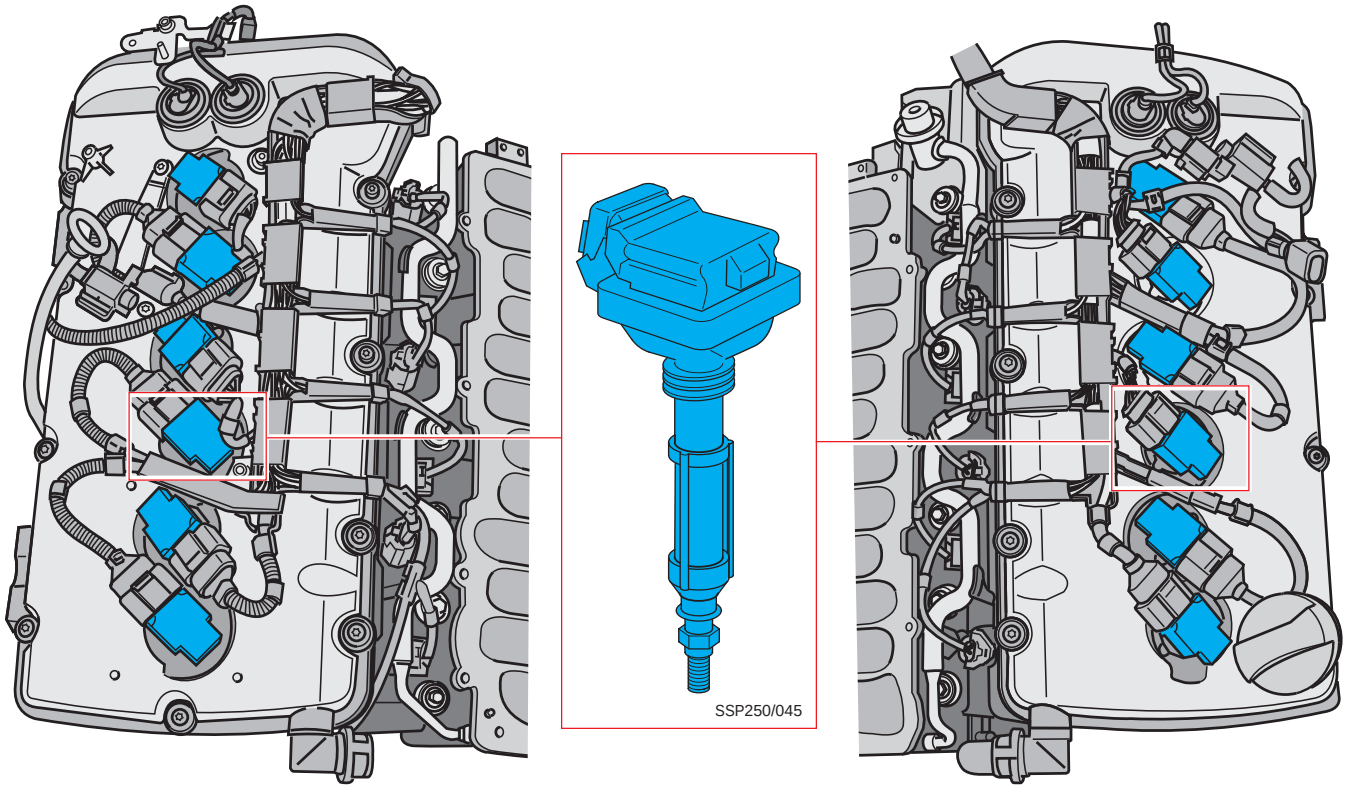
The output stage and ignition coil are combined in each element of the ignition coils with power output stage, which means that the ignition can be influenced by the engine management system individually for each cylinder.

- Ignition coils with power output stage N70, N127, N291, N292, N323, N324 are activated by Engine Control Module 1 J623.
- Engine Control Module 2 J624 activates ignition coils with power output stage N325, N326, N327, N328, N329, N330.

Effects of failure

If an ignition coil fails, a fuel mixture deviation is detected by the self-diagnosis system.

The engine runs at reduced power and a fault is recorded in the engine control module for that bank.



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Knock Control

Input Signals

- Knock sensor signals
- Camshaft position sensor signals

Knock Sensors

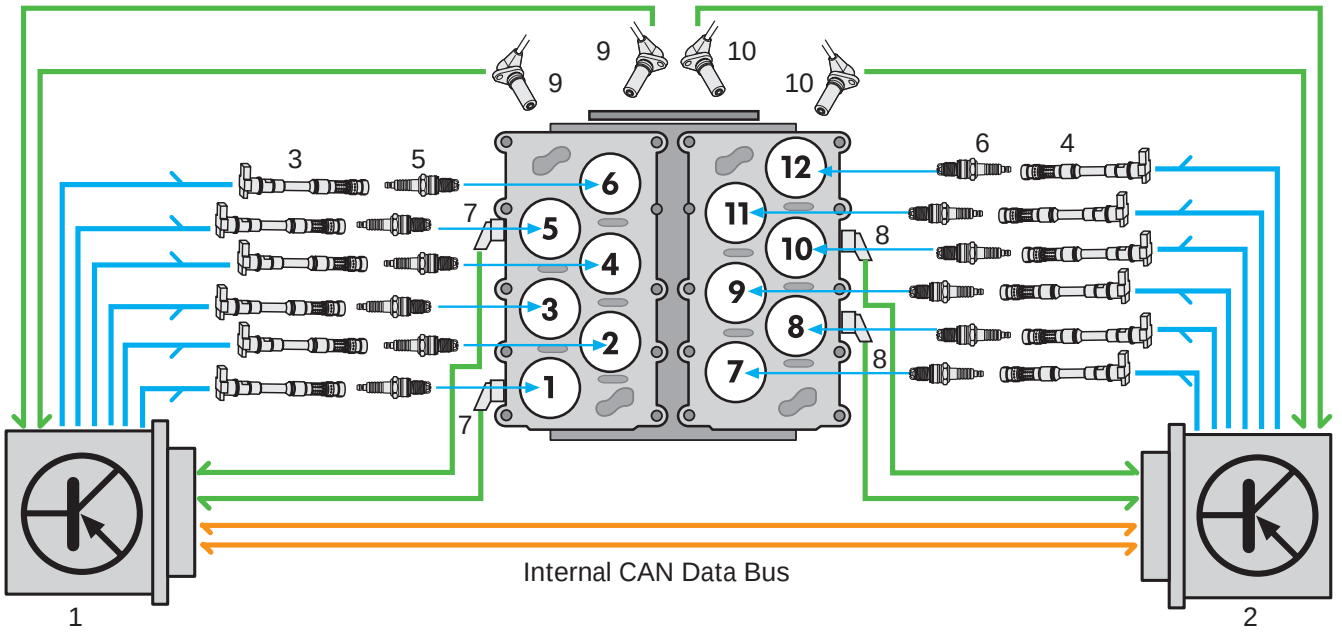
Cylinder-selective knock control is combined with electronic control of the firing point. Each bank in the W12 engine has two knock sensors mounted on the crankcase.

The plug and socket connections are color coded to avoid confusing the sensors with the connectors in the engine wiring harness.

One of the two engine control modules detects the knocking cylinder from input from the knock sensors in the affected cylinder bank.

- On the W12 engine, Knock Sensor 1 G61 and Knock Sensor 2 G66 transmit their signals to Engine Control Module 1 J623.
- Knock Sensor 3 G198 and Knock Sensor 4 G199 transmit their signals to Engine Control Module 2 J624.

The knock signals can be related to individual cylinders with the aid of the camshaft position sensor signals.



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Bank I

1 Engine Control Module 1 J623
3 Ignition Coils with Power Output Stage N70, N127, N291, N292, N323, N324
5 Spark Plugs Q
7 Knock Sensors 1 and 2 G61, G66
9 Camshaft Position Sensors 1 and 3 G40, G300

Bank II

2 Engine Control Module 2 J624
4 Ignition Coils with Power Output Stage N325, N326, N327, N328, N329, N330
6 Spark Plugs Q
8 Knock Sensors 3 and 4 G198, G199
10 Camshaft Position Sensors 2 and 4 G163, G301

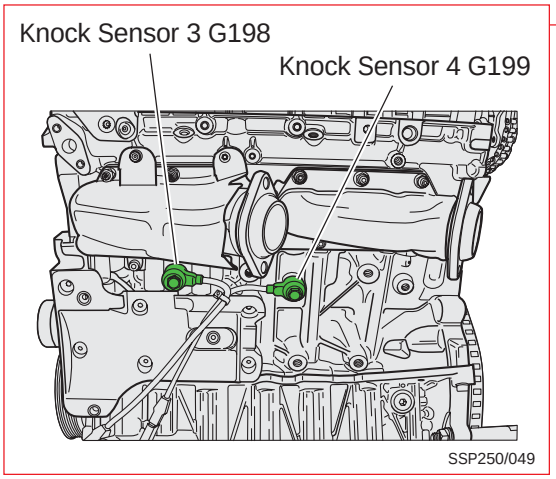
If the knock sensors detect knocking in a cylinder, the engine control module for that bank changes the firing point of the affected cylinder by retarding the firing point until knocking no longer occurs.

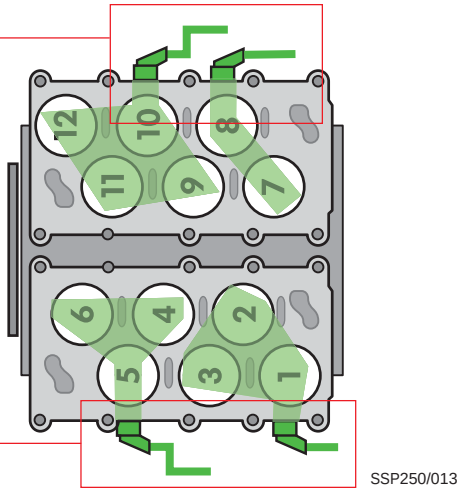
When the affected cylinder no longer has the tendency to knock, the engine control module returns the ignition timing to its former setting by advancing the firing point.

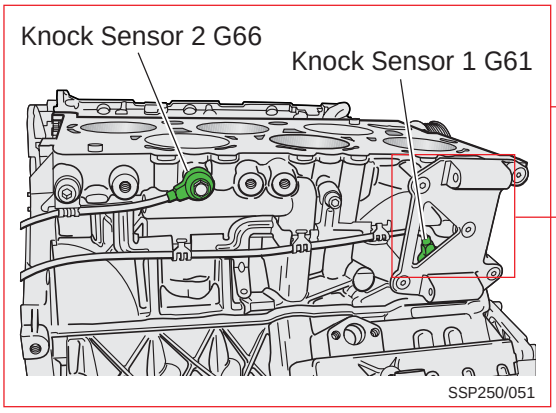
Effects of failure

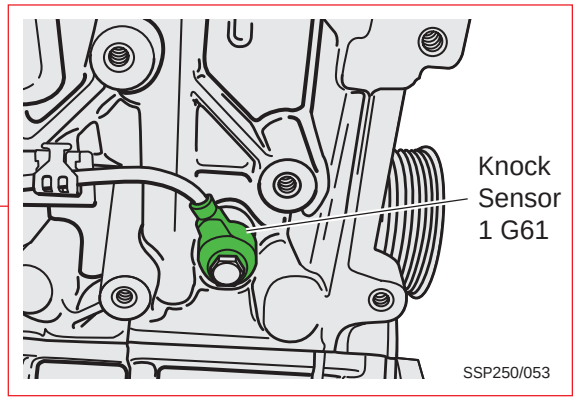
If a knock sensor fails, the ignition advance angles of the cylinder group are retarded to a safety ignition advance angle. This can also lead to a rise in fuel consumption.

If all the knock sensors fail, the engine management system reverts to emergency knock control. Ignition advance angles are generally retarded and full engine performance is no longer available.

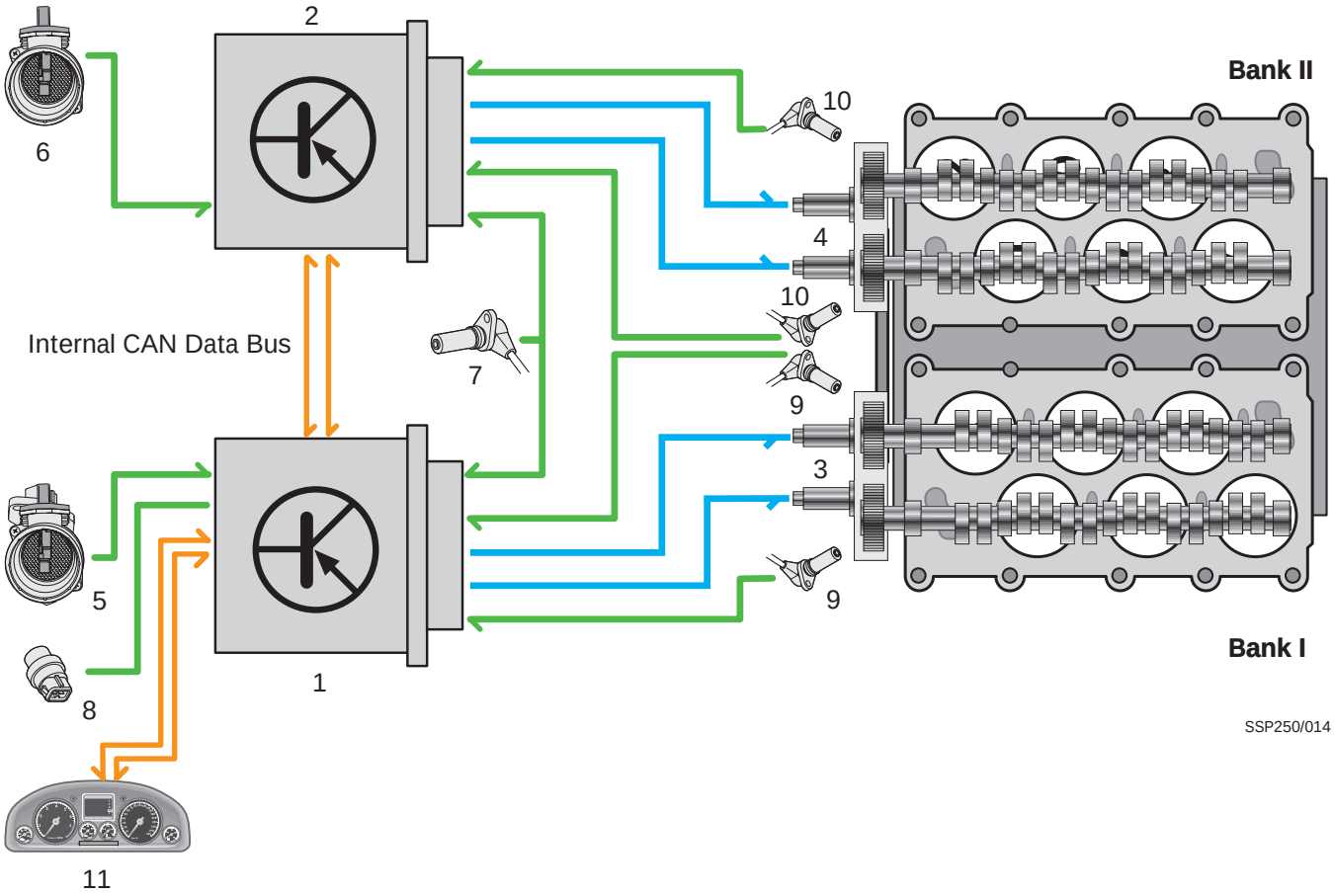








Variable Valve Timing



Bank I

1 Engine Control Module 1 J623
3 Valve 1 for Camshaft Adjustment N205 and Camshaft Adjustment Valve 1 (Exhaust) N318
5 Mass Air Flow Sensor G70 with Intake Air Temperature Sensor G42
7 Engine Speed Sensor G28
8 Engine Coolant Temperature Sensor G62
9 Camshaft Position Sensors 1 and 3 G40, G300
11 Engine Oil Temperature from the Control Module with Indicator Unit in Instrument Panel Insert J285 via the Drivetrain CAN Data Bus

Bank II

2 Engine Control Module 2 J624
4 Valve 2 for Camshaft Adjustment N208 and Camshaft Adjustment Valve 2 (Exhaust) N319
6 Mass Air Flow Sensor 2 G246 with Intake Air Temperature Sensor 2 G299
7 Engine Speed Sensor G28
10 Camshaft Position Sensors 2 and 4 G163, G301

Input Signals

- Camshaft position sensor signals
- Engine speed sensor signal
- Mass air flow engine load signals
- Coolant temperature
- Engine oil temperature

To carry out variable valve timing, the engine control modules require information about engine speed, engine load, engine temperature, the position of the crankshaft and camshaft, plus the oil temperature from the instrument cluster via the drivetrain CAN data bus.

Depending on the operating state:

- Engine Control Module 1 J623 activates Valve 1 for Camshaft Adjustment N205 and Camshaft Adjustment Valve 1 (Exhaust) N318 for cylinder bank I.
- Engine Control Module 2 J624 activates Valve 2 for Camshaft Adjustment N208 and Camshaft Adjustment Valve 2 (Exhaust) N319 for cylinder bank II.

Engine oil travels to the camshaft adjuster inner rotors through oil galleries in the central housing.

The camshaft adjuster inner rotors turn and adjust the camshafts in accordance with control maps stored in the two engine control modules. Both the intake and exhaust camshafts are continuously variable.

If the fault memory is erased, the adaptation of the camshafts is also erased. This requires the performance of a camshaft timing adaptation procedure. If this adaptation is not done, camshaft timing will not be properly adjusted and performance will be noticeably reduced.

Camshaft Position Sensors

The camshaft position sensors are all Hall-effect sensors. They are mounted in the engine timing chain cover. Their task is to inform the engine control modules of the positions of the intake and exhaust camshafts.

They accomplish this task by scanning quick-start sender wheels located on the ends of the camshafts.

Engine Control Module 1 J623 processes the signals for cylinder bank I:

- Camshaft Position Sensor G40 sends its intake camshaft position signal.
- Camshaft Position Sensor 3 G300 sends its exhaust camshaft position signal.

Engine Control Module 2 J624 processes the signals for cylinder bank II:

- Camshaft Position Sensor 2 G163 sends its intake camshaft position signal.
- Camshaft Position Sensor 4 G301 sends its exhaust camshaft position signal.

