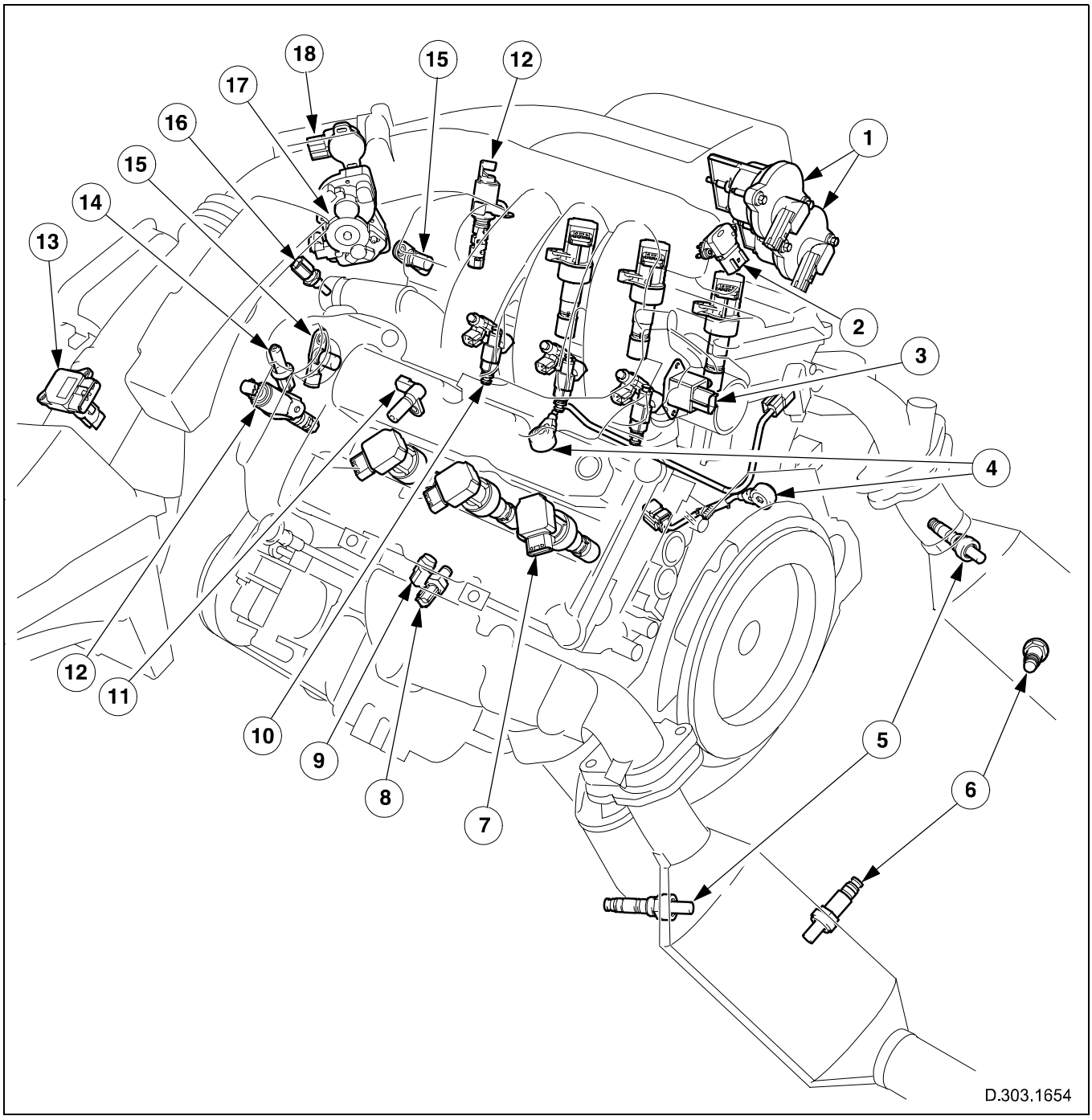

Fig. 53 V6 Normally Aspirated Engine — sensor and actuator location

Key to Fig. 53

1. Intake manifold tuning valves
2. Manifold absolute pressure sensor
3. Fuel pressure sensor
4. Knock sensors
5. Heated oxygen sensor 1
6. Heated oxygen sensor 2
7. On-plug ignition coil with integrated amplifier
8. Engine oil pressure switch
9. Engine oil temperature sensor
10. Fuel injector
11. Crankshaft position sensor
12. Oil control solenoid — variable valve timing
13. Mass air flow sensor with integrated intake air-temperature sensor
14. Engine fuel temperature sensor
15. Camshaft position sensor
16. Engine coolant temperature sensor
17. Throttle motor
18. Throttle position sensor

The arrows represent the ECM's input and output signals.

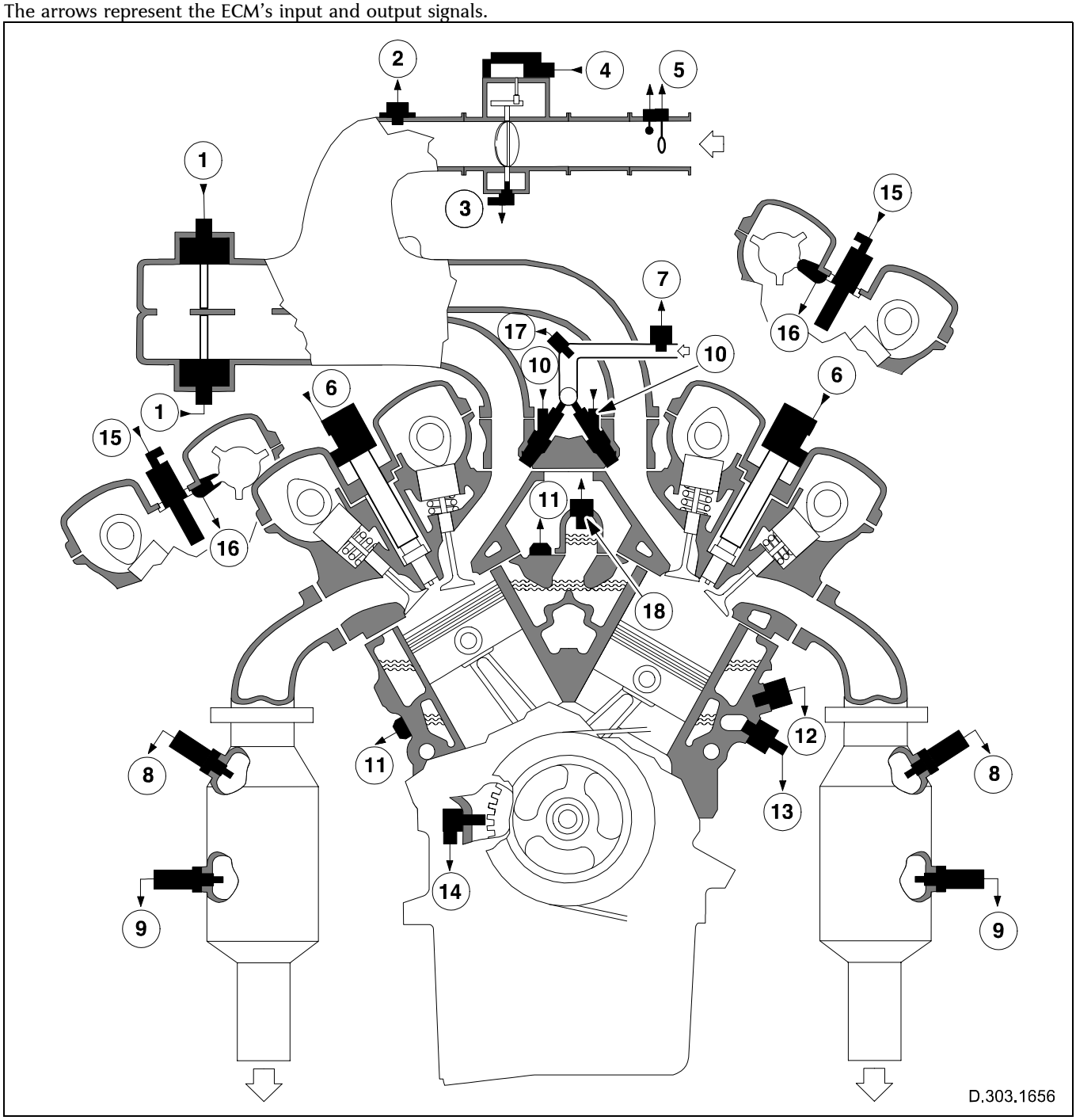

Fig. 54 V6 Normally Aspirated Engine — sensors and actuators schematic

Key to Fig. 54

1. Intake manifold tuning valves
2. Manifold absolute pressure sensor
3. Throttle position sensor
4. Throttle motor
5. Mass air flow sensor with integrated intake air-temperature sensor
6. On-plug ignition coil with integrated amplifier
7. Fuel pressure sensor
8. Heated oxygen sensor 1
9. Heated oxygen sensor 2
10. Fuel injector
11. Knock sensor
12. Engine oil pressure switch
13. Engine oil temperature sensor
14. Crankshaft position sensor
15. Oil control solenoid — variable valve timing
16. Camshaft position sensor
17. Engine fuel temperature sensor
18. Engine coolant temperature sensor

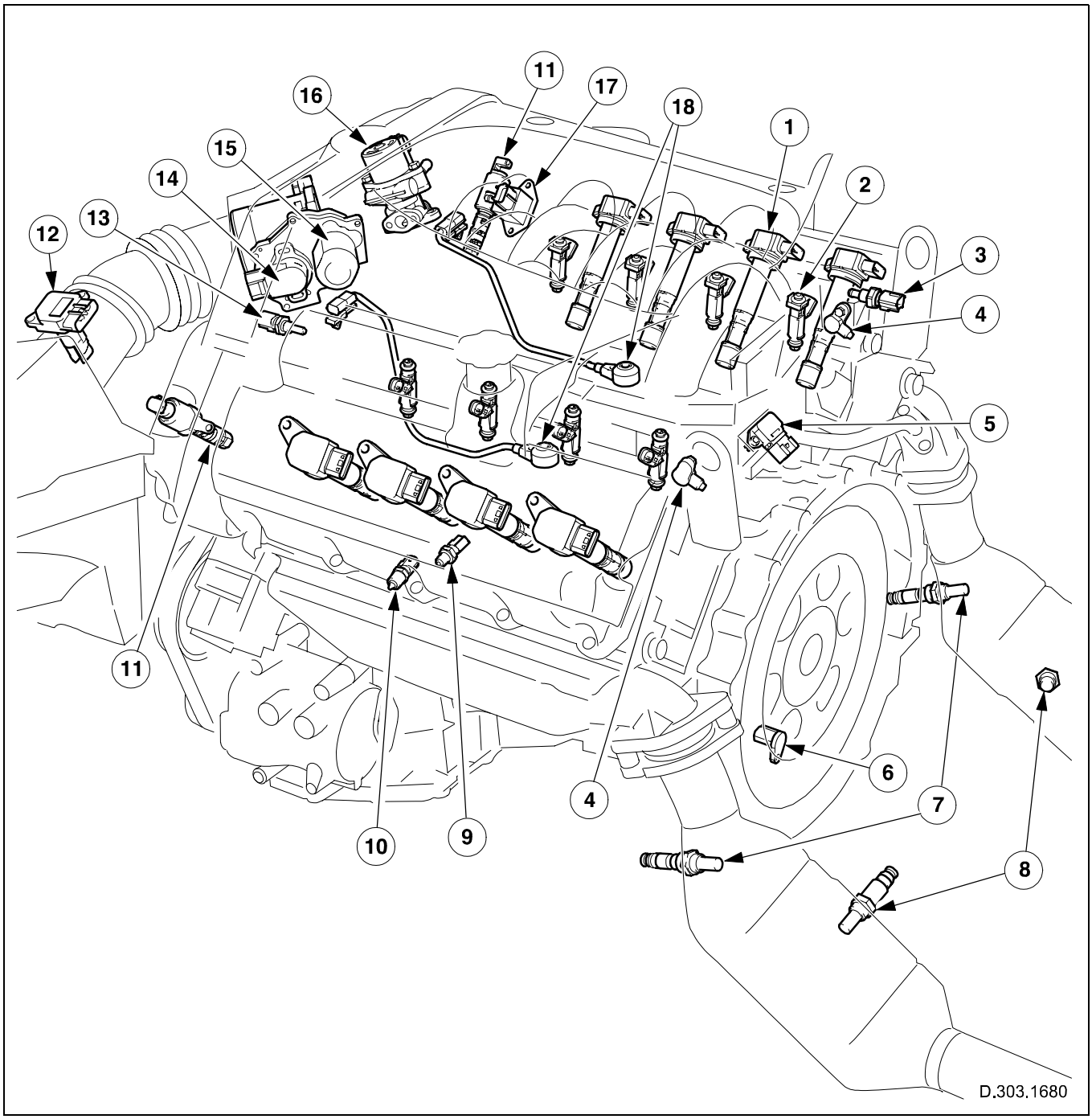

Fig. 55 V8 Normally Aspirated Engine — sensor and actuator location

Key to Fig. 55

1. On-plug ignition coil with integrated amplifier
2. Fuel injector
3. Engine fuel temperature sensor
4. Camshaft position sensor
5. Manifold absolute pressure sensor
6. Crankshaft position sensor
7. Heated oxygen sensor 1
8. Heated oxygen sensor 2
9. Engine oil pressure switch
10. Engine oil temperature sensor
11. Oil control solenoid — variable valve timing
12. Mass air flow sensor with integrated intake air-temperature sensor
13. Engine coolant temperature sensor
14. Throttle position sensor
15. Throttle motor
16. Exhaust gas recirculation valve
17. Fuel pressure sensor
18. Knock sensor

The arrows represent the ECM's input and output signals.

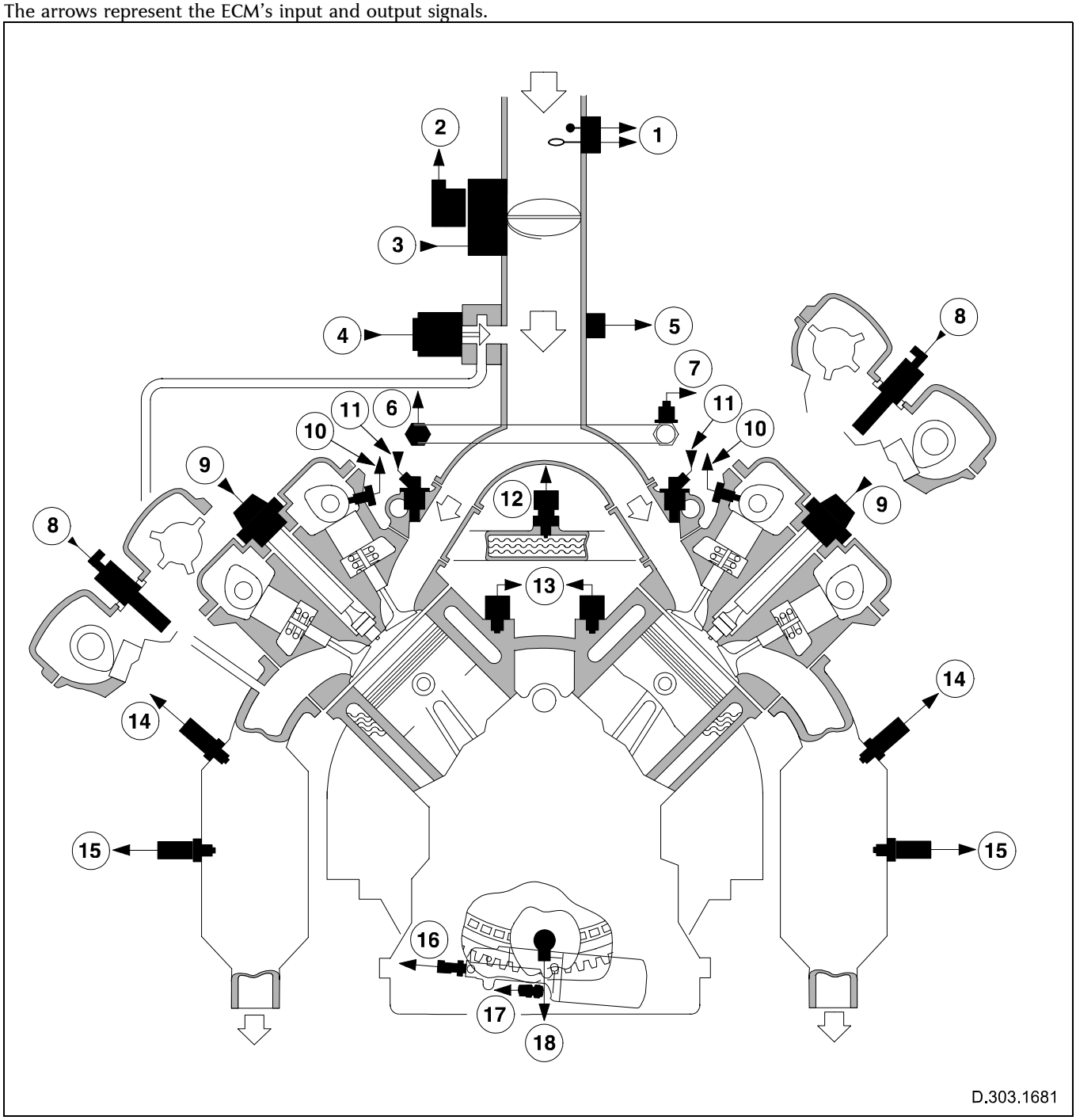

Fig. 56 V8 Normally Aspirated Engine — sensors and actuators schematic

Key to Fig. 56

1. Mass air flow sensor with integrated intake air-temperature sensor
2. Throttle position sensor
3. Throttle motor
4. Exhaust gas recirculation valve
5. Manifold absolute pressure sensor
6. Engine fuel temperature sensor
7. Fuel pressure sensor
8. Oil control solenoid — variable valve timing
9. On-plug ignition coil with integrated amplifier
10. Camshaft position sensor
11. Fuel injector
12. Engine coolant temperature sensor
13. Knock sensor
14. Heated oxygen sensor 1
15. Heated oxygen sensor 2
16. Engine oil pressure switch
17. Engine oil temperature sensor
18. Crankshaft position sensor

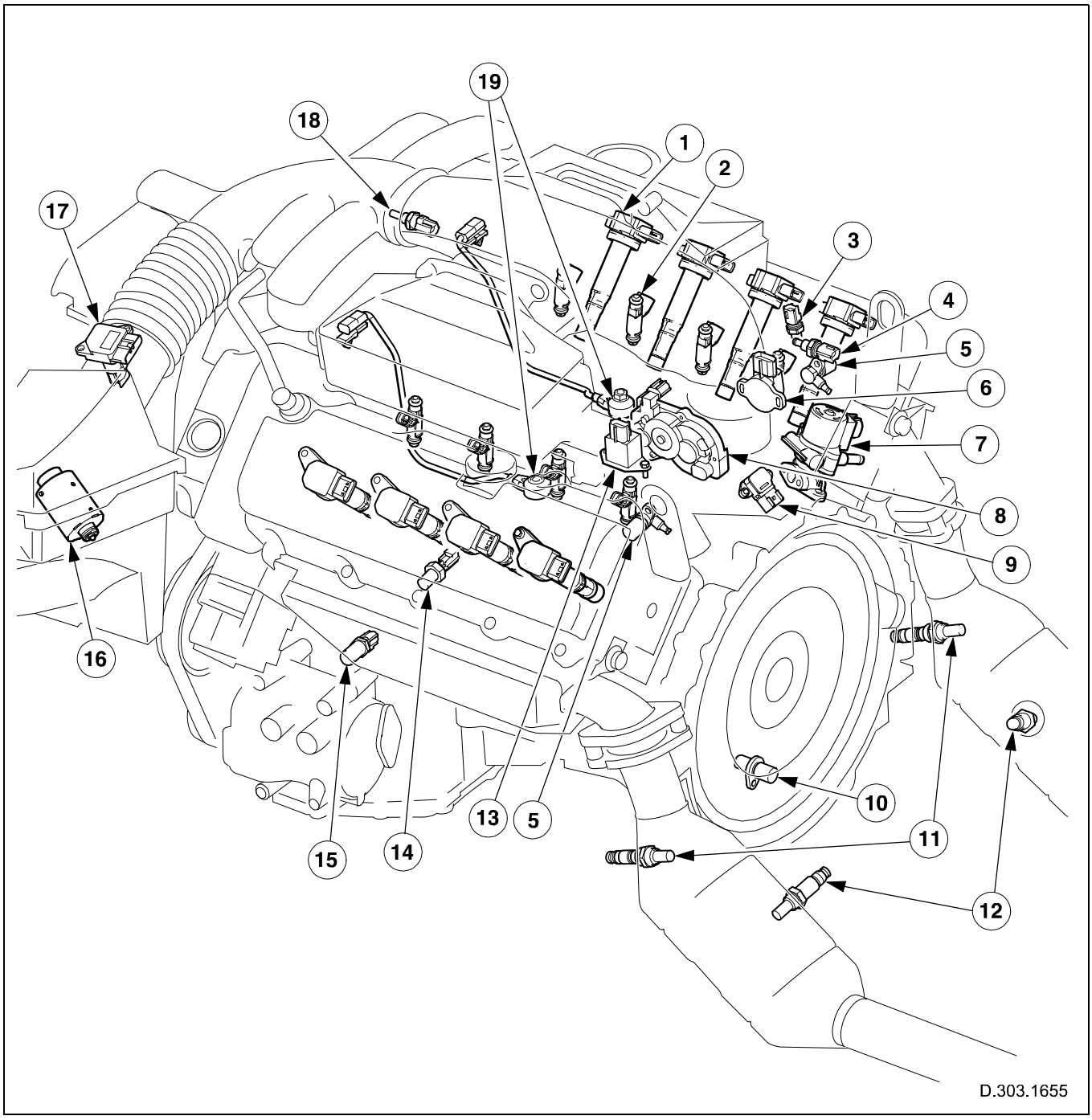

Fig. 57 V8 supercharged Engine — sensor and actuator location

Key to Fig. 57

1. On-plug ignition coil with integrated amplifier
2. Fuel injector
3. Air temperature sensor
4. Engine fuel temperature sensor
5. Camshaft position sensor
6. Throttle position sensor
7. Exhaust gas recirculation valve
8. Throttle motor
9. Manifold absolute pressure sensor
10. Crankshaft position sensor
11. Heated oxygen sensor 1
12. Heated oxygen sensor 2
13. Fuel pressure sensor
14. Engine oil pressure switch
15. Engine oil temperature sensor
16. Air intake control-flap solenoid
17. Mass air flow sensor with integrated intake air-temperature sensor
18. Engine coolant temperature sensor
19. Knock sensor

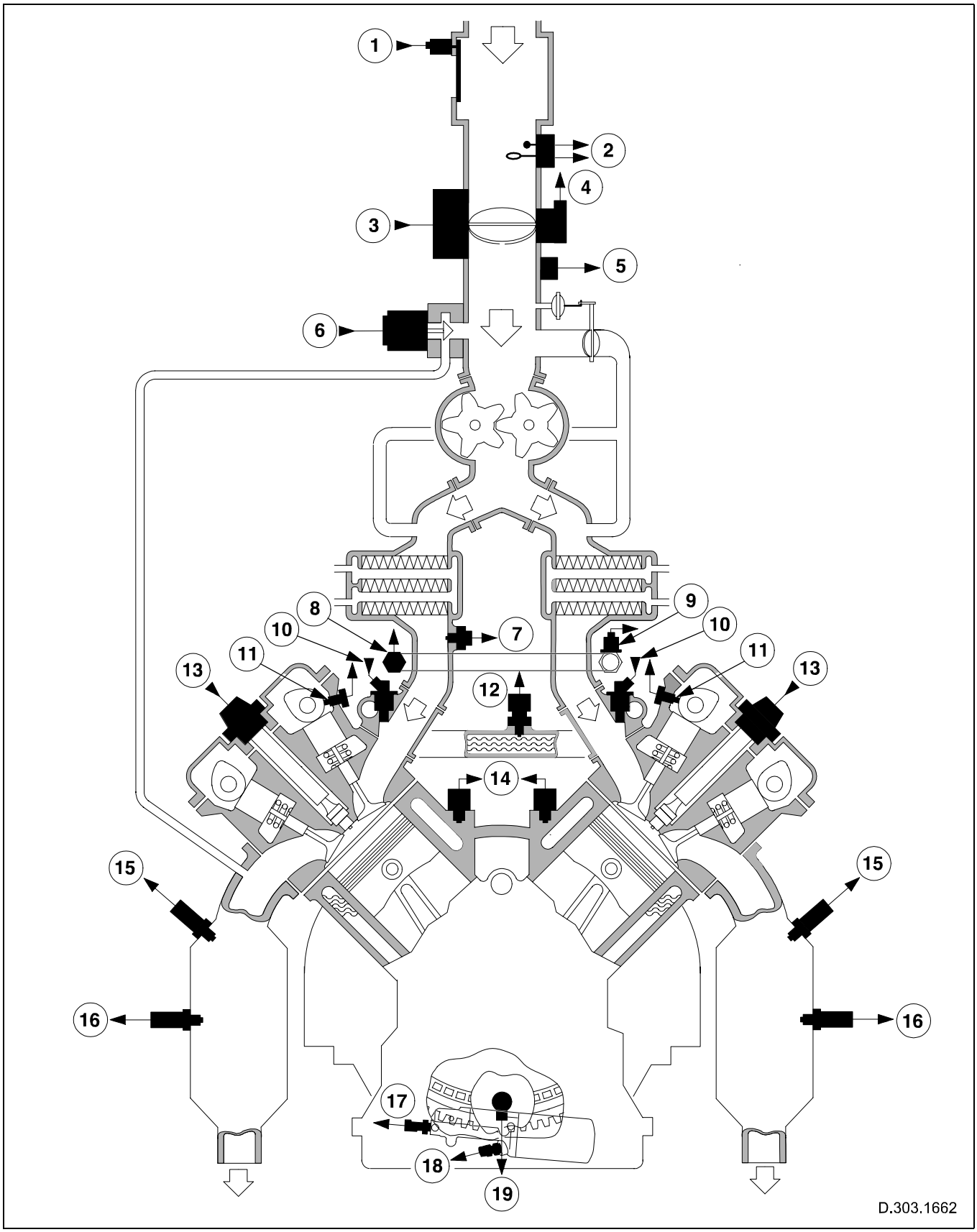

Fig. 58 V8 supercharged Engine — sensors and actuators schematic

Key to Fig. 58

1. Air intake control-flap solenoid
2. Mass air flow sensor with integrated intake air-temperature sensor
3. Throttle motor
4. Throttle position sensor
5. Manifold absolute pressure sensor
6. Exhaust gas recirculation valve
7. Air temperature sensor
8. Engine fuel temperature sensor
9. Fuel pressure sensor
10. Fuel injector
11. Camshaft position sensor
12. Engine coolant temperature sensor
13. On-plug ignition coil with integrated amplifier
14. Knock sensor
15. Heated oxygen sensor 1
16. Heated oxygen sensor 2
17. Engine oil pressure switch
18. Engine oil temperature sensor
19. Crankshaft position sensor

Automatic Transmission

Introduction

A six-speed, electronically controlled, automatic transmission is introduced into the new XJ, which is compatible with all engine applications. The transmission has been specially developed for vehicles with an engine torque of up to 600 Newton-meters (Nm).

In comparison to the previous five-speed transmission, the six-speed transmission provides:

- Higher torque capacity;
- Reduced length;
- Reduced weight;
- Reduced assembly components;
- Improved fuel consumption;
- Improved vehicle performance.

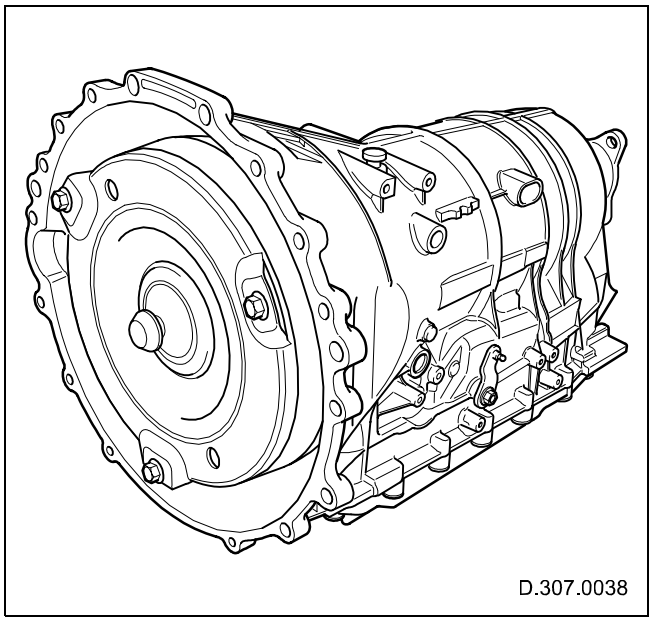

Fig. 59 Automatic transmission

The transmission is physically different for V6 and V8 engine applications. The main difference is that the V8 application has recesses in the bell housing to accommodate the exhaust catalysts.

Key Data

- Six forward gears;
- One reverse gear;
- Coaxial planetary transmission;
- Hydrodynamic torque converter with an integral converter lock-up clutch;
- Hydraulic valve body with integral transmission control module;
- Electronic-hydraulic shift point position and gear shift control;
- Manual shifting;
- Self-diagnosis;
- Fill for life transmission fluid.

Gear Ratios

1st - 4.17:1
2nd - 2.34:1
3rd - 1.52: 1
4th - 1.14:1
5th - 0.87:1
6th - 0.69:1
Reverse - 3.40:1

Transmission Operation

- The transmission unit uses planetary gears with hydraulic-electronic control.
- The valve body and transmission control module (TCM) form a combined element, installed in the transmission's fluid pan.
- The TCM uses a newly developed shift strategy known as adaptive shift strategy.