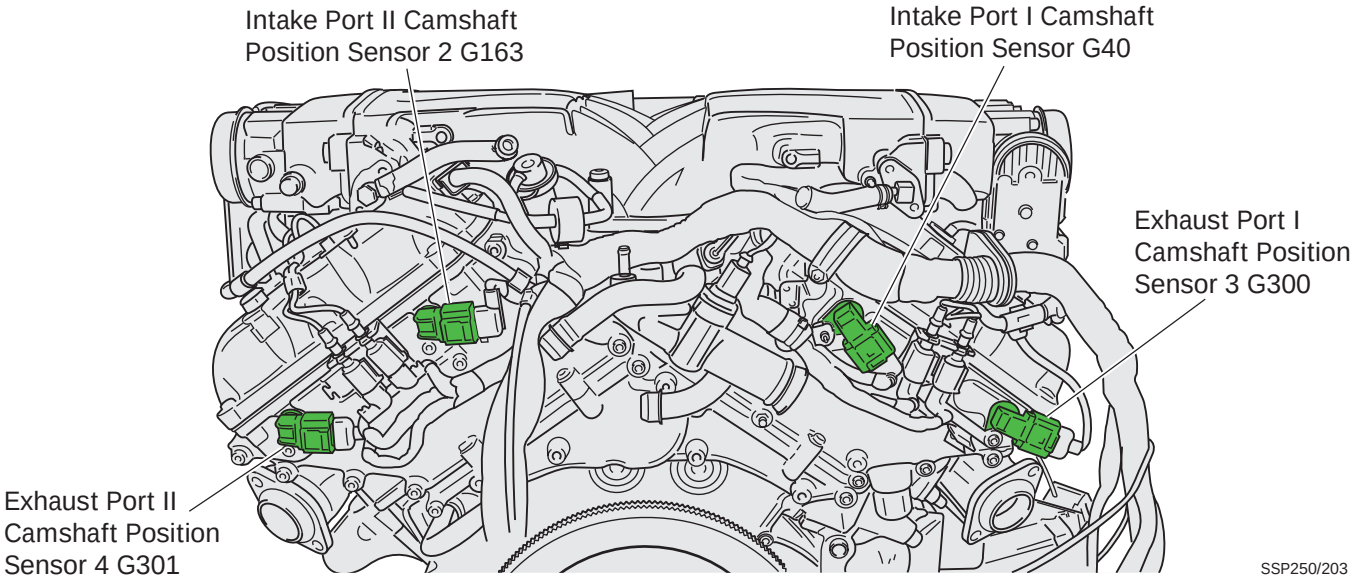
All of the camshaft position sensor signals act as input signals for variable valve timing.

To calculate injection times (duration) and firing points for the cylinders in bank I, the signal from Camshaft Position Sensor G40 to Engine Control Module 1 J623 is processed. The signal from Camshaft Position Sensor 2 G163 to Engine Control Module 2 J624 is processed so the injection times and firing points can be calculated for the cylinders in bank II.

Effects of failure

A camshaft position sensor failure will prevent variable valve timing in the associated cylinder bank.

The camshafts will revert to their reference positions (emergency running positions) using default settings stored in control maps in their associated engine control modules. The engine will continue to run with reduced torque, and will start again after it has been turned off.



Camshaft Adjustment Valves

These electromagnetic solenoid valves are integrated in the camshaft adjuster central housing oil supply modules.

Based on signals from Engine Control Module 1 J623 for bank I or from Engine Control Module 2 J624 for bank II, they distribute oil pressure to the inner rotors of the camshaft adjusters to move the camshafts the direction and distance needed for optimal engine performance.

The intake camshafts are continuously variable within a range of 52 degrees.

The exhaust camshafts can be continuously adjusted within a range of 22 degrees.

Engine Control Module 1 J623 activates the camshaft adjustment valves for cylinder bank I:

- Valve 1 for Camshaft Adjustment N205
- Camshaft Adjustment Valve 1 (Exhaust) N318

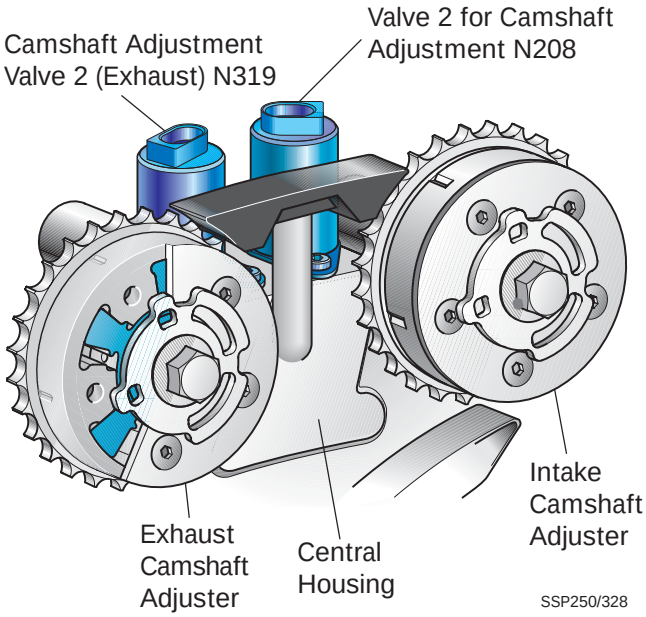
Engine Control Module 2 J624 activates the camshaft adjustment valves for cylinder bank II:

- Valve 2 for Camshaft Adjustment N208
- Camshaft Adjustment Valve 2 (Exhaust) N319

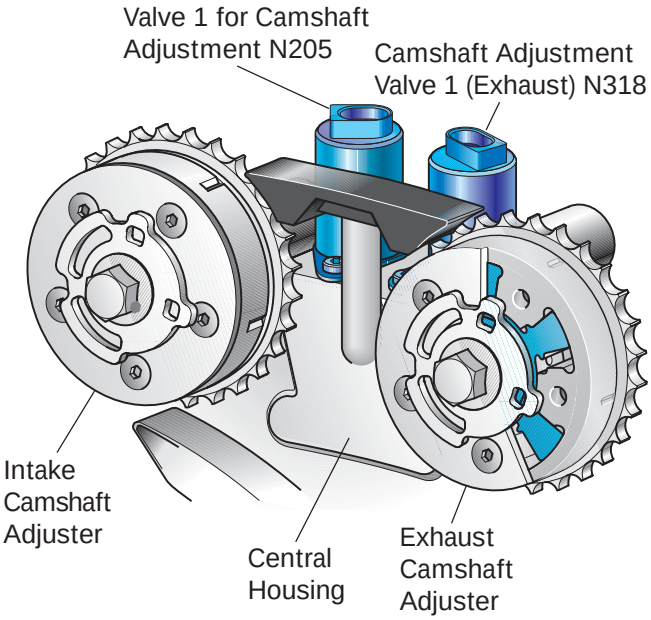
Effects of failure

If an electrical wire to a camshaft adjuster is faulty or a camshaft adjuster fails because it has jammed mechanically or oil pressure is too low, no camshaft timing adjustment can take place.

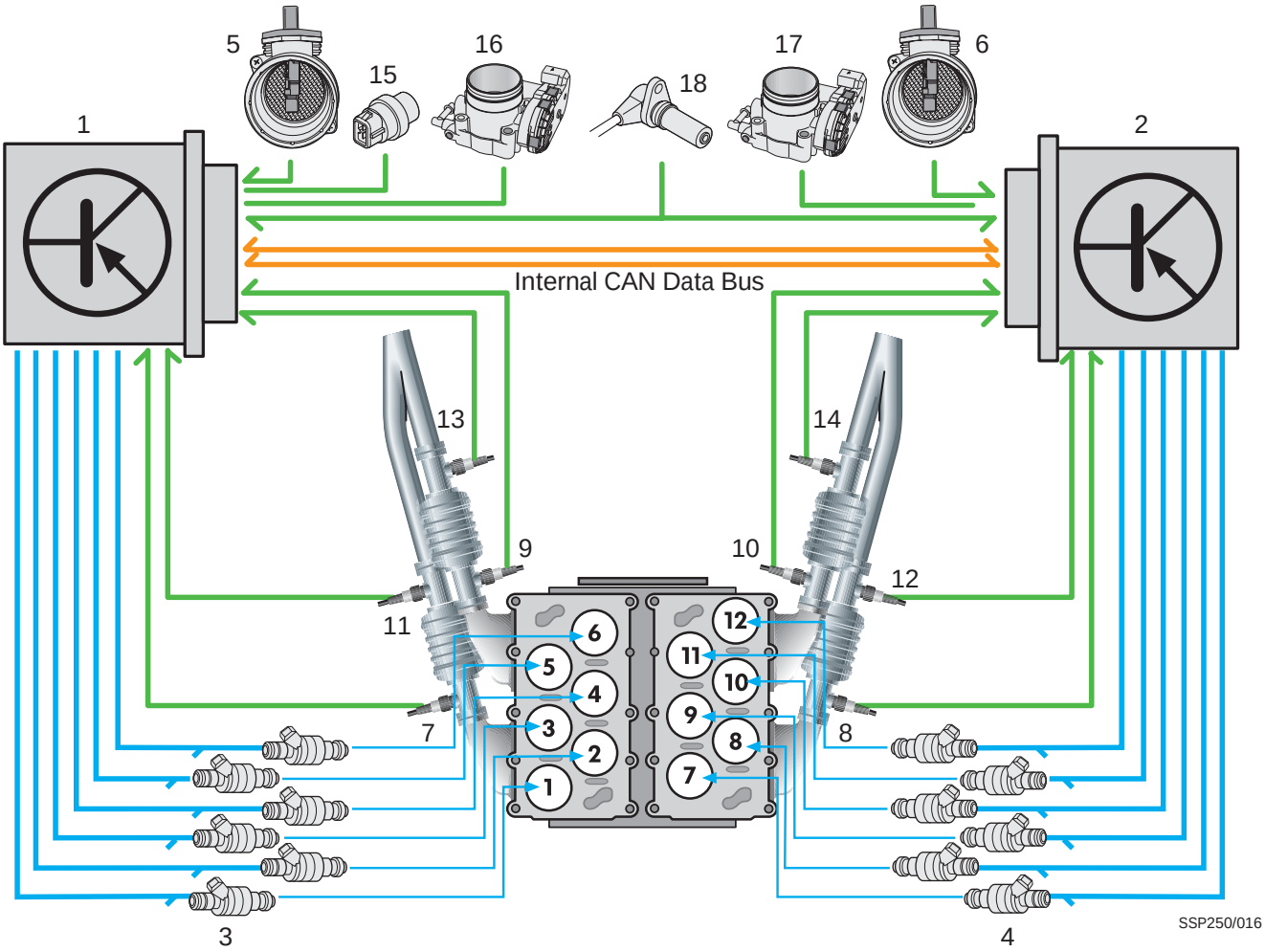
Bank II



Bank I



Oxygen Sensor Control



Bank I

1 Engine Control Module 1 J623

3 Fuel Injectors N30, N31, N32, N33, N83, N84

5 Mass Air Flow Sensor G70 with Intake Air Temperature Sensor G42

7 Heated Oxygen Sensor G39 (Before Catalytic Converter)

9 Heated Oxygen Sensor 2 G108 (Before Catalytic Converter)

11 Oxygen Sensor Behind Three Way Catalytic Converter G130

13 Oxygen Sensor 2 Behind Three Way Catalytic Converter G131

15 Engine Coolant Temperature Sensor G62

16 Throttle Valve Control Module J338

18 Engine Speed Sensor G28

Bank II

2 Engine Control Module 2 J624

4 Fuel Injectors N85, N86, N299, N300, N301, N302

6 Mass Air Flow Sensor 2 G246 with Intake Air Temperature Sensor 2 G299

8 Heated Oxygen Sensor 3 G285 (Before Catalytic Converter)

10 Heated Oxygen Sensor 4 G286 (Before Catalytic Converter)

12 Oxygen Sensor 3 Behind Three-Way Catalytic Converter G287

14 Oxygen Sensor 4 Behind Three-Way Catalytic Converter G288

17 Throttle Valve Control Module 2 J544

18 Engine Speed Sensor G28

Input Signals

- Engine speed sensor signal
- Mass air flow engine load signals
- Oxygen sensor signals
- Coolant temperature
- Throttle valve control module signals

The Phaeton W12 engine management system employs heated oxygen sensor control. Its purpose is to maintain a lambda value of 1 during combustion so that the exhaust gases can be cleaned as completely as possible in the catalyst.

Lambda refers to the ratio between the actual measured air-fuel ratio and the theoretically ideal air-fuel mixture of 14.7 to 1 (the stoichiometric ratio at which complete combustion takes place).

In the heated oxygen sensor control used on the W12 engine, the correct composition of the air-fuel mixture for the two cylinder banks is achieved through separate closed control loops. For each cylinder head the W12 engine has two exhaust manifolds.

Each of these exhaust manifolds has an oxygen sensor upstream and downstream of the catalytic converter. The eight oxygen sensors used on the W12 engine inform the two engine control modules about how much oxygen remains in the exhaust gas.

Using these signals, each engine control module calculates the momentary composition of the air-fuel mixture. If there are deviations from the nominal value, the injection period is adjusted.

In addition, an adaptive oxygen sensor control is carried out in idling mode as well as in two part-throttle ranges. This means that the two engine control modules adjust to the operating states and store the learned values.

Oxygen Sensors

Pre-catalyst broad-band oxygen sensors

- Heated Oxygen Sensor G39
- Heated Oxygen Sensor 2 G108
- Heated Oxygen Sensor 3 G285
- Heated Oxygen Sensor 4 G286

Broad-band oxygen sensors are installed near the catalytic converters upstream from the catalyst.

The lambda value is determined by a linear increase in current intensity, making it possible to measure across the entire engine speed range.

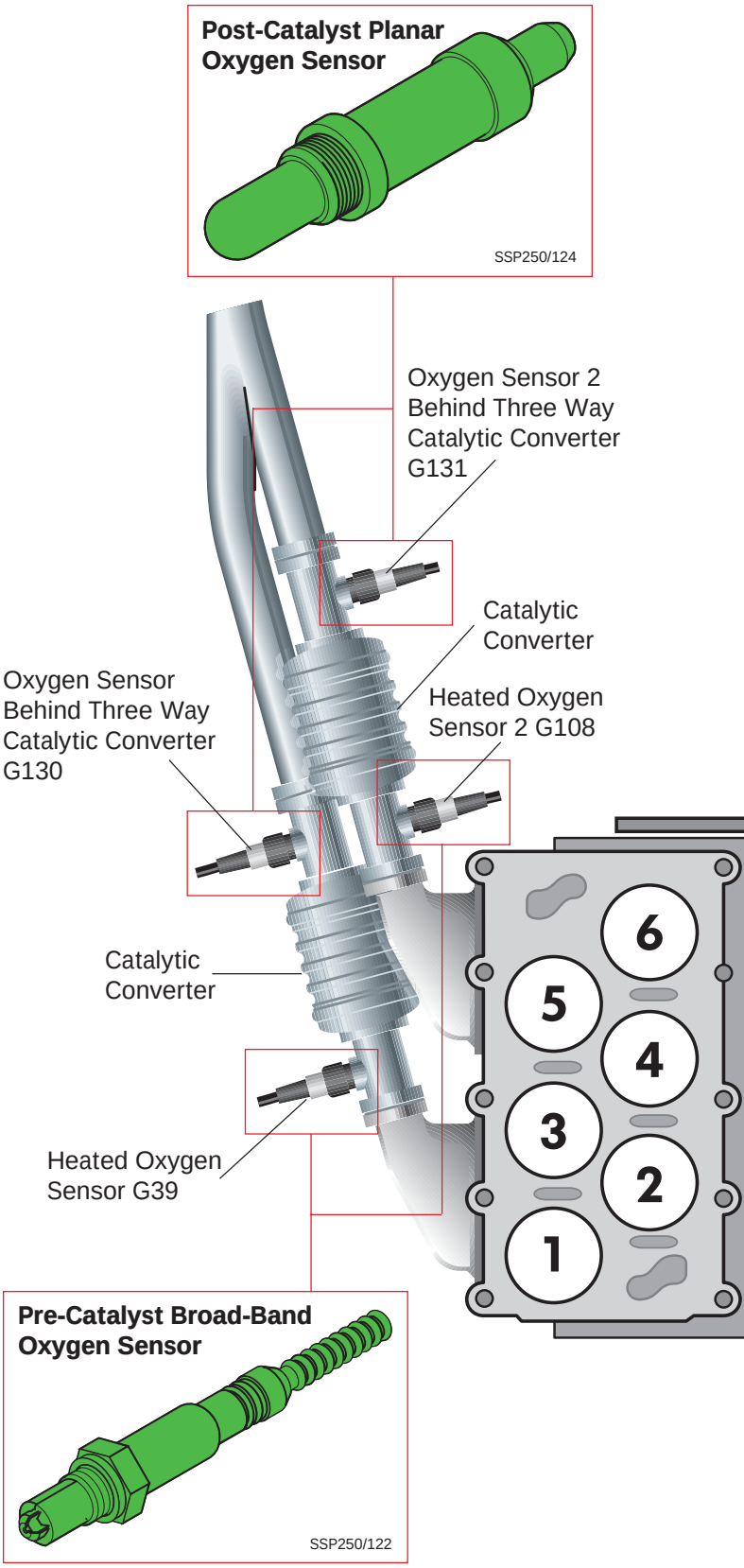
Use of signals

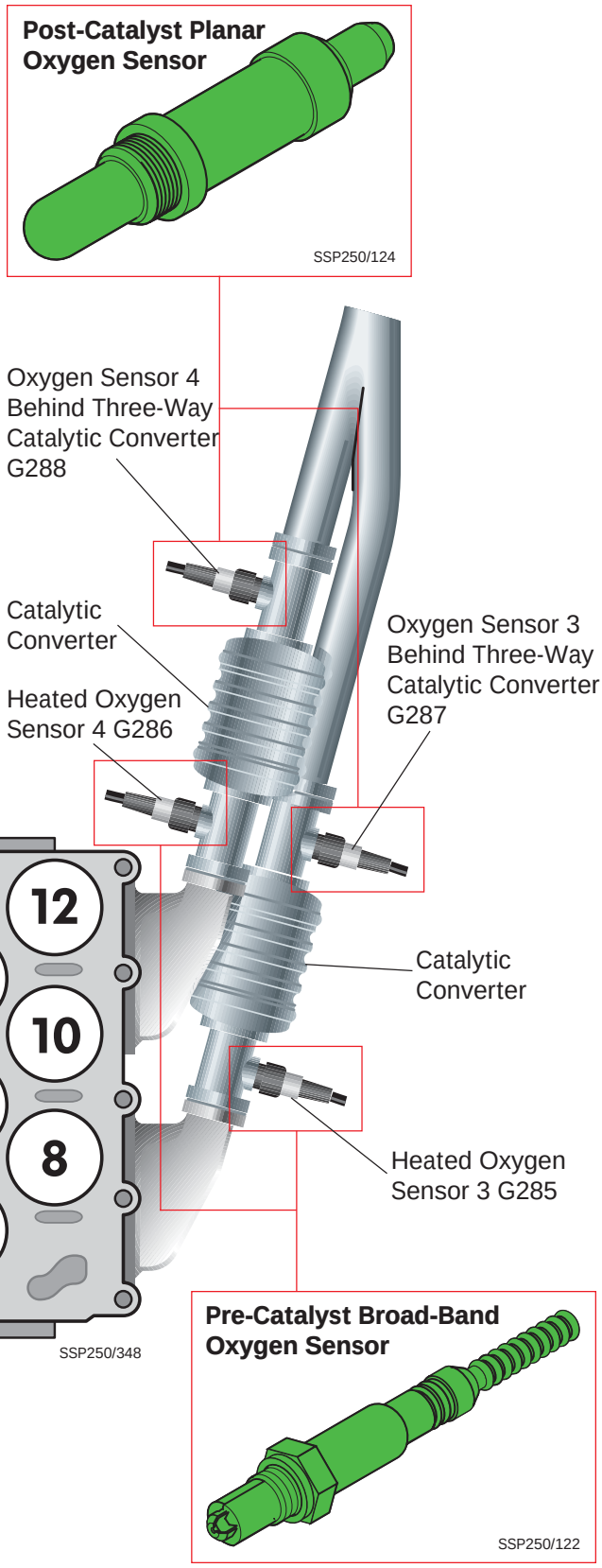
The broad-band oxygen sensors upstream from the catalyst supply the signals for fuel-air mixture control.

- Pre-catalyst broad-band Heated Oxygen Sensor G39 and Heated Oxygen Sensor 2 G108 transmit their signals to Engine Control Module 1 J623 for bank I mixture control.
- Pre-catalyst broad-band Heated Oxygen Sensor 3 G285 and Heated Oxygen Sensor 4 G286 transmit their signals to Engine Control Module 2 J624 for bank II mixture control.

Effects of failure

If a pre-catalyst sensor fails, oxygen sensor control can no longer occur. Adaptation is blocked. The engine will continue to run using default values stored in the engine control module control maps.





Post-catalyst planar oxygen sensors

- Oxygen Sensor Behind Three Way Catalytic Converter G130
- Oxygen Sensor 2 Behind Three Way Catalytic Converter G131
- Oxygen Sensor 3 Behind Three-Way Catalytic Converter G287
- Oxygen Sensor 4 Behind Three-Way Catalytic Converter G288

The post-catalyst planar oxygen sensors are installed near the catalytic converters downstream from the catalyst. Because of its two-state measurement range it may also be called a two-state oxygen sensor. It monitors the exhaust gases downstream from the catalyst around the value lambda = 1.

Use of signals

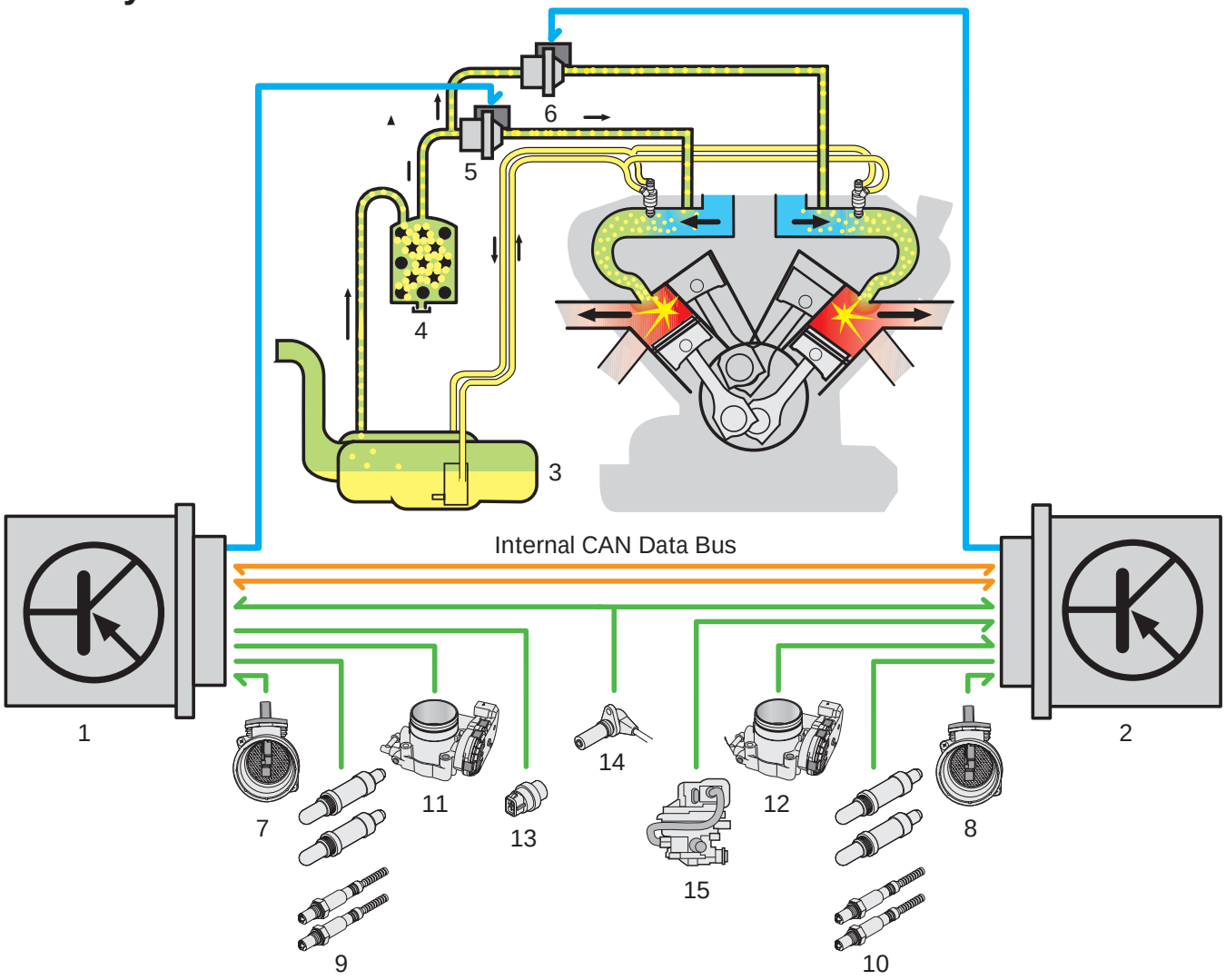
The post-catalyst planar oxygen sensors downstream of the catalyst test the function of the catalyst and the oxygen sensor closed control loop.

- Post-catalyst planar Oxygen Sensor Behind Three Way Catalytic Converter G130 and Oxygen Sensor 2 Behind Three-Way Catalytic Converter G131 transmit their signals to Engine Control Module 1 J623 for bank I mixture control.
- Post-catalyst planar Oxygen Sensor 3 Behind Three-Way Catalytic Converter G287 and Oxygen Sensor 4 Behind Three-Way Catalytic Converter G288 transmit their signals to Engine Control Module 2 J624 for bank II mixture control.

Effects of failure

If a post-catalyst sensor fails, oxygen sensor control can continue, but the function of the catalytic converter can no longer be monitored.

EVAP System



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Bank I

1 Engine Control Module 1 J623
3 Fuel Tank
4 Evaporative Emission (EVAP) Canister
5 Evaporative Emission Canister Purge Regulator Valve N80
7 Mass Air Flow Sensor G70 with Intake Air Temperature Sensor G42
9 Oxygen Sensors G39, G108, G130, G131
11 Throttle Valve Control Module J338
13 Engine Coolant Temperature Sensor G62
14 Engine Speed Sensor G28

Bank II

2 Engine Control Module 2 J624
6 Evaporative Emission Canister Purge Solenoid Valve N115
8 Mass Air Flow Sensor 2 G246 with Intake Air Temperature Sensor 2 G299
10 Oxygen Sensors G285, G286, G287, G288
12 Throttle Valve Control Module 2 J544
14 Engine Speed Sensor G28
15 Leak Detection Pump V144

Input Signals for Controlling the EVAP System

- Engine speed sensor signal
- Mass air flow engine load signals
- Coolant temperature
- Oxygen sensor signals
- Throttle valve control module signals

The EVAP system prevents fuel vapor that develops in the fuel tank from escaping to the atmosphere. The fuel vapor is stored in the EVAP canister (activated charcoal filter).

When evaluation of the input signals determines that conditions are right for them to do so, Engine Control Module 1 J623 activates Evaporative Emission Canister Purge Regulator Valve N80 for cylinder bank I, and Engine Control Module 2 J624 activates Evaporative Emission Canister Purge Solenoid Valve N115 for bank II.

The fuel vapor is released from the EVAP canister and routed through the intake manifold to the cylinders for combustion.

This briefly changes the fuel-to-air ratio. This change in the mixture is detected by the oxygen sensors, causing the oxygen sensor control to make a corrective adjustment.

EVAP System Purge Valves

- Evaporative Emission Canister Purge Regulator Valve N80
- Evaporative Emission Canister Purge Solenoid Valve N115

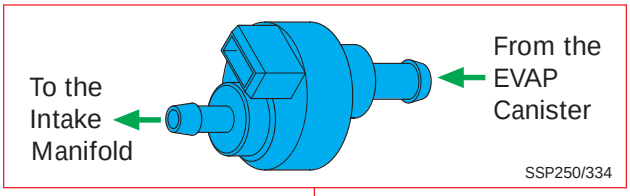
The EVAP system purge valves are located behind the intake manifold.

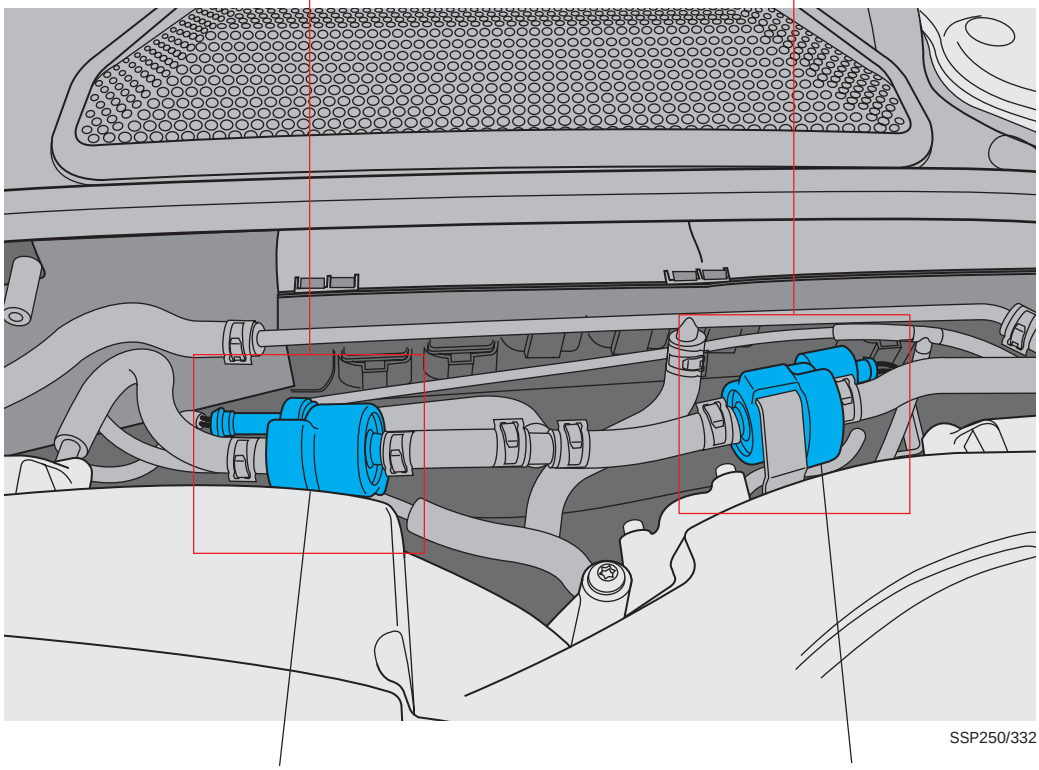
Opening the valves vents fuel vapor collected in the EVAP canister activated-charcoal filter to the intake manifold for combustion.

Effects of signal failure

If there is a power interruption, the purge valves remain closed and EVAP canister purge cannot occur.

Fuel tank ventilation will be inhibited as the EVAP canister activated-charcoal filter becomes saturated with fuel.

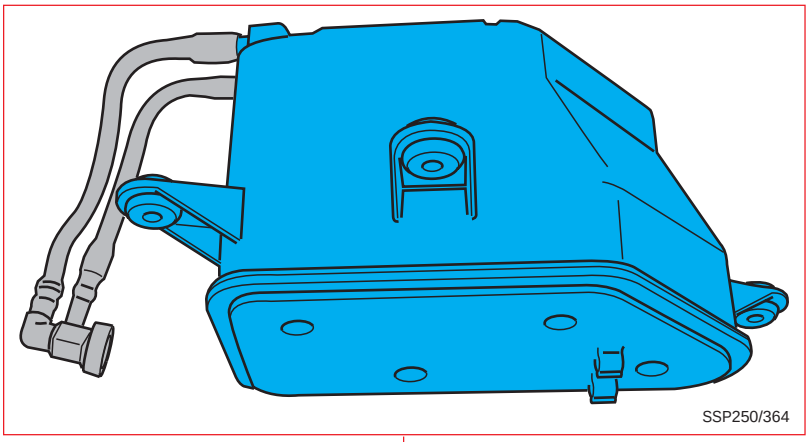




EVAP Canister

The EVAP canister is located underneath the vehicle in the spare tire recess. The spare tire recess is closed off by a plastic cover to keep components clean.

The EVAP canister contains an activated-charcoal filter. The activated-charcoal absorbs fuel vapors generated in the fuel tank. The stored fuel vapor is vented to the engine through the intake manifold when the EVAP system purge valves are opened.



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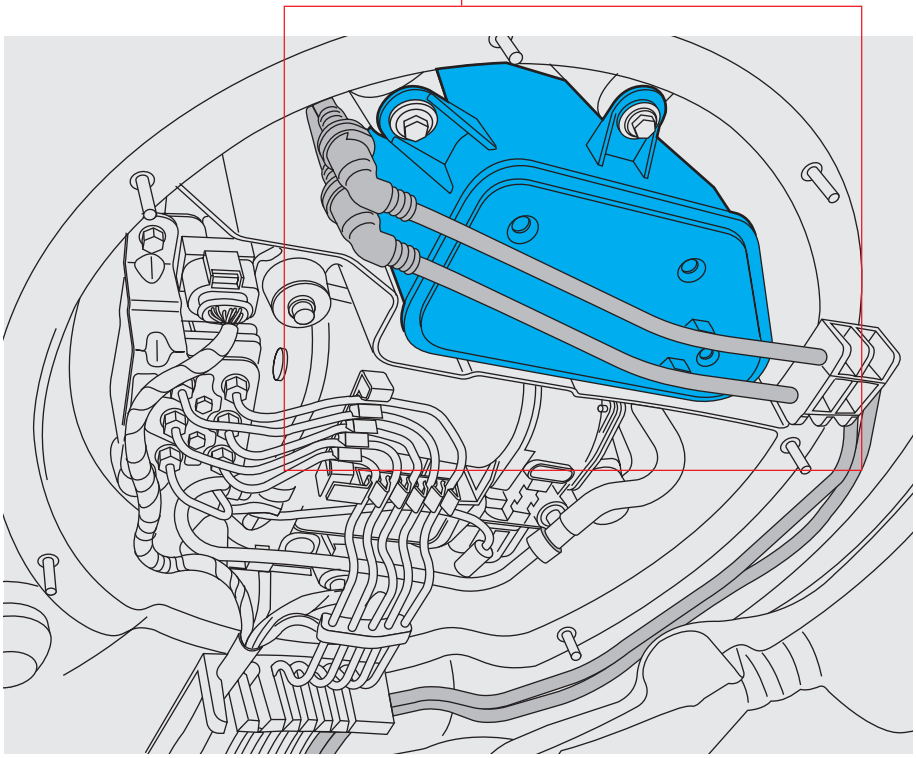

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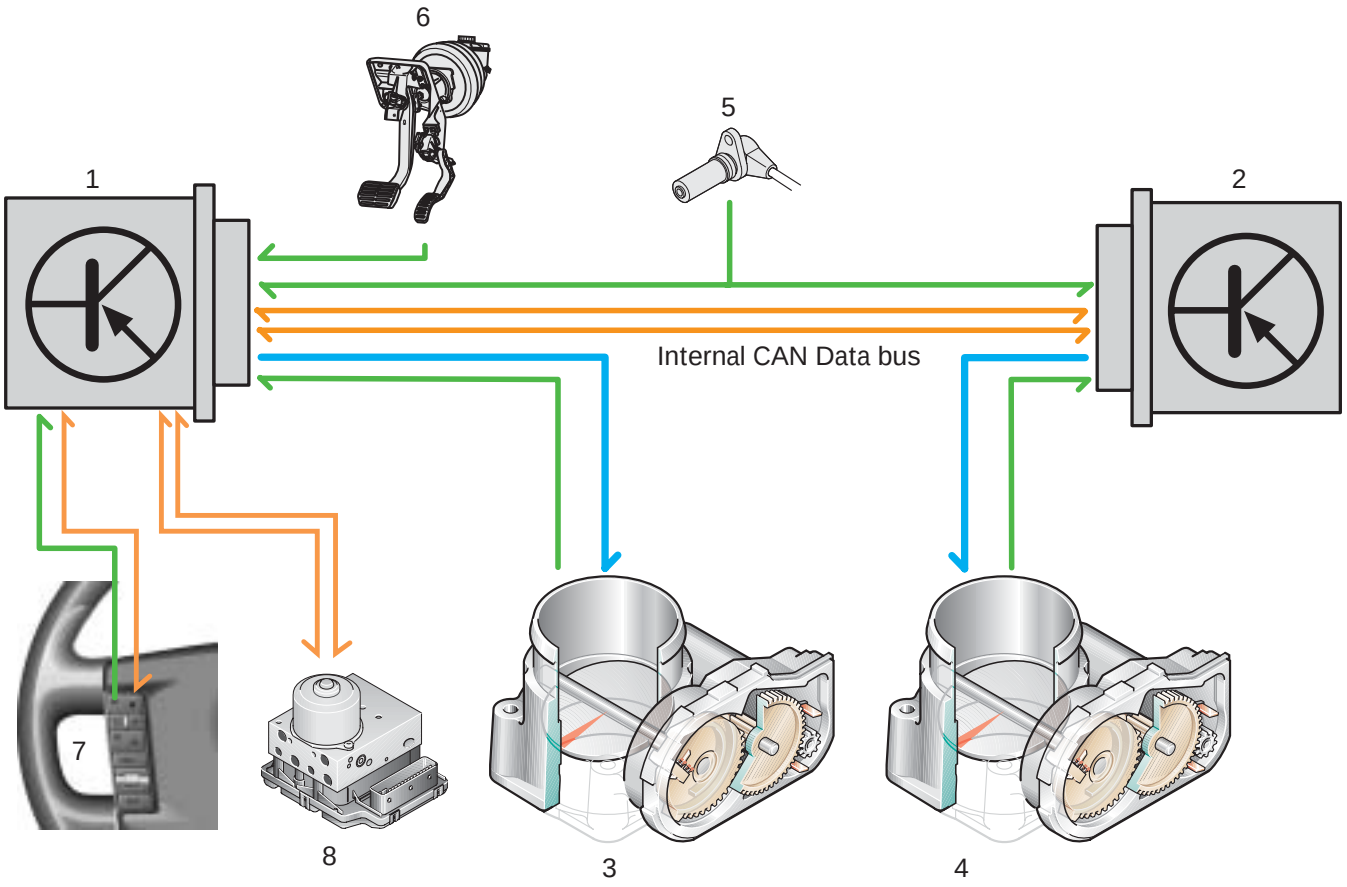
Cruise Control System Without Adaptive Cruise Control

The cruise control system can be activated at and above a vehicle speed of 18.6 mph (30 km/h).