Engine power reaches the transmission via a torque converter with an integral converter lock-up clutch. The six-forward gears and one-reverse gear are obtained from a single-web planetary gear set, followed by a double planetary gear set, known as the Lepelletier-type gear sets. These gears make it possible to obtain six-forward speeds.

Gear selection is achieved by controlling the flow of automatic transmission fluid to operate various internal clutches. The TCM controls the electrical components for gear-selection shift pressure and torque converter slip-control. In the event of a system malfunction the TCM provides failure-mode effect management, to maintain maximum functional operation of the transmission, with minimum reduction in vehicle and occupant safety.

In the event of loss of transmission control through electrical power failure, the basic transmission functions: Park, Reverse, Neutral and Drive are retained by the hydraulic system. The transmission will operate in limp-home mode: third or fifth gear fixed, dependent upon gear selection at the time of the malfunction.

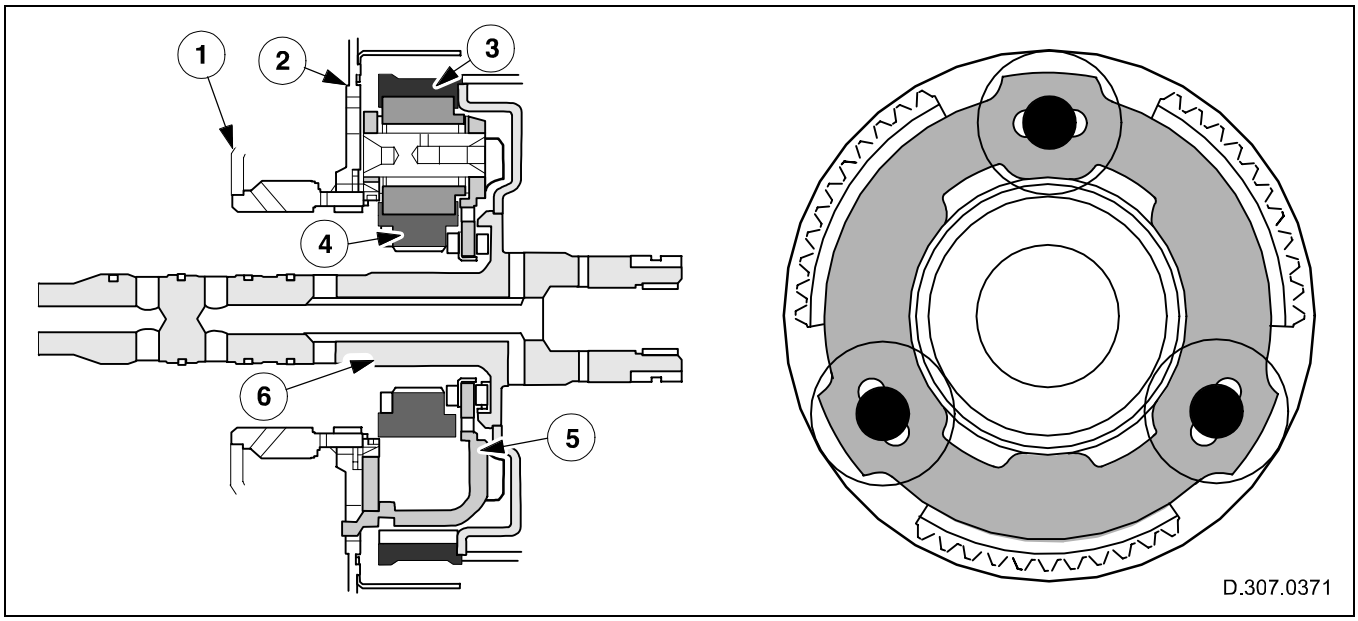

Fig. 60 Single-web planetary gear set

1. Cylinder
2. Baffle plate
3. Ring gear
4. Planetary gear
5. Planetary gear spider
6. Turbine shaft

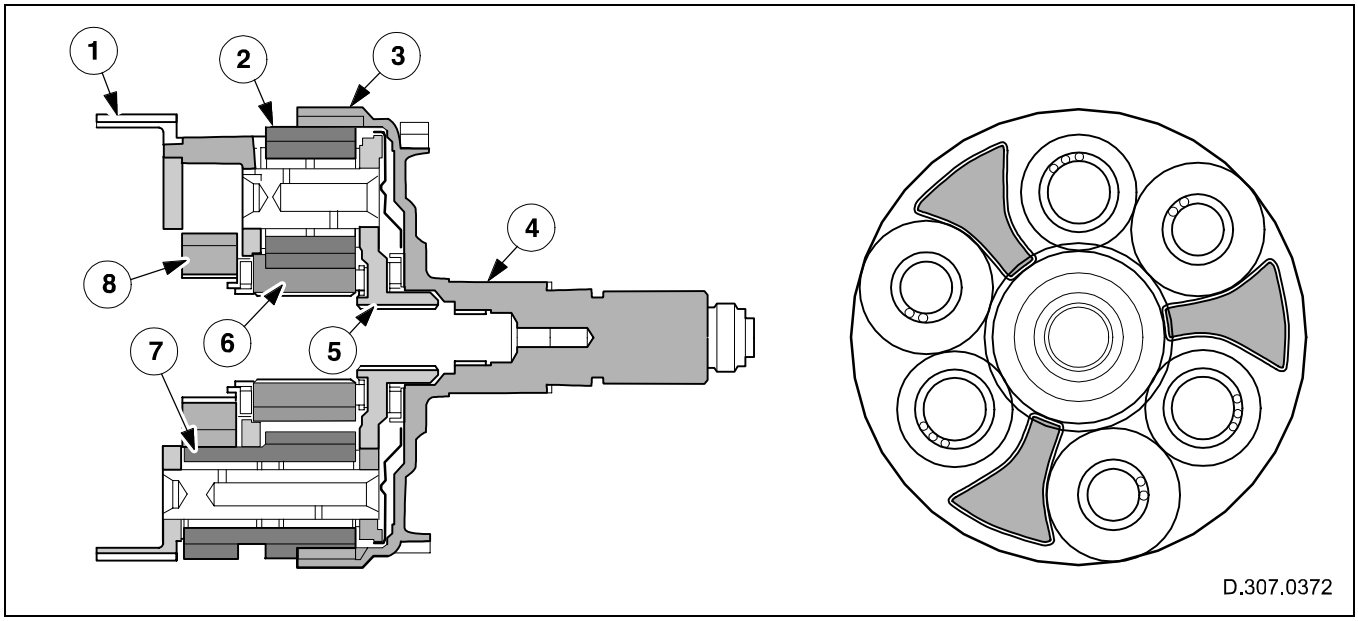

Fig. 61 Double-web planetary gear set

1. Planetary gear spider
2. Planetary gears (short)
3. Ring gear
4. Output
5. Planetary gear spider
6. Sunwheel
7. Double planetary gears (long)
8. Sunwheel

Parking Lock

The parking lock acts by inserting a pawl into the teeth of the parking lock gearwheel on the transmission output shaft.

Fluid Pump

The half-moon type fluid-pump is located between the torque converter and transmission housing. The pump is driven directly by the engine via the torque converter shell, and supplies fluid to the transmission and valve body. The pump draws in fluid through a filter and delivers it at high-pressure to the main pressure valve in the valve body. The valve adjusts the pressure and returns excess fluid to the fluid pan.

Torque Converter

The torque converter is a three-element unit containing a single-plate lock-up clutch and torsional vibration damper. The lock-up clutch eliminates slip in the torque converter, therefore helping to keep engine fuel consumption to a minimum. The lock-up clutch can be controlled and engaged in any of the six forward gears.

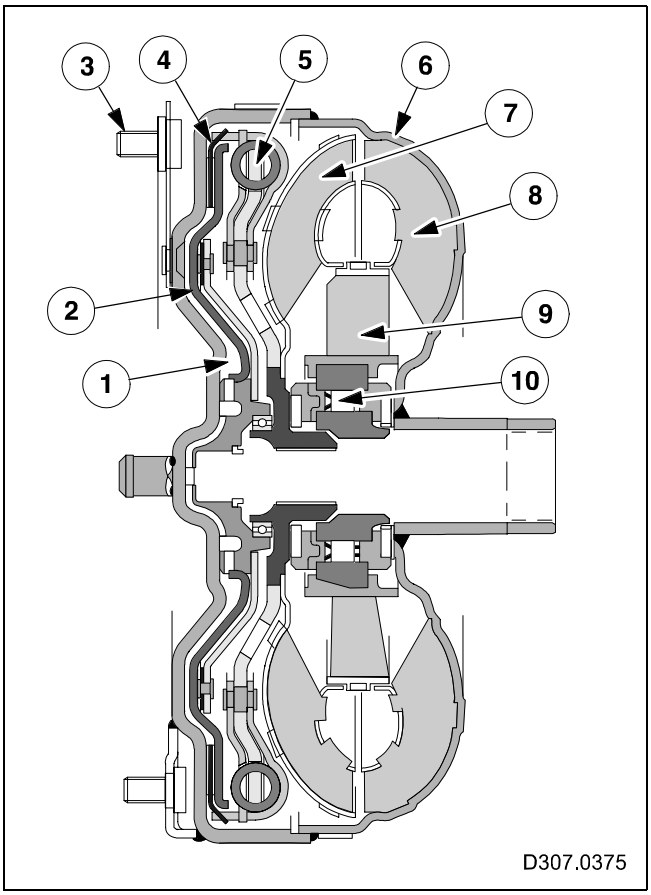

Fig. 62 Torque converter with torsional vibration damper

1. Space behind lock-up clutch
2. Lock-up clutch piston
3. Attachment to flywheel
4. Lined plate of lock-up clutch
5. Torsional vibration damper
6. Converter cover
7. Turbine
8. Impeller
9. Stator
10. Stator freewheel

Shift Elements

In addition to the torque converter lock-up clutch the other shift elements are:

- Three rotating multi-plate clutches ‘A’, ‘B’ and ‘E’.
- Two fixed multi-disc brakes ‘C’ and ‘D’.

All gear shifts ‘1st to 6th’ or from ‘6th to 1st’, are power-on overlapping shifts. When during a shift, one of the clutches must continue to transmit the drive at lower main pressure until the other clutch is able to accept the input torque.

The shift elements, clutches or brakes are engaged hydraulically. The fluid pressure is built up between the cylinder and the piston, therefore pressing the plates together. When fluid-pressure drops, the cup-spring that is pressing against the piston moves it back to its original position. The purpose of these shift elements is to perform in-load shifts with no interruption to traction. Multi-plate clutches ‘A’, ‘B’ and ‘E’ supply power from the engine to the planetary gear train. Multi-disc brakes ‘C ’ and ‘D’ press against the transmission housing in order to achieve a torque reaction effect.

Shift Overlap Control

Another feature of the transmission, is that freewheels (one-way clutches) are replaced by actuation of the relevant clutches when overlap gearshift takes place. This arrangement provides a reduction in transmission weight and size.

The electronic-hydraulic shift action is obtained by means of various valves in the valve body being actuated by pressure regulators. They engage or disengage the relevant clutches or brakes at the correct moments.

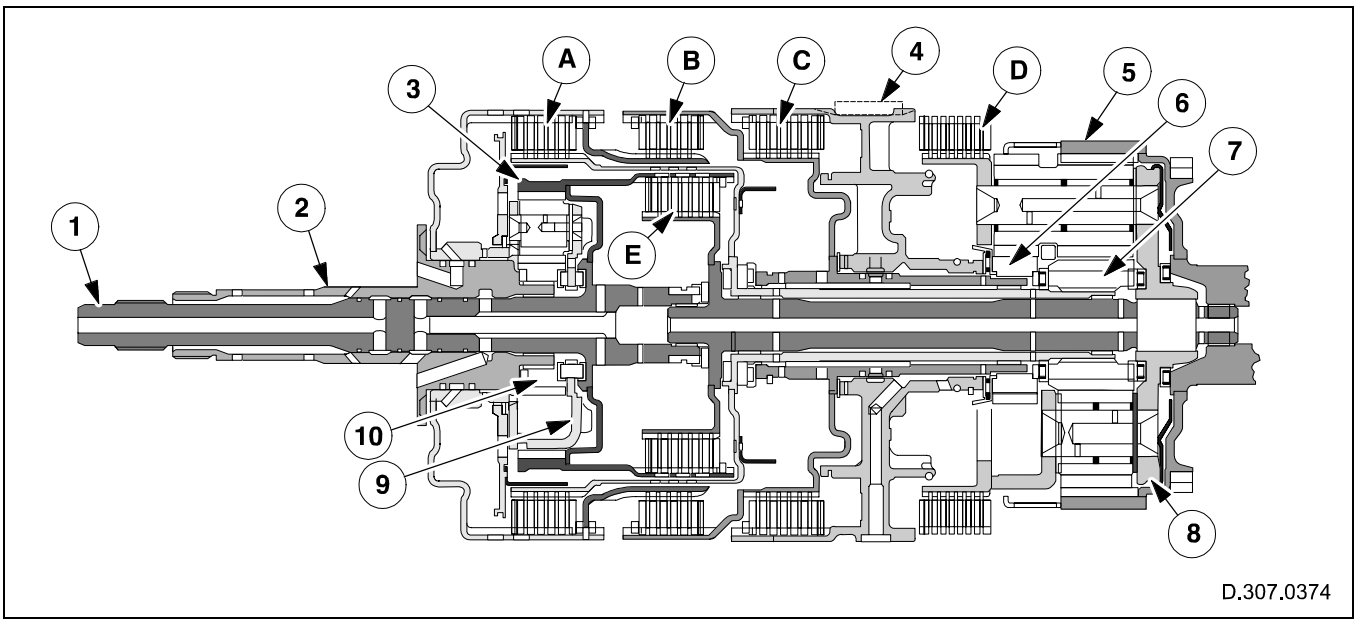

Fig. 63 Shift elements

A. Clutch
B. Clutch
C. Brake
D. Brake
E. Clutch
1. Turbine shaft
2. Stator shaft
3. Ring gear 1
4. Shaft key — fixed connection to transmission housing
5. Ring gear 2
6. Sunwheel 2
7. Sunwheel 3
8. Double planetary gear carrier
9. Planetary gear spider
10. Sunwheel 1

Transmission Control Module / Valve Body

The transmission control module (TCM) and valve body are a combined unit, installed in the transmission's fluid pan.

This combination of components provides the following advantages:

- Minimum tolerances, as the TCM is directly connected to the solenoids;
- Better coordination of gearshifts;
- Increased refinement;
- Optimized shift quality;
- Good reliability, since the number of plug connections and interfaces are reduced.

CAUTION: When working on the TCM/Valve body, precaution must be taken to avoid damage to the component through electrostatic discharge. Refer to 'JTIS' for further information.

The TCM controls the operation of the transmission, by processing signals, for example:

- transmission input and output speeds;

via the CAN:

- throttle pedal position;
- gear selector position;
- engine torque and speed;
- transmission fluid temperature;
- brake pedal status;
- engine oil temperature;
- engine coolant temperature;
- wheel speed.

Using these signals and stored information, the TCM calculates the correct gear and torque converter lock-up clutch setting, plus the optimum pressure settings for gear shift and lock-up clutch control.

Five pressure regulators and one solenoid valve are used to direct transmission-fluid flow, select internal clutches, and control the fluid pressure at the clutch for gear control. A separate pressure regulator is used exclusively for torque-converter clutch control. The TCM monitors input and output signals to confirm correct system operation. If a malfunction does occur, the TCM reverts to a default state and informs the driver of a problem via the instrument-cluster message center.

System diagnosis is performed using 'WDS'.

Sensors

Speed sensors

The TCM monitors the two transmission speed-sensors located on the valve body: one for measuring input shaft speed (turbine speed), and one for measuring output shaft speed.

Temperature sensor

The TCM uses the input signals from the temperature sensor located on the valve body, to activate various shift strategies.

Gearshift position sensor

The gearshift position sensor is located on the valve body. The TCM uses inputs from this sensor to determine the selected gear-range on the automatic side of the J-gate. Signals from the position sensor also ensure that the engine will only start when the gear selector is in the park or neutral position. The ECM uses the signals to prohibit operation of the starter relay if the incorrect gear is selected.

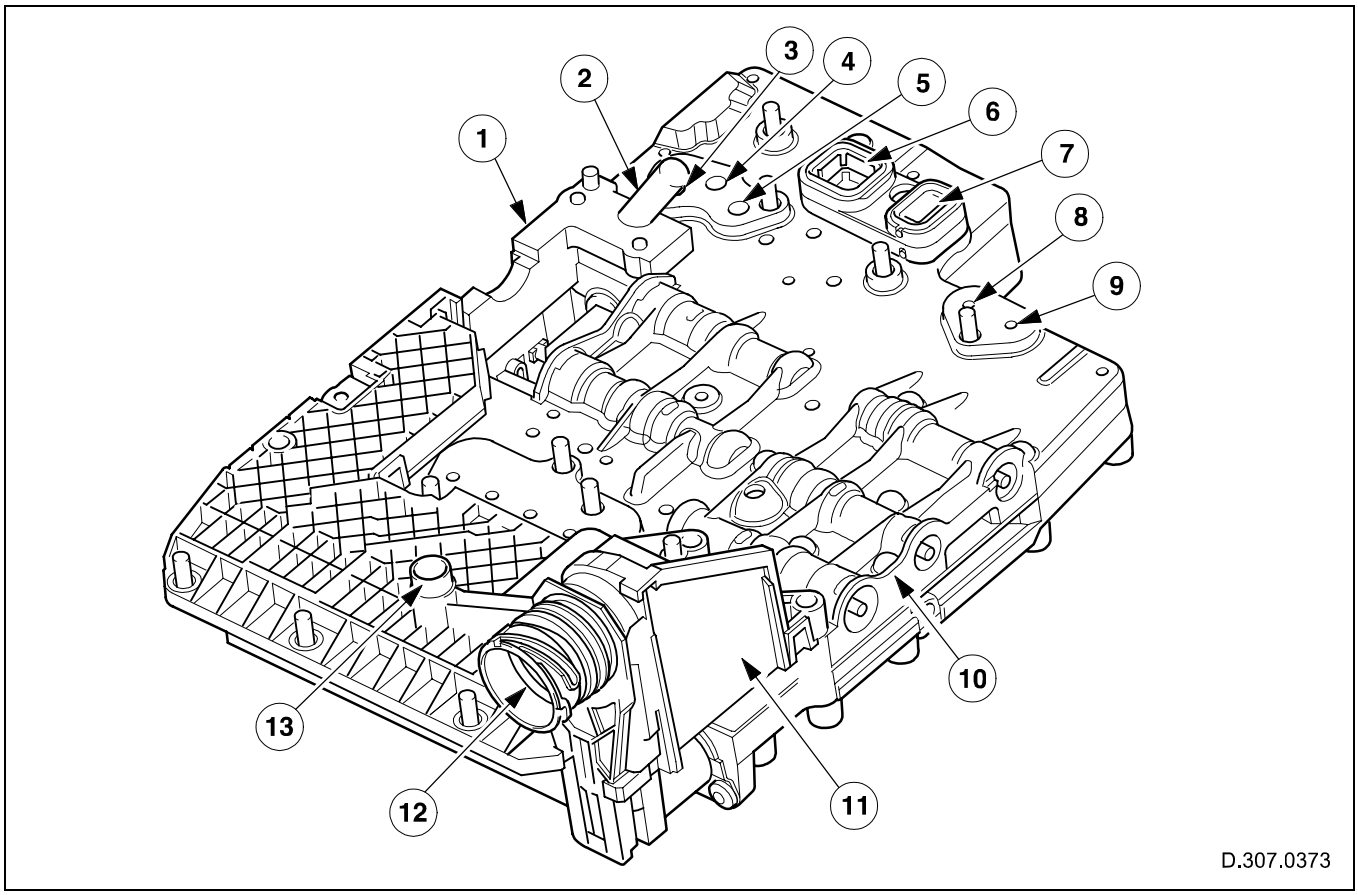

Fig. 64 Transmission Control Module / Valve Body

1. Position switch
2. Turbine speed sensor
3. To cooler
4. Converter lock-up clutch — engaged
5. Converter lock-up clutch — released
6. Discharge port
7. Suction port
8. Clutch 'E'
9. Clutch 'A'
10. Hydraulic valve body
11. Traction control module
12. Transmission plug
13. Output speed sensor

Safety Features

The safety features protect against incorrect operation by the driver and system malfunctions. For example:

- Each time the vehicle is started a 'fail-safe' check is performed on the TCM and associated electronics;
- A 'limp-home' mode is functioned, if a power failure occurs;
- Prevents reverse gear selection at forward speeds;
- Prevents manual gear down-shifting at excessive engine speeds.

Shift Selection

The TCM uses various driver selected modes and adaptive modes as below. Each mode introduces a different gear selection strategy, depending on driver requirements and driving conditions (vehicle status).

Driver selected modes:

- Normal mode:
  - Activated by the sports 'S' switch on the J-Gate surround, the switch does not illuminate when normal mode is selected.
  - Normal mode will remain active until the driver selects 'sports mode' or 'cruise control'. On the deactivation of 'cruise control', the system returns to the mode previously activated.
  - Normal mode can be overridden by various adaptive modes.
- Sport mode:
  - Activated by the sports 'S' switch on the J-Gate surround, the switch will illuminate when sport mode is selected.
  - The sport mode strategy enables gearshift points to be extended to higher engine speeds, and downshifts at lower accelerator-pedal angles.
  - Sport mode will remain active until the driver selects 'normal mode' or 'cruise control'. On the deactivation of 'cruise control', the system returns to the mode previously activated.
  - Sport mode can be overridden by various adaptive modes.
- Cruise control mode:
  - When activated the TCM receives signals from the ECM via the CAN.
  - The TCM implements a shift-map strategy to reduce gearshift activity and subsequently increase fuel economy.

Adaptive modes, these modes are selected automatically depending on driving conditions and vehicle status:

- Hot mode:
  - A gear selection and torque converter lock-up strategy is implemented, to reduce heat generated in the transmission when any of the following become hot enough to reach a critical threshold value:
    transmission fluid,
    transmission casing,
    engine oil,
    engine coolant temperature.
  - The hot mode strategy reduces generated heat by selecting higher gears and engaging the lock-up clutch at lower vehicle speeds.

  NOTE: With hot mode implemented the driver may experience unexpected up-shifts when running at high vehicle speeds and loads.
- Traction control mode:
  - Under normal driving conditions an increase or decrease in wheel speed would be recognized by the TCM as the vehicle accelerating or decelerating and a gear would be selected in proportion to the speed of wheel rotation.
  - In a situation where the vehicle is not accelerating in proportion to the wheel rotation speed, for example a slipping wheel. The TCM, in response to signals from the ABS module, will still command the transmission to select a higher-gear to help reduce wheel slip. The high gear will remain engaged until traction at the slipping wheel is regained.
- Gradient and towing mode:
  - The gradient and towing mode is activated when the TCM detects reduced vehicle acceleration at given throttle positions. This reduction in acceleration is recognized by the TCM as the vehicle either towing or ascending a gradient. Therefore, to provide the vehicle with maximum traction effort, a shift-map is used that extends the amount of time lower-gears are engaged, and subsequently delays the selection of higher gears.

Adaptive Shift Strategy

By increasing the linking of the transmission control system with other vehicle systems such as engine, brakes (ABS) and steering, a number of signals are made available to the TCM, which describe how the vehicle is being driven and on what road conditions. Using this information the TCM is able to exploit the vehicle's performance capability, and conversely maximize driving refinement and economy.

By monitoring signals associated to:

- longitudinal and lateral acceleration,
- engine speed and engine torque,
- engine oil temperature,
- position and movement of the accelerator, and
- individual wheel speed,

additional functions in the TCM can be realized. On the basis, of this information the TCM recognizes whether:

- the vehicle is maneuvering round a corner,
- all the wheels are gripping,
- the driver is braking,
- or if the driver wishes to accelerate.

From these signals, conclusions are made regarding the vehicle's actual load status and the topography of the stretch of road (uphill or downhill gradient), and what shift strategy should be applied to the transmission function.

For example, when 'sport' mode is selected and an enthusiastic driving style is detected on a demanding road. The TCM will adjust the transmission shift strategy to complement the conditions by inhibiting sixth-gear and selecting lower gears earlier to prevent 'hunting' between gears.

Under heavy braking, the TCM will select a lower gear to enable an immediate acceleration response on application of the accelerator pedal. Similarly, if the accelerator pedal is released rapidly following hard acceleration, selection of a higher gear is inhibited to increase engine braking and improve subsequent acceleration response.

To complement these features, when the TCM detects the vehicle rounding a corner, selection of a higher gear is inhibited until the vehicle exits the corner.

Once a more sedate driving style is detected, sixth gear will be reinstated and the shift strategy will return to normal.

Transmission Cooling

Transmission Fluid Cooler

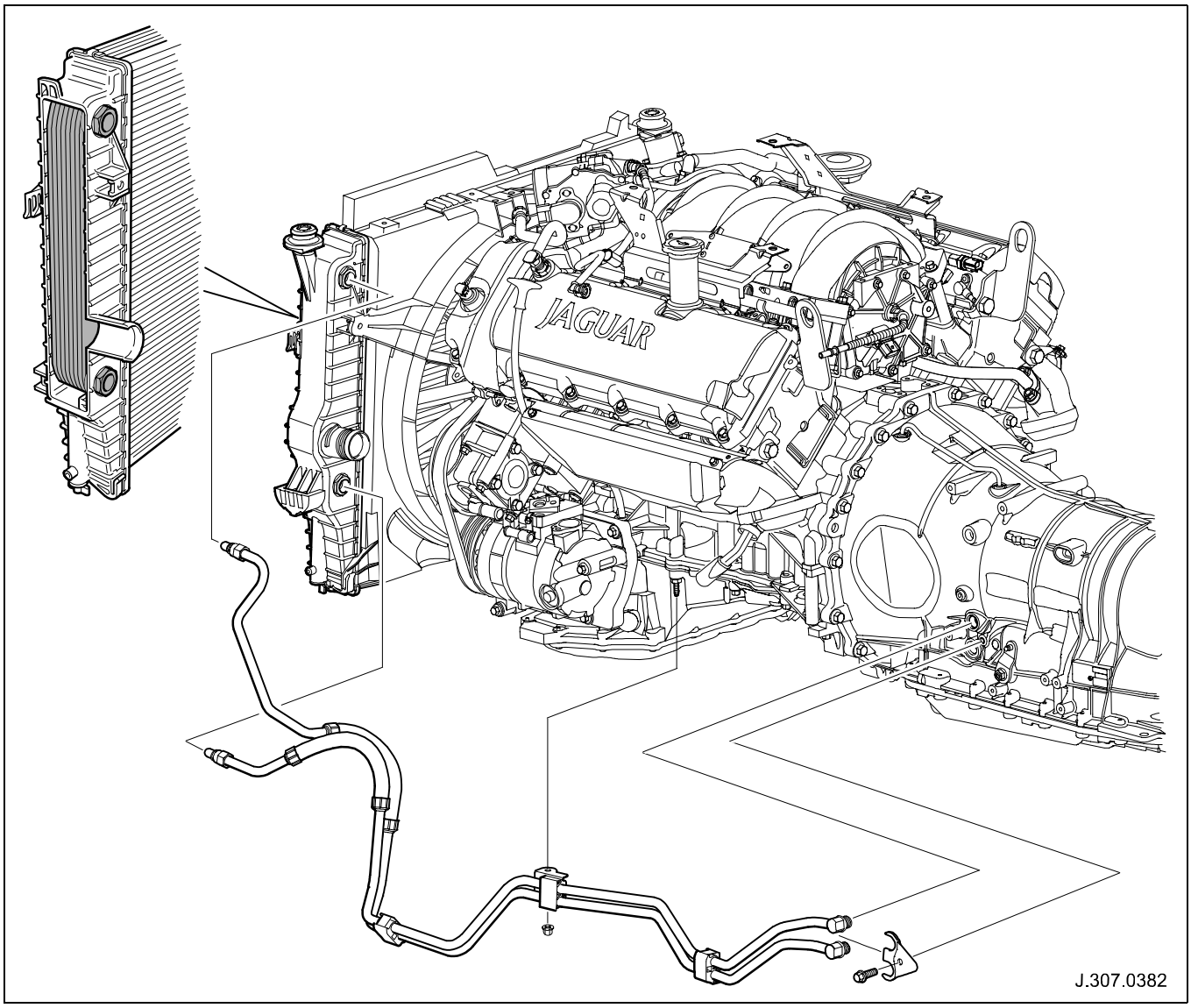

Fig. 65 Transmission cooling (V8 derivative shown)

The transmission fluid-cooler is integrated into the end-tank of the engine's coolant radiator. The fluid cooler is of aluminum construction, comprising tubes and louvered fin-cores. The tubes are arranged horizontally to provide a cross flow of the transmission fluid through the cooler. The engine coolant passes through the cooler's fins to provide the cooling effect.

This arrangement provides improved cooling performance in comparison to the air-cooled system, as the transmission-fluid temperature is controlled in conjunction with the engine coolant temperature. Improved temperature control is also achieved when the vehicle is at a standstill with the engine running.

Automatic Transmission External Controls

Transmission Selector Mechanism

The XJ incorporates a new design of transmission selector mechanism with:

- Improved mounting frame and installation method;
- Improved setting procedure;
- New design of selector interlock mechanism;
- New design of key interlock mechanism;
- Reduction in component weight.

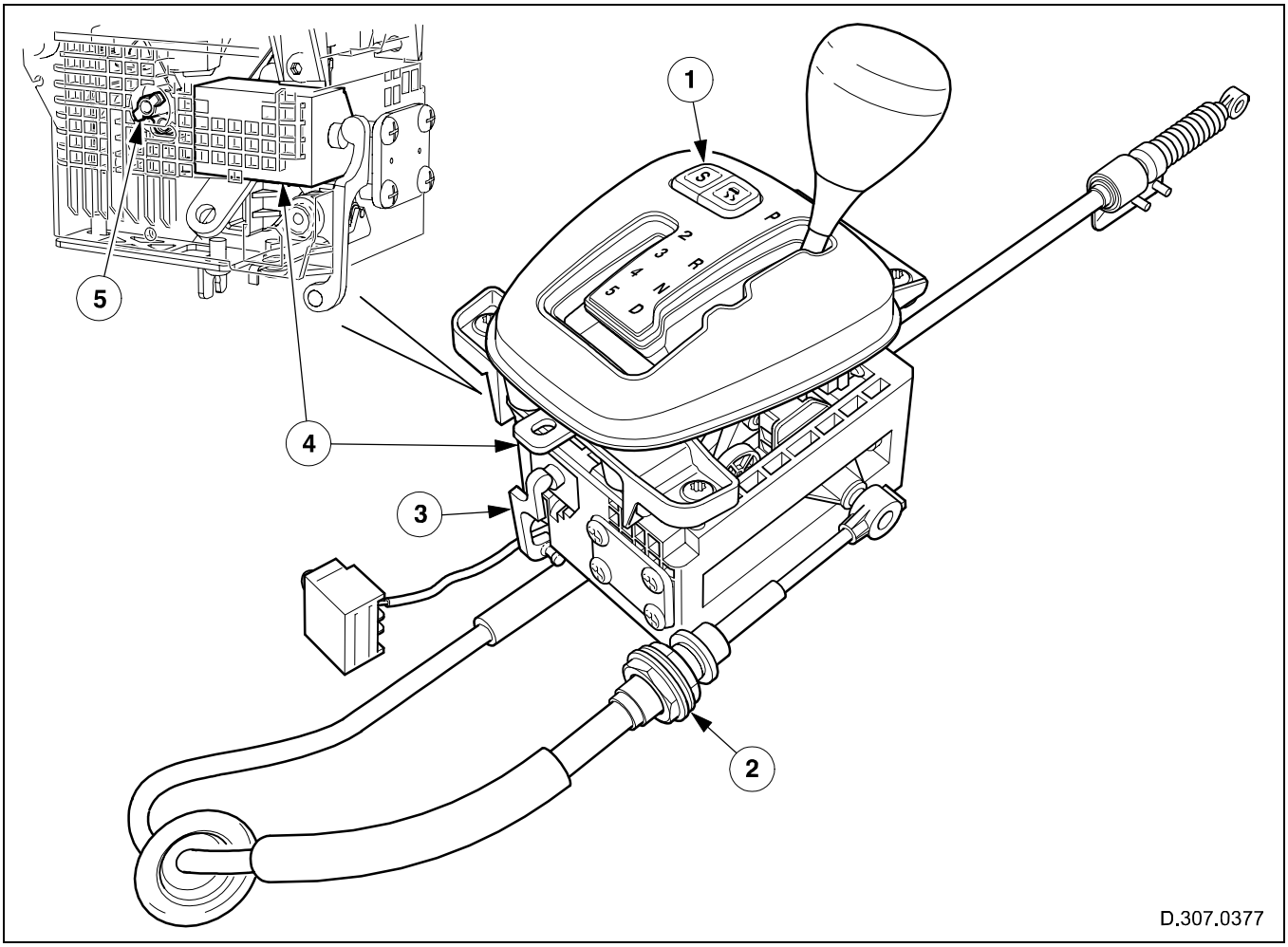

Fig. 66 Transmission selector mechanism and cable

1. Sports mode switch
2. Cable adjustment mechanism
3. Selector interlock mechanism
4. Selector interlock solenoid
5. Selector interlock override

J-gate

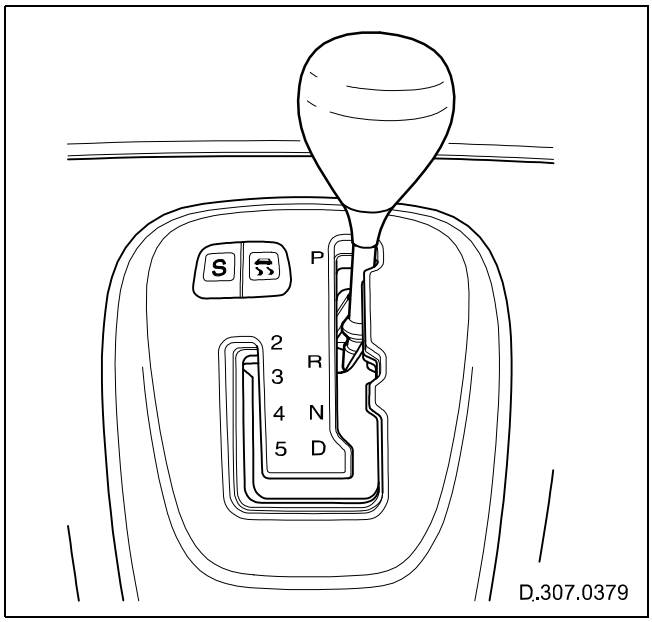

Fig. 67 J-gate selector positions

The J-gate is designed to accommodate either automatic or manual driving techniques:

- Automatic, right-hand side of the J-gate:
  - Enables selection of park 'P' through to drive 'D'.
  - The link between the selector lever and the transmission is via a cable.
  - A position switch within the transmission informs the transmission control module (TCM) of gear selection.
  - The TCM transmits gear selection information to other vehicle modules via the CAN.
  - With drive 'D' selected, gear selection is controlled by the TCM in response to signals received relating to vehicle status, for example throttle position, vehicle speed, etc. These signals are received via the CAN.
  - In addition, when 'D' is selected and sixth gear is engaged, the selector lever can be shifted sideways across the gate to fifth gear. Sixth gear will be inhibited until the selector lever is moved back to 'D'.
- Manual, left-hand side of the J-gate:
  - Enables individual selection of second, third, fourth and fifth gears.
  - The TCM detects the driver's gear selection through signals transmitted from the selector mechanism, via the CAN.

The sports mode switch, marked 'S' on the J-gate surround enables the driver to select either normal 'N' or sport 'S' modes. For further information on gear selection and sports mode switch, refer to **Automatic Transmission**.

Selector Interlock

The selector interlock is solenoid-operated; refer to **Fig. 66**. Its function, is to prevent the selector lever being moved from park 'P' until the ignition is 'ON' and the brake pedal is depressed. The solenoid remains in a de-energized state until the brake pedal is depressed.

NOTE: If the brake pedal is depressed while the ignition is switched 'ON' the position 'P' on the J-gate will flash. This indicates to the driver that the brake pedal must be released and then depressed to enable the selector lever to be moved out of park 'P'.

NOTE: If the selector lever is moved into park 'P' when the driver is simultaneously operating the brake pedal, the position 'P' on the J-gate will flash. This indicates to the driver that the brake pedal must be released and then depressed to enable the selector lever to be moved out of park 'P'.

Selector Interlock Override

In the event of a discharged or disconnected battery a provision is made to manually override the selector interlock solenoid enabling the selector lever to be moved from the park 'P' position. The interlock override is accessed by removing the top cover of the J-gate; refer to 'JTIS'.

Key Interlock

The key interlock system prevents the removal of the ignition key when the gear-shift lever is not in the park 'P' position.

- ROW vehicles: The park-switch incorporated in the selector mechanism functions the key interlock solenoid located in the ignition barrel to prevent the removal of the ignition key.
- NAS vehicles: The key interlock system is functioned by a cable operated mechanism to prevent the removal of the ignition key.

Limp Home Mode

In the event of an electrical or mechanical malfunction, the selector ranges on the right-hand side of the J-gate will still function; refer to **Automatic Transmission**. The selector mechanism performs its own internal fault monitoring and relays any fault codes to the TCM for diagnosis using 'WDS'.

Exhaust System

The exhaust system on the New XJ is constructed of stainless steel with polished tail-pipe sleeves, which are detachable. The system meets specific flow-resistance requirements and general engine conditions of each XJ powertrain variant.

Exhaust system performance is optimized with the introduction of thin-wall high-cell-density substrates to increase geometric surface-area and minimize backpressure. A low-weight exhaust system on the normally aspirated vehicle has revised resonator internals to optimize noise quality. The resonators on the supercharged variant are tuned to provide low backpressure and optimum sound quality.

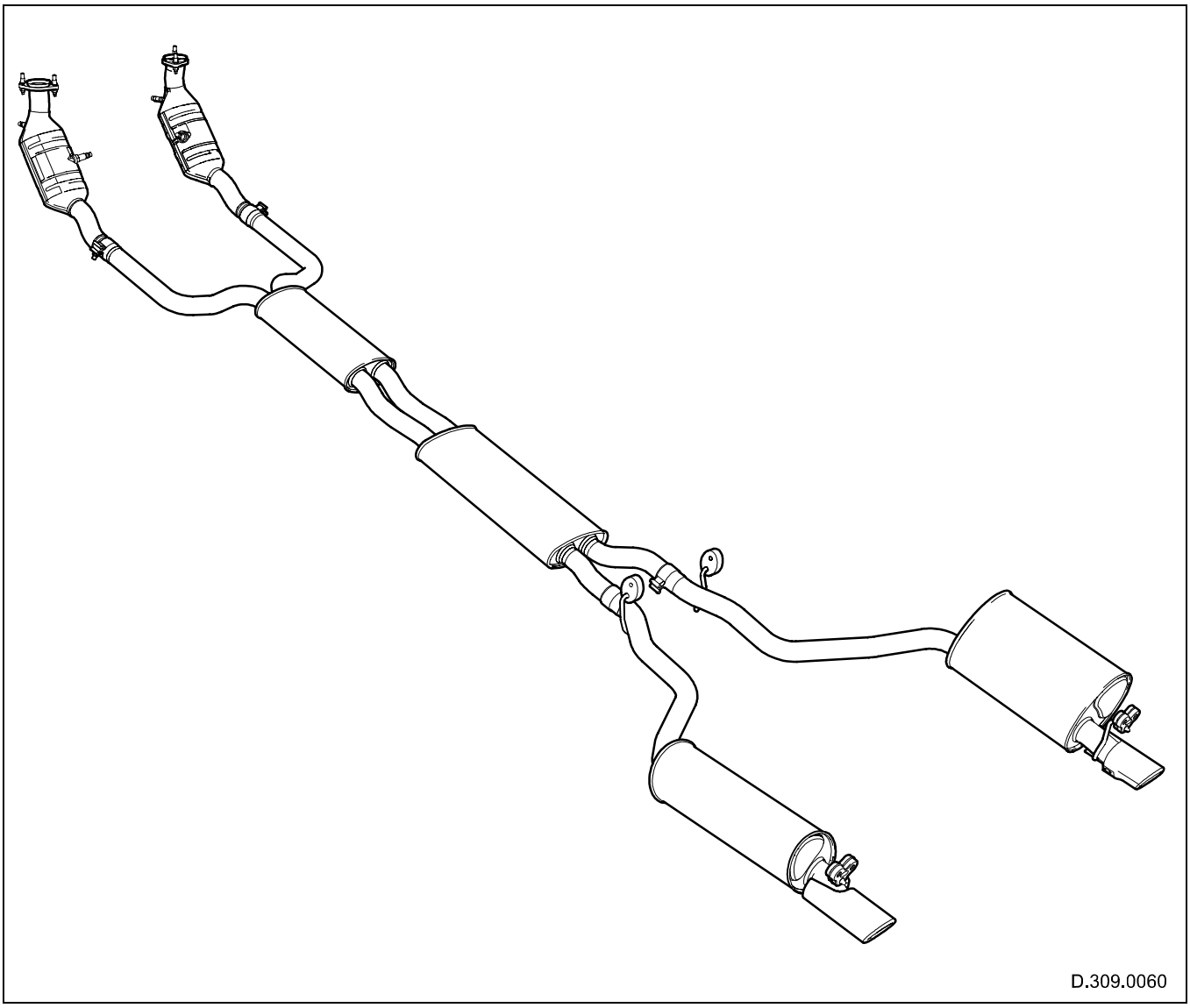

Fig. 68 Exhaust system - V8 Supercharged variant shown

Exhaust system tuning for each engine variant are as follows:

- The V8 normally aspirated system has 2 x 44 in^3 catalyst bricks in each down pipe, the front having 900 cells/in^2 and the rear 400 cells/in^2.
- The V8 supercharged system has 2 x 44 in^3 catalyst bricks in each down pipe, the front and rear bricks both having 600 cells/in^2.
- The V6 system has 2 x 44 in^3 catalyst bricks in each down pipe, the front and rear bricks both having 600 cells/in^2.
- The internals of the rear mufflers are different for each powertrain variant to achieve a different sound quality.

The entire exhaust system is assembled as follows:

- Two-bolt flanges, which are self-sealing, connect the two down-pipe catalyst assemblies to the exhaust manifolds.
- The resonator assembly attaches to the two down pipes and is secured by clamps. The two mufflers connect to the rear of the resonator assembly and are also secured by clamps.
- Four isolator rubbers support the exhaust system: two at the front of the muffler assembly and two at the tailpipe end.

Fuel Tank and Lines

Introduction

The XJ Range features a new fuel system incorporating a saddle tank positioned underneath the vehicle. A single fuel-pump located inside the tank on normally aspirated vehicles, provides optimal fuel-delivery performance. The flow-rate requirement of supercharged vehicle is achieved by the employment of a twin-pump fuel delivery system. The addition of an electronic returnless fuel system is also a further enhancement to the system.

Key Data

- Fuel tank capacity:
  - normally aspirated 85 liters (18.7 gallons),
  - supercharged 84.5 liters (18.6 gallons).
- Fuel rail pressure: 3.8 - 5.0 bar referenced to inlet manifold pressure.
- Maximum fuel flow - normally aspirated: 120 liters/hour at 3.8 bar (to atmosphere).
- Maximum fuel flow - supercharged: 180 liters/hour at 4.8 bar (to atmosphere).

Fuel Tank

To optimize luggage compartment capacity the fuel tank is now positioned underneath the vehicle, below the rear seat. This positioning necessitated the installation of a saddle tank to allow the vehicle's driveshaft to pass through the arch of tank. The tank is constructed of high-density polyethylene and is retained by two metal straps attached to the vehicle's underbody. A heat shield fitted to the underside of the tank isolates the tank from exhaust heat.

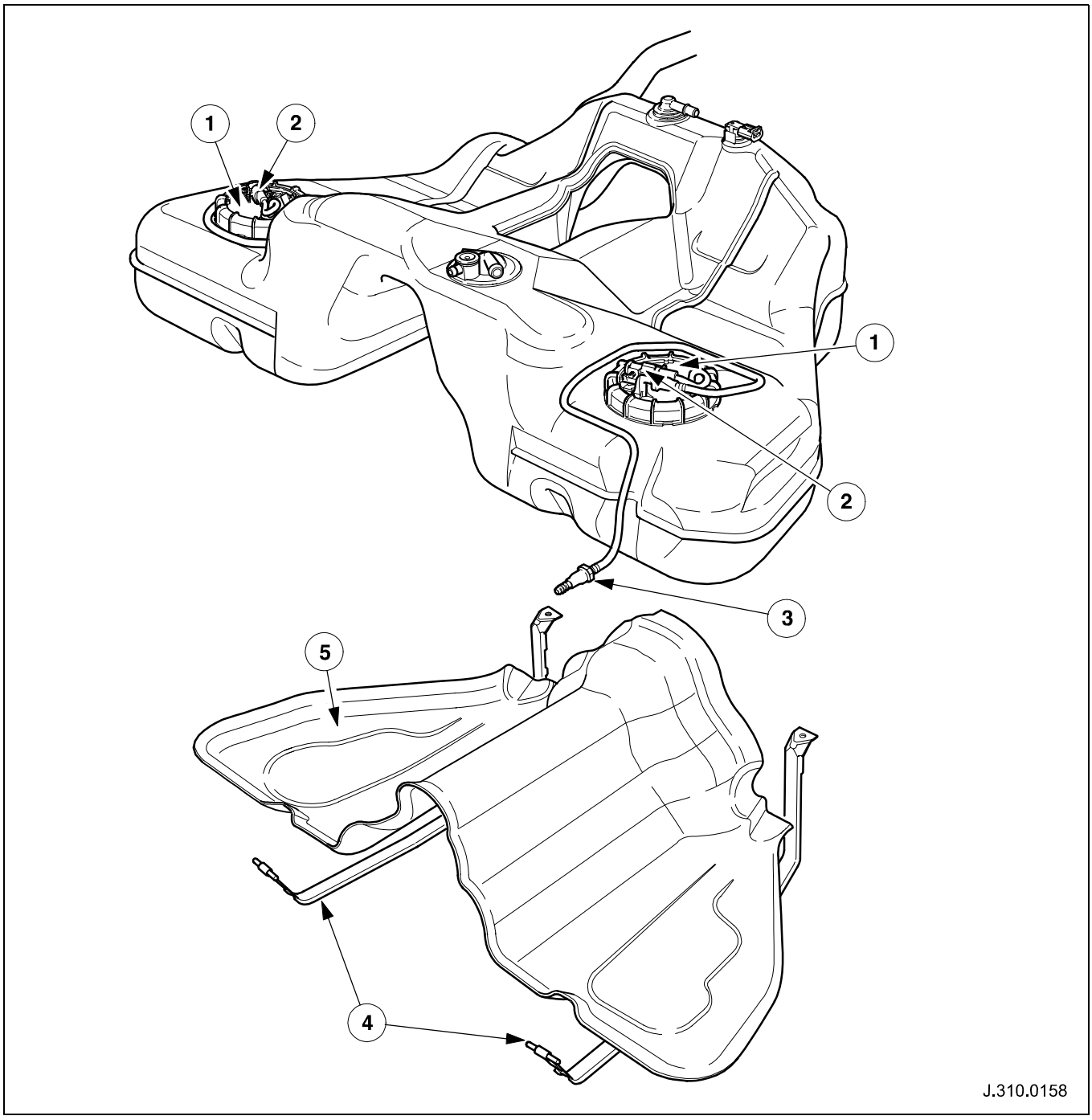

Fig. 69 Fuel tank - supercharged application shown

1. Fuel pump
2. Fuel pump and fuel level sensor, electrical connector
3. Fuel delivery line
4. Fuel tank retaining straps
5. Heat shield

Fuel Delivery - Normally Aspirated Vehicles

The fuel pump is a variable-speed rotary-vane type, which operates in a fuel module located in the right-hand fuel tank compartment. A fuel transfer module is located in the left-hand compartment; refer to **Fig. 70**. Both components are secured by screw-on plastic closure rings and have integral top plates for external line-work and electrical connectors.

The fuel delivery line connects to the module on the right-hand-side of the tank. The line has a revised diameter and route, with the fuel filter situated underneath the vehicle's floor on the left-hand side of the vehicle.

Fuel is maintained at an equal level between the fuel tank compartments by circulating the fuel through internal crossover lines via suction jet-pumps. High-pressure fuel from the fuel pump is directed through the jet-pump's orifice, creating a low-pressure area to be formed around the orifice. Fuel is drawn into this low-pressure area and directed into the crossover line to the opposing module.

Fuel is pumped from the fuel pump to the fuel rail via the parallel pressure relief valve and fuel filter. The parallel pressure relief valve contains two spring-loaded valves, which operate in opposite directions. The function of the valve is to:

- Assist engine starting by retaining a pre-set fuel pressure in the fuel delivery line and fuel rail.
- Limit fuel-rail pressure due to temporary vapor increase in hot conditions.
- Limit fuel-rail pressure caused by sudden load changes for example, a fully open to closed throttle transition.
- Prevent leakage from the tank in the event that the fuel delivery line is severed.

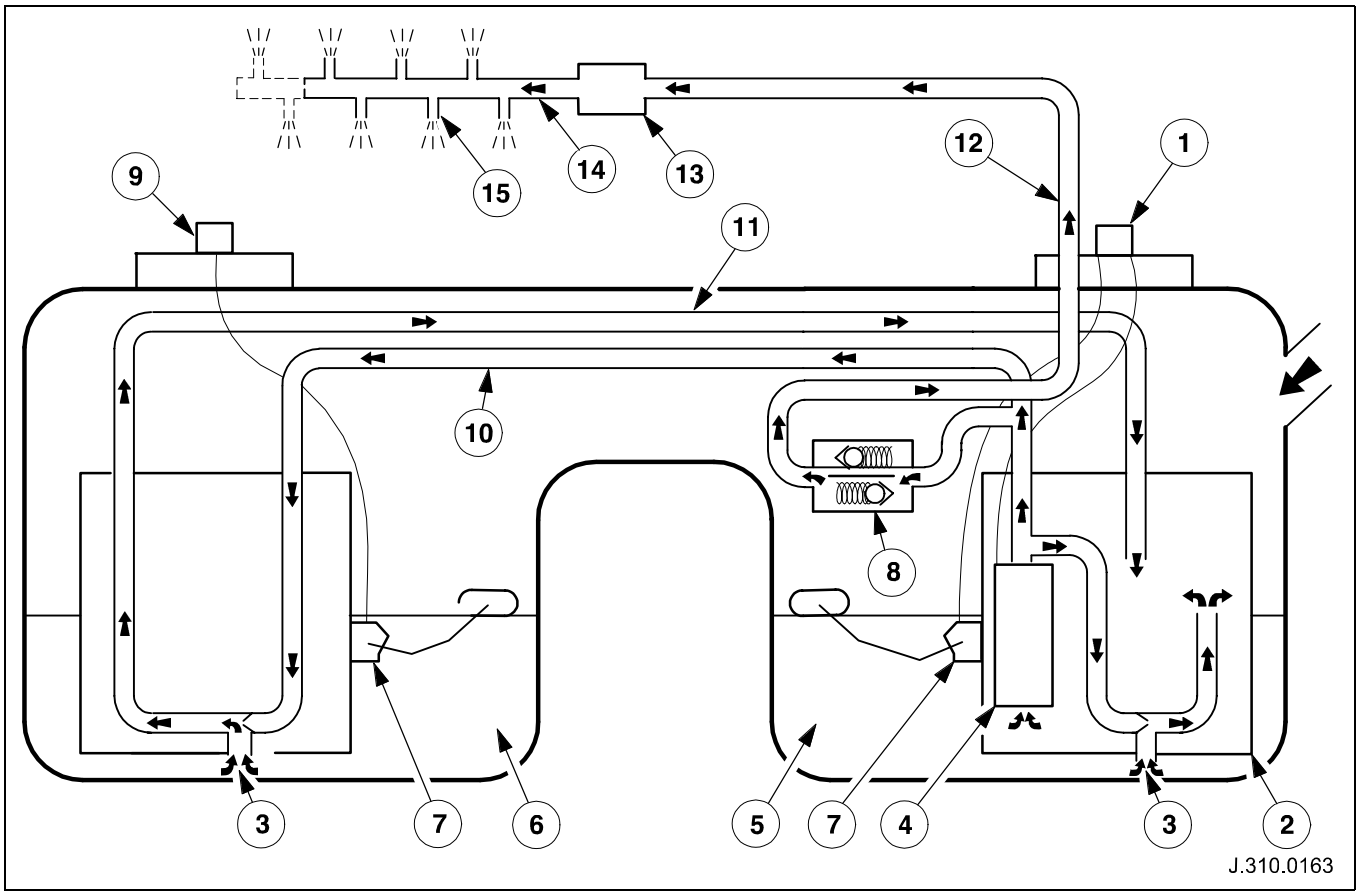

Fig. 70 Schematic of fuel tank internals - normally aspirated application

1. Fuel pump and fuel level sensor, electrical connector
2. Fuel pump module
3. Suction jet-pump
4. Fuel pump
5. Right-hand fuel compartment
6. Left-hand fuel compartment
7. Fuel level sensor
8. Parallel pressure relief valve
9. Fuel level sensor, electrical connector
10. High-pressure crossover circulation line
11. Low-pressure crossover circulation line
12. Engine fuel-delivery line
13. Fuel filter
14. Fuel rail
15. Fuel injector

Fuel Delivery - Supercharged Vehicles

The twin Gerotor fuel pumps are high-performance variable-speed types, with each pump operating in a fuel module located in each fuel tank compartment; refer to **Fig. 71**. The pumps are secured by screw-on plastic closure rings and have integral top plates for external line-work and electrical connectors.

The fuel delivery line connects to the module on the left-hand-side of the tank. The line has a revised diameter and route, with the fuel filter situated underneath the vehicle's floor on the left-hand side of the vehicle.

Fuel is maintained at an equal level between the fuel tank compartments by circulating the fuel through internal crossover lines via suction jet-pumps. High-pressure fuel from the fuel pumps is directed through the jet-pump's orifice, creating a low-pressure area to be formed around the orifice. Fuel is drawn into this low-pressure area and directed into the crossover lines to the opposing module.

Fuel is pumped from the fuel pump to the fuel rail via the parallel pressure relief valves and a fuel filter. Each parallel pressure relief valve contains two spring-loaded valves, which operate in opposite directions. The function of the valves is to:

- Assist engine starting by retaining a pre-set fuel pressure in the fuel supply line and fuel rail.
- Limit fuel-rail pressure due to temporary vapor increase in hot conditions.
- Limit fuel-rail pressure caused by sudden load changes for example, a fully open to closed throttle transition.
- Prevent leakage from the tank in the event that the fuel delivery line is severed.

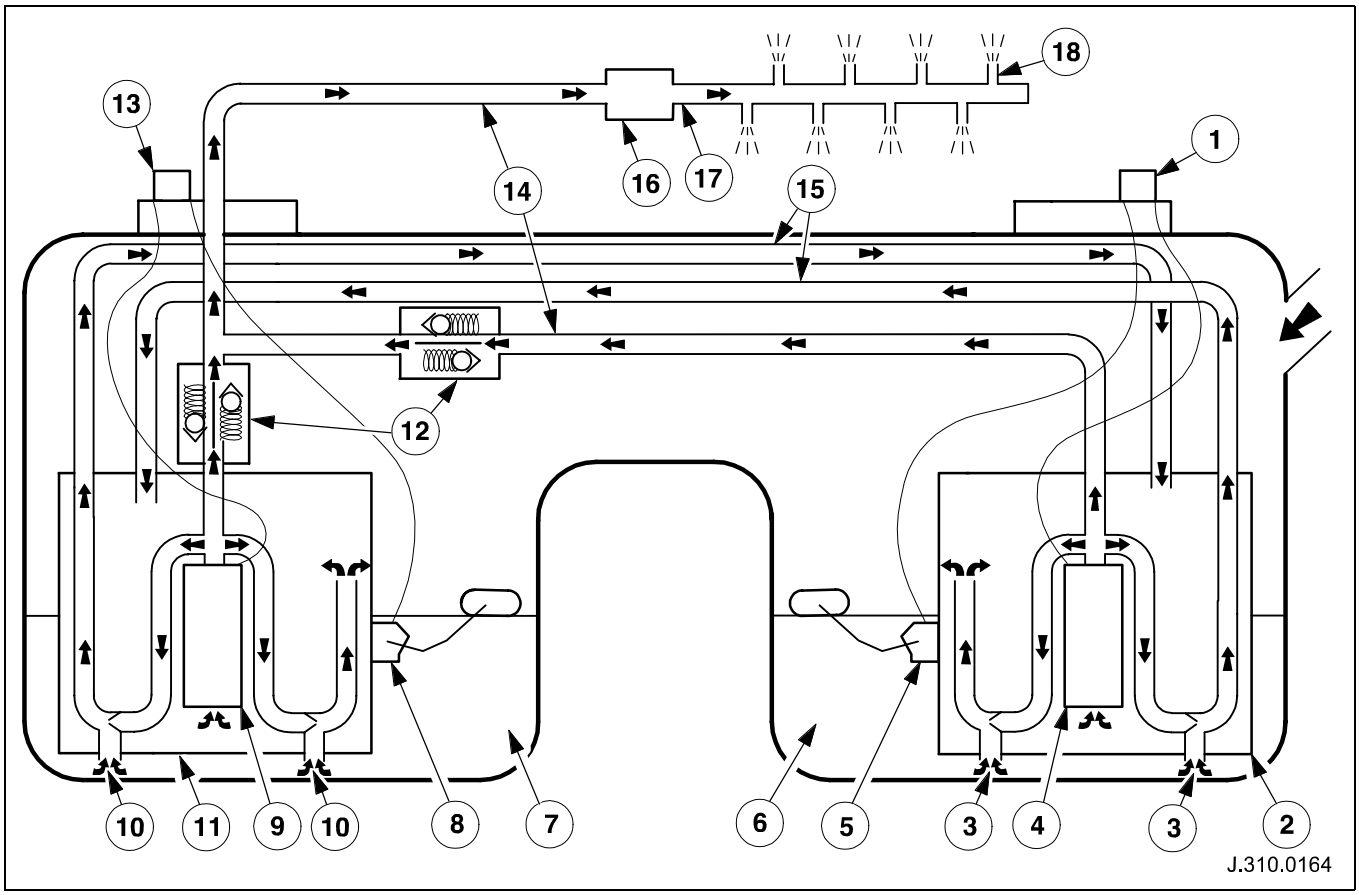

Fig. 71 Schematic of fuel tank internals - supercharged application

1. Fuel pump and fuel level sensor, electrical connector
2. Fuel pump module
3. Suction jet-pump
4. Fuel pump
5. Fuel level sensor
6. Right-hand fuel compartment
7. Left-hand fuel compartment
8. Fuel level sensor
9. Fuel pump
10. Suction jet-pump
11. Fuel pump module
12. Parallel pressure relief valve
13. Fuel pump and fuel level sensor, electrical connector
14. Engine fuel-delivery line
15. Low-pressure crossover line
16. Fuel filter
17. Fuel rail
18. Fuel injector

Returnless Fuel System

The returnless fuel system supplies the correct amount of fuel as required by the engine at any given moment. This eliminates the requirement of excess fuel returning to the fuel tank.