For information about the Phaeton cruise control system with automatic distance regulation, refer to *The Phaeton Adaptive Cruise Control,* Self-Study Program Course Number 898303.



SSP250/018

Bank I

1 Engine Control Module 1 J623
3 Throttle Valve Control Module J338
5 Engine Speed Sensor G28
6 Brake Pedal Switch F47
7 Cruise Control Switch E45
8 Vehicle Speed Signal from ABS Control Module with EDL/ASR/ESP J104

Bank II

2 Engine Control Module 2 J624
4 Throttle Valve Control Module 2 J544
5 Engine Speed Sensor G28

Input Signals

- Engine speed sensor signal
- Throttle valve control module signals
- Road speed signal
- Brake actuated signal
- Cruise control on and off signals

The signal from Cruise Control Switch E45 is sent to Engine Control Module 1 J623. Engine Control Module 1 J623 directs the relevant information via the internal CAN data bus to Engine Control Module 2 J624. The two throttle drives open the throttle valves depending on the road speed.

Throttle Drive G186 is activated by Engine Control Module 1 J623. Throttle Drive 2 G296 is activated by Engine Control Module 2 J624. When the “brake actuated“ signal is received, the cruise control system is turned off.

Cruise Control Switch E45

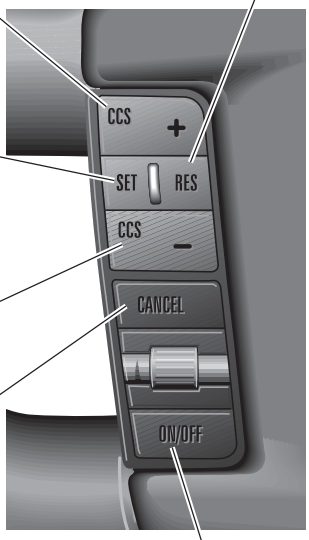
The cruise control system is actuated using Cruise Control Switch E45 on the left-hand side of the multi-function steering wheel.

“CCS +” Button
Increases the set speed without touching the accelerator pedal.

“SET” Button
Stores the required speed:
- Actuate when the desired speed has been reached.
- Remove foot from the accelerator pedal.
- The speed is kept constant.

“CCS –” Button
Reduces the set speed without touching the accelerator pedal.

“CANCEL” Button
Cancels selected speed.



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“RES“ Button
Resumes the previously stored speed

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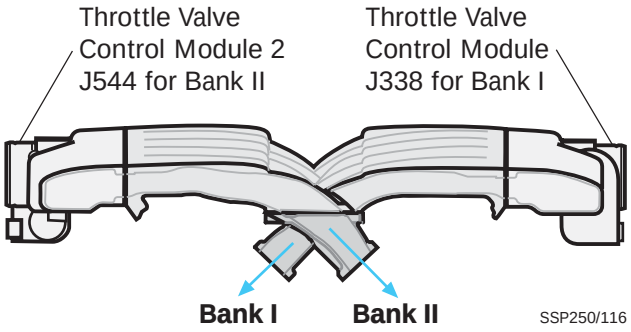
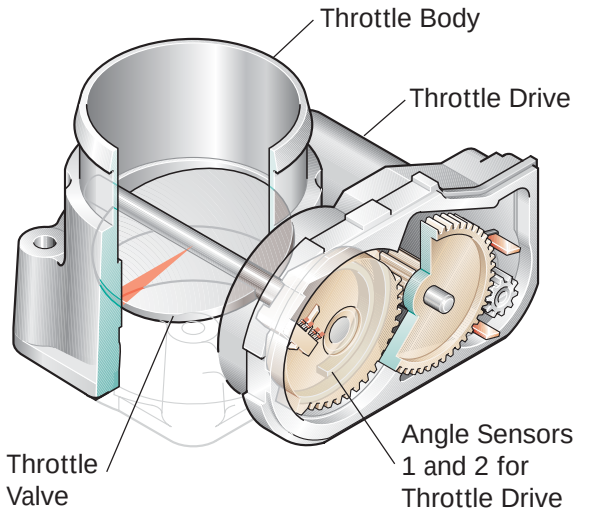
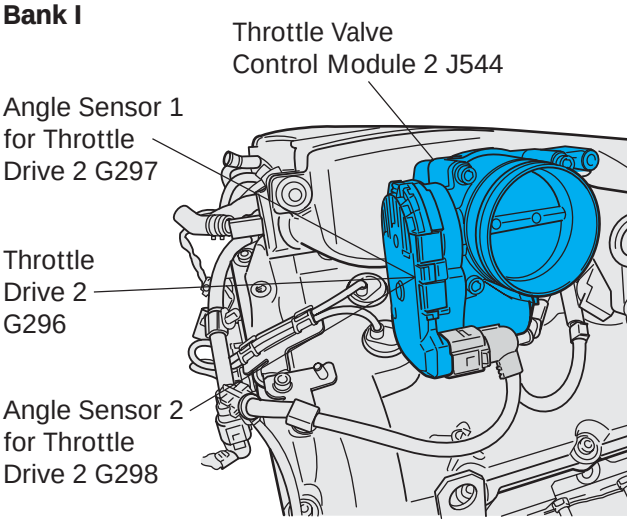
“On/Off” Button





Bank I

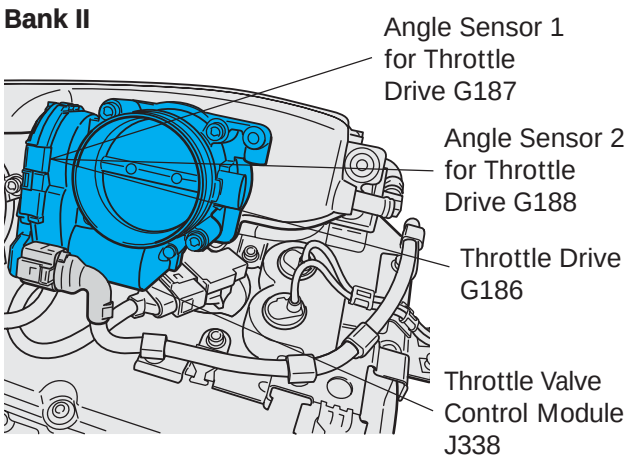


Throttle Valve Control Modules

- Throttle Valve Control Module J338
- Throttle Valve Control Module 2 J544

Angle Sensor 1 for Throttle Drive 2 G297 and Angle Sensor 2 for Throttle Drive 2 G298 of Throttle Valve Control Module 2 J544 transmit the current position of the throttle valve to Engine Control Module 2 J624.

Engine Control Module 2 J624 activates the electric motor for Throttle Drive 2 G296 to open or close the throttle valve, or to adjust to a particular throttle valve setting.



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Angle Sensor 1 for Throttle Drive G187 and Angle Sensor 2 for Throttle Drive G188 of Throttle Valve Control Module J338 transmit their signals to Engine Control Module 1 J623. Throttle Drive G186 in turn is activated by Engine Control Module 1 J623.

Effects of failure

If one angle sensor fails, the affected throttle valve goes into emergency operation mode. The vehicle speed is limited to 75 mph (120 km/h).

If both angle sensors fail in a single throttle valve, the cylinder bank containing the faulty throttle valve switched off at an engine speed of 1200 rpm. The Electronic Power Control Warning Lamp K132 lights up. It is still possible to achieve a vehicle speed of up to 75 mph (120 km/h).

Brake Light Switch F and Brake Pedal Switch F47

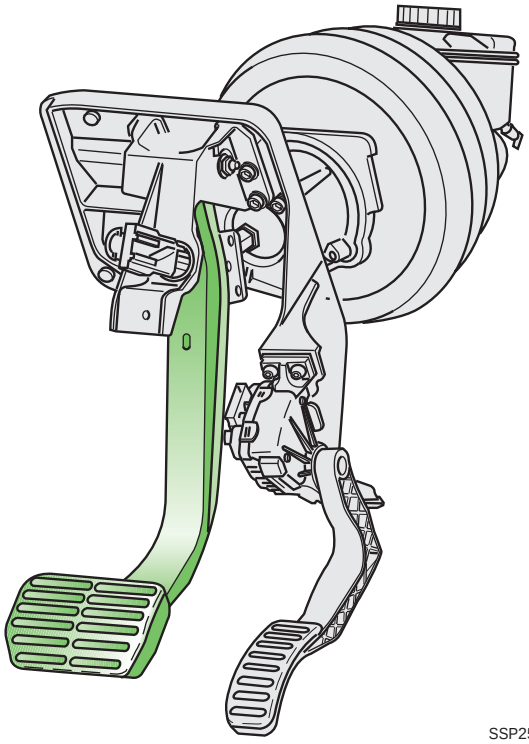
The Brake Light Switch F and Brake Pedal Switch F47 are part of one component located on the pedal bracket.

Use of signals

When the brake pedal is pressed, both of these switches send a “brake actuated” signal to Engine Control Module 1 J623, which immediately turns the cruise control system off if it is in use.

Effects of failure

If either the Brake Light Switch F or the Brake Pedal Switch F47 fails, cruise control system operation is no longer possible.



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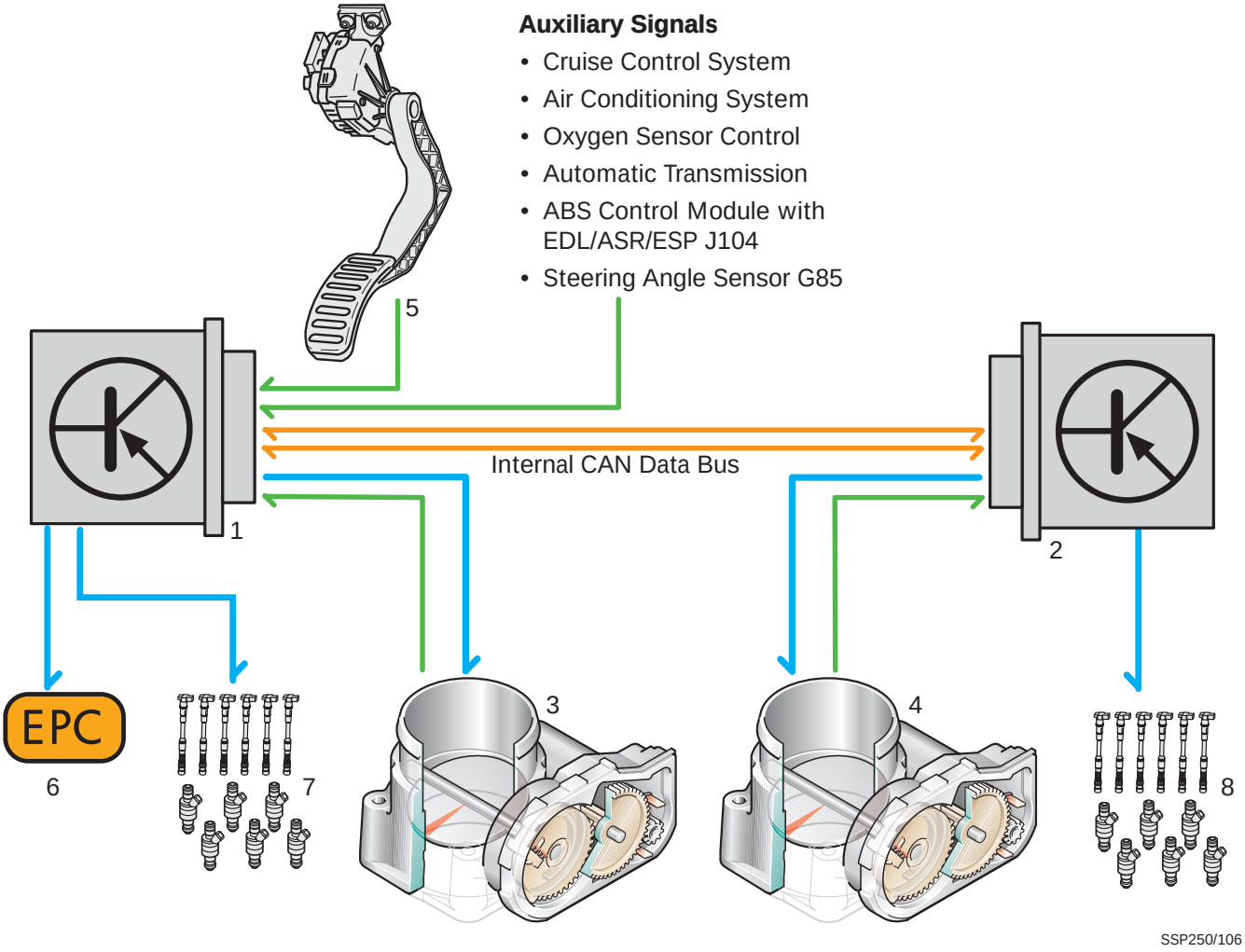
Electronic Power Control



Bank I

1 Engine Control Module 1 J623

3 Throttle Valve Control Module J338

5 Accelerator Pedal Module with Throttle Position Sensor G79
Sender 2 for Accelerator Pedal Position G185

6 Electronic Power Control Warning Lamp K132

7 Ignition Coils with Power Output Stage N70, N127, N291, N292, N323, N324, and Fuel Injectors N30, N31, N32, N33, N83, N84

Bank II

2 Engine Control Module 2 J624

4 Throttle Valve Control Module 2 J544

8 Ignition Coils with Power Output Stage N325, N326, N327, N328, N329, N330, and Fuel Injectors N85, N86, N299, N300, N301, N302

Input Signals

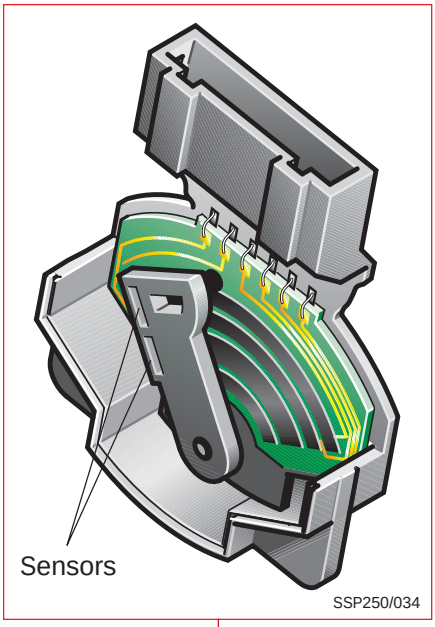
- Signals from the Accelerator Pedal Module with Throttle Position Sensor G79 and Sender 2 for Accelerator Pedal Position G185
- Auxiliary signals

Driver input and the signals from the accelerator pedal module are sent to Engine Control Module 1 J623.

Engine Control Module 1 J623 calculates the optimum implementation for the torque requirements, making allowance for all of the auxiliary signals, and transfers the data to Engine Control Module 2 J624.

Implementation for each bank is accomplished by a separate servo-adjustable throttle valve, the ignition system, and the fuel injection system.

The Electronic Power Control Warning Lamp K132 lights up to inform the driver if there is a fault in the system.



Accelerator Pedal Module

The accelerator pedal module is located on the pedal bracket. The accelerator pedal module comprises:

- The accelerator pedal
- Throttle Position Sensor G79
- Sender 2 for Accelerator Pedal Position G185

Both Throttle Position Sensor G79 and Sender 2 for Accelerator Pedal Position G185 are sliding potentiometers, secured to a common shaft. Each time the accelerator pedal position is changed, the resistances of the sliding potentiometers also change, changing the voltages transmitted to Engine Control Module 1 J623.

The signals from the two sensors provide Engine Control Module 1 J623 with the information it requires to recognize the position of the accelerator pedal.

Effects of failure

If either Throttle Position Sensor G79 or Sender 2 for Accelerator Pedal Position G185 fails, the system initially goes to idling mode. If the second sensor is detected within a defined period, driving mode is re-enabled.

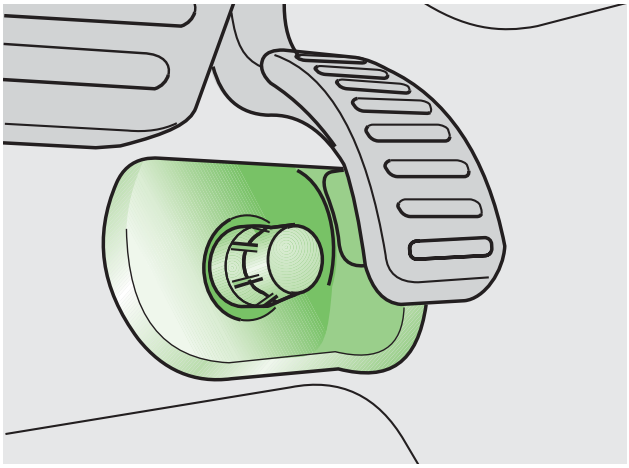
If both sensors fail, the engine only runs at an increased idling speed and no longer responds to movement of the accelerator pedal.

The Electronic Power Control Warning Lamp K132 lights up to inform the driver if there is a fault in the system.

Kick-Down Switch F8

Once the accelerator pedal has been pushed down as far as the Kick-Down Switch F8, the full-throttle position has been reached. If the accelerator pedal is further depressed, a spring in Kick-Down Switch F8 is overcome and a switching contact is closed.

Together with signals from Throttle Position Sensor G79 and Sender 2 for Accelerator Pedal Position G185, the signal from Kick-Down Switch F8 provides Engine Control Module 1 J623 with the information it requires to recognize the kick-down position.