The benefits of the returnless fuel system are listed below:

- reduces load on the electrical system;
- improves fuel economy;
- eliminates the effects of fuel pressurization and depressurization;
- eliminates the effects of engine-heat causing extra fuel vapor being generated in the fuel tank by returning fuel.

Normally Aspirated Vehicles

The fuel pump module (FP module), via pulse-width modulated signals from the ECM, controls the amount of fuel supplied by the fuel pump to the fuel rail. The ECM receives signals from the fuel pressure sensor and fuel temperature sensor, located on the fuel rail, to indicate the pressure of the fuel in the fuel rail. In response to these signals, plus other engine and driver demand signals, the ECM calculates the amount of fuel required and requests the FP module to vary the fuel pump delivery to suit the engine's requirements.

- The fuel pump module is integrated into the rear electronic module (REM), located in the right-hand side of the luggage compartment.

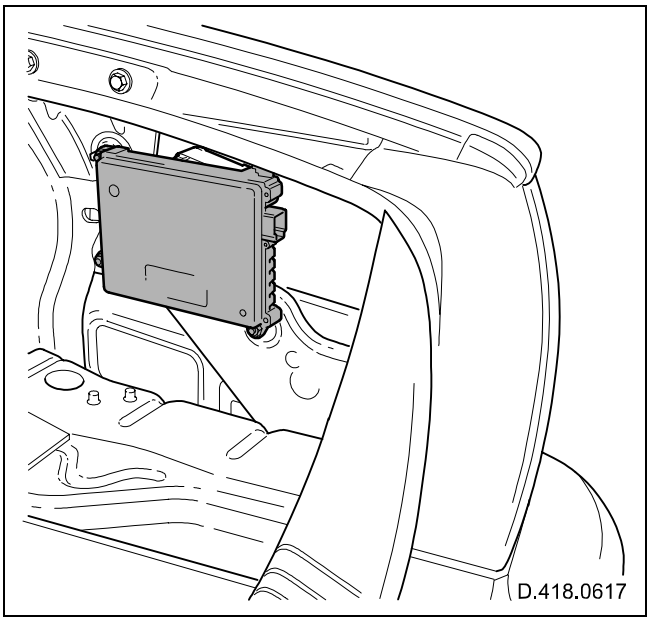

Fig. 72 Fuel pump module (integral to rear electronic module)

Supercharged Vehicles

The supercharged engine's fuel system works on the same principal as the normally aspirated system, however to meet the fuel flow-rate requirements of the supercharged engine, the fuel tank incorporates two fuel pumps, which operate simultaneously; refer to **Fig. 71**. The right-hand fuel pump is controlled by the FP module integrated into the REM, via signals from the ECM. A secondary FP module, also via signals from the ECM controls the left-hand fuel pump.

- The secondary FP module is located in the right-hand side of the luggage compartment, behind the REM.

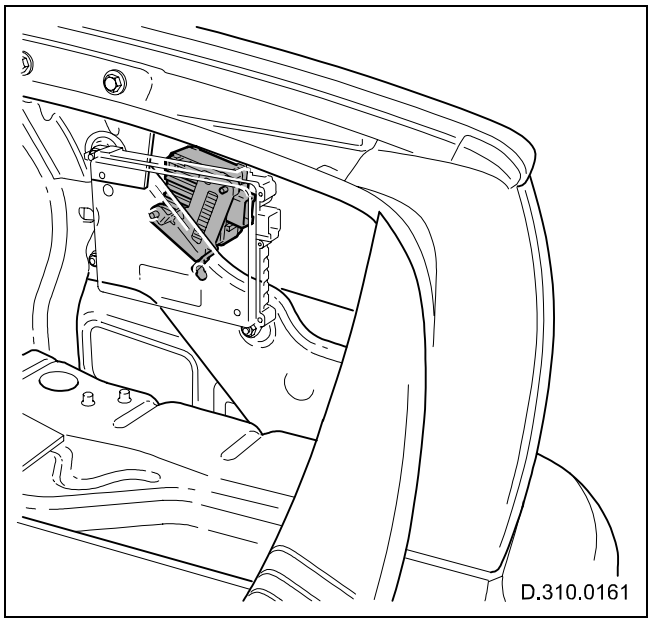

Fig. 73 Secondary fuel pump module - supercharged

Fuel Tank Level Monitoring

Each fuel tank compartment incorporates an independent fuel level sensor. Signals from each sensor are calculated by the REM and then relayed to the instrument cluster. The total quantity of fuel in the tank is displayed on the fuel gauge. A low-fuel warning light is also displayed on the fuel gauge face.

Inertia Fuel Shutoff Switch

In the event of an accident, the inertia fuel shutoff switch may trip, (depending on the severity and type of impact), isolating the fuel pump operation. Once the switch has tripped it must be reset before attempting to restart the engine.

The switch is located behind the trim on the left-hand side of the vehicle, forward of the front door post, below the fascia. A finger access hole in the trim allows access to reset the switch.

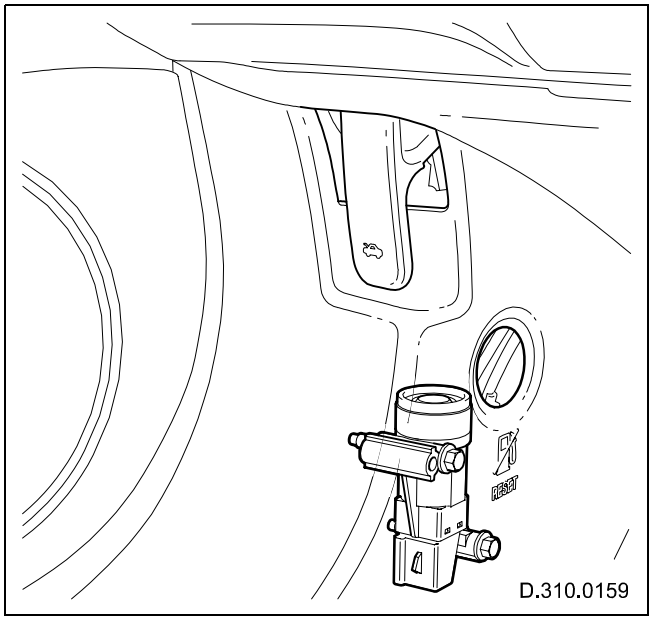

Fig. 74 Inertia fuel shutoff switch

Resetting the Switch

WARNING: To avoid the possibility of fire or personal injury, do not reset the inertia switch if you see or smell fuel.

If no fuel leaks are apparent, reset the inertia switch as follows:

1. Turn the ignition switch to position '0'.
2. Press down the rubber reset button on top of the inertia switch.
3. Turn the ignition switch to position 'II', pause for two seconds, then return the key to position '0'.
4. Make a further check for fuel leaks.

Climate Control System

NOTE: Specific climate control features will vary depending on both vehicle and market specification.

The climate control system provides filtered air to the passenger compartment from a fully automatic, temperature controlled system.

A 2-zone system is installed as standard and provides dual automatic distribution as a default, where:

- Driver and front passenger can independently control the passenger-compartment air temperature for their individual comfort.
- Mode selections such as face, face/floor, floor and defrost are automatic and also independent from side-to-side.

NOTE: The automatic mode selection reflects the temperature set (Tset) from side-to-side.

- Default operation for the Tset is: the passenger side Tset follows the driver Tset. The 'Dual' operation indicator remains extinguished.
- Changes to the passenger Tset will illuminate the 'Dual' indicator, confirming the Tset for each side can be chosen independently.
- Should the passenger Tset be different to the driver Tset and that situation is no longer desirable (the passenger has vacated the vehicle), selecting 'Dual' extinguishes the indicator and synchronizes the passenger side temperature with the driver side Tset (returns the operation of the system to the default).

A 4-zone system is available as an optional installation. The additional two zones, refers to the passenger compartment area behind the front seats.

Independent control of the temperature in the two rear zones can be achieved using the rear climate control panel or using the touch-screen (where fitted); refer to **Rear Climate Control System**.

NOTE: The climate control system will also respond to spoken commands if the optional voice control system is fitted; refer to **Voice Activated Control System**.

The system is designed to provide efficient regulation of the vehicle environment without intervention from the occupant(s). Sensors inside the vehicle, monitor temperature, humidity and direct sunlight. In response, the electronic control system automatically adjusts the heat input, blower speed, air intake and air flow distribution to reduce misting and maintain the selected temperature(s).

NOTE: All windows and the closing roof panel should be closed before automatic operation is selected, in order to provide optimum comfort under most driving conditions.

Major Differences

When compared to the previous XJ range of vehicles, the new XJ has the following major differences:

- No water control valve;
- Re-introduction of air blend doors;
- Side-to-side automatic temperature control;
- Side-to-side air flow distribution;
- Variable displacement compressor (no magnetic clutch);
- Condenser with integral receiver-drier.
- Air intake filter;
- Single blower.

Display and User Controls

Control Panel With LCD

The climate control functions are selected by push buttons and a rotary control. When a function button is pressed, selection is confirmed by a 'beep' and illumination of the tell-tale LED.

NOTE: In manual mode, the LCD uses graphic symbols to provide confirmation of the system status.

The LCD in figure **Fig. 81** shows a range of symbols and messages that could be displayed; it is for guidance only.

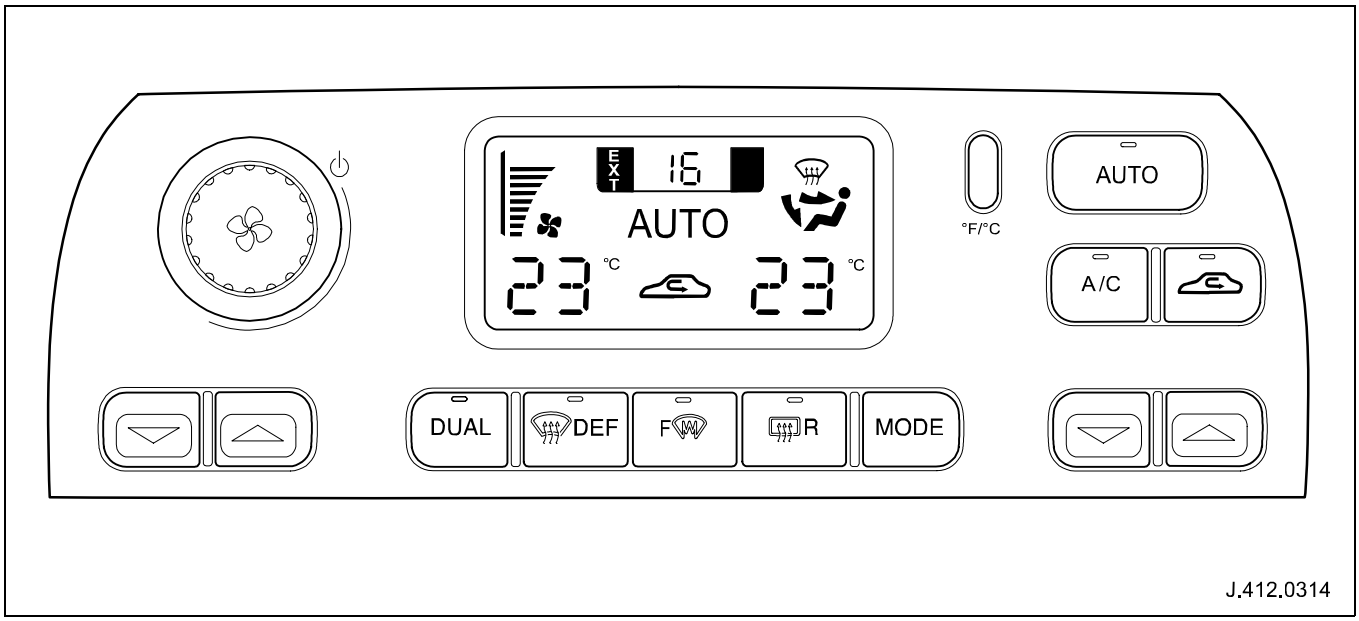

Fig. 75 Control panel with LCD (heated front screen option)

Control Panel with Touch-screen

The control panel with touch-screen is a multifunction touch-screen console which comprises on-screen simulated buttons (soft buttons) and perimeter buttons (hard buttons); refer to **Telematics** for further information.

Selecting 'Options' will cause a different screen to be displayed. From the available options, front seat occupants (subject to market and vehicle specification) may choose:

- 'Adjust settings' for the rear climate control system.
- 'Match' the rear system settings to those chosen by the driver.
- 'Lock' the rear control panel so that rear seat occupants are unable to change any settings.
- °C or °F as default unit of measurement.
- Smog sensitivity level (where applicable).

Temperature LCD

When the climate control system is operational, the small, integral LCD, located below the touch-screen, provides confirmation of:

- external (EXT) ambient temperature;
- required interior temperature (selected by the driver);
- required interior temperature (selected by the passenger).

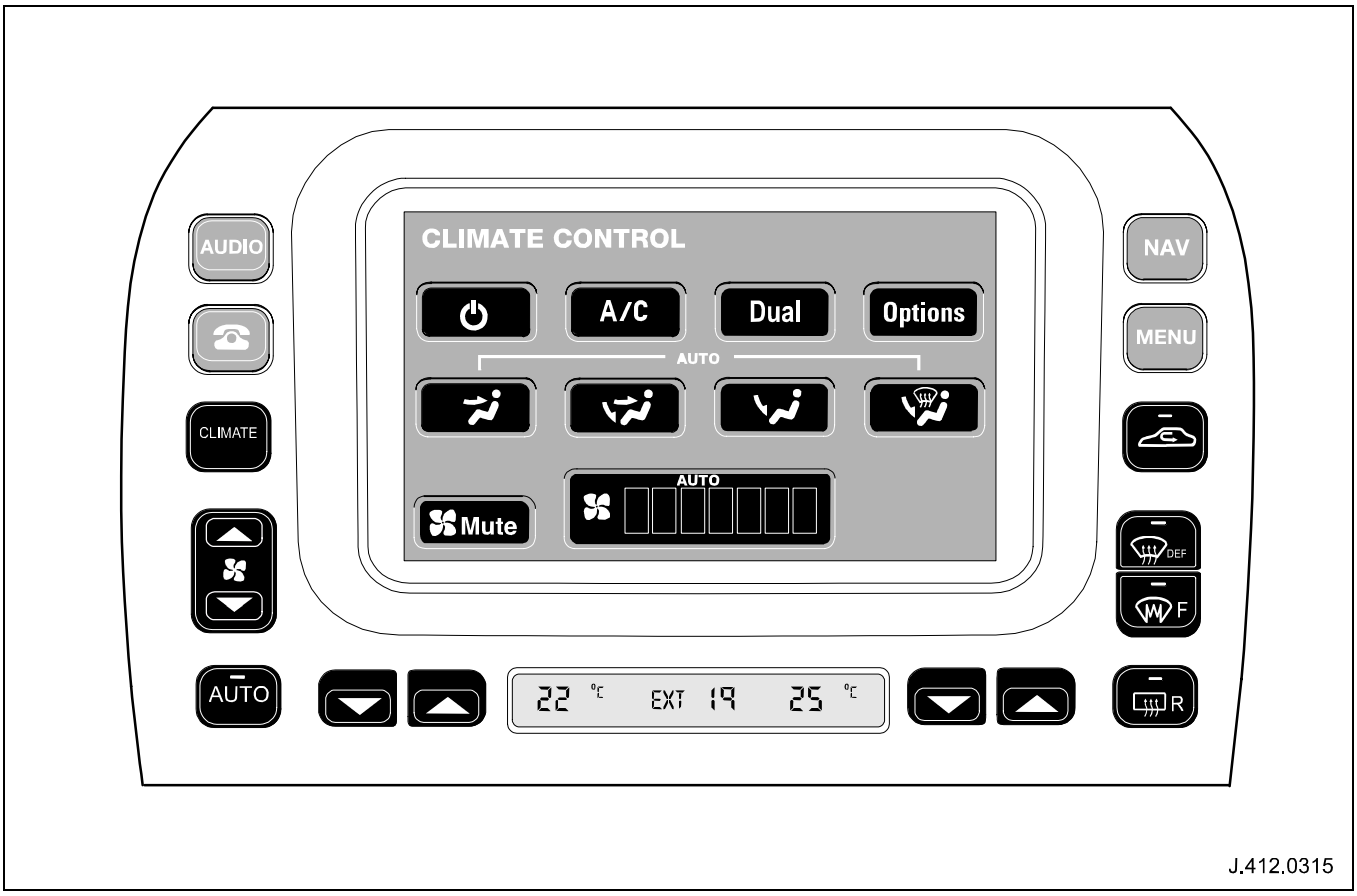

Fig. 76 Climate control buttons

Automatic Climate Control

The automatic climate control system comprises:

- Control panel with LCD or touch-screen control panel (telematics display module).
- Climate control assembly; refer to **Heating and Ventilation**.
- Air conditioning components; refer to **Air Conditioning**.
- Discrete sensors; refer to **Control Components**.
- Climate control module; refer to **Control Components**.

System Features

Following reconnection of the battery and with the ignition key at position 'II', the climate control system will default to 'OFF' but with a stored value of 23°C.

In circumstances when the display shows either 'HI' or 'LO' instead of a value, the default value can be established by 'pressing and holding' the 'AUTO' button for 2 seconds.

When the ignition key is turned to position '0' or removed from the ignition, the system (depending on conditions) may set the air distribution doors to a predetermined configuration after 120 seconds.

Defrost

Selecting defrost 'DEF' automatically selects 'A/C'and:

- deactivates timed or latched air-recirculation (a condition which cannot be reversed while the system is in this mode);

NOTE: Selecting 'AUTO' or 'DEF' cancels the condition.

- Activates heated front and rear screens (where fitted).

Recirculated and fresh air

NOTE: Timed or latched recirculation are not available when 'DEF' has been selected.

When automatic control (AUTO) is selected, as part of a complex strategy to prevent window-misting and improve occupant comfort, the fresh-air intake door is controlled automatically. In addition, the intake door can also be controlled manually in the following manner:

Timed air-recirculation

'Briefly pressing' the recirculation button engages the recirculation feature for a period of time that will vary depending on climatic conditions and is specifically designed to prevent 'misting'.

- The tell-tale LED will remain illuminated and extinguish after the time-out period has elapsed.

NOTE: The telematics screen (where fitted) confirms the status by displaying a timed recirculation symbol.

Latched air-recirculation

'Pressing and holding' the recirculation button for 2 seconds, latches the recirculation feature (does not time-out). Latched air-recirculation is confirmed by:

- a screen symbol;
- an audible 'double beep'.

NOTE: When latched recirculation has been selected, to reduce condensation, the air conditioning will operate automatically.

Latched fresh air

Pressing the recirculation button when the recirculation LED is illuminated, closes the recirculation door and sends the system to the latched fresh-air condition.

NOTE: Smog sensor operation (where applicable) is automatically cancelled.

Pressing the 'AUTO' button returns the recirculation door to normal, automatic operation.

NOTE: Timed recirculation, latched recirculation and latched fresh air modes are cancelled when the ignition key is turned to position '0'.

Electrical Connections

Refer to **New XJ Range Electrical Guide** for detailed connection information between climate control components

Diagnostics

The climate control system:

- constantly monitors the status of the system;
- where appropriate, stores a DTC within the climate control module for analysis using WDS.

Air Distribution and Filtering

Air distribution and filtering is achieved using the following:

- Combination filter.
- Instrument panel registers.
- Footwell ducting.
- Defrost ducting.
- Defrost and cool-air bypass doors (driver and passenger).
- Floor/face doors (driver and passenger).
- Temperature blend doors (driver and passenger).
- Recirculation door.
- Rear floor-ducting.
- Rear face-ducting.

NOTE: Vehicles installed with the rear climate control system (RCCS) do not utilize the rear face-ducting, which is terminated at the climate control assembly. The RCCS uses direct ducting; refer to **Floor Console**.

The combination filter provides particle filtration and in addition minimizes odors entering the vehicle via the air distribution system.

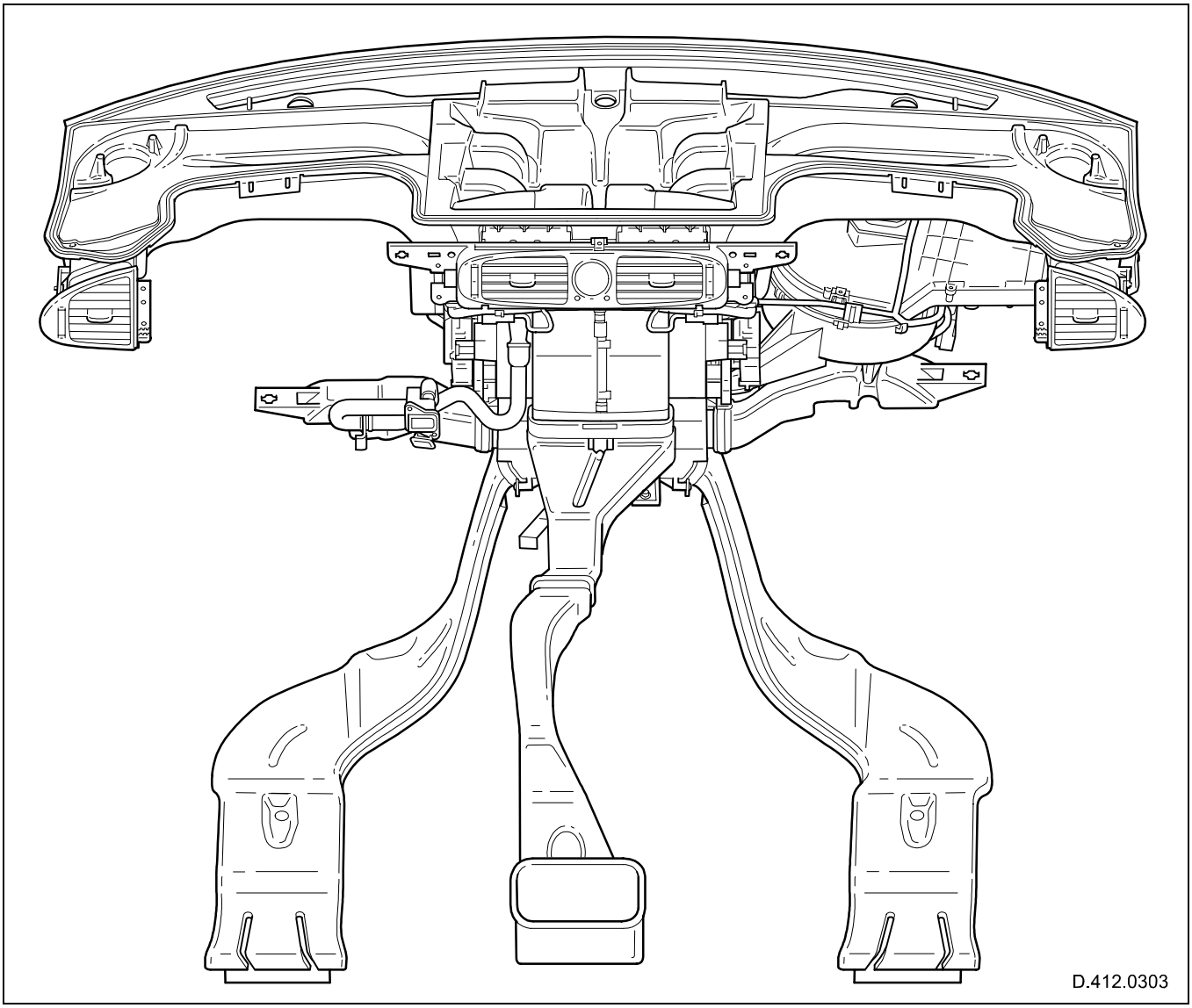

Fig. 77 Air distribution and filtering (2-zone)

Heating and Ventilation

Heating and ventilation is determined by the climate control assembly which comprises the following:

- Evaporator core; refer to **Air Conditioning**.
- Heater core.
- Auxiliary coolant pump (not installed for V6 2-zone climate control variant).
- Blower and blower speed module.
- Door actuators; refer to **Control Components**.
- Airflow doors; refer to **Air Distribution and Filtering**.
- Evaporator and discharge sensors; refer to **Control Components**.

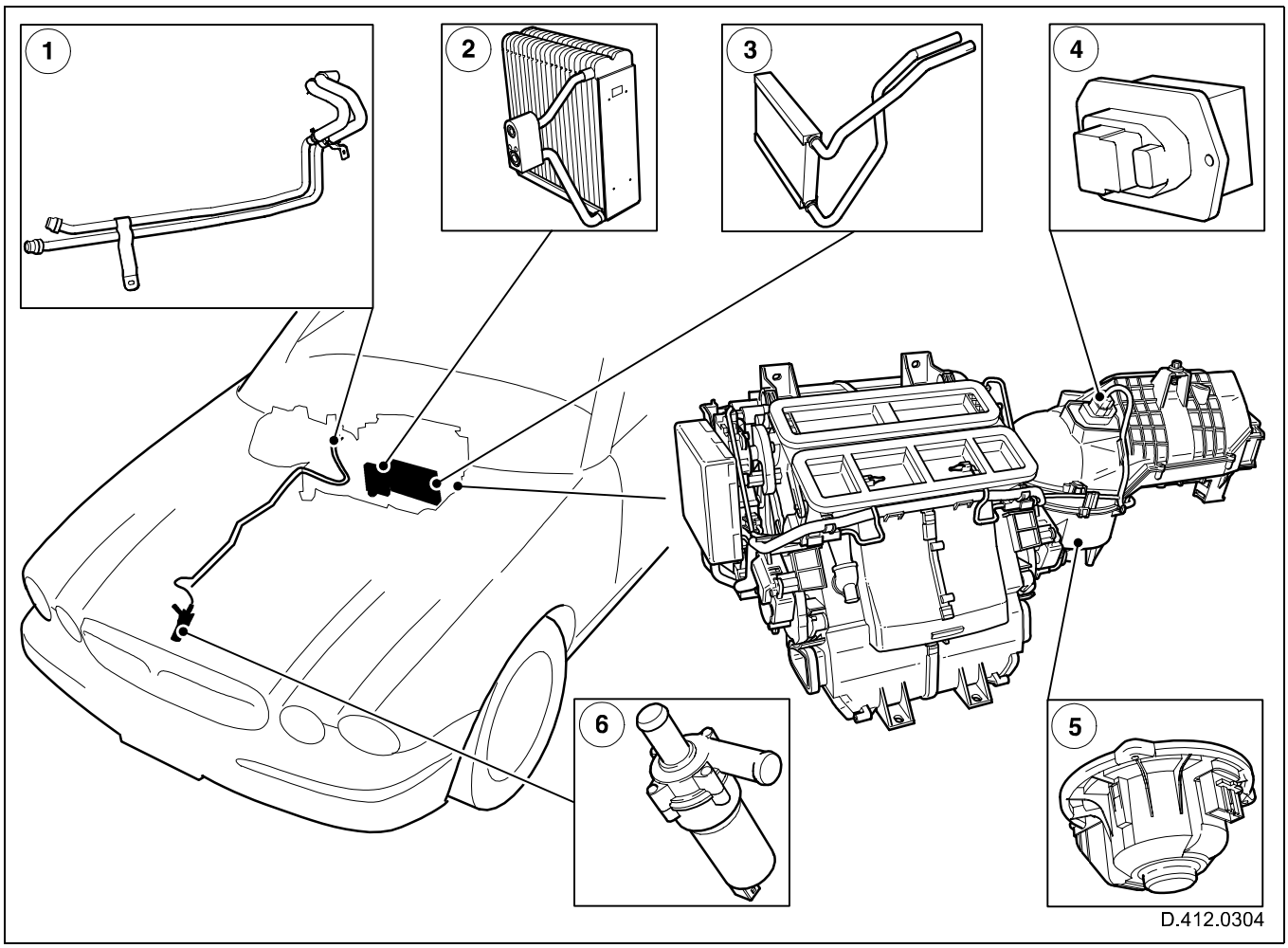

Fig. 78 Heating and ventilation components

1. Heater hose assembly
2. Evaporator core
3. Heater core
4. Blower speed module
5. Blower motor
6. Auxiliary coolant pump (not V6 2-zone)

Heater Core

The single heater core is located within the climate control assembly and connected via the heater pipes to the engine cooling system; refer to **Powertrain**, **Engine Cooling**.

Auxiliary Coolant Pump

Also part of the engine cooling system, the auxiliary coolant pump is located at the radiator and cooling fan assembly and controlled via the blower motor relay, by the CCM.

Blower

The blower is driven by a d.c. motor. The motor receives battery voltage via the blower motor relay, as determined by the CCM. The motor speed is determined by the blower speed module.

Blower Speed Module

The blower speed module determines the blower motor speed depending on the signal received from the CCM. If 'AUTO' mode is selected, the speed module responds to the CCM, by selecting an appropriate output voltage. The difference between that voltage and the battery voltage determines the voltage across the motor and hence its speed. One of up to 32 different voltage levels can be chosen by the module.

The motor speed (which can also be controlled manually) is visually indicated by display segments:

- 1 to 11 for the climate control panel with LCD.
- 1 to 7 for the telematics display version.

NOTE: Until the engine coolant temperature has reached a predetermined level, the auto-blower control will only operate at low speed.

Heated Screens and Mirrors

Heater functionality is constantly monitored by the electrical load management system (ELMS); refer to **Electrical Load Management System**. The ELMS dictates that in circumstances where the generated electrical power is less than the electrical consumption, selected systems may be temporarily inhibited or operated for a reduced period of time if necessary.