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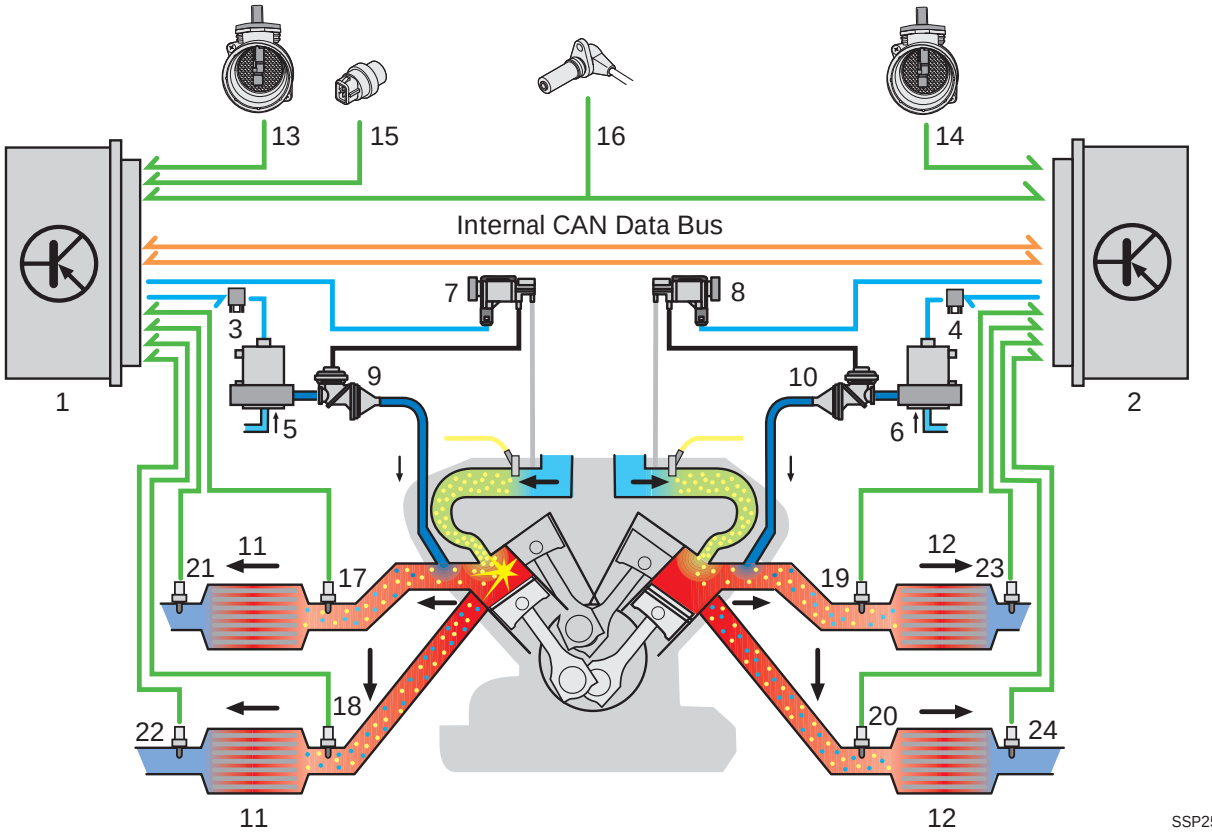
Effects of failure

In the event of Kick-Down Switch F8 failure, the values from Throttle Position Sensor G79 and Sender 2 for Accelerator Pedal Position G185 are used.

Secondary Air System



Bank I

1 Engine Control Module 1 J623
3 Secondary Air Injection Pump Relay J299
5 Secondary Air Injection Pump Motor V101
7 Secondary Air Injection Solenoid Valve N112
9 Combination Valve 1
11 Catalytic Converter
13 Mass Air Flow Sensor G70 with Intake Air Temperature Sensor G42
15 Engine Coolant Temperature Sensor G62
16 Engine Speed Sensor G28
17 Heated Oxygen Sensor G39 (Before Catalytic Converter)
18 Heated Oxygen Sensor 2 G108 (Before Catalytic Converter)
21 Oxygen Sensor Behind Three Way Catalytic Converter G130
22 Oxygen Sensor 2 Behind Three Way Catalytic Converter G131

Bank II

2 Engine Control Module 2 J624
4 Secondary Air Injection Pump Relay 2 J545
6 Secondary Air Injection Pump Motor 2 V189
8 Secondary Air Injection Solenoid Valve 2 N320
10 Combination Valve 2
12 Catalytic Converter
14 Mass Air Flow Sensor 2 G246 with Intake Air Temperature Sensor 2 G299
16 Engine Speed Sensor G28
19 Heated Oxygen Sensor 3 G285 (Before Catalytic Converter)
20 Heated Oxygen Sensor 4 G286 (Before Catalytic Converter)
23 Oxygen Sensor 3 Behind Three-Way Catalytic Converter G287
24 Oxygen Sensor 4 Behind Three-Way Catalytic Converter G288

Input Signals

- Oxygen sensor signals
  (signals from oxygen sensors before the catalytic converter for system diagnosis only)
- Coolant temperature
- Mass air flow engine load signals

The secondary air system reduces exhaust emissions in the cold starting phase. During a cold start there is an increased percentage of unburned hydrocarbons in the exhaust. The catalytic converters cannot process this quantity because they have not yet reached their operating temperature.

To achieve this, the level of oxygen in the exhaust gases is enriched by injecting air behind the exhaust valves. This causes afterburning. The heat this releases brings the catalytic converters to their operating temperature more quickly.

The input signals are sent to Engine Control Module 1 J623 and Engine Control Module 2 J624.

When the input signals indicate the need for secondary air injection in the right cylinder bank to Engine Control Module 1 J623, it actuates the Secondary Air Injection Solenoid Valve N112 and the Secondary Air Injection Pump Relay J299.

The Secondary Air Injection Pump Relay J299 in turn activates the Secondary Air Injection Pump Motor V101. At the same time, combination valve 1 is actuated by vacuum via the Secondary Air Injection Solenoid Valve N112.

Likewise, for the left bank Engine Control Module 2 J624 actuates the Secondary Air Injection Solenoid Valve 2 N320 and the Secondary Air Injection Pump Relay 2 J545.

The Secondary Air Injection Pump Relay 2 J545 activates the Secondary Air Injection Pump Motor 2 V189. Combination valve 2 is actuated by the Secondary Air Injection Solenoid Valve 2 N320.

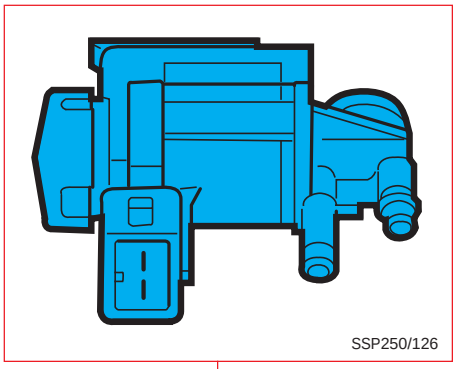
Secondary Air Injection Pump Motor V101 and Secondary Air Injection Pump Motor 2 V189 can then temporarily push air behind the exhaust valves into the exhaust gas stream to facilitate afterburning of the excess hydrocarbons.

Secondary Air Injection Solenoid Valve N112 and Secondary Air Injection Solenoid Valve 2 N320

Secondary Air Injection Solenoid Valve N112 and Secondary Air Injection Solenoid Valve 2 N320 are three/two-way solenoid valves. They are switched by Engine Control Module 1 J623 and Engine Control Module 2 J624, respectively. They activate the combination valves 1 and 2 through vacuum lines.

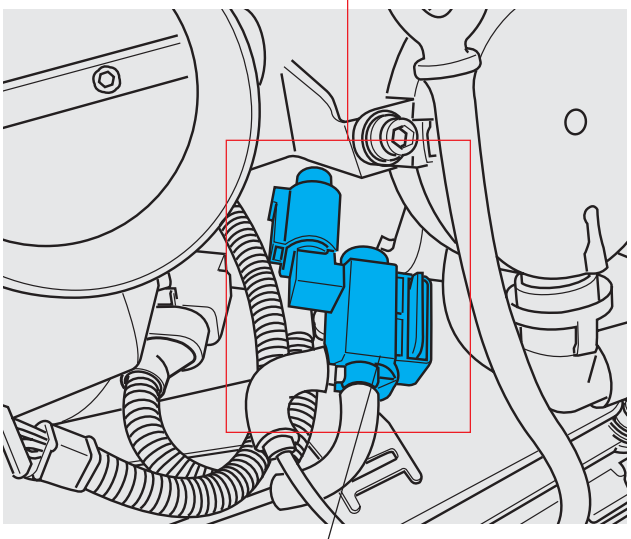
Effects of failure

If an engine control module signal fails, the controlled combination valve can no longer be opened. The secondary air injection pump motor for the affected cylinder bank is unable to inject air.



SSP250/126

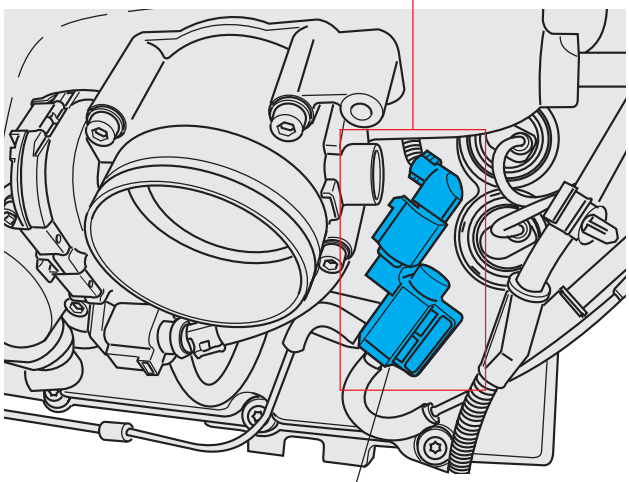
Bank I



Secondary Air Injection Solenoid Valve N112

SSP250/370

Bank II



Secondary Air Injection Solenoid Valve 2 N320

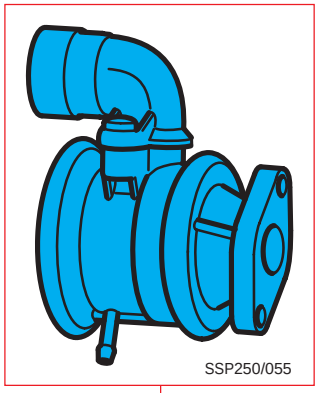
SSP250/336

Combination Valves

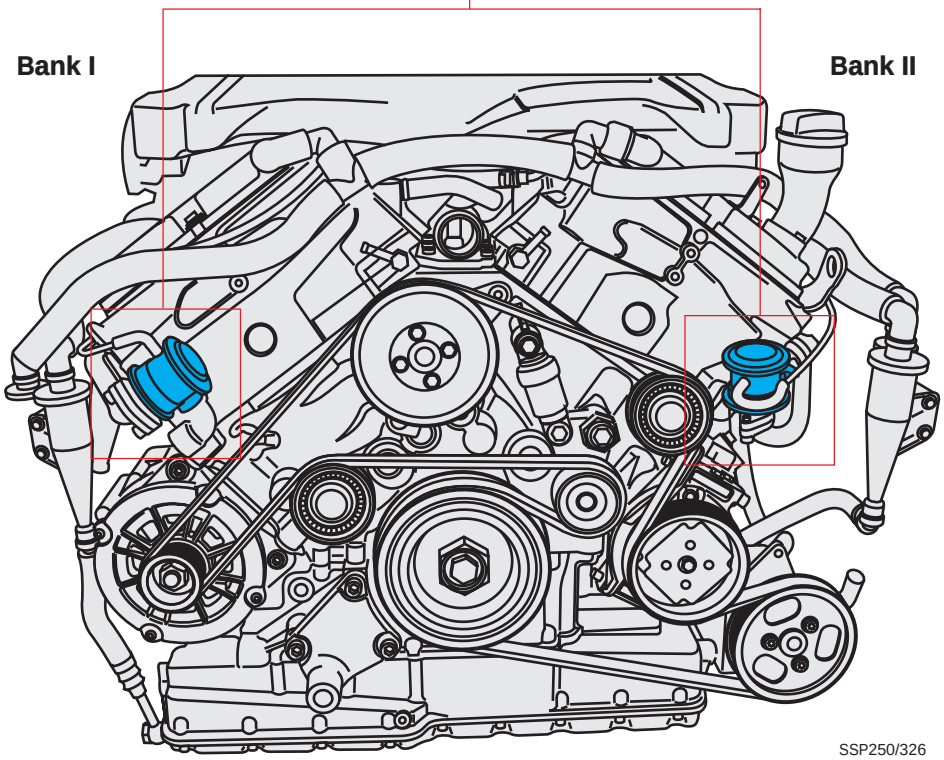
Vacuum from the Secondary Air Injection Solenoid Valve N112 and Secondary Air Injection Solenoid Valve 2 N320 operates combination valves 1 and 2, respectively.

They open the air paths from Secondary Air Injection Pump Motor V101 and Secondary Air Injection Pump Motor 2 V189 to the cylinder head secondary air ducts.

When combination valves 1 and 2 are closed, they prevent hot exhaust gases from reaching the pump motors.



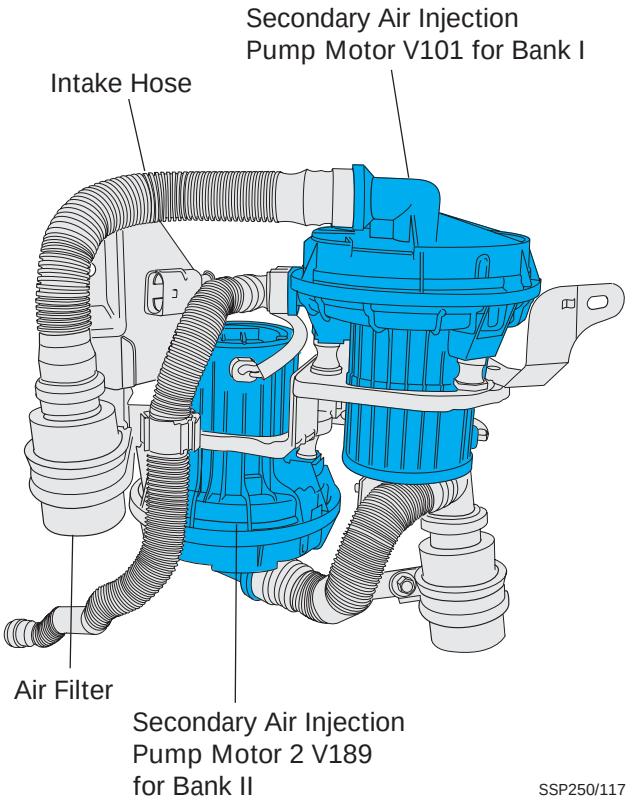
SSP250/055



SSP250/326

Secondary Air Injection Pump Motor V101 and Secondary Air Injection Pump Motor 2 V189

These pump motors pump air through the secondary air system into the exhaust gas stream behind the exhaust valves. This contributes to pollution control during the engine warm-up period by adding oxygen to the exhaust gas mix to facilitate the afterburning of excess hydrocarbons.

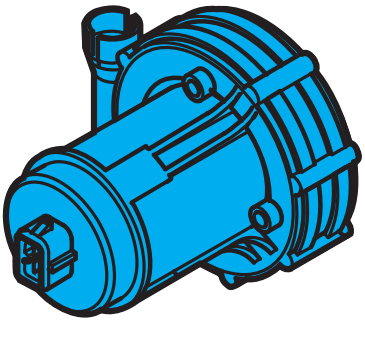


SSP250/117

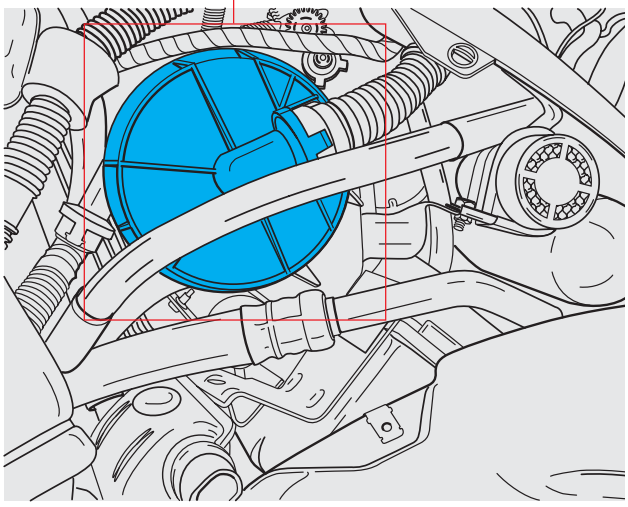
The heat generated by this afterburning brings the catalytic converters to their operating temperature more quickly.

Effects of failure

If the power supply is interrupted, no air is pumped into the exhaust gas stream.



SSP250/052

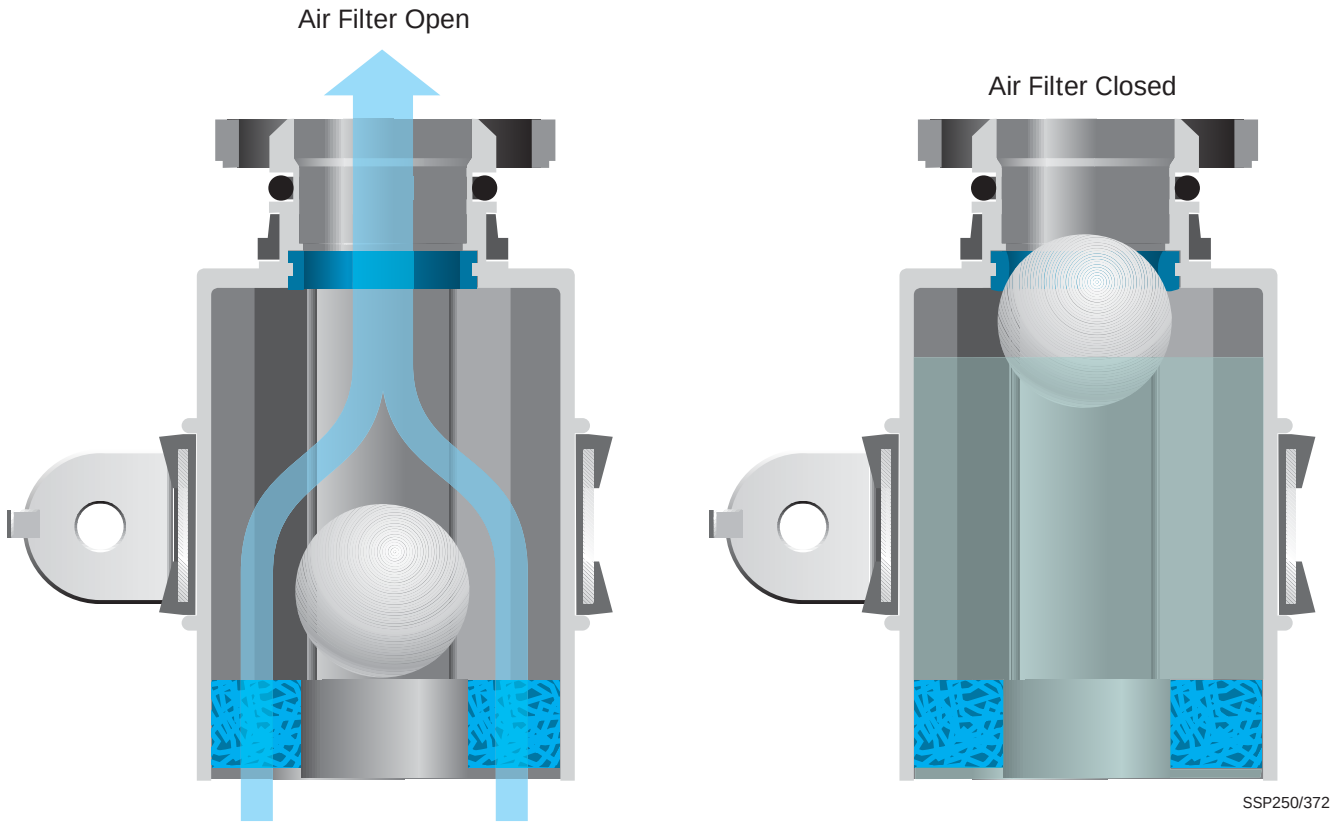


SSP250/119

Air Filter

An air filter is attached to the entrance of the intake hose for Secondary Air Injection Pump Motor V101 for bank I and Secondary Air Injection Pump Motor 2 V189 for bank II.