NOTE: Tell-tale LEDs remain illuminated so that any corrective action is not apparent to the driver.

Heated front screen

Depending on vehicle specification, the heated front screen (HFS) may incorporate a fine-wire electrical grid for total heating, or a small grid in the area where the wipers park, only.

NOTE: The total heating option comprises two independent grids, one for the driver's side and one for the passenger side.

On receipt of a ground signal from the CCM, battery voltage is switched via separate relays to both sides of the screen. The heater elements will only be activated after data has been exchanged between the climate control module (CCM) and the engine control module (ECM):

- CCM sends request to ECM.
- ECM confirms or denies request.
- CCM activates the appropriate relay, provided the request has been confirmed.

As part of the continuous demisting strategy, when the ambient temperature is low, providing the power consumption is less than the generated power, the ELMS will permit the activation of the heated front screen to prevent the possibility of misting.

NOTE: The tell-tale LED will not illuminate so that the action is not apparent to the driver.

The heated front screen (where fitted) is automatically selected when the engine is 'running' and the ambient temperature falls below 5°C.

NOTE: The tell-tale LED will illuminate.

Heated rear screen

On receipt of a ground signal from the CCM, battery voltage is switched via a relay, to the heated rear screen (HRS).

NOTE: The strategy for activating the heated rear screen is identical to the strategy for the HFS.

Heated exterior mirrors

The heated exterior mirrors are activated by the same relay as the heated rear screen but are separately fused.

Basic functionality

NOTE: Both heated screens will be activated automatically at temperatures below predetermined levels.

The heated rear screen and both exterior mirror heaters will operate when selected, provided the engine is running; operation will halt after 21 minutes or can be manually halted.

The heated front screen (if fitted), will operate when selected, provided the engine is running; operation will halt after 6.5 minutes or can be manually halted.

Heated Steering Wheel

The steering wheel heater, where installed, is activated when the driver's seat heater switch is operated. The switch provides an input to the front electronic module (FEM), which responds by supplying an output signal via the clockspring contacts to the heated steering wheel (HSW) electronics . The HSW electronics receives supply voltage via the power coupling and slip rings.

The HSW power coupling, which attaches to the clockspring, comprises two spring contacts that interface with the HSW electronics, to ensure power and ground connections are maintained.

The HSW electronics, controls the operation of the HSW element when appropriate, maintaining a surface temperature of approximately 30°C (86°F).

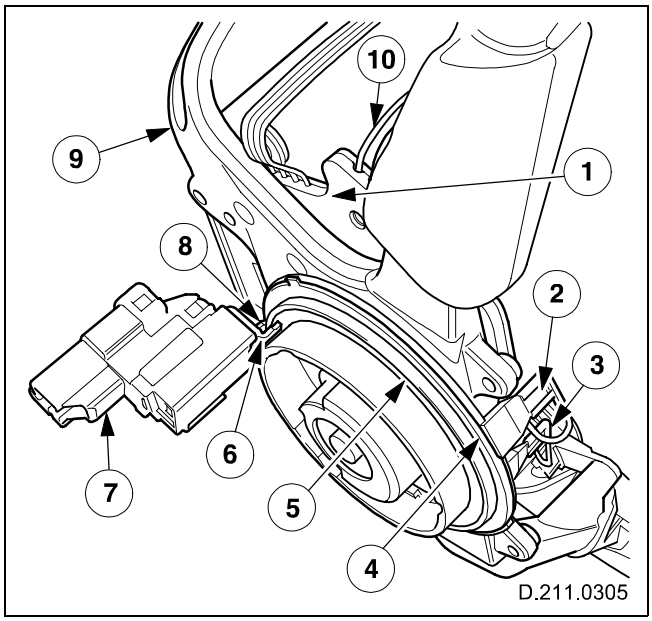

Fig. 79 Heated steering wheel connections

1. HSW electronics
2. Spade connector (positive)
3. Spade connector (negative)
4. Slip ring (positive)
5. Slip ring (negative)
6. Spring contact (negative)
7. Power coupling
8. Spring contact (positive)
9. Steering wheel armature
10. To HSW heater element

Air Conditioning

Air conditioning comprises the following system components:

- Evaporator core and thermal expansion valve.
- Compressor inlet line.
- Compressor.
- Condenser with integral receiver-drier.
- Condenser outlet line.
- Pressure transducer (part of compressor outlet line but serviceable separately).
- Combined evaporator intake/discharge line assembly with integral service ports.
- Compressor outlet line.

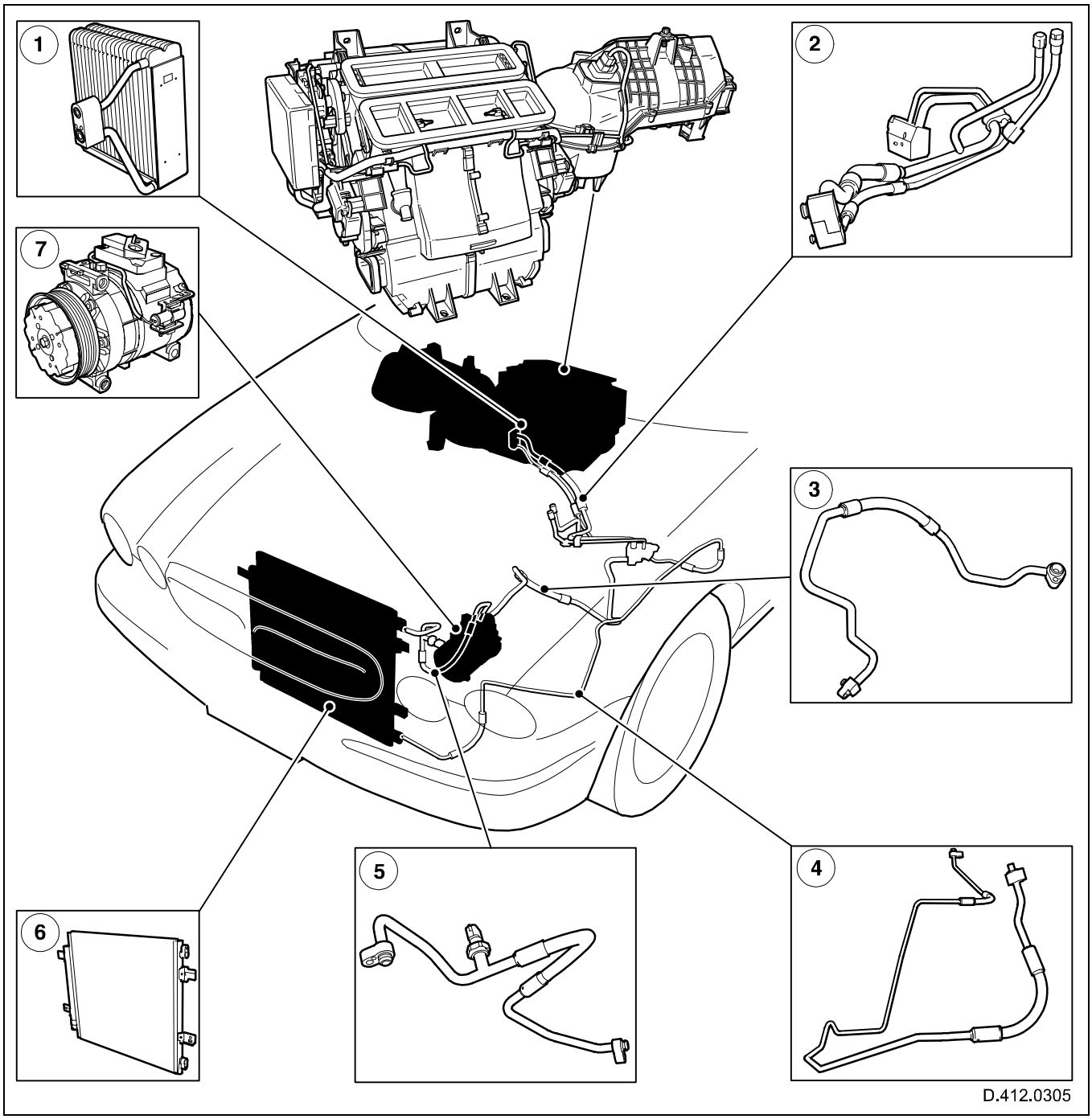

Fig. 80 Air conditioning components

1. Evaporator core and thermal expansion valve
2. Evaporator intake/discharge line assembly
3. Compressor inlet line
4. Condenser outlet line
5. Compressor outlet line
6. Condenser/receiver-drier
7. Compressor

Operation

With reference to **Fig. 81**:

- The compressor (6) is mounted directly to the engine and driven by the accessory drive belt. The compressor, compresses the low-pressure, gaseous refrigerant received from the evaporator core. The refrigerant is discharged from the compressor to the condenser/receiver-drier (4) as a high-pressure, high-temperature vapor.

NOTE: The manifold block of the compressor tube assembly incorporates a pressure relief valve.

- The condenser converts the high-pressure vapor to a liquid by utilizing the cooling effect of the air flowing over the condenser. The high-pressure warm liquid leaves the condenser, travels along the liquid line and enters the thermal expansion valve (2).
- The thermal expansion valve regulates the flow of refrigerant and causes a pressure reduction as it enters the evaporator core (1).
- The resultant reduction in pressures, causes the refrigerant to boil and removes heat and moisture from the air passing through the evaporator core into the passenger compartment. The heat transfer results in cool refrigerant vapor leaving the evaporator and returning to the compressor.

NOTE: Moisture from the atmosphere condenses on the fins of the evaporator before draining to the outside of the vehicle via the single, integrated condensate drain-tube.

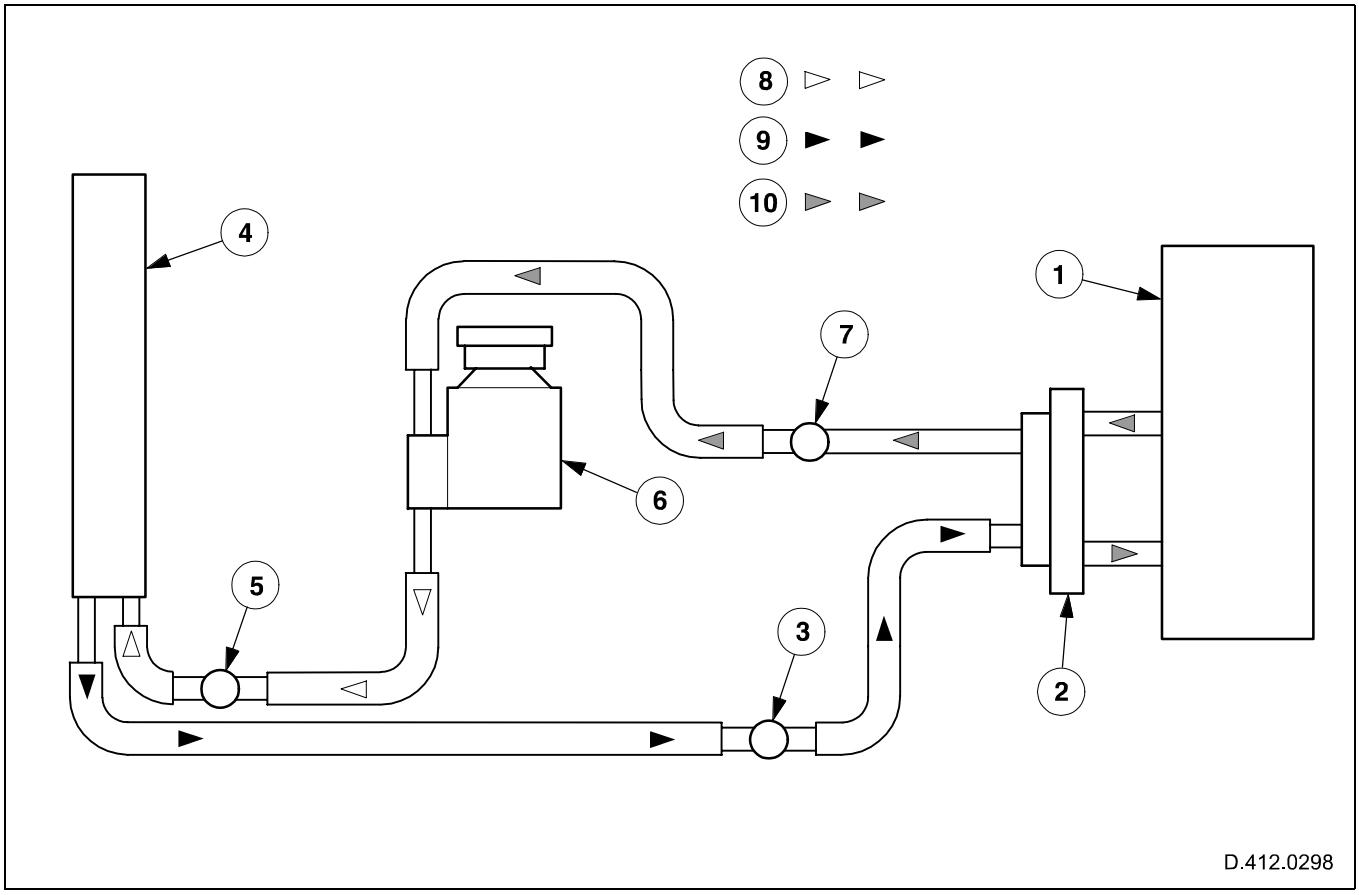

Fig. 81 Air-conditioning refrigerant flow (2–zone)

1. Evaporator core
2. Thermostatic expansion valve
3. High-side charge port
4. Condenser/receiver-drier
5. Pressure transducer
6. Compressor
7. Low-side charge port
8. High-pressure refrigerant (gaseous and hot)
9. High-pressure refrigerant (liquid and warm)
10. Low-pressure refrigerant (gaseous/liquid)

Compressor

The compressor installed is uniquely designed to suit the engine configuration and whether a 2-zone or a 4-zone climate control system is installed. The compressor does not have a magnetic clutch, instead, operation is continuous in response to a PWM signal supplied directly from the CCM to the compressor solenoid. Since there is no clutch cycling, the operation of the compressor is significantly quieter and more efficient as far as engine load is concerned. This type of compressor is capable of responding to smaller changes in system demands to accommodate requirements such as providing a 'chilling' effect without causing 'icing' of the evaporator.

Evaporator temperature

As part of an advanced automatic, evaporator temperature control, the evaporator temperature is controlled and varied by the CCM in response to parameters which include:

- Length of time the vehicle has been running.
- Ambient temperature.
- Passenger compartment temperature.
- Passenger compartment humidity.

NOTE: Selecting defrost automatically selects the air conditioning a condition which cannot be overridden while the system is in this mode.

Condenser/receiver-drier

The condenser and receiver-drier are integrated into a single unit, which incorporates a serviceable desiccant-sack.

Service ports

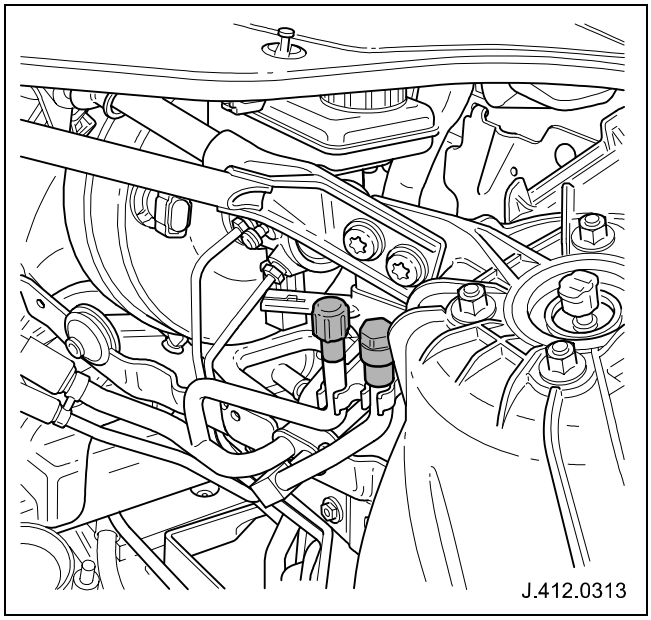

Fig. 82 Location of service ports

Control Components

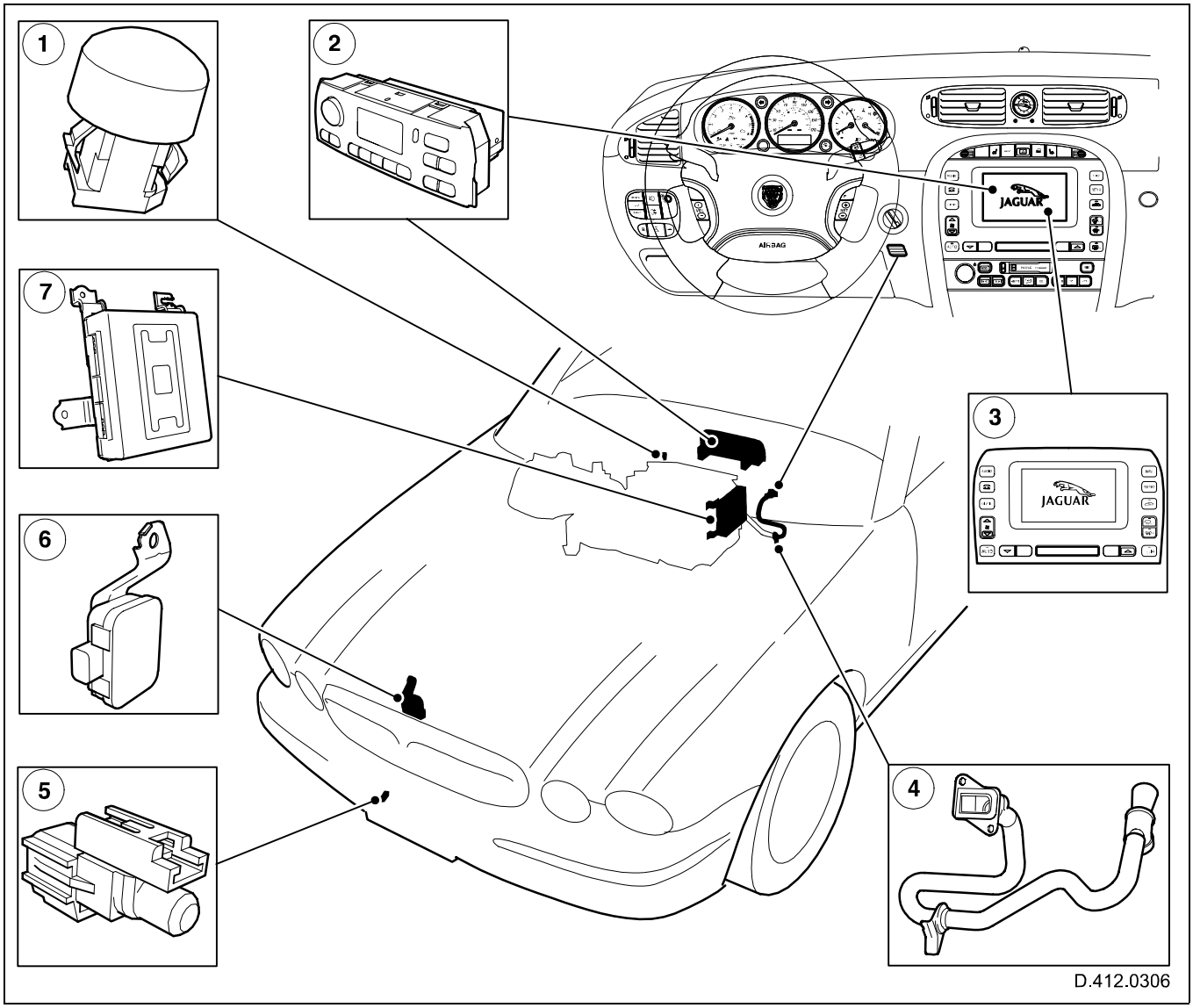

Fig. 83 Automatic climate control components

1. Dual sunload-sensor
2. Control panel with LCD
3. Telematics display module (optional installation)
4. In-vehicle temperature and humidity sensor
5. Ambient air temperature sensor
6. Air quality (smog) sensor
7. Climate control module

Climate Control Module

The climate control module (CCM) is mounted to the driver's side of the climate control assembly; refer to **Fig. 83** and configured to suit either the control panel with LCD or the touch-screen.

Configuration

The module is configured to suit the following options:

- telematics display module or climate control panel with LCD;
- Left-hand drive or right-hand drive;
- Heated front screen or heated wiper park;
- Smog sensor installed or smog sensor not installed;
- 2-zone or 4-zone climate control system.

NOTE: A replacement climate control module must be configured using WDS; refer to **JTIS.**

In response to signals from the in-vehicle temperature sensor, the CCM can drive the air distribution system (when under automatic control) to unique distribution modes in order to reduce the possibility of misting. In addition, the CCM may also increase the auto-blower speed. Manually selected distribution or blower speeds are unaffected.

NOTE: If the CCM detects the risk of misting, signals from the smog sensor are ignored until it is considered acceptable to resume normal operation.

Signal processing and CAN

The climate control module processes electrical input signals from the control panel and the temperature sensors and then provides, where appropriate, output signals to the actuators and display modules. In addition data are sent bidirectionally between the engine control module and the climate control module using the CAN.

Signals provided by the ECM to the CCM include:

- engine speed;
- air conditioning system pressure;
- engine coolant temperature;
- heated screen inhibit;
- air-conditioning compressor inhibit.

Signals provided by the CCM to the ECM include:

- compressor torque;
- heated screen request.

Climate Control Sensors

The climate control module uses feedback from the following sensors before making any necessary adjustments; refer to **New XJ Range Electrical Guide** for detailed connection information:

Evaporator discharge temperature sensor

The evaporator discharge temperature sensor is a thermistor-type device that provides primary feedback to the climate control module. The CCM processes this signal along with others and provides an output to the compressor.

NOTE: The evaporator sensor is integral to the evaporator housing and is therefore not individually serviceable.

Discharge temperature sensors

The discharge temperature sensors are thermistor-type devices, strategically placed to measure the temperature of the face-level air being discharged by the climate control assembly for both driver and front passenger.

NOTE: The sensors are not serviceable.

In-vehicle temperature and humidity sensor

The in-vehicle temperature and humidity sensor comprises two components, a thermistor-type device for measuring in-vehicle temperature and a capacitive device for measuring humidity.

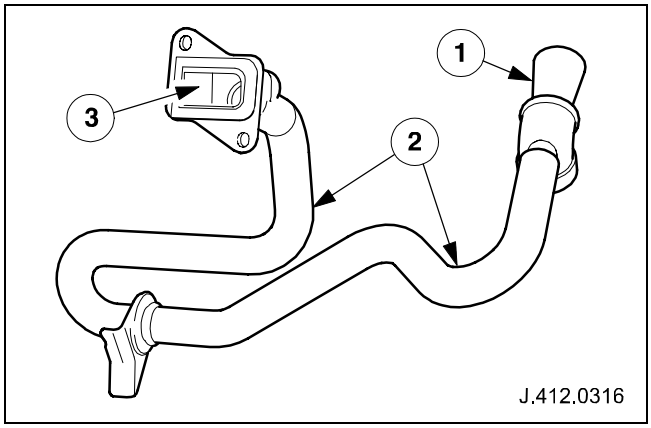

Fig. 84 In-vehicle temperature and humidity sensors

1. Venturi
2. Venturi to sensor hoses
3. Sensor housing

Ambient air temperature sensor

NOTE: The displayed ambient temperature will not change unless the vehicle is travelling faster than 40 km/h (25 mile/h).

The ambient air temperature sensor is a thermistor-type device, located behind the lower front grille.

NOTE: The sensor requires airflow in order to provide effective feedback to the system. The airflow must not be hindered by the addition of accessories.

Dual sunload-sensor

The dual sunload-sensor comprises:

- photo-diodes (that convert light levels to electrical output signals);
- electronic circuits for processing the electrical signals.

NOTE: Obstructing the sunload sensor will significantly affect the behavior of the systems.

Air quality (smog) sensor

The air quality sensor (when installed) is mounted in the engine compartment, in front of the radiator. The sensor detects the presence of petroleum based compounds such as CO and NOx. The levels of CO and NOx, triggers a chemical reaction within the sensor, which generates an electrical output signal proportional to the reaction. The signal is used by the climate control module (CCM) to determine whether the recirculation door should be closed.

The sensitivity of the air quality sensor, for vehicles fitted with the touch-screen (telematics display module) can be set from the 'Options' screen:

- select the 'Climate' hard button;
- select the 'Options' soft button from the climate control screen;
- adjust settings to suit:
  5 - most sensitive.
  3 - regular usage.
  1 - least sensitive.
  0 - sensor inactive.

NOTE: When the sensitivity is set to '0', the recirculation door can still be operated manually and will also be automatically operated when so determined by the CCM.

The sensitivity of the sensor, for vehicles not fitted with the touch-screen can be adjusted from the climate control panel in the following manner:

- Simultaneously pressing 'AUTO' and 'RECIRC' will display a single digit number in the LCD.
- The driver's 'temperature demand' buttons can be used to change the sensitivity level.
- Pressing 'MODE' exits the adjustment mode (exit is automatic after 6 seconds).

NOTE: The smog sensor signal is ignored if:

- **the air conditioning is active and the ambient temperature is 0°C (32°F) or less;**
- **the air conditioning is inactive and the ambient temperature is 5°C (41°F) or less;**
- **the CCM detects conditions which may give rise to interior misting;**
- **latched fresh-air recirculation has been selected.**

Actuators

All actuators are dc motors, mounted to the climate control assembly and controlled by the CCM.

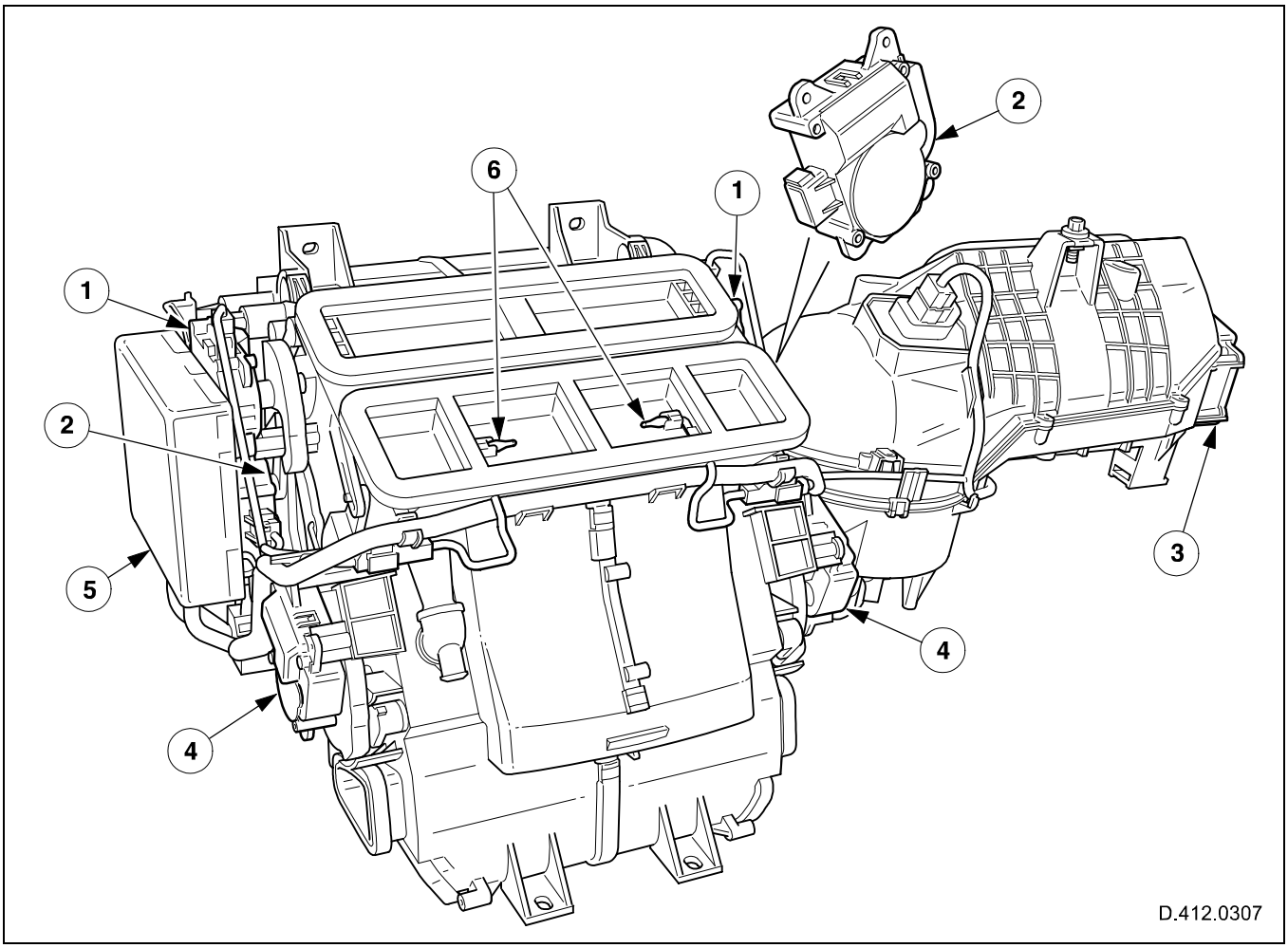

Fig. 85 Control components - climate control assembly

1. Defrost and cool-air bypass door actuator
2. Temperature blend door actuator
3. Recirculation door actuator
4. Floor/face door actuator
5. Climate control module
6. Discharge sensor
7. Evaporator temperature sensor (not illustrated)

Rear Climate Control System

NOTE: Where installed, the rear climate control system (RCCS) will only function when the front climate control system (FCCS) has first been activated. Any deactivation of the FCCS, will automatically deactivate the RCCS. Reactivation of the FCCS will not automatically reactivate the RCCS, manual intervention is required.

Rear Climate Control Panel

The rear climate control panel has its own integrated control module that, where appropriate can be overridden by signals from the main CCM.

Provided the FCCS is already active, the RCCS can be controlled by:

- rear seat passengers using the rear climate control panel (RCCP);
- front seat passengers using the touch-screen (telematics display module).

NOTE: Adjustments using the RCCP are ignored when the telematics display is showing the 4-zone climate control.

Climate control features can be controlled by push buttons and a rotary control. When a function button is pressed, selection is confirmed by a 'beep'. The LCD uses graphic symbols to provide additional confirmation of the system status.

NOTE: The RCCP is not configurable but may be reprogrammed using WDS if necessary; refer to **JTIS**.

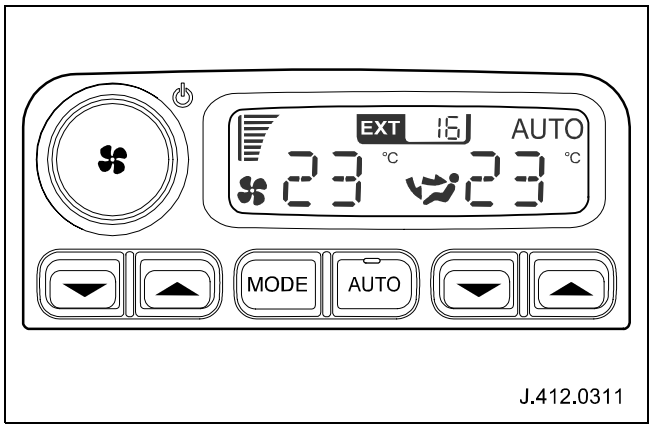

Fig. 86 Rear climate control panel

Operation

Provided the FCCS is already active, the RCCS can be activated using the RCCP by selecting 'AUTO' or depressing the blower knob.

AUTO operation

Selecting 'AUTO' provides full automatic temperature control, including blower speed and air distribution, for both rear positions.

Temperature control

The left and right zone temperatures can be set independently using the red and blue buttons, in the same manner as the front system.

NOTE:

- **HI/LO (maximum/minimum temperatures) cannot be selected from the rear control panel.**
- **Selection of HI/LO using the driver's Tset button, will apply to all four zones and overrides any rear temperature selections.**

MODE button

Pressing the 'MODE' button deselects the 'AUTO' tell-tale LED and allows a choice of manual air distribution. Each press of the 'MODE' button, will cycle through the following air flow options: face level only; face and floor levels; floor only.

Blower speed

Rotating the blower speed knob deselects the 'AUTO' tell-tale LED and allows the blower speed to be changed as confirmed by the bars on the LCD.

NOTE: Selecting the defrost (DEF) option from the front control panel, will limit the rear system blower-speed, but otherwise the rear system will function normally.

Deactivation

Depressing the blower control knob will deactivate the rear system.

Air Distribution

Air distribution to the rear passenger zones is via the registers that are integral to the 4–zone floor console; refer to **Floor Console**.

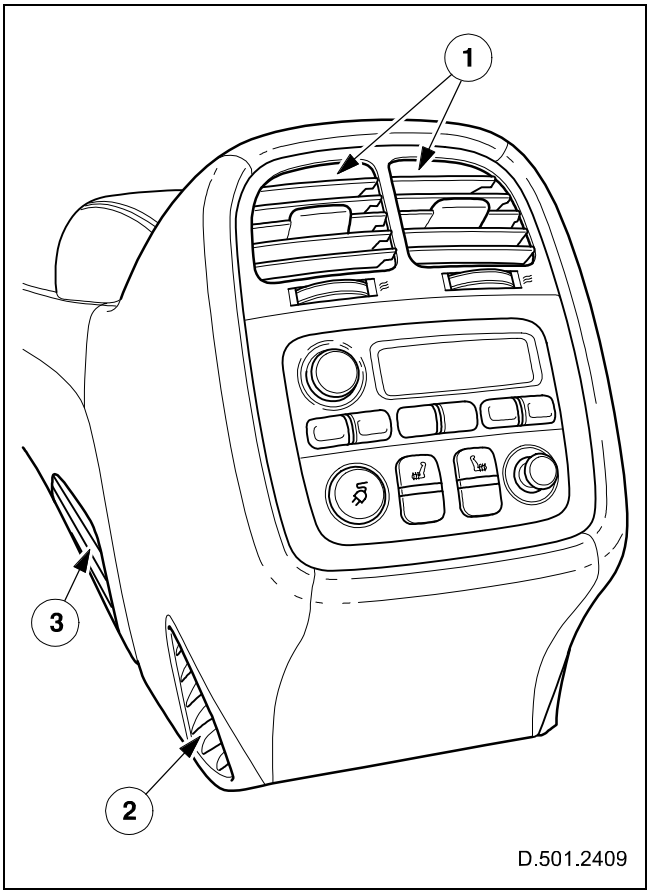

Fig. 87 Rear air distribution

1. Rear face-registers
2. Rear floor-registers
3. Input register

NOTE: The rear face-registers are unique to the 4-zone arrangement.

General

Refer to **New XJ Range Electrical Guide** for detailed connection information and an indication of the flow of electrical data between climate control components.

Diagnostics

The climate control system:

- constantly monitors the status of the system;
- where appropriate, stores a DTC within the climate control module for analysis using WDS.

Air conditioning charge weight

The air conditioning charge weight for 4-zone systems is different to 2-zone systems; refer to the information label located in the engine compartment and to **JTIS**.

Rear Climate Control System Components

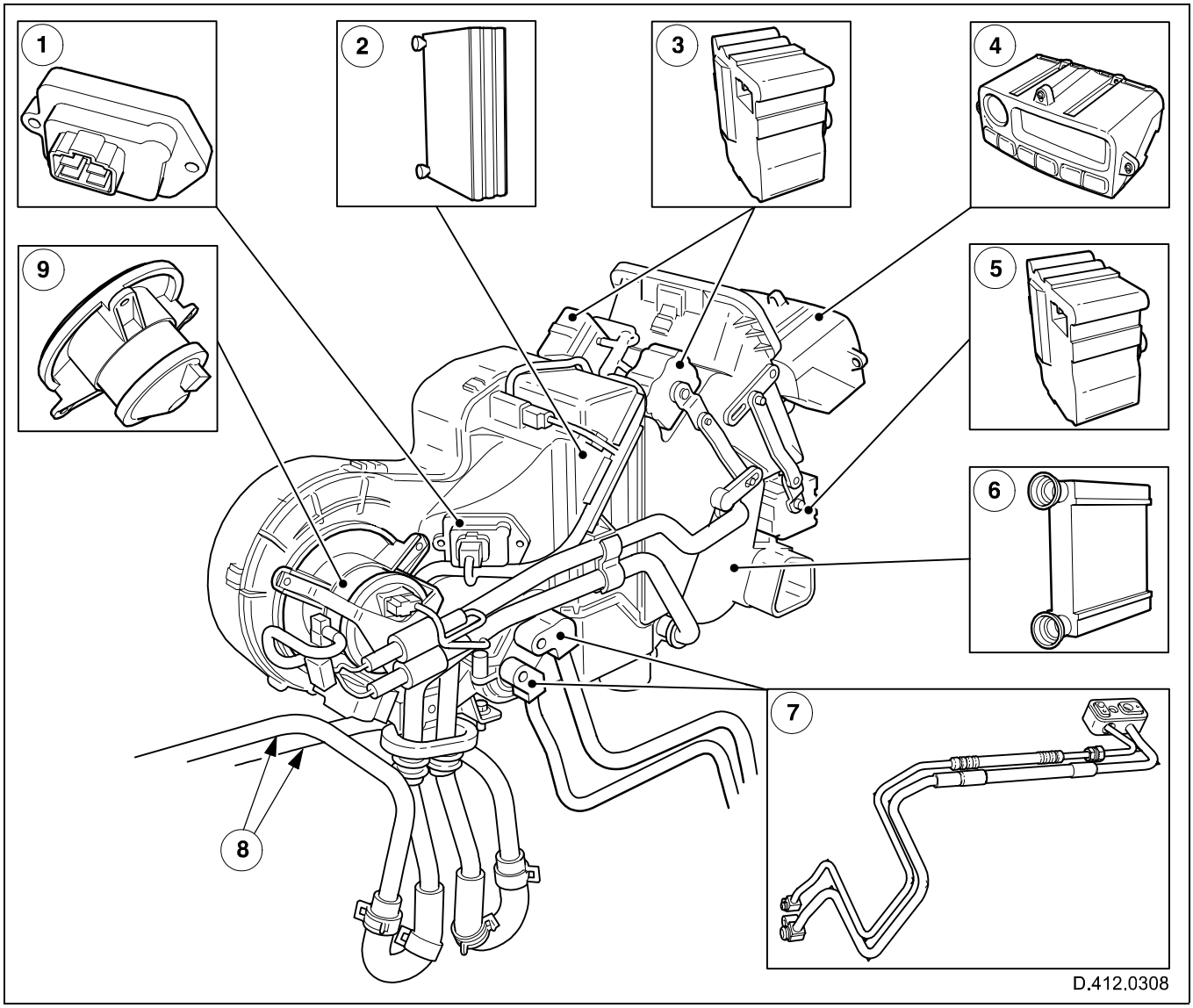

Fig. 88 System components

1. Blower speed module
2. Evaporator core
3. Temperature blend door actuator
4. Climate control panel (includes control module)
5. Floor/face door actuator
6. Heater core
7. Evaporator lines assembly
8. Heater pipes
9. Blower motor
10. Evaporator sensor (not shown)

NOTE: The blower speed module used for the rear climate control assembly is unique and not interchangeable with that installed to the front climate control assembly.

NOTE: Not illustrated, but part of the system and integral to the rear climate control assembly are the thermal expansion valve and magnetic shut-off valve for the refrigerant.

System Interconnections

Fig. 89 shows a typical layout for vehicles fitted with front and rear climate control systems.

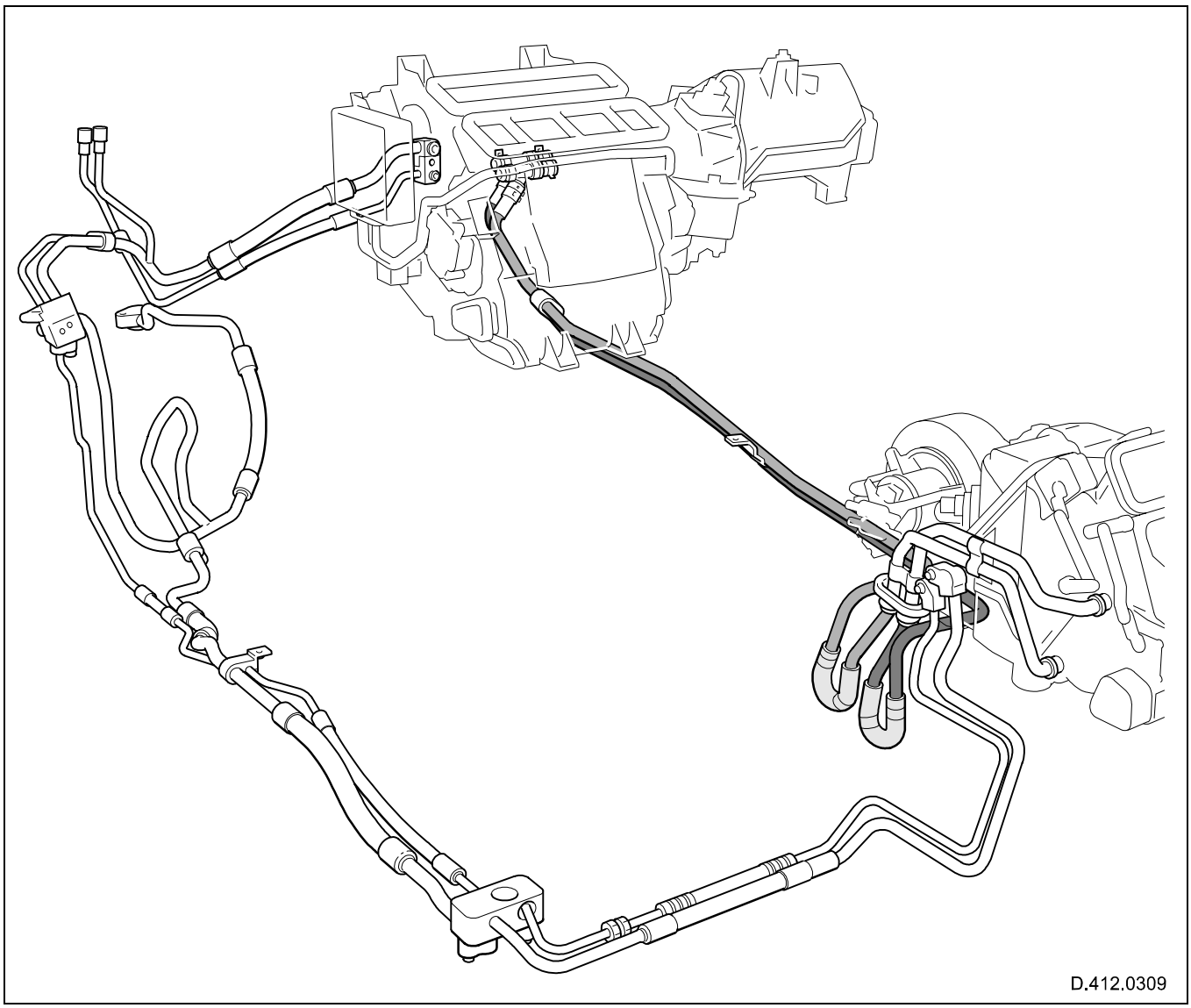

Fig. 89 Rear climate control - typical layout

Refrigerant Flow

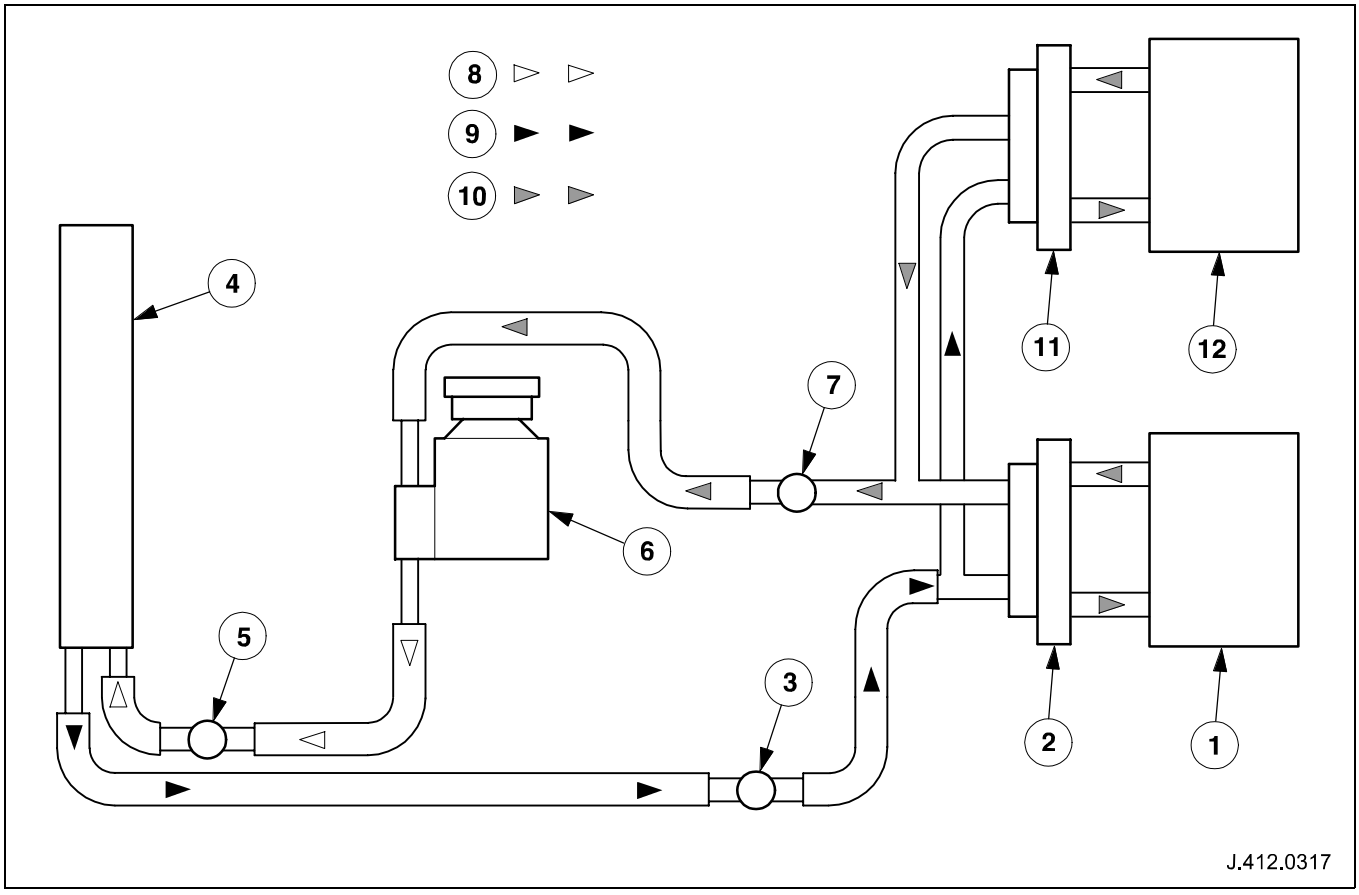

Fig. 90 Air-conditioning refrigerant flow (4–zone)

1. Front evaporator core
2. Front thermostatic expansion valve
3. High-side charge port
4. Condenser/receiver-drier
5. Pressure transducer
6. Compressor
7. Low-side charge port
8. High-pressure refrigerant (gaseous and hot)
9. High-pressure refrigerant (liquid and warm)
10. Low-pressure refrigerant (gaseous/liquid)
11. Rear thermostatic expansion valve
12. Rear evaporator core

NOTE: Not illustrated, but part of the system and integral to the rear climate control assembly is the magnetic shut-off valve for the refrigerant.

Instrumentation and Warning Systems

Instrument Cluster and Panel Illumination

The dimmer control is mounted within the auxiliary lighting switch assembly and is used to adjust the level of backlighting for switches and instruments including:

- Instrument cluster.
- Climate control panel (where applicable).
- Telematics display module (where applicable).
- Audio unit.
- J-gate module (LEDs).
- Auxiliary lighting switch assembly.
- Steering wheel mounted switches.
- Center console switch assembly.
- Fuel filler-flap and trunk lid release switch assembly.
- Overhead console switches and mood lamp.
- Driver door and memory switch assembly.
- Window switches.
- Front and rear ashtray/cigar lighter.
- Front and rear accessory power points.
- Rear climate control panel.
- Climate control registers.
- Rear seat switches.
- Rear seat heater switches.
- Rear grab handle.
- Mood lamp; refer to **Overhead Console**.

NOTE: Pushing and releasing the dimmer control knob releases it from the stowed position for ease of operation.

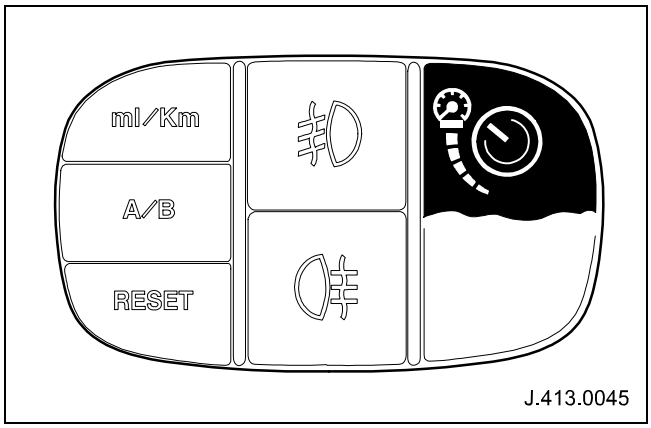

Fig. 91 Dimmer control

The driver-determined level of backlighting is set using the dimmer control, which is directly wired to the instrument cluster. The instrument cluster provides data (via the SCP network) to the front electronic module (FEM), appropriate to the chosen setting. The FEM responds by outputting a pulse-width modulated (PWM) signal to drive the backlighting at the chosen level.

NOTE: The instrument cluster backlighting uses LEDs which are controlled internally - not via the FEM.

Instrument Cluster

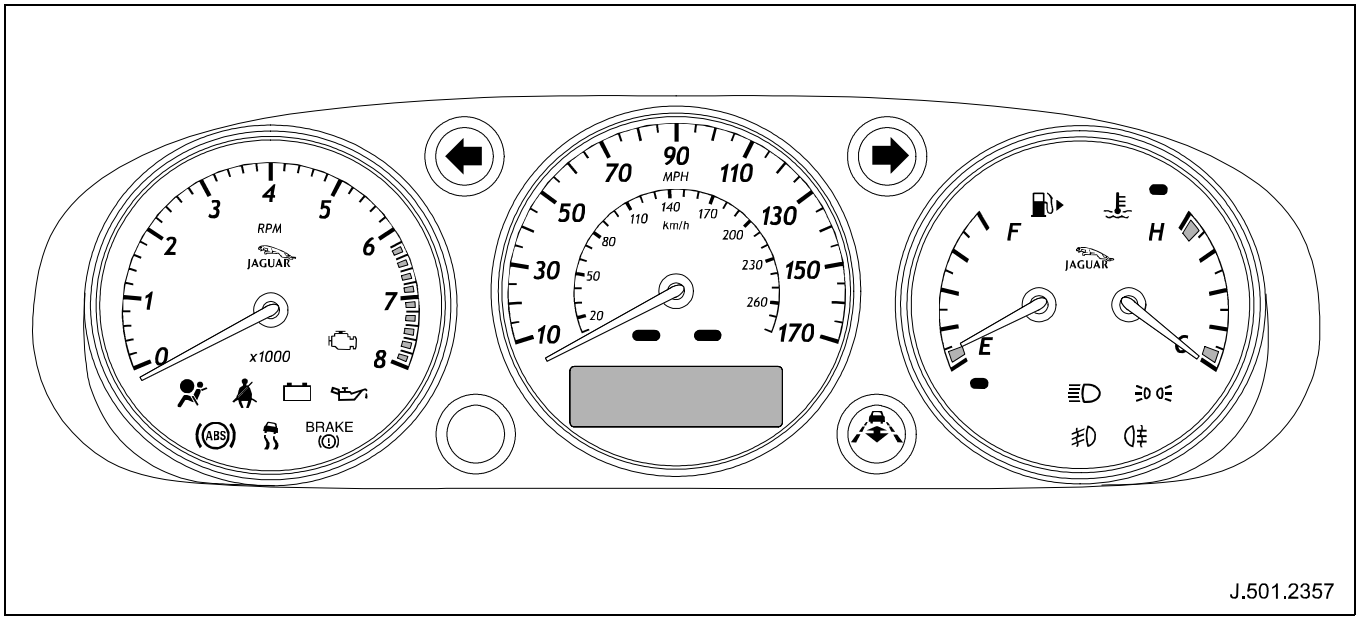

Fig. 92 Instrument cluster

Detailed instrument cluster (IC) features vary depending on market and vehicle specification.

The instrument cluster is a configurable module and:

- provides an interface between the passive anti-theft system (PATS) transceiver, the engine control module (ECM) and the rear electronic module (REM) to enable the immobilization feature; refer to **Anti-Theft**;
- provides a signal to the steering column lock module (SCLM) via the SCP network;
- provides the control for the steering column position (refer to **Steering System**);
- provides multiplex network gateway functionality for CAN and SCP; refer to **Module Communications Network**;
- provides a signal to the VAPS solenoid; refer to **Steering System**.

NOTE: The vehicle speed signal is compared to VAPS curves (stored in the memory of the IC) and an appropriate predetermined signal is output to the VAPS solenoid.

- outputs the warning chimes, except parking aid and adaptive speed control (driver intervene);
- provides decoding for the ignition, courtesy lighting switch and exterior lighting switch.

NOTE: The instrument cluster must be configured to match the ECM and SCLM (refer to **JTIS**).

The cluster comprises four gauges, warning lamps and LCD message center.

Two warning lamps are located above the message center, one red, the other amber. The warning lamps alert the driver to the status of the warning message simultaneously displayed:

- The 'RED' warning lamp indicates a primary warning message that requires immediate investigation by the driver or a Jaguar Dealer.
- The 'AMBER' warning lamp indicates a secondary warning message requiring:
  - appropriate response by the driver;
  - the reporting of any associated malfunction to a Jaguar Dealer at the earliest opportunity.

In addition to the indicators normally found on the instrument cluster such as the malfunction indicator lamp (MIL), there are indicators for:

- Speed control follow-mode active.
- Dynamic stability control/traction control.

Depending on market and vehicle specifications, the following warnings may be displayed via the message:

NOTE: In some instances there is no equivalent visual indicator on the cluster.

- Engine malfunction.
- Door ajar warnings.
- Low washer fluid.
- Dynamic stability control/traction control warning (confirmation of status).
- Speed (cruise) control.

The message center also conveys the following information, when appropriate:

- transmission fault warnings;
- turn signal indicator bulb failure;
- low coolant warning;
- parking brake fault;
- check fuel filler cap;
- DSC on/off/fail;
- autolamp delay setting message;
- pedal (adjustment) inhibit (when speed control is activated);
- column / pedal adjustment status (visual confirmation of selection made using rotary action of the column / pedal adjustment switch);
- ACC (speed control) messages (where applicable).

Odometer, Trip Odometer / Trip Computer

Odometer

The odometer is an integral part of the instrument cluster. The current odometer value is displayed by the message center and is the default display of the trip computer. Odometer values are displayed in miles or kilometers, with suppressed leading zeroes, as six significant figures and no decimal places. The values are stored in non-volatile memory to prevent any loss of data during battery disconnection.

NOTE: The displayed odometer reading will not roll-over when it reaches its maximum value, it will stop.

Trip Computer

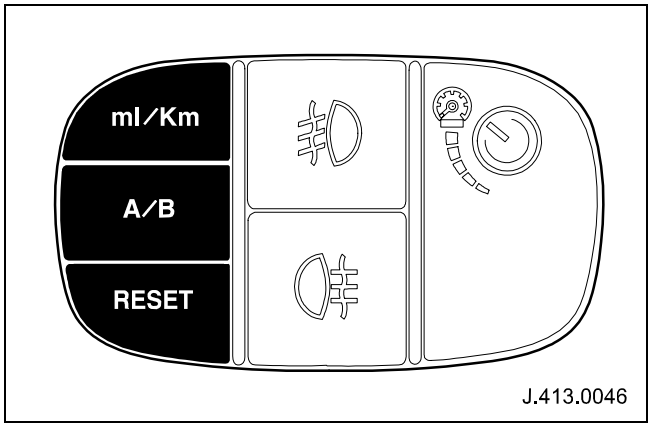

Fig. 93 Trip computer control switches

The trip computer is an integral part of the instrument cluster and is controlled by the three switches located at the outboard side of the auxiliary lighting switch.

- The 'ml/Km' button provides the option to display data in metric or imperial units.
- The 'A/B' button provides the option to track two separate journeys in the trip-computer memory.

- The 'RESET' button is multi-purpose and is used to:
  - cycle between the trip, odometer and message modes;
  - clear (hide) messages (briefly press the button with message-mode selected);
  - reset the selected (A or B) trip-computer memory to zero (hold the button for approximately 3 seconds).

Pressing the 'TRIP' button (located at the end of the left-hand column stalk) will cycle the trip-computer information in the following order:

- odometer;
- trip distance;
- distance-to-empty;
- average fuel consumption;
- instantaneous fuel consumption;
- average speed.

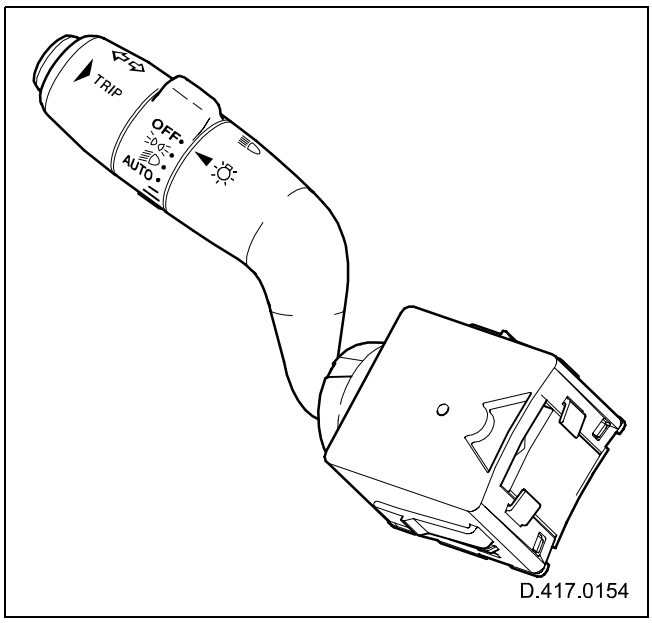

Fig. 94 Trip button

Parking Aid

Reverse Parking Aid

The reverse parking aid system is installed as standard and comprises:

- Parking aid module.
- Audible warning speaker.
- Ultrasonic sensors.

The parking aid module is mounted in the left-hand corner of the luggage compartment near the spare wheel.

NOTE: The module cannot be configured and the system cannot be deactivated manually.