There is a ball in each air filter that closes the air intake openings to the pumps when the vehicle travels through puddles (snorkel effect).



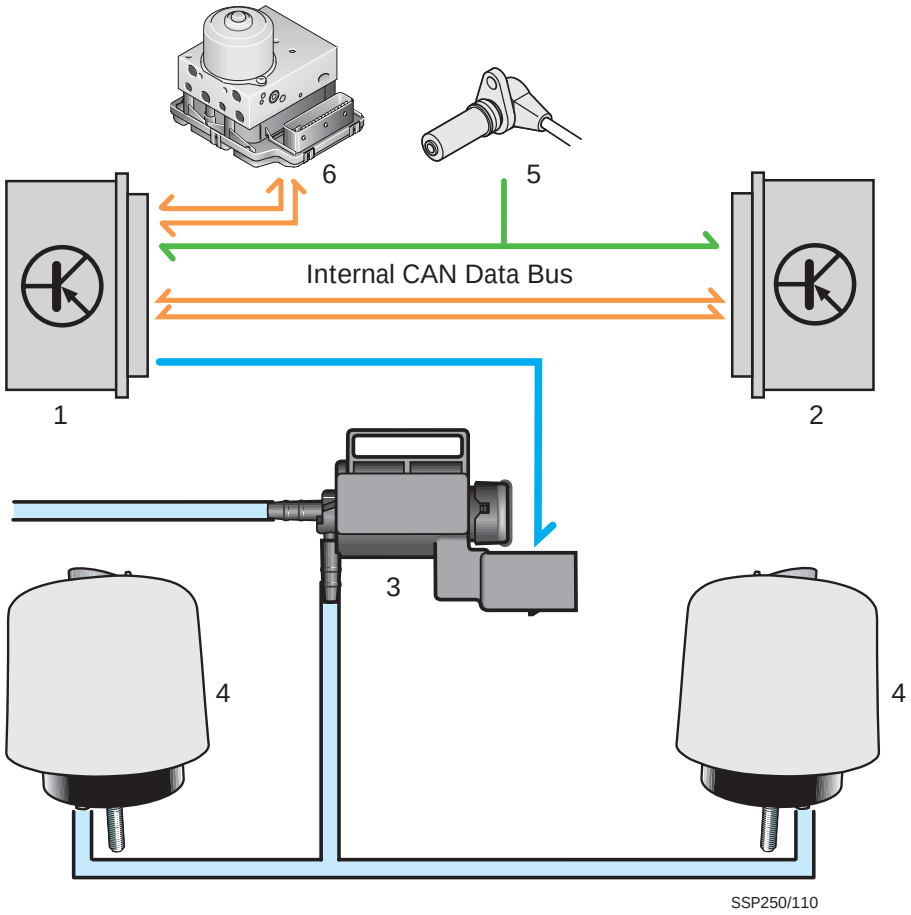
Engine Mount Damping Control

Input Signals

- Engine speed sensor signal
- Vehicle speed

The hydraulically damped engine mounts with electro-pneumatic actuation reduce the transfer of engine vibration to the body over the entire engine speed range.

The Engine Control Module 1 J623 controls the Right Electro-Hydraulic Engine Mount Solenoid Valve N145 depending on the engine speed and the vehicle speed.



Bank I

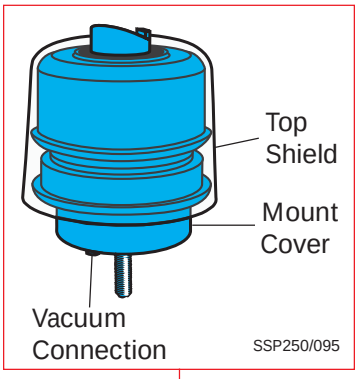
1 Engine Control Module 1 J623
3 Right Electro-Hydraulic Engine Mount Solenoid Valve N145
4 Engine Mount
5 Engine Speed Sensor G28
6 Vehicle Speed Signal from ABS Control Module with EDL/ASR/ESP J104

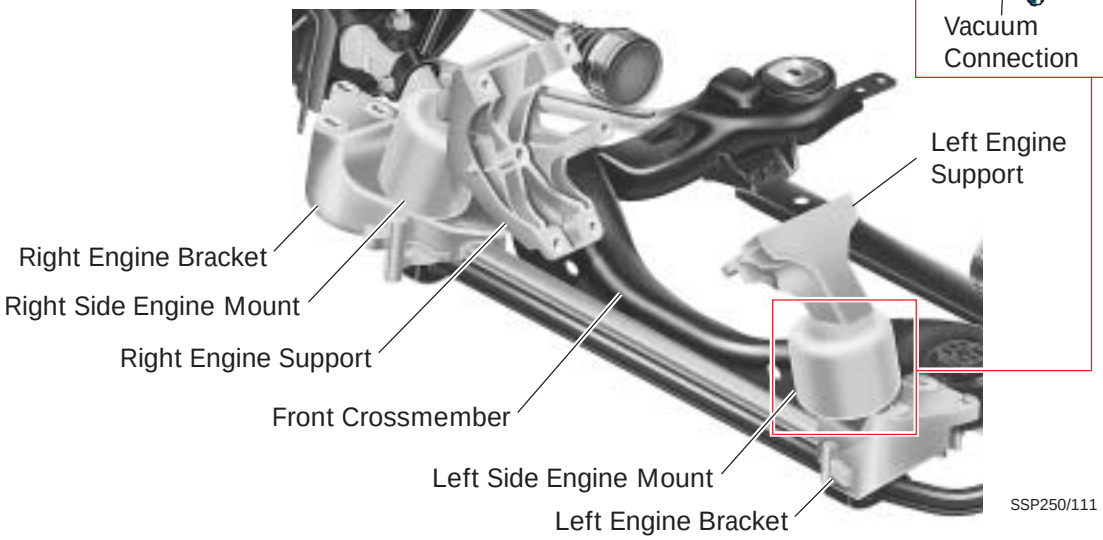
Bank II

2 Engine Control Module 2 J624
5 Engine Speed Sensor G28

Hydraulically Damped Engine Mounts

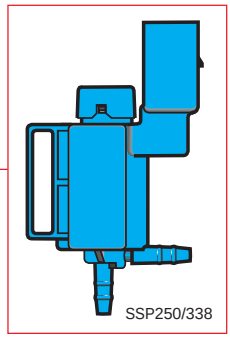
The two hydraulically damped engine mounts are located between the engine supports and brackets on either side of the engine.

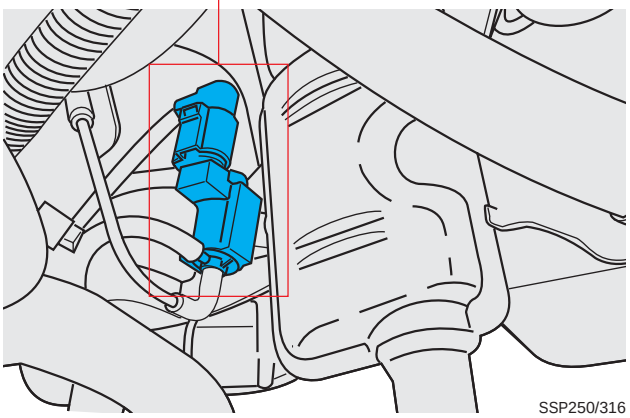




Right Electro-Hydraulic Engine Mount Solenoid Valve N145

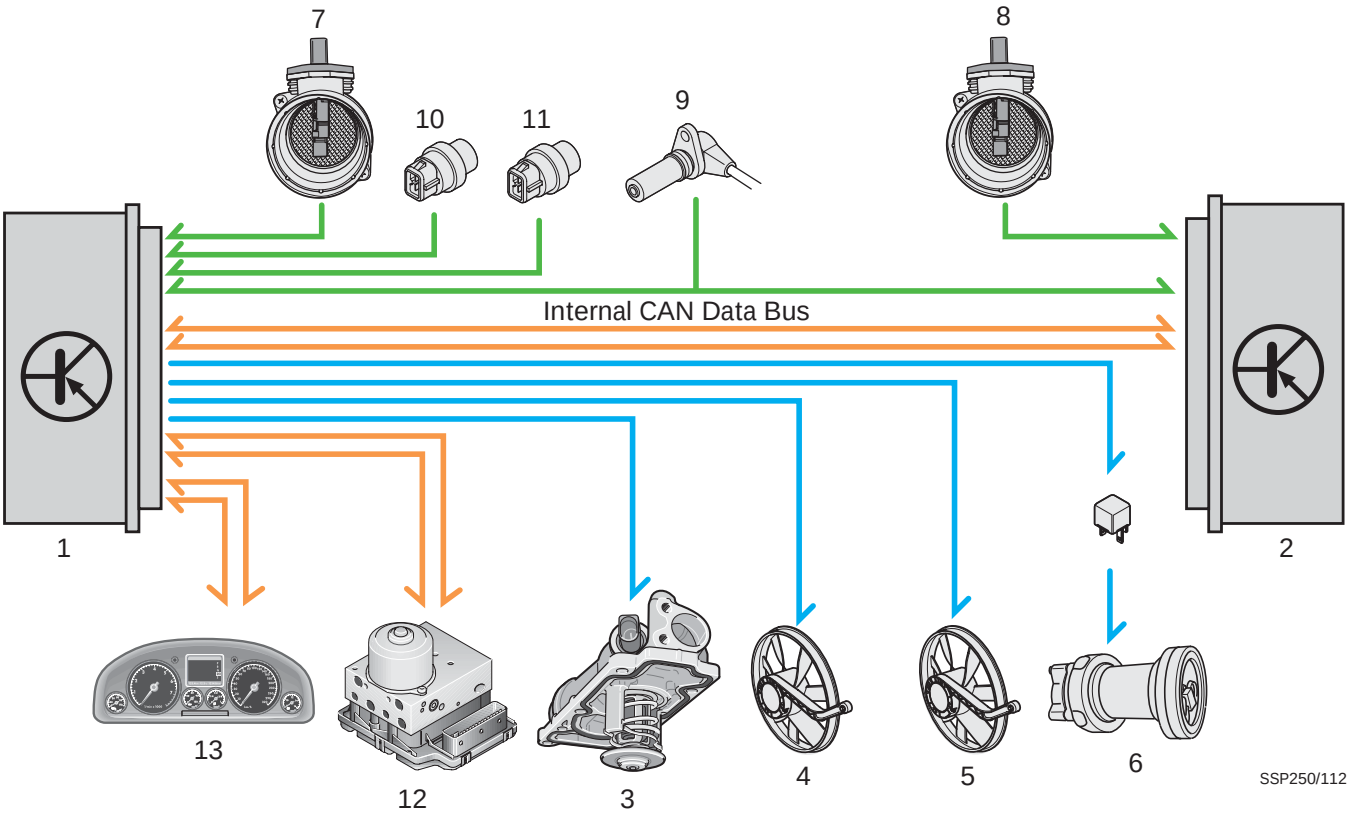
Depending on the engine speed and the vehicle speed, the Engine Control Module 1 J623 actuates the Right Electro-Hydraulic Engine Mount Solenoid Valve N145 which in turn switches the mounts between the dynamically soft engine mount damping state in idling mode and the relatively hard engine mount damping state in driving mode.





For a detailed explanation of how the engine mount damping control functions, please refer to *Passat W8 Engine Management, Motronic ME 7.1.1,* Self-Study Program Course Number 843103.

Electronically Controlled Engine Cooling



Bank I

1 Engine Control Module 1 J623

3 Map Controlled Engine Cooling Thermostat F265

4 Coolant Fan V7

5 Coolant Fan 2 V177

6 Coolant Pump V36

7 Mass Air Flow Sensor G70 with Intake Air Temperature Sensor G42

9 Engine Speed Sensor G28

10 Engine Coolant Temperature Sensor G62

11 Engine Coolant Temperature Sensor (on Radiator) G83

12 Vehicle Speed Signal from ABS Control Module with EDL/ASR/ESP J104

13 Engine Oil Temperature from the Control Module with Indicator Unit in Instrument Panel Insert J285 via the Drivetrain CAN Data Bus

Bank II

2 Engine Control Module 2 J624

8 Mass Air Flow Sensor 2 G246 with Intake Air Temperature Sensor 2 G299

9 Engine Speed Sensor G28

The electronically controlled engine cooling system adjusts the coolant temperature to suit the engine operating state.

Input Signals

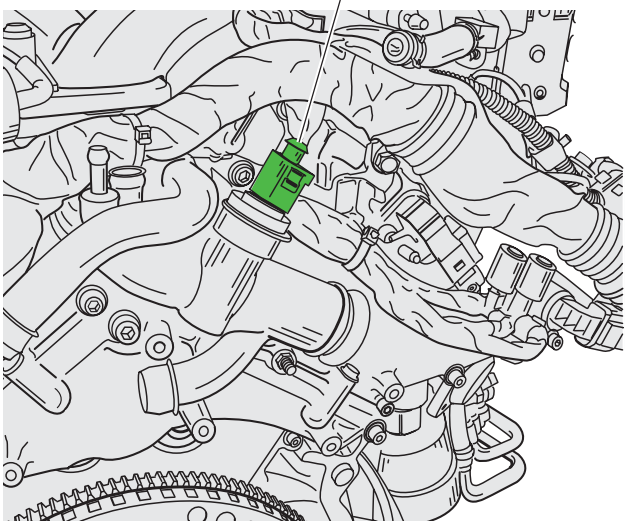
- Engine speed sensor signal
- Mass air flow engine load signals
- Coolant temperature at the engine outlet
- Coolant temperature at the radiator outlet
- Vehicle speed
- Engine oil temperature

The coolant temperature is regulated steplessly. If a large cooling capacity proves necessary after the input signals are processed, the Map Controlled Engine Cooling Thermostat F265 is activated according to “maps” stored in Engine Control Module 1 J623.

To further increase cooling capacity, Engine Control Module 1 J623 activates the two map-controlled radiator fans.

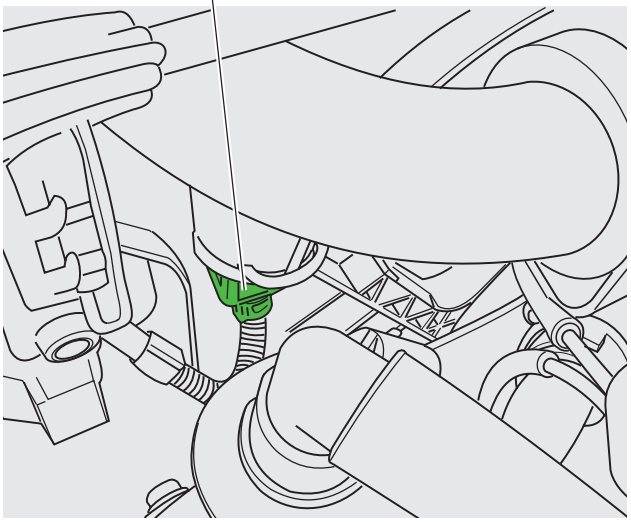
As used here, **map** refers to an electronic database that sets up the relationship between incoming sensor information and outgoing control signals. Maps are also referred to as “look-up tables.”

Engine Coolant Temperature Sensor G62 on the coolant outlet pipe at the rear of the engine



SSP250/121

Engine Coolant Temperature Sensor (on Radiator) G83 at the radiator outlet



SSP250/356

Engine Coolant Temperature Sensor G62 and Engine Coolant Temperature Sensor (on Radiator) G83

The actual coolant temperature values are measured at two different points in the cooling circuit. Engine Coolant Temperature Sensor G62 is located on the coolant outlet pipe at the rear of the engine and Engine Coolant Temperature Sensor (on Radiator) G83 is located at the radiator outlet.

Both sensors transmit their signals to Engine Control Module 1 J623 only. Engine Control Module 2 J624 receives the necessary information via the internal CAN data bus from Engine Control Module 1 J623.

Effects of failure

An engine temperature model is calculated from the values for the engine load (intake air mass), engine speed, intake air temperature when the engine was started, plus the time elapsed since the engine was started. While the engine is running, this model is constantly compared with the temperature signal from Engine Coolant Temperature Sensor G62.

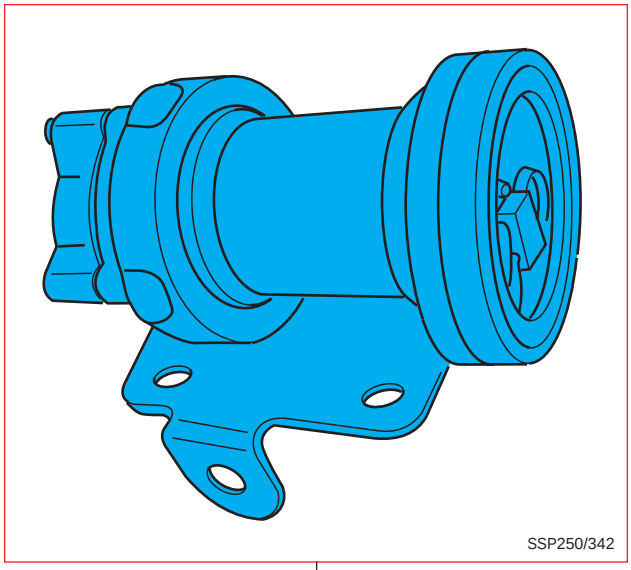
If the measured temperature from Engine Coolant Temperature Sensor G62 falls below the calculated model temperature, it is assumed that Engine Coolant Temperature Sensor G62 is transmitting a faulty signal. Calculations continue using the established model temperature as a back-up temperature.

After-Run Coolant Pump V51

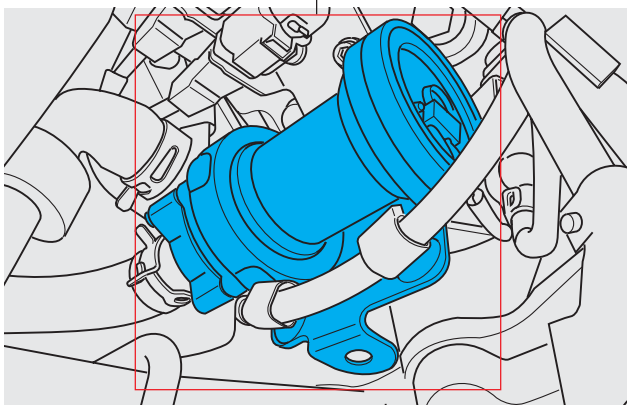
After-Run Coolant Pump V51 is an electrically driven pump activated according to maps stored in Engine Control Module 1 J623. It is located in the large cooling circuit, and has two functions in the circuit:

- It supports the mechanically driven coolant pump at low engine speeds. This guarantees adequate coolant circulation even during stop-and-go driving. After-Run Coolant Pump V51 is activated by Engine Control Module 1 J623 if required by its stored control maps after evaluation of the engine speed and coolant temperature input signals.
- After-Run Coolant Pump V51 also ensures the circulation of coolant after the engine is turned off. After-Run Coolant Pump V51 is map-controlled by Engine Control Module 1 J623 depending on the coolant temperatures at the radiator and engine outlets, the engine oil temperature, and the intake air temperature.