The reverse parking aid system becomes active when the ignition key is turned to position 'II'.

CAUTION: Completing a parking maneuver with the gear shift lever in neutral is not advisable; the sensors are not active and therefore no audible warning will be emitted.

The ultrasonic sensors are designed to detect the presence of obstacles as the vehicle is being parked. Should an object be detected within the sensor range of 1.8m (71 inches) from the rear of the vehicle, the speaker should emit an intermittent audible warning. As the vehicle moves closer to the object, at a distance of 0.3m (12 inches), the intermittent audible warning should change to a continuous audible warning.

NOTE: When driving into a confined space such as a home garage, the outer sensors will detect the side walls and after 3 seconds will disable the audible warning; as movement continues, the inner sensors will eventually detect the rear wall and the audible warning will recommence.

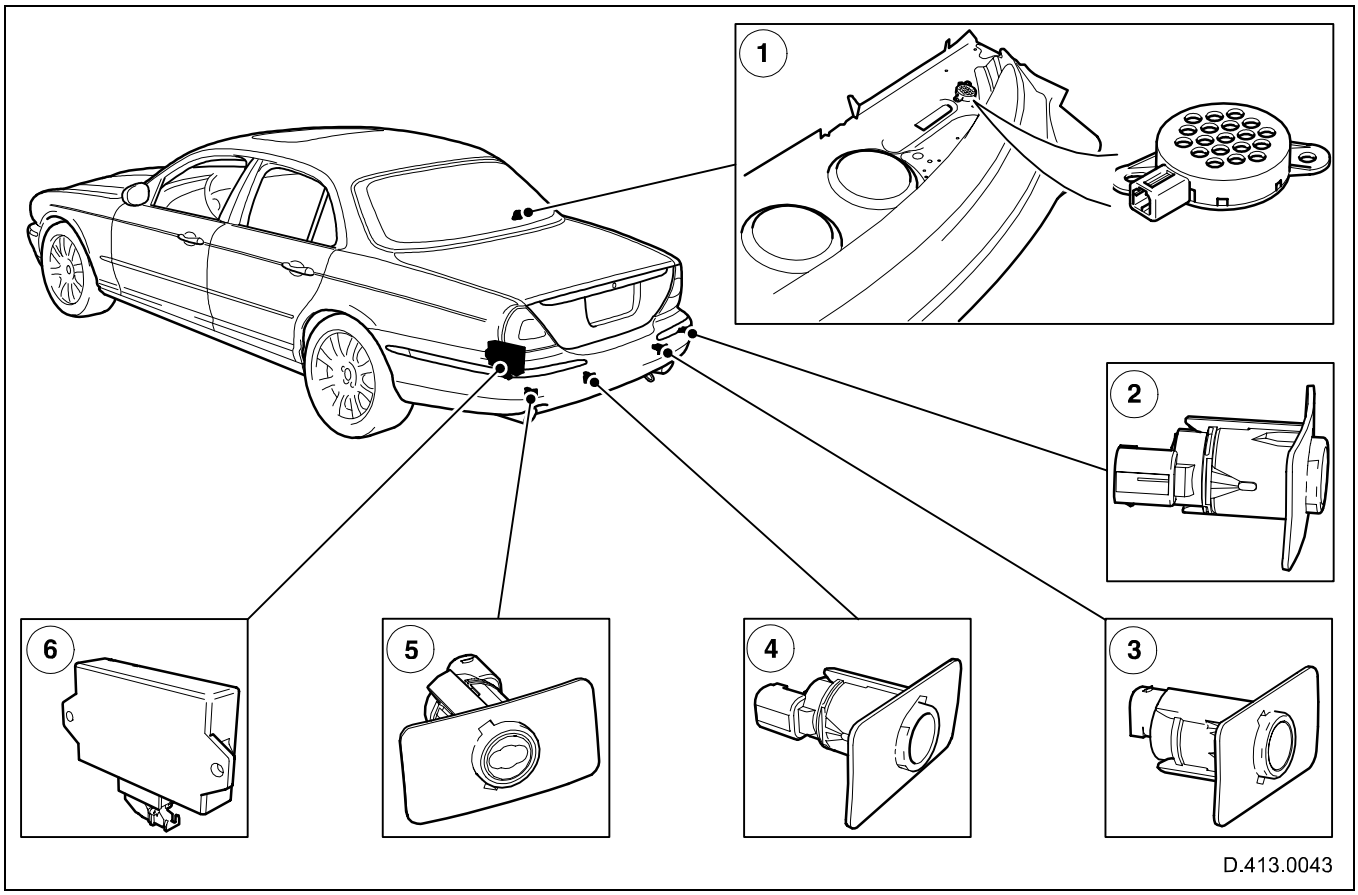

Fig. 95 Reverse parking aid components

1. Speaker
2. Ultrasonic sensor
3. Ultrasonic sensor
4. Ultrasonic sensor
5. Ultrasonic sensor
6. Parking aid module

When trying to establish whether the system is behaving correctly, the following points should be taken into account:

- The range reduces to 0.6m (23.6 inches) at the vehicle corners.
- The vertical range is designed to protect the highest and lowest points at the rear of the vehicle.
- Curbs that are low enough to pass under the vehicle will not be detected.
- Curbs that are higher than 0.18m (7 inches) will be detected.

NOTE: The system is automatically inhibited when the trailer socket is connected.

Front Parking Aid

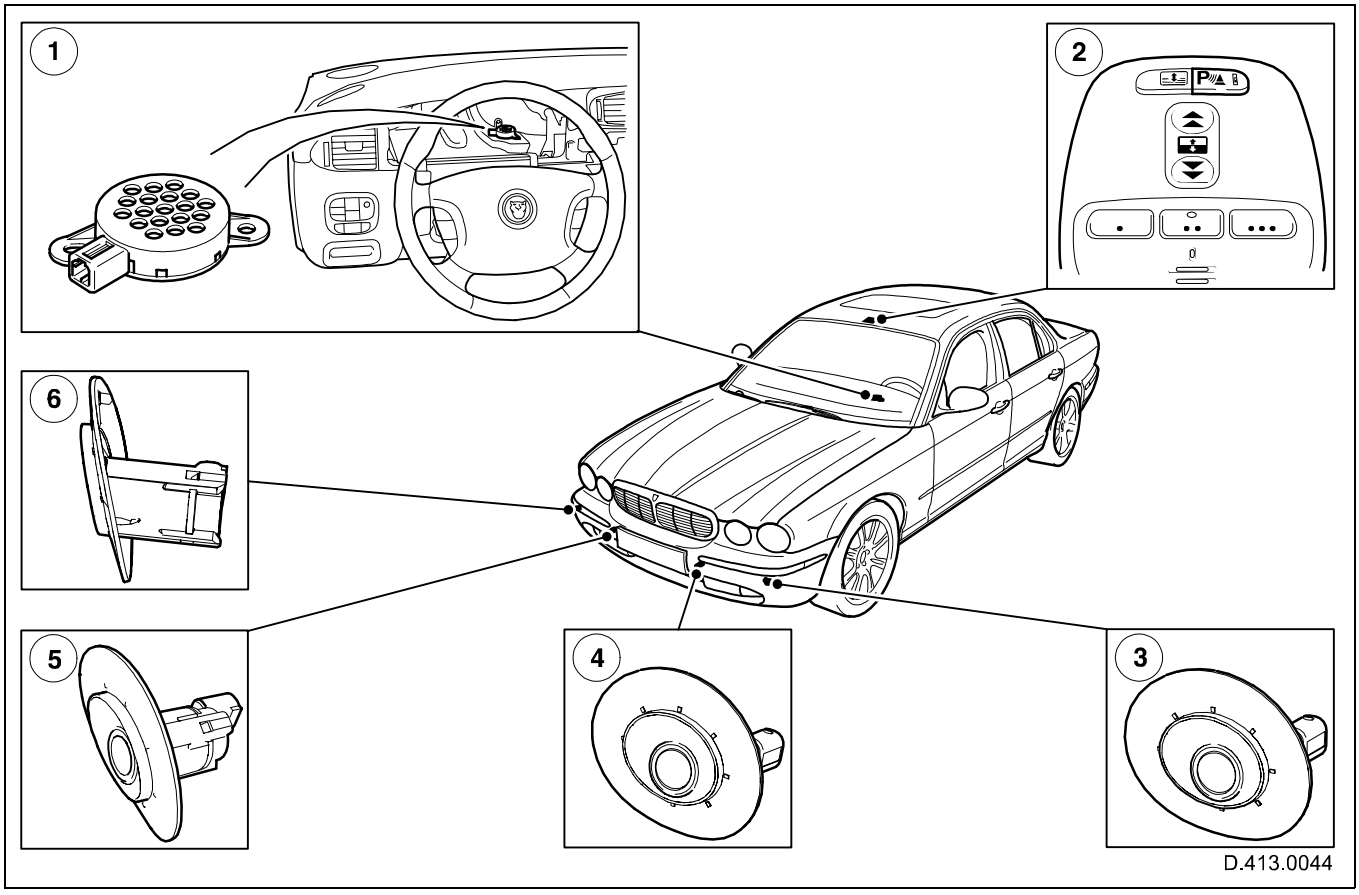

Fig. 96 Parking aid components (front)

1. Speaker
2. Deactivation switch
3. Ultrasonic sensor
4. Ultrasonic sensor
5. Ultrasonic sensor
6. Ultrasonic sensor

The front parking aid system, is installed as an option, requires a different parking aid module to that installed for the reverse parking aid system and comprises:

- Parking aid module.
- Audible warning speaker.
- Ultrasonic sensors.
- Deactivation switch.

The deactivation switch, located in the overhead console, provides the driver with the option to deactivate the system.

CAUTION: Deactivation applies to both the front and reverse parking aid systems.

A warning lamp, integral to the switch, illuminates to confirm the systems have been deactivated.

NOTE: Should a malfunction be detected, the system will be automatically deactivated and the warning lamp illuminated.

The ultrasonic sensors are designed to detect the presence of obstacles as the vehicle is being parked. Should an object be detected within the sensor range of 0.8m (31 ins) from the front of the vehicle, the speaker should emit an intermittent audible warning. As the vehicle moves closer to the object, at a distance of 0.25m (10 inches), the intermittent audible warning should change to a continuous audible warning.

NOTE: The front sensors are not effective at speeds above 15 km/h (9 mile/h) or below 7 km/h (4.5 mile/h).

System Malfunctions

Retrieval of the DTC and subsequent diagnosis of the system should be undertaken using WDS.

NOTE: For reliable operation, all sensors should be kept free from ice and grime. Cleaning the sensors using a high pressure spray should only be undertaken briefly and not from a distance of less than 200 mm (8 inches).

Reverse parking aid only

When reverse gear is engaged, any system malfunction will cause a continuous audible warning to be emitted for 3 seconds (only once per ignition cycle) and a DTC will be stored.

Front and reverse parking aid

When a system malfunction is detected, once per ignition cycle:

- a continuous audible warning will be emitted for 3 seconds;
- the deactivation switch LED will illuminate;
- the system will be deactivated;
- a DTC will be stored.

Battery and Charging Systems

Electrical Load Management System

Load management is not a new concept, but previous forms were restricted to specific modules and worked in isolation from the rest of the electrical system.

A subtle, centralized, electrical monitoring and control strategy has been introduced, designed to accommodate an increase in major electrical features, by limiting the detrimental effect on the battery and ultimately the vehicle.

The electrical load management system (ELMS) does not affect the core functionality of any vehicle system and is transparent to the customer:

- Spare capacity from the generator is utilized to ensure the most efficient operation of components that have particularly demanding power requirements.
- The battery is protected from rapid discharge by the temporary de-selection of features that will only be reinstated when the ELMS permits.

The system constantly compares power consumption against generated power using the vehicle systems listed in **Table 4**.

System	Provides data	Processes data	Performs actions
Engine management	x	x	x
Climate control	x	x	x
Electrical body	x	x	x
Suspension	x		
CAN		x	
SCP		x	
Instrument cluster		x	

Table 4 Contribution of vehicle systems to the ELMS

The ELMS is co-ordinated by the engine control module (ECM), which holds look-up tables (for data comparison purposes) and determines the following operating sequence:

1. Estimate maximum available generator current:
   - uses engine speed, road speed, ECT, IAT, electrical system voltage (at the ECM) and time (since the engine was started).

NOTE: The load management strategy will be inhibited should there be a failure in measurement of any of the above parameters.

2. Calculate the present level of vehicle electrical system loading based on network messages and EMS information:
   - uses CAN and SCP to determine which features are active. Intermittent loads such as seat movements, window lifts and turn signals are not considered.
3. Assess the operational condition of the electrical power supply by continuously monitoring:
   - system voltage at ECM;
   - ambient air temperature.
4. Decide what actions, if any, are required to protect the battery:
   - dependent on the results of the power supply calculations;
   - decides which features to inhibit;
   - determines required idle speed required to support features (subject to limits imposed by the requirements of the powertrain).
5. Perform required actions via CAN or SCP to inhibit or reinstate features.

The ELMS will be inhibited when:

- a CAN system failure is detected;
- the charge warning indicator while the engine is running.

NOTE: When the charge warning indicator is illuminated, the ELMS inhibits the operation of all electrically heated components. This maximizes the period for which the vehicle will remain operational before the battery becomes fully discharged.

Electrical Features

The following features are considered when accessing the level of electrical load:

- Heated front screen.
- Heated rear screen / heated mirrors.
- Heated wiper park.
- Blower motor.
- Side lamps.
- Dipped beam.
- Main beam.
- Front fog lamps.
- Rear fog lamps.
- Windscreen wipers - low speed.
- Windscreen wipers - high speed.
- Heated steering wheel.
- Heated seat (driver).
- Heated seat (passenger).
- Rear heated seat (behind front passenger).
- Rear heated seat (behind driver).
- Air suspension compressor.
- Adaptive damping mode.
- Engine cooling fan.
- Brake lights.

Feature Priority

The operation of the various electrically heated components is continually monitored by the ELMS. The ELMS determines that, in circumstances where the generated electrical power is less than the electrical consumption, selected systems may be inhibited or operated using reduced power for as long as is necessary.

NOTE: Warning LEDs remain illuminated so that any corrective action is not apparent to the driver.

The inhibition of features is examined in the following order:

1. Heated wiper park.
2. Heated rear screen / heated mirrors.
3. Heated front screen.
4. Heated steering wheel.
5. Rear heated seat (behind driver).
6. Rear heated seat (behind front passenger).
7. Heated seat (passenger).
8. Heated seat (driver).

Generator and Regulator

Electrically the generator is similar to previous models except for the voltage regulator functionality.

The engine control module (ECM) can switch the voltage regulator between two voltages to optimize the charging of the battery.

When measured at the generator terminals:

- The low voltage regulator setting is 13.6 volts.
- The high voltage regulator setting is 15.3 volts.

NOTE: The values, which will decrease with a rise in temperature or current flow, are measured with the generator at 25°C (77°F) and charging at a rate of 5 amps.

The ECM:

- Determines the voltage setting of the voltage regulator.
- Always selects the high voltage setting once the vehicle has started.
- Determines the period of time that the high voltage remains selected.

The ECM selects one of three different time periods dependent upon the operating conditions when the vehicle is started:

- The longest time period is selected when both the ECT and the IAT are below 15°C (59°F).
- The intermediate time period is selected when either the ECT or the IAT are above 15°C (59°F) and are also within 10°C (50°F) of each other.
- The shortest time period is the default and is used to provide a short period of boost charge.

NOTE: At the end of these time periods the voltage is always set to the low voltage setting to prevent the battery from being overcharged.

The time periods are variable depending upon the temperature and the battery voltage.

The target voltage of the battery ranges between 14 volts and 14.6 volts (measured at the ECM) depending upon the ambient temperature and the vehicle operating conditions.

NOTE: Once this target voltage has been achieved, providing the vehicle has been operating for at least the shortest time period, the ECM will reduce the voltage regulator to the minimum setting of 13.6 volts.

There are three connections between the ECM and the generator; refer to **New XJ Range Electrical Guide** for details:

1. The voltage regulator request setting from the ECM to the generator.
2. A square signal from the generator to the ECM, which enables the ECM to monitor the generator load on the engine.
3. A charging system indicator signal wire from the generator to the ECM.

If the voltage regulator request line is open circuit or short circuit to battery voltage, the generator will permanently charge at 15.3V. If it is short to ground, it will permanently charge at the lower voltage, 13.6V.

NOTE: A DTC will be generated if a circuit malfunction is detected in any of the three lines connecting the ECM to the generator or if the connector is disconnected. The charging system indicator will also illuminate.

In-vehicle Entertainment Systems

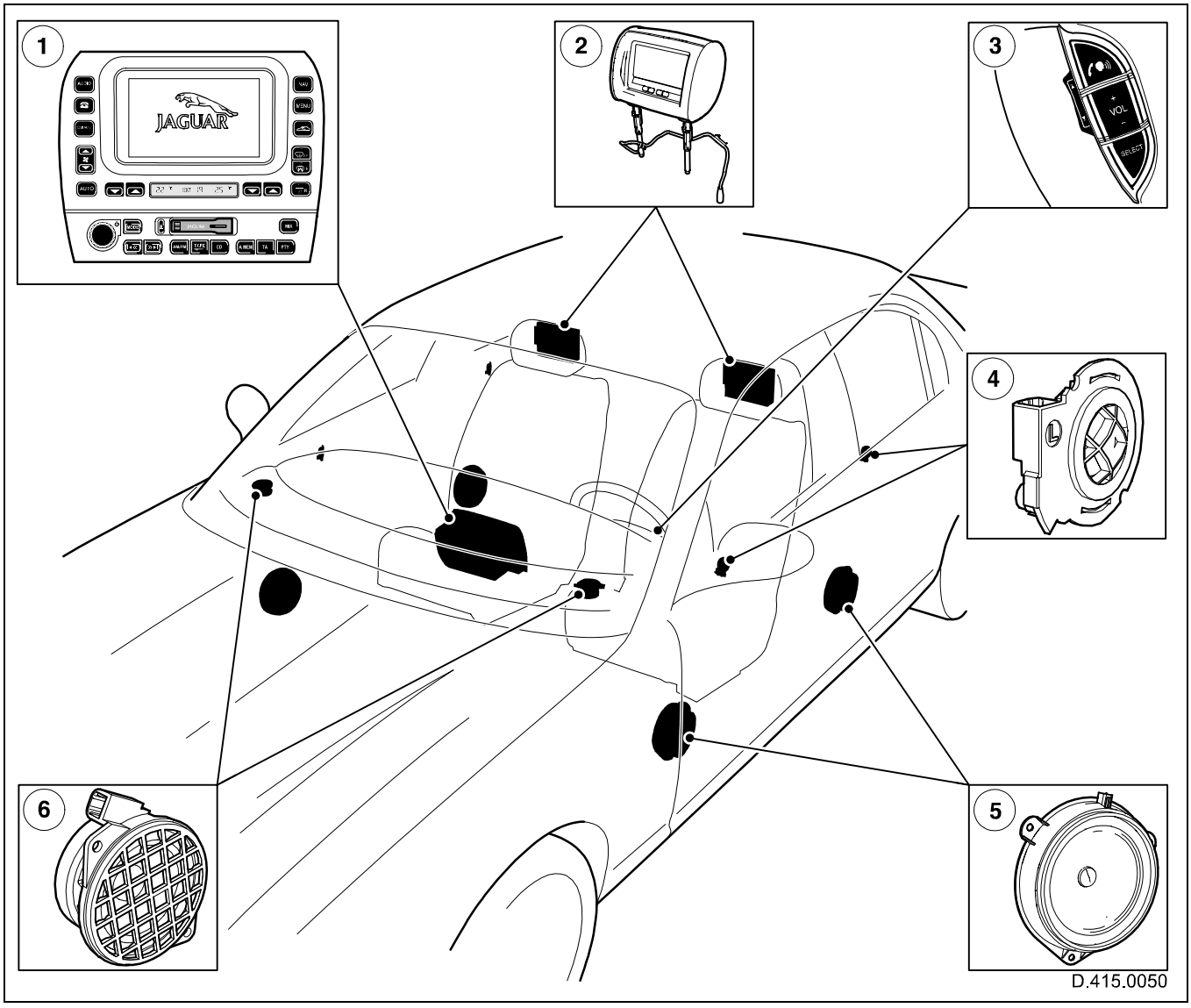

Fig. 97 Entertainment system components - forward locations

1. Audio unit (telematics version)
2. Rear multimedia display (option)
3. Steering wheel telematics controls
4. Tweeter
5. Mid-bass speaker
6. Mid-range speaker

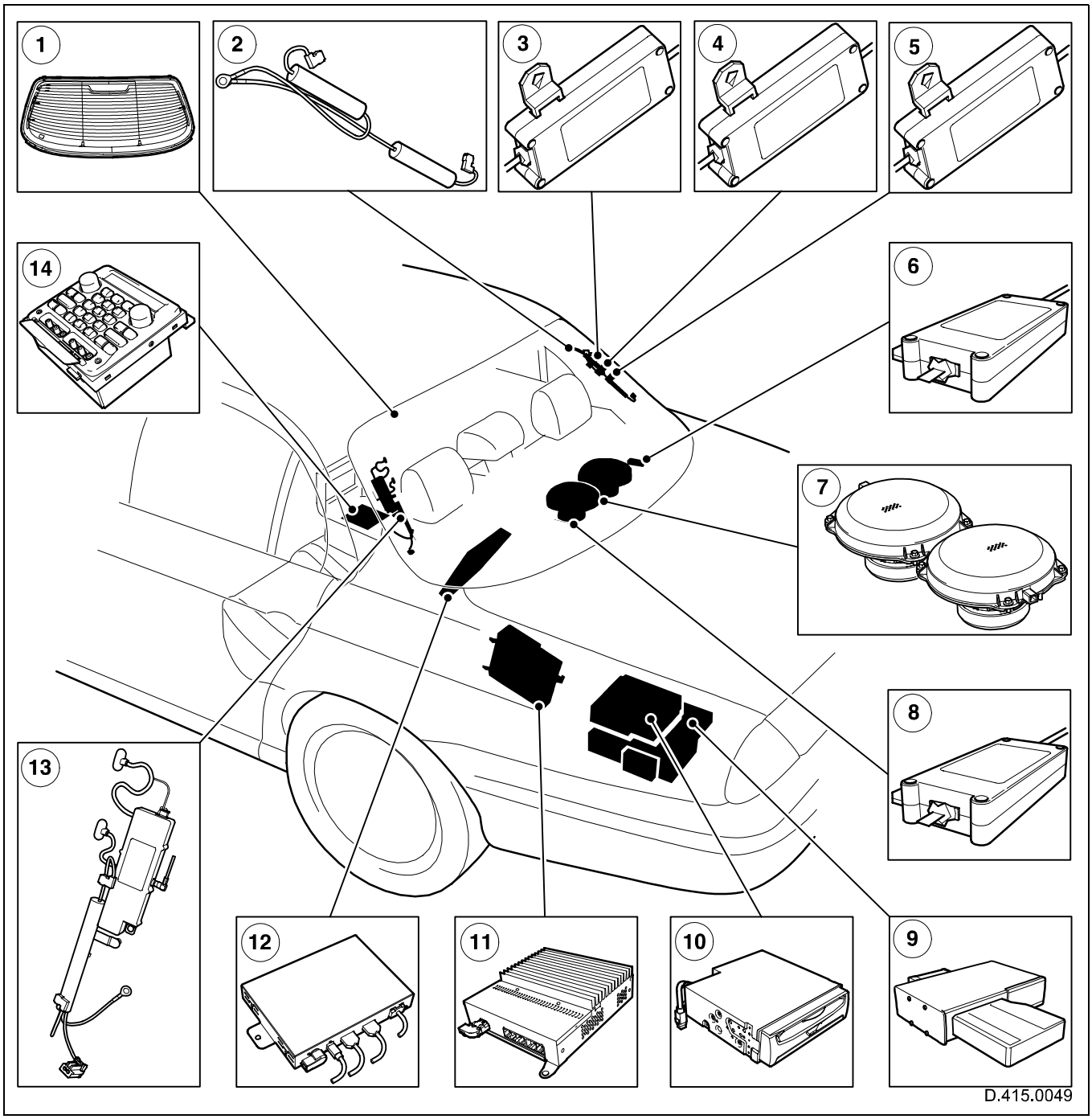

Fig. 98 Entertainment system components - rearward locations

Key to Fig. 98

1. Antennas
2. Double-wavetrap
3. VICS antenna amplifier (Japan only)
4. Television antenna amplifier
5. Television antenna amplifier
6. Television antenna amplifier
7. Sub-woofers (premium system)
8. Television antenna amplifier
9. CD changer (option)
10. DVD player (option)
11. Remote amplifier (premium system)
12. Audio/video switching unit
13. Antenna amplifier and wavetrap
14. Passenger entertainment control panel

NOTE: Specific components will vary according to vehicle and market specifications.

The entertainment systems comprise:

- Audio system.
- Antenna.
- Speakers.
- Video system.
- Rear multimedia system; refer to **Rear Multimedia System**.

NOTE: The entertainment system may also be operated by spoken commands if the optional **Voice Activated Control System** is installed.

Audio System

The audio system comprises:

- Audio unit.
- CD changer (option).
- Steering wheel telematics controls.
- Remote amplifier (option).

Audio Unit

Depending on vehicle specification, the audio unit is combined with the telematics display module (telematics version, **Fig. 99**) or integrated with the phone keypad and small LCD (non-telematics version, **Fig. 100**).

The audio unit:

- Manages the D2B network and provides the gateway to the SCP network; refer to **D2B network**.
- Stores diagnostic trouble codes for itself and the CD changer (where installed).

NOTE: The installation of new components within the audio system will necessitate the reconfiguration of the system using WDS.

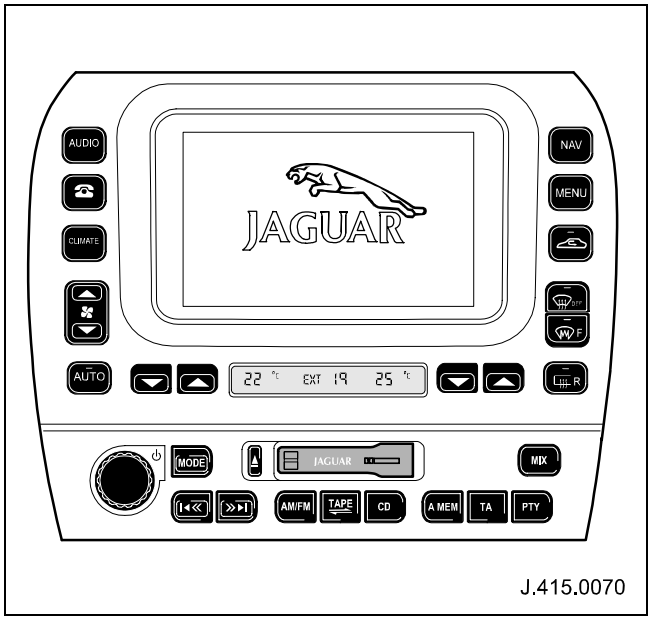

Fig. 99 Audio unit - telematics version

Telematics version

NOTE: The telematics display module also provides the ability for the user to control such features as climate control; refer to **Telematics Display Module**.

The telematics version of the audio unit is integrated with the telematics display module and comprises:

- radio cassette or single-slot CD or single-slot MD
- integral amplifier (4 x 35W output) or remote amplifier (8 x 40W output).

When the rear multimedia option is installed, a 'pop-up window' will appear when certain functions from the rear multimedia system are selected; the window is for information only and will disappear after a few seconds.

Non-telematics version

The non-telematics audio unit comprises:

- radio cassette or single-slot CD or single-slot MD
- liquid crystal display (LCD) including clock;
- integrated phone keypad;
- integral amplifier (4 x 35W output) or remote amplifier (8 x 40W output).

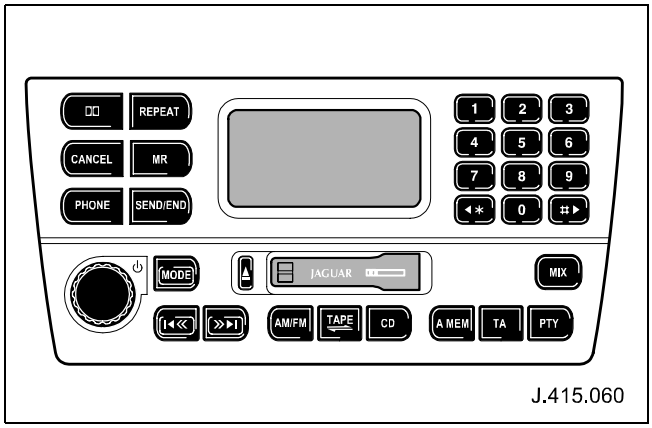

Fig. 100 Audio unit - non-telematics version

NOTE: The non-telematics version of the audio unit is complemented by the climate control panel/module; refer to **Climate Control System**.

Remote Amplifier

The remote amplifier (where installed) is:

- located in the luggage compartment to the left-hand side;
- mounted to the rear-stack bracket;
- capable of delivering 8 x 40W output;
- part of the **D2B network**.

CD Changer

The CD changer (where installed) is:

- located in the luggage compartment to the left-hand side;
- mounted to the rear-stack bracket;
- operated from either version of the audio unit; refer to **Audio Unit**;
- part of the **D2B network**.