If constant short trips are made with the vehicle, the temperature required to activate the After-Run Coolant Pump V51 is never reached. To prevent it from seizing for lack of use under these conditions, the After-Run Coolant Pump V51 is activated for approximately five seconds each time the engine is started.



SSP250/342



SSP250/340

Effects of failure

The self-diagnosis system does not detect a blocked After-Run Coolant Pump V51.

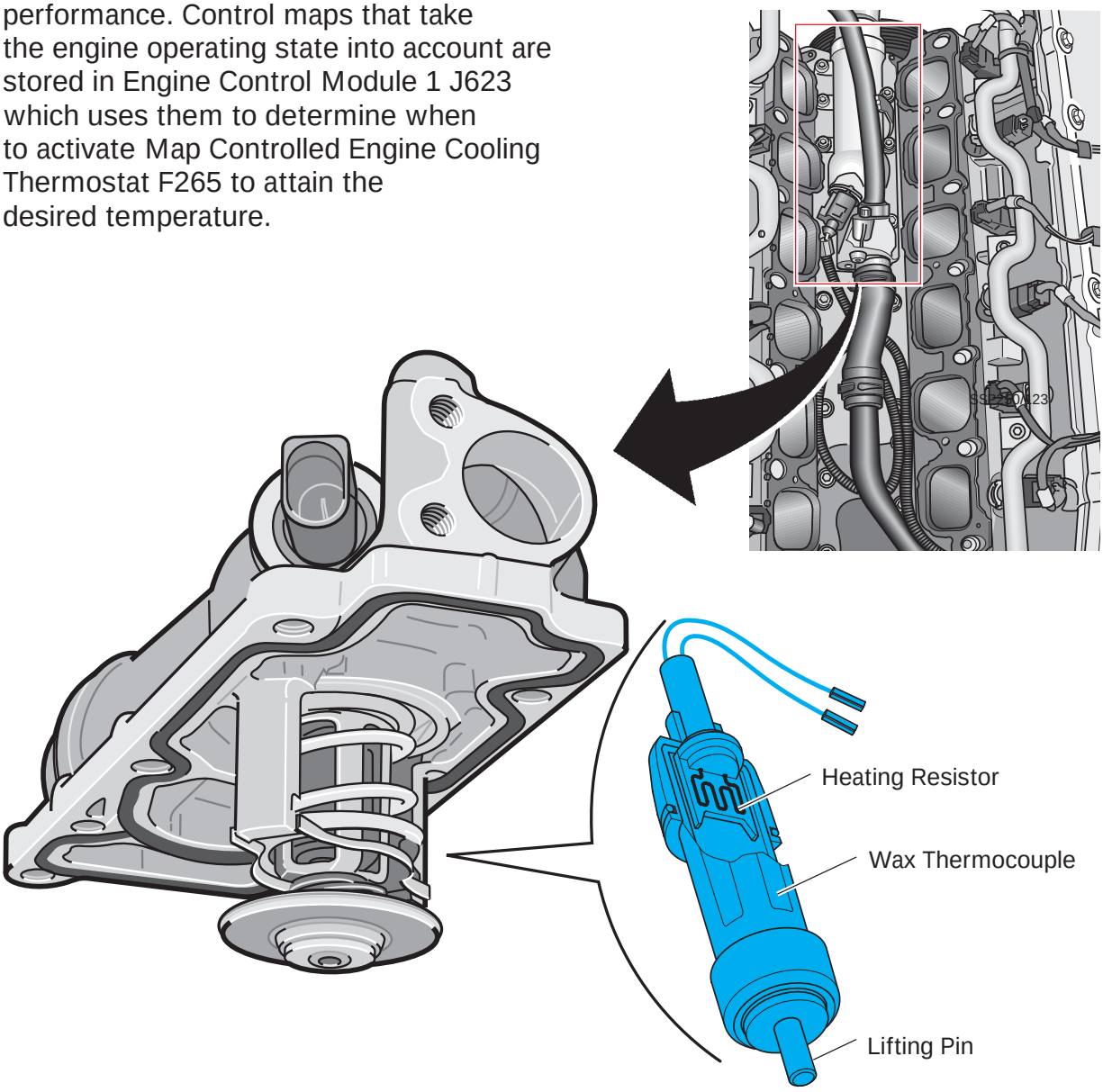
Map Controlled Engine Cooling Thermostat F265

Map Controlled Engine Cooling Thermostat F265 is inserted from above into the upper part of the crankcase. It controls coolant flow between the small and the large cooling circuits.

Different engine operating phases require different engine temperatures for optimum performance. Control maps that take the engine operating state into account are stored in Engine Control Module 1 J623 which uses them to determine when to activate Map Controlled Engine Cooling Thermostat F265 to attain the desired temperature.

Effects of failure

If there is no operating voltage present, the large cooling circuit is opened by the wax thermocouple expansion element at a coolant temperature of 230°F (110°C) or above without the benefit of resistor heating and the coolant fans are actuated.



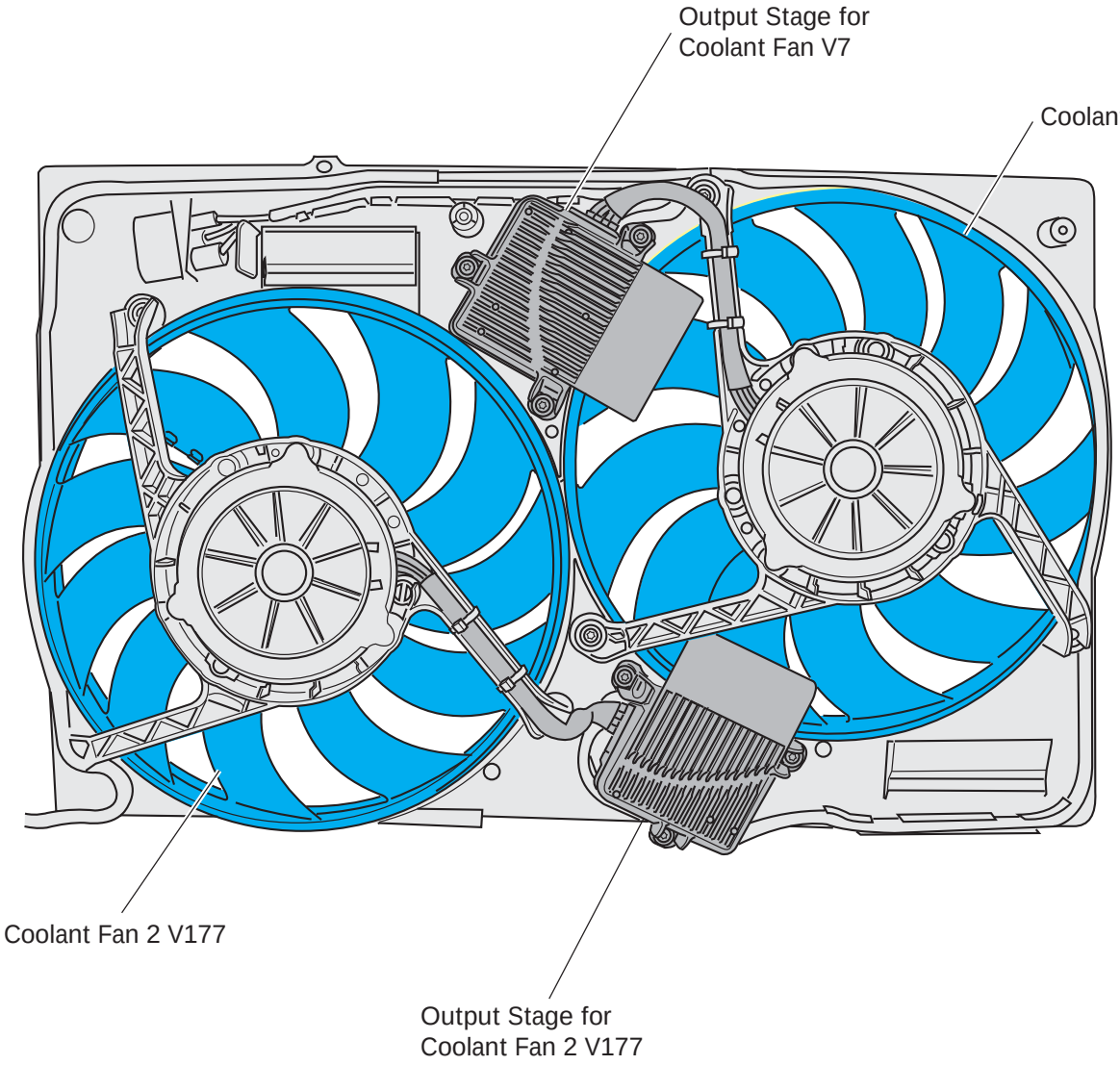
SSP250/059

Coolant Fan V7 and Coolant Fan 2 V177

Coolant Fan V7 and Coolant Fan 2 V177 are located at the front of the engine compartment behind the air conditioning condenser and the radiator.

The fans are activated as required by Engine Control Module 1 J623 using a stored control map.

The fan controllers are integrated into the output stages for the coolant fans. Based on the signals from Engine Control Module 1 J623, the coolant fans can be operated individually and at two different fan speeds.



SSP250/344

ME 7.1.1 Functional Diagram for Phaeton W12 Engine

Components

E221 Control Unit in Steering Wheel
E227 Button for Cruise Control

F Brake Light Switch
F8 Kick-Down Switch
F47 Brake Pedal Switch

G39 Heated Oxygen Sensor
G42 Intake Air Temperature Sensor
G61 Knock Sensor 1
G66 Knock Sensor 2
G70 Mass Air Flow Sensor
G79 Throttle Position Sensor
G83 Engine Coolant Temperature Sensor (on Radiator)
G108 Heated Oxygen Sensor 2
G130 Oxygen Sensor Behind Three Way Catalytic Converter
G131 Oxygen Sensor 2 Behind Three Way Catalytic Converter
G185 Sender 2 for Accelerator Pedal Position
G186 Throttle Drive
G187 Angle Sensor 1 for Throttle Drive
G188 Angle Sensor 2 for Throttle Drive

J271 Motronic Engine Control Module Power Supply Relay
J338 Throttle Valve Control Module
J428 Control Module for Distance Regulation
J527 Steering Column Electronic Systems Control Module
J623 Engine Control Module 1
J670 Motronic Current Supply Relay 2

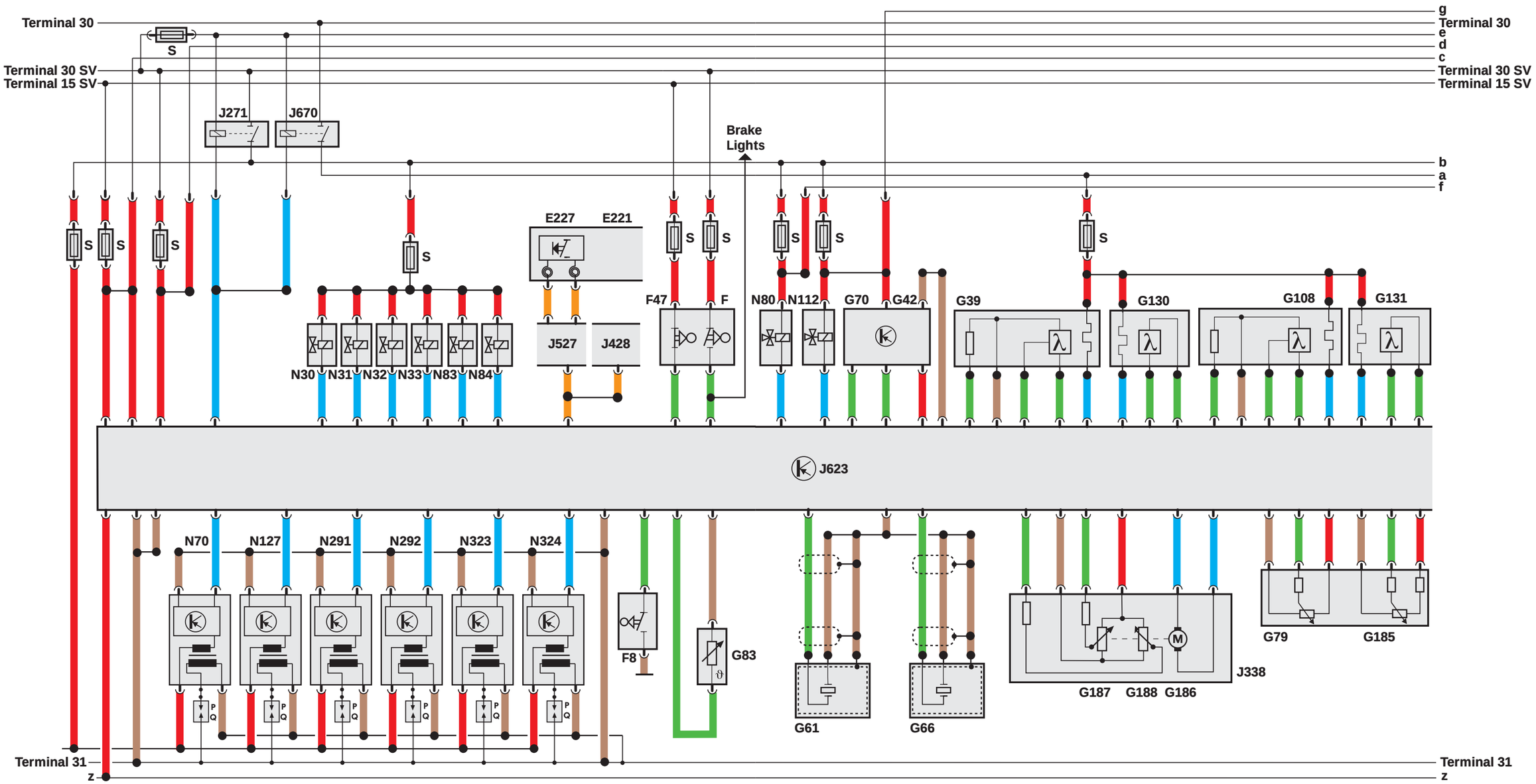
N30 Cylinder 1 Fuel Injector
N31 Cylinder 2 Fuel Injector
N32 Cylinder 3 Fuel Injector
N33 Cylinder 4 Fuel Injector
N70 Ignition Coil 1 with Power Output Stage
N80 Evaporative Emission Canister Purge Regulator Valve
N83 Cylinder 5 Fuel Injector
N84 Cylinder 6 Fuel Injector
N112 Secondary Air Injection Solenoid Valve
N127 Ignition Coil 2 with Power Output Stage
N291 Ignition Coil 3 with Power Output Stage
N292 Ignition Coil 4 with Power Output Stage
N323 Ignition Coil 5 with Power Output Stage
N324 Ignition Coil 6 with Power Output Stage

S Fuse

Color Coding

= Input Signal
= Output Signal
= Positive
= Ground
= CAN Data Bus

Functional Diagram



SSP250/302-304

Functional Diagram

Components

F265 Map Controlled Engine Cooling Thermostat

G6 Fuel Pump
G23 Transfer Fuel Pump
G28 Engine Speed Sensor
G40 Camshaft Position Sensor
G62 Engine Coolant Temperature Sensor
G300 Camshaft Position Sensor 3

J17 Fuel Pump Relay
J49 Fuel Pump 2 Relay
J235 Engine Coolant Pump Relay
J299 Secondary Air Injection Pump Relay
J623 Engine Control Module 1
J624 Engine Control Module 2

N145 Right Electro-Hydraulic Engine Mount Solenoid Valve
N205 Valve 1 for Camshaft Adjustment
N318 Camshaft Adjustment Valve 1 (Exhaust)

S Fuse

V7 Coolant Fan
V51 After-Run Coolant Pump
V101 Secondary Air Injection Pump Motor
V177 Coolant Fan 2

Auxiliary Signals

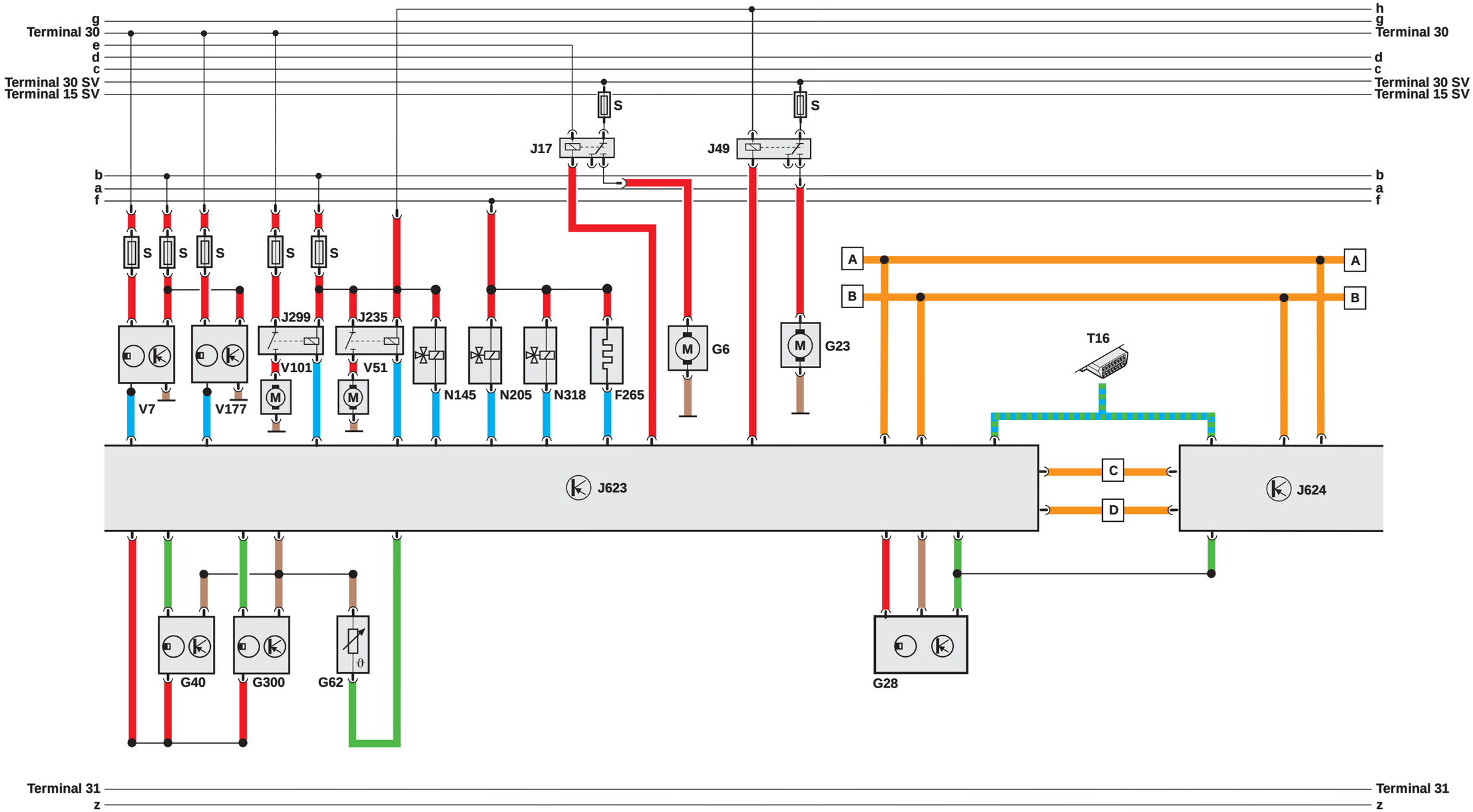
A Low Drivetrain CAN Data Bus
B High Drivetrain CAN Data Bus
C Low Internal CAN Data Bus
D High Internal CAN Data Bus

T16 16-Pin Connector (Diagnosis Connection)

Color Coding

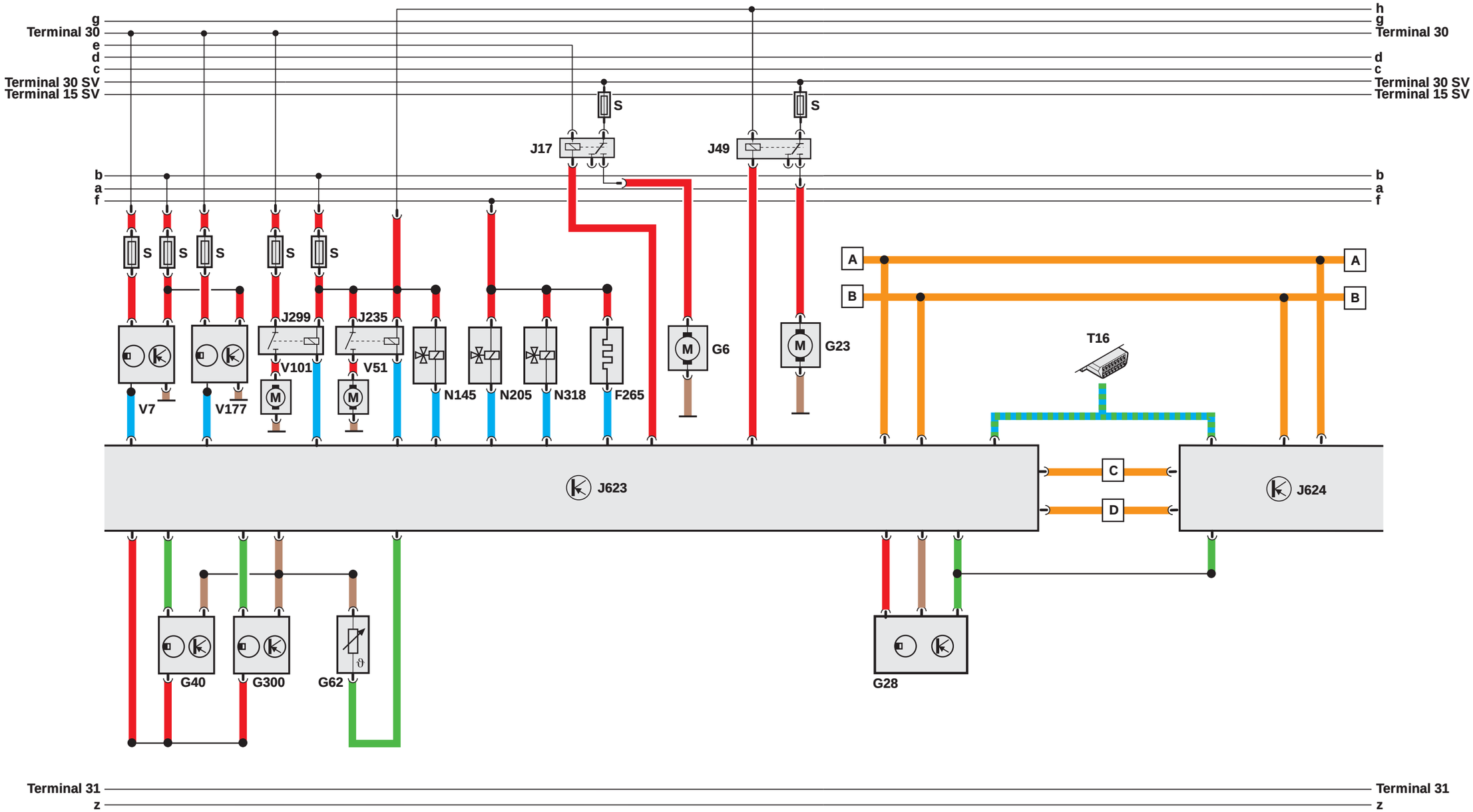
= Input Signal
= Output Signal
= Positive
= Ground
= CAN Data Bus

Functional Diagram



SSP250/306-308

Functional Diagram



SSP250/306-308

Functional Diagram

Components

G163 Camshaft Position Sensor 2
G198 Knock Sensor 3
G199 Knock Sensor 4
G246 Mass Air Flow Sensor 2
G285 Heated Oxygen Sensor 3
G286 Heated Oxygen Sensor 4
G287 Oxygen Sensor 3 Behind Three-Way Catalytic Converter
G288 Oxygen Sensor 4 Behind Three-Way Catalytic Converter
G296 Throttle Drive 2 (Power Accelerator Actuation)
G297 Angle Sensor 1 (on Throttle Drive 2 Power Accelerator Actuation)
G298 Angle Sensor 2 (on Throttle Drive 2 Power Accelerator Actuation)
G301 Camshaft Position Sensor 4

J544 Throttle Valve Control Module 2
J545 Secondary Air Injection Pump Relay 2
J624 Engine Control Module 2

N85 Cylinder 7 Fuel Injector
N86 Cylinder 8 Fuel Injector
N208 Valve 2 for Camshaft Adjustment
N299 Cylinder 9 Fuel Injector
N300 Cylinder 10 Fuel Injector
N301 Cylinder 11 Fuel Injector
N302 Cylinder 12 Fuel Injector
N319 Camshaft Adjustment Valve 2 (Exhaust)
N320 Secondary Air Injection Solenoid Valve 2
N325 Ignition Coil 7 with Power Output Stage
N326 Ignition Coil 8 with Power Output Stage
N327 Ignition Coil 9 with Power Output Stage
N328 Ignition Coil 10 with Power Output Stage
N329 Ignition Coil 11 with Power Output Stage
N330 Ignition Coil 12 with Power Output Stage
N333 Evaporative Emission Canister Purge Regulator Valve 2

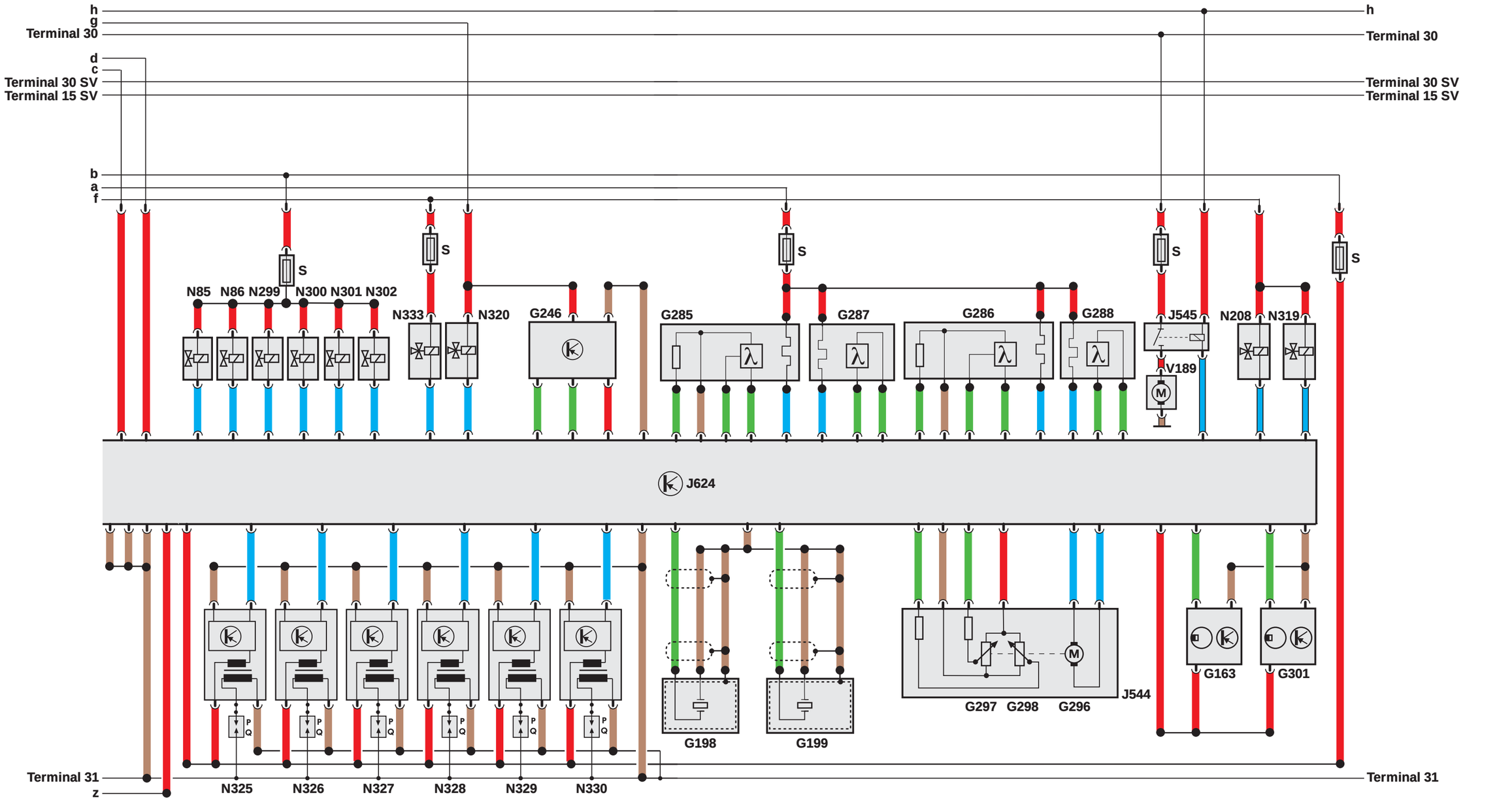
S Fuse

V189 Secondary Air Injection Pump Motor 2

Color Coding

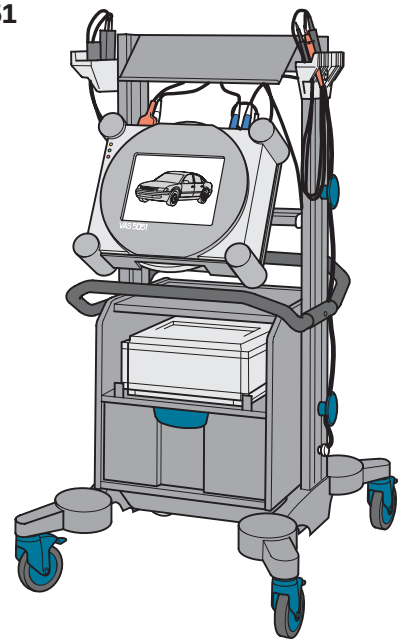
= Input Signal
= Output Signal
= Positive
= Ground
= CAN Data Bus

Functional Diagram



SSP250/310-312

VAS 5051



SSP250/378

VAS 5052

SSP250/235

Self-Diagnosis System

The two engine control modules permit extensive self-diagnosis of all subsystems and electrical components.

They communicate with various vehicle diagnosis systems.

- VAS 5051
- VAS 5052

Using the Vehicle Diagnosis, Test and Information System VAS 5051 it is possible to carry out the following:

- Vehicle self-diagnosis
- Measurements
- Guided fault-finding
- Administration

Using the mobile Vehicle Diagnosis and Service Information System VAS 5052 it is possible to carry out or operate the following:

- Vehicle self-diagnosis
- Service information system
- Administration

You must interrogate the DTC memory of both Engine Control Module 1 J623 and Engine Control Module 2 J624 during diagnosis procedures.

Reading the Fault Memory

If faults occur in the system, they are detected by the self-diagnosis system and stored in the fault memory. The fault memory can be read in **function 02** with the vehicle diagnosis system.

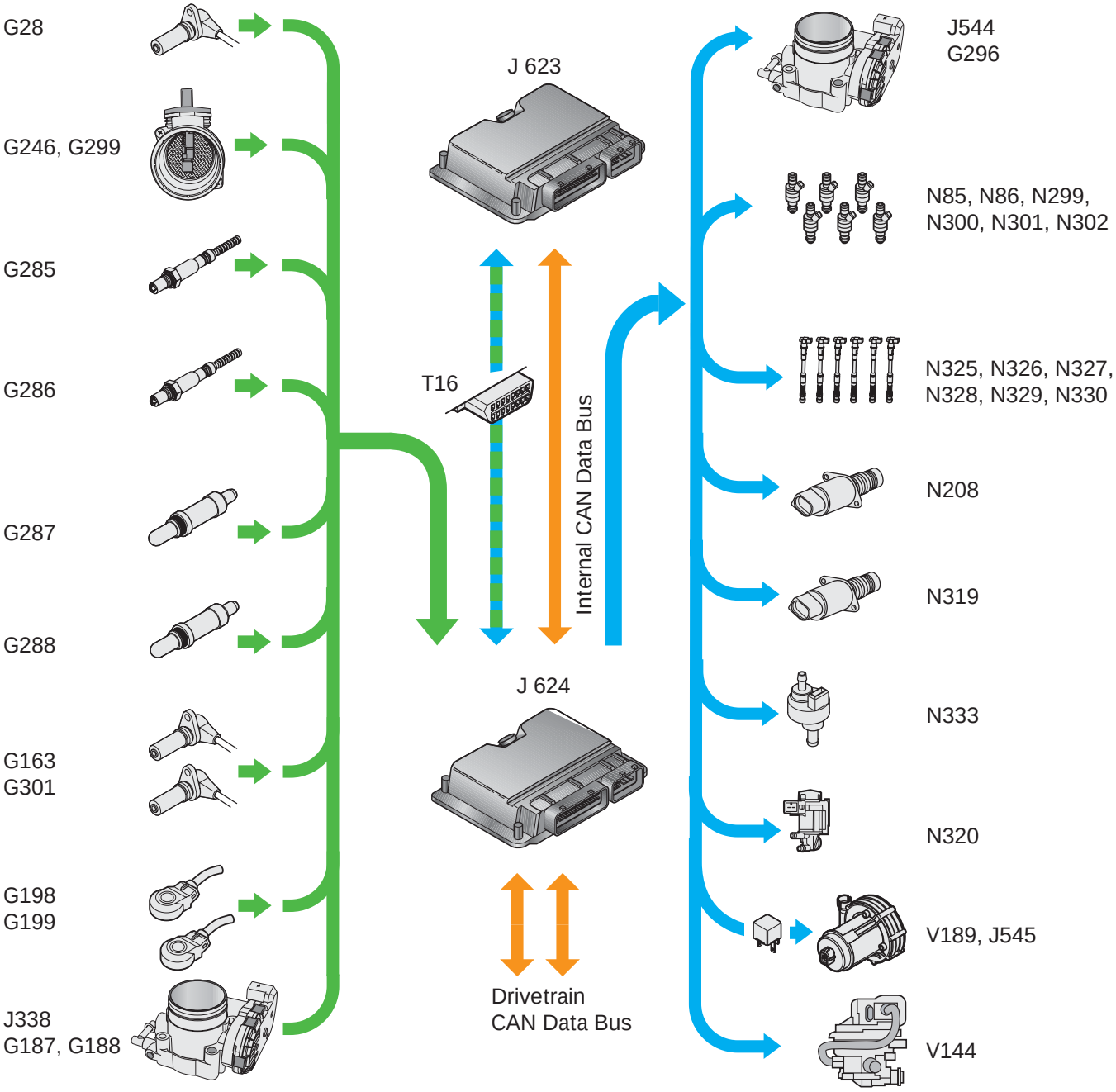
Please note that **repairs group 01** is integrated in "Guided fault-finding." The "Read data block" and "Actuator diagnosis" functions are also located there.

Engine Control Module 1 J623

The following components are monitored by the self-diagnosis system through Engine Control Module 1 J623:

Engine Control Module 2 J624

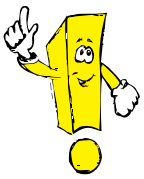
The following components are monitored by the self-diagnosis system through Engine Control Module 2 J624:



SSP250/374

Erasing the Fault Memory

After “Interrogate fault memory” the erase function deletes the contents of the fault memory. The readiness code and various adaptation values such as the camshaft adaptation values and the lambda adaptation values are also erased. To check that the fault memory has been erased correctly, the ignition must be turned off once.



After completing “Erase fault memory,” check whether the camshafts have been re-adapted. If there has been no adaptation, the camshaft timing will remain unadjusted, resulting in a noticeable reduction in performance.

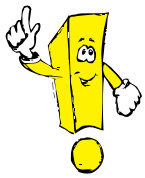
There are two procedures for adapting the camshafts:

- With a short idling phase after the fault memory has been erased and the engine has been restarted.
- By starting basic adjustment following the instructions in the Repair Manual.

Careful consideration should be given before erasing the fault memory because the readiness code is also deleted at the same time, making it necessary to start “Generate readiness code.” The readiness code must always be generated at the conclusion of any repair work, so that it is not deleted again when further work is carried out.
The readiness code is generated with VAS 5051 in the “Guided fault-finding” function.

Readiness Code

Once all of the diagnoses have been conducted, the 8-digit readiness code must be set. It is possible to assign a 0 (diagnosis carried out) or 1 (diagnosis not carried out) to each position in the number code. The readiness code does not show whether or not there are faults in the system. An illuminated Malfunction Indicator Lamp K83 indicates that one or more faults have been detected and stored.



A vehicle may only leave the workshop and be delivered to the customer if the readiness code has been generated.

Notes

An on-line Knowledge Assessment (exam) is available for this Self-Study Program.

The Knowledge Assessment may or may not be required for Certification.

You can find this Knowledge Assessment at:

www.vwwebsource.com

From the vwwebsource.com Homepage, do the following:

- Click on the Certification tab
- Type the course number in the Search box
- Click "Go!" and wait until the screen refreshes
- Click "Start" to begin the Assessment

For Assistance, please call:

Certification Program Headquarters

1 – 877 – CU4 – CERT
(1 – 877 – 284 – 2378)

(8:00 a.m. to 8:00 p.m. EST)

Or, E-Mail:

Comments@VWCertification.com

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