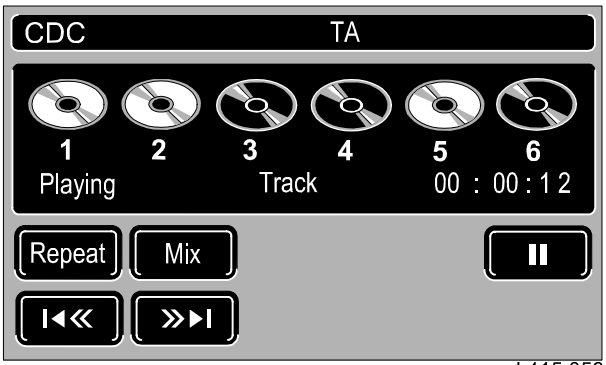

Fig. 101 CD changer - telematics display screen

Steering Wheel Telematics Controls

To ensure minimum disruption to concentration when driving, limited control of audio, telephone and voice activation systems is possible using the steering wheel telematics controls.

The controls provide the following functionality:

- Answer phone call, mute, or select voice activation.
- Increase or decrease volume.
- Selection of radio FM, AM, tape cassette, CDs, and phone ready mode.
- Cycle through preset radio stations, the next CD track or tape AMS (automatic music search).

Antenna

The following antennas (where applicable) are integrated into the rear window glass:

- FM element (incorporated into the demist pattern).
- AM element (separate element at the top left side of the glass).
- The FM/AM antenna amplifier is located at the left-hand C-post and is connected to the screen by press studs.

NOTE: The power connection to the demist screen includes an in-line filter known as a positive wavetrap.

Diversity antenna

Depending on vehicle and market specification the demist screen can be configured as a 3-part diversity antenna to provide improved FM reception in multipath areas. Three antennas are derived from the demist pattern to provide three FM inputs. The amplifier switches between each of the three FM inputs and sends the strongest to the radio.

Diversity antenna for TV and VICS

The television receiver uses '4-part antenna diversity' to obtain the optimum signal from four television antenna patterns. There are four television antenna amplifiers to suit, two are located on the package tray and two at the right-hand C-post.

Japan only

An additional antenna amplifier is installed for the vehicle information communications system (VICS); refer to **Fig. 98**.

Speakers

The premium audio sound system comprises:

- Four lightweight mid-bass door speakers;
- Four door-mounted tweeters;
- Two mid-range speakers (instrument panel mounted);
- Two sub-woofers.

The standard audio sound system comprises:

- Four lightweight mid-bass door speakers;
- Four door-mounted tweeters.

Video System

The video system is optional and dependent on market and vehicle specification, it comprises:

- Telematics display module; refer to **Telematics Display Module**.
- Television antennas and amplifiers; refer to **Antenna**.

The television receiver is integrated into the telematics display module (where applicable) and teletext is available in appropriate markets.

NOTE: The video system may have been extended to accommodate rear seat passengers; refer to **Rear Multimedia System**.

Rear Multimedia System

The rear multimedia system, which is an optional installation, depending on market and vehicle specifications, comprises:

- Passenger entertainment control panel;
- Rear multimedia displays;
- DVD player;
- Audio/video switching unit.

The rear multimedia system provides rear seat passengers with the opportunity to select from a choice of different entertainment sources, independent of each other and to that selected by the front passenger. The system is flexible enough to allow for example, the front passenger to watch a television broadcast, one rear passenger to watch a DVD and the other to use a games console.

NOTE: Rear seat passengers can also control the main entertainment system components: audio unit (tape cassette/mini-disc/tuner) and CD changer.

In addition, when combined with the multi-zone voice option, the system allows rear seat passengers to participate in hands-free conference calls (provided the cellular phone system is installed) or to voice-control audio and climate control functions.

Passenger Entertainment Control Panel

Depending on market and vehicle specifications, the panel is located in the rear armrest or the rear floor console. The panel is part of the D2B network; refer to **D2B network** and interfaces with the audio/video switching unit to facilitate user control of any installed multimedia options; refer to **Fig. 105**.

The panel has two input sockets to allow individual connection of audio headsets and two sets of auxiliary inputs to allow connection of external audio/video sources such as a games console, a camcorder or an MP3 player.

NOTE: The passenger entertainment control panel can be inhibited by front seat passengers.

To inhibit the passenger entertainment control panel:

- non-telematics version - select and hold the 'MODE' button on the audio unit until 'TRAFFIC' is displayed. Repeatedly press the 'MODE' button until 'RMS' mode is displayed (this immediately follows the RMS rear speaker mode setting). Use the 'TRACK UP'/'TRACK DOWN' keys to make the desired selection.
- telematics version - select 'MENU' from the telematics screen, followed by 'REAR MULTIMEDIA', then select from one of the three options: Unlock, Headphone Only, Lock.

NOTE: Cellular phone and voice capabilities will also be inhibited.

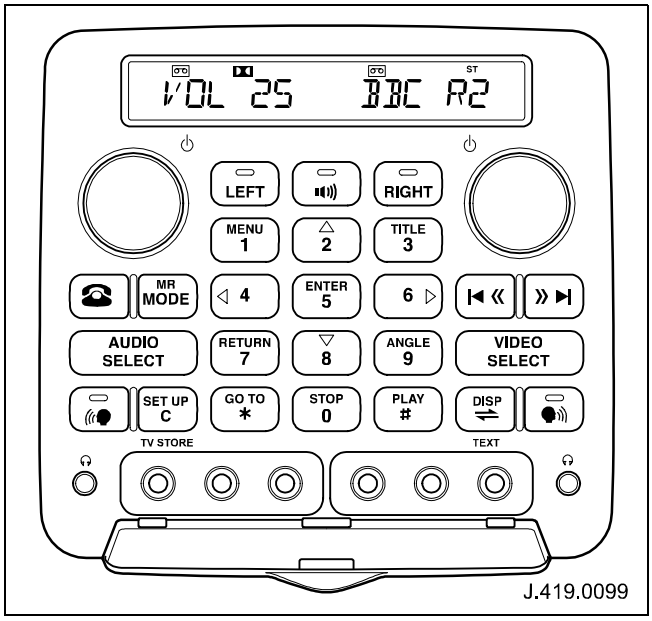

Fig. 102 Passenger entertainment control panel

Depending on the options installed, the control panel can be used to select and control the following: single CD, mini-disc, tape cassette and tuner, DVD, TV (including teletext, where available) and cellular phone dialing.

NOTE: The panel, provided the multi-zone voice option is installed, allows rear seat passengers to participate in hands-free conference calls (provided the cellular phone system is installed) or to voice-control audio and climate control functions; refer to **Voice Activated Control System**.

Audio can be directed to one of three output sources by selecting the appropriate mode:

- LEFT headset
- CABIN speakers
- RIGHT headset

NOTE: Selection of the mode is confirmed by the illumination of the tell-tale LED on the corresponding button.

Momentarily pressing the 'AUDIO SELECT' button on the passenger entertainment control panel displays the current signal source. A different source can be selected by each subsequent press of the button until the desired choice is displayed. Available options (subject to that particular option being installed) include: FM, AM (MW, LW), TAPE (or MD, CD), TV, DVD, AUX1, AUX2.

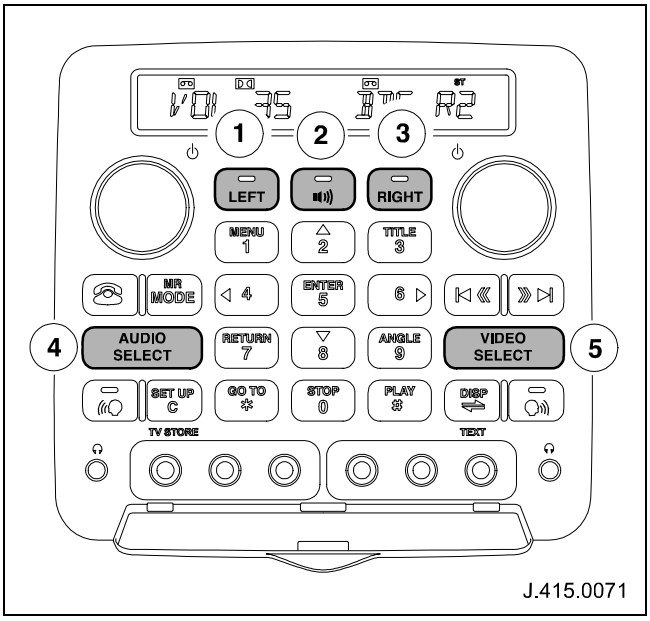

Fig. 103 Selection control buttons

1. LEFT headset select
2. CABIN speakers select
3. RIGHT headset select
4. AUDIO SELECT
5. VIDEO SELECT

Rear Multimedia Display

The rear multimedia displays are 6.5in color liquid crystal displays, mounted within the head restraints of the front seats.

Each display has the following user controls:

- 'ON/OFF' button.
- 'MENU' button.
- Two buttons: '-' and '+'for navigating the 'on-screen' options.

Momentarily pressing the 'VIDEO SELECT' button on the passenger entertainment control panel displays the current signal source. A different source can be selected by each subsequent press of the button until the desired choice is displayed. Available options (subject to that particular option being installed) include: TV, DVD, AUX1, AUX2.

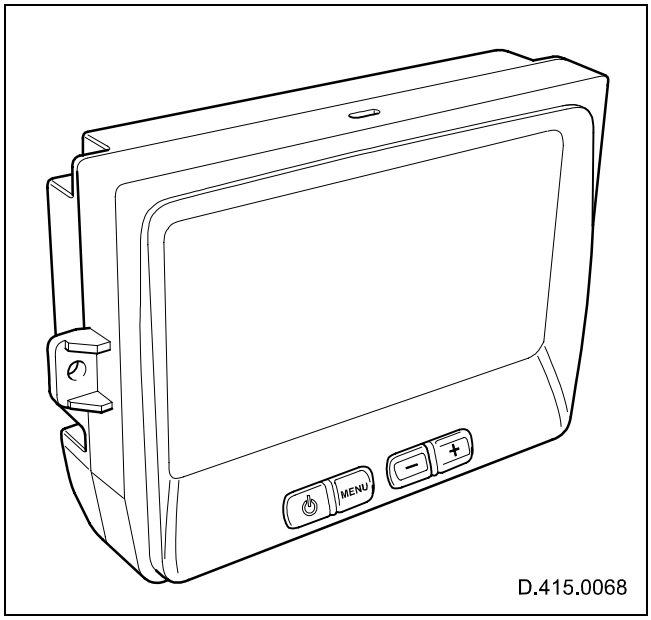

Fig. 104 Rear multimedia display

DVD Player

The optional DVD player is mounted to the left-hand side of the luggage compartment as part of the multimedia stack.

NOTE: The DVD player is region-specific and therefore will only read compatible DVDs.

Audio/video Switching Unit

The audio/video switching unit interfaces with any installed multimedia equipment and the passenger entertainment control panel to allow rear seat passengers to select a particular signal source, which typically includes:

- Television (via the telematics display module).
- Main audio (CD, mini-disc, tuner).
- DVD player.

The diagram, **Fig. 105** provides an indication of how the unit interfaces the multimedia components; refer to **New XJ Range Electrical Guide** for detailed connection information.

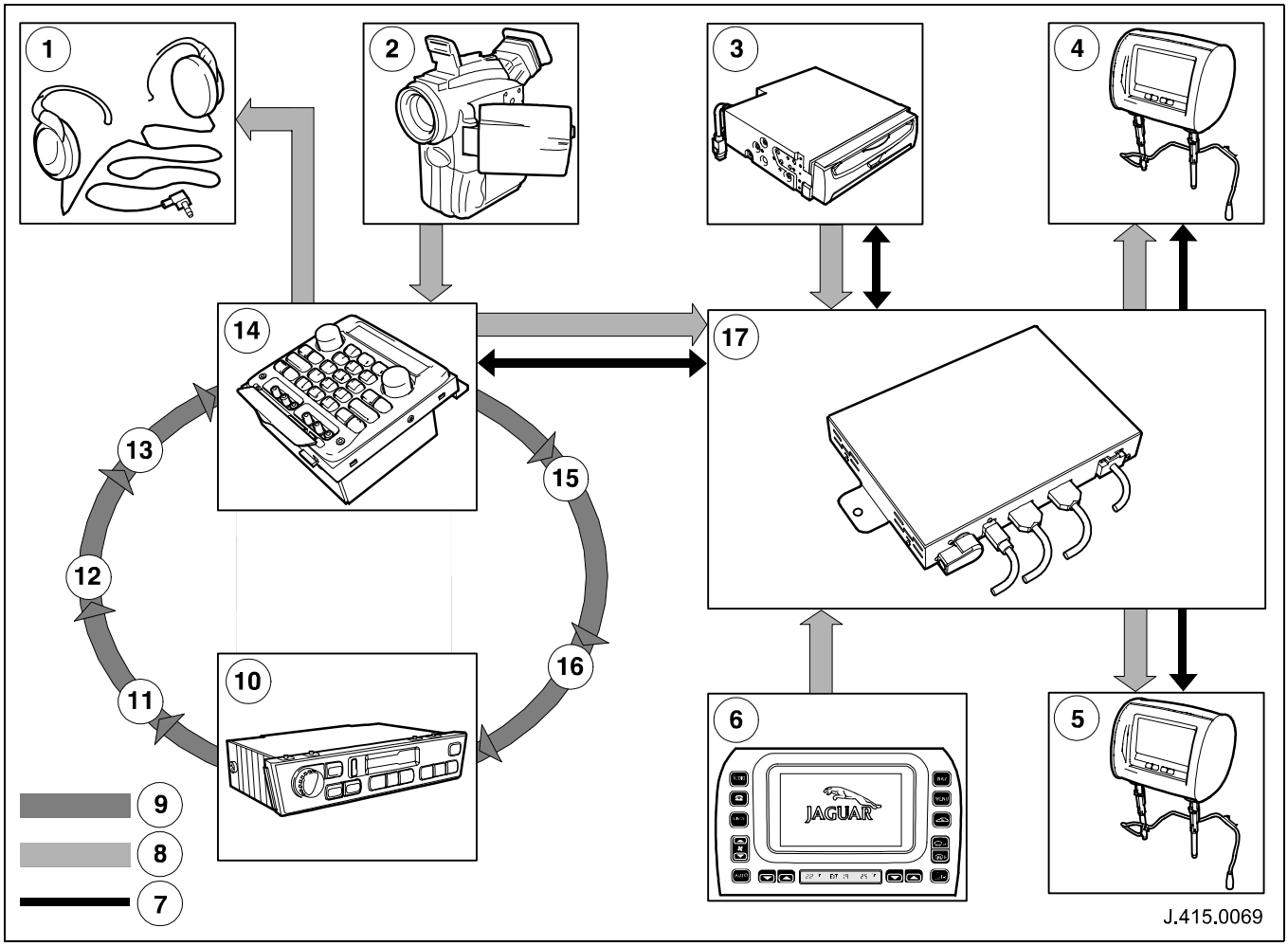

Fig. 105 Audio/video switching interface diagram

1. Personal headset
2. Camcorder (or other compatible device)
3. DVD player
4. Rear multimedia display
5. Rear multimedia display
6. TV receiver (integral to telematics module)
7. Control signals
8. Audio/video signals
9. D2B network
10. Audio unit
11. CD changer
12. Cellular phone control module
13. Voice activation module
14. Passenger entertainment control panel
15. Navigation control module
16. Power amplifier
17. Audio/video switching unit

Lighting

Exterior Lighting

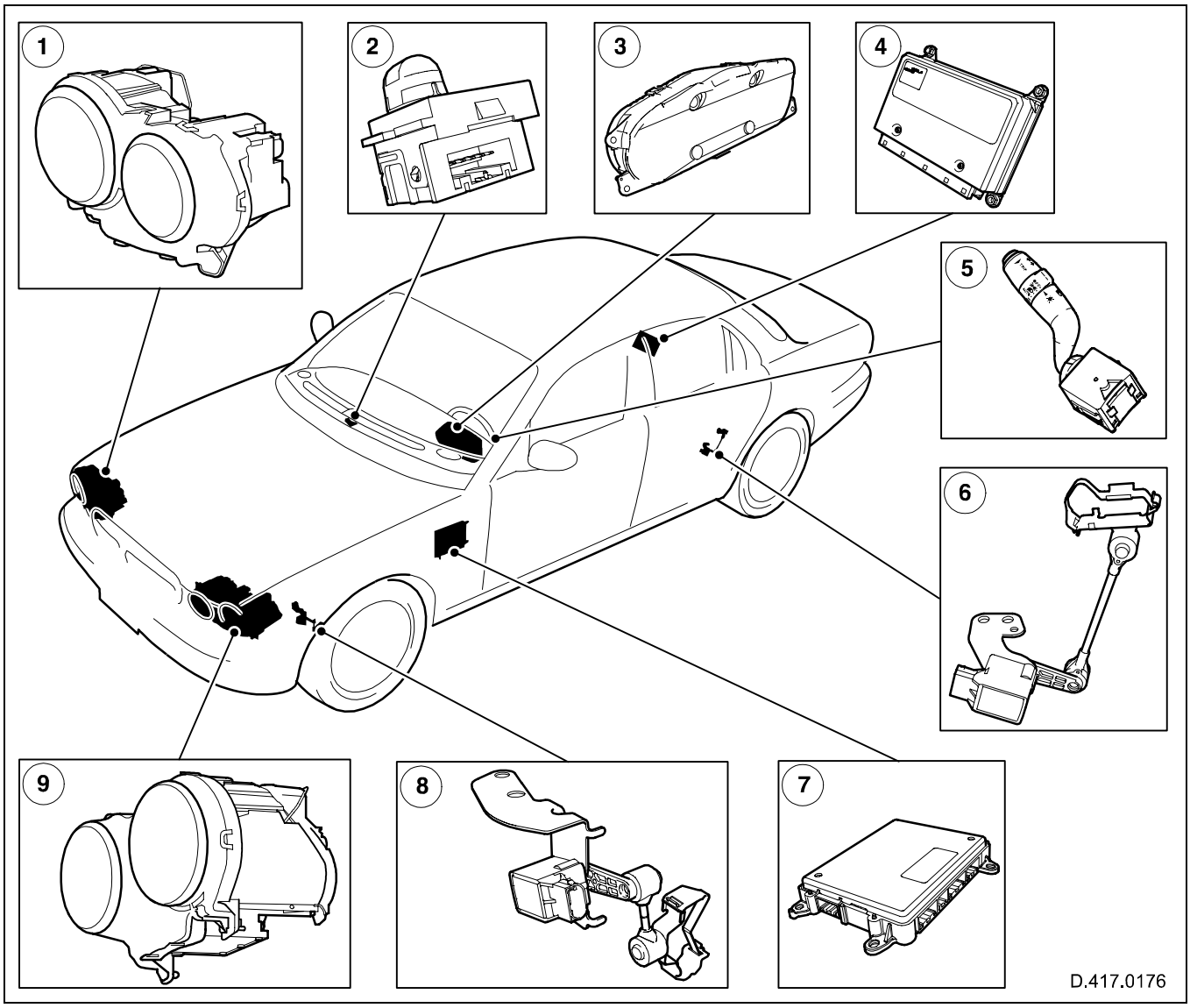

Fig. 106 Headlamp features

1. Right-hand headlamp assembly
2. Autolamp sensor
3. Instrument cluster
4. Air suspension module
5. Main lighting switch
6. Left-hand rear-axle level sensor assembly
7. Front electronic module
8. Left-hand front-axle level sensor assembly
9. Left-hand headlamp assembly

The exterior lighting is activated by choosing the appropriate option on the main lighting switch assembly (the left-hand column stalk).

Depending on market and vehicle specification the headlamp assembly will comprise one of three options:

- Conventional halogen lighting.
- Xenon, high intensity discharge lighting (low beam functionality only).

NOTE: A conventional halogen bulb is used for the high beam and 'flash-to-pass' feature.

- Bi-xenon, high intensity discharge lighting (high and low beam functionality).

NOTE: A conventional halogen bulb is used for the 'flash-to-pass' feature only. The xenon lamp is not suitable for operating in this manner, doing so will cause premature failure of the lamp and/or the control module.

All lighting input signals are decoded by the instrument cluster and an appropriate signal sent via the SCP network to the front electronic module (FEM) and rear electronic module (REM). Providing other conditions are correct, the FEM and REM will output a ground signal to the appropriate lamps or relays; refer to **New XJ Range Electrical Guide** for detailed information.

Main Lighting Switch

The left-hand stalk is a multi-function switch assembly used to activate the following as appropriate:

- Side lamps;
- Low-beam headlamp;
- High-beam headlamp;
- Autolamp;
- Turn signal indicator lamps;
- Exit delay;
- Trip cycle; refer to **Odometer, Trip Odometer / Trip Computer**.

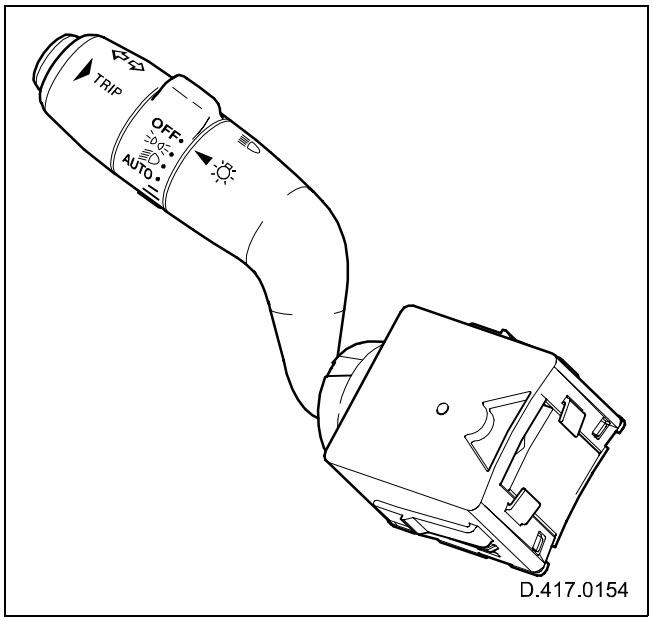

Fig. 107 Main lighting switch

Exit delay

The exit-delay feature is controlled by the front electronic module (FEM) and is activated when one of the exit-delay positions is selected using the rotary collar on the main lighting switch. Depending on the position selected, the main beam will illuminate for 10s, 30s or 2m.

NOTE: The feature does not function when the rotary collar is set to 'AUTO'.

Halogen Headlamps

NOTE: Approximately 5 minutes after activating the headlamps, a noticeable fall in light output may be observed. The effect is due to a voltage boost feature that has been introduced; refer to **Generator and Regulator**.

Bi-xenon and Xenon High-Intensity Discharge Headlamps

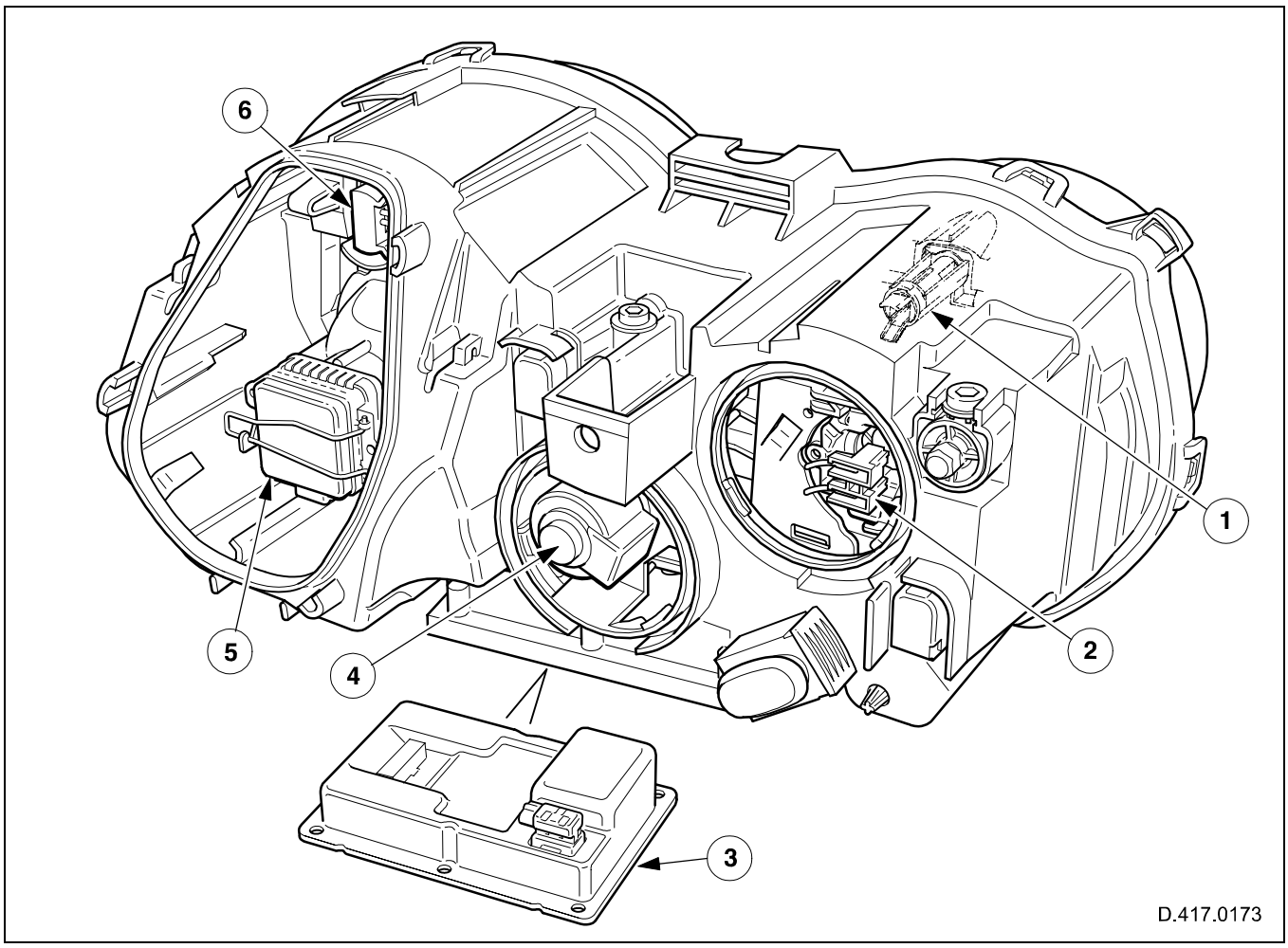

Fig. 108 High-intensity discharge lamp assembly

1. Pilot lamp
2. High beam (flash-to-pass) lamp
3. Xenon lamp control module
4. Motor (automatic headlamp leveling)
5. Xenon lamp assembly
6. Turn signal lamp

NOTE: Due to national legislation, vehicles equipped with high-intensity discharge headlamps require the installation of **Automatic Headlamp Leveling** and a **Headlamp Cleaning System**.

The high-intensity discharge headlamp assembly (where applicable) comprises:

- Xenon lamp;
- Halogen lamp;
- Pilot lamp;
- Turn signal lamp;
- Xenon lamp control module;
- Ignitor;
- Headlamp leveling motor.

Vehicles fitted with the high-intensity discharge lighting system use xenon lamps for the low beam instead of standard halogen lamps.

NOTE: In some markets, vehicles are fitted with a bi-xenon lamp assembly that can also provide a high beam output; refer to **Xenon Lamp Assembly**

- The turn signal and pilot lamps are conventional lamps.

Xenon Lamp Assembly

The bi-xenon lamp uses a solenoid-operated flap to switch between low and high-beam operation. During low-beam operation the flap prevents light from entering the bottom of the diverging lens. When high-beam is required, operation of the high-beam switch, energizes the solenoid, which moves the flap away from the xenon lamp, allowing light to enter the bottom of the diverging lens to produce the high-beam pattern.

NOTE: A conventional halogen bulb is used for the 'flash-to-pass' feature only; the xenon lamp is not operated. Igniting and extinguishing the xenon lamp several times during a small period of time, will cause premature failure of the lamp and/or the control module.

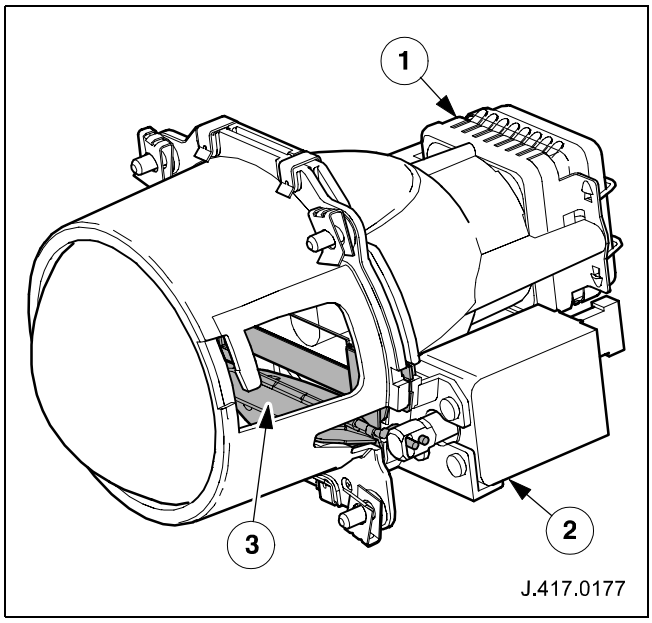

Fig. 109 Bi-xenon lamp assembly

1. Igniter
2. Solenoid
3. Flap

The 35 watt xenon lamp produces a beam with an intensity that is approximately three times that produced by a conventional lamp of the same wattage.

The chamber, item 1 (**Fig. 110**) contains xenon gas and a mixture of metal halide salts.

High voltage (typically 20kV) ignition is provided by the xenon lamp control module and an arc forms in the chamber as the gap between the two electrodes is bridged. After ignition there is a warm-up period of approximately three seconds, during which the metal-halide salts evaporate. This brief excess-current phase is followed by stabilization of the arc and the regulation of the lamp output at 35W by the control module.

NOTE: Unlike conventional lamps, xenon lamps do not deteriorate and so should last the lifetime of the vehicle.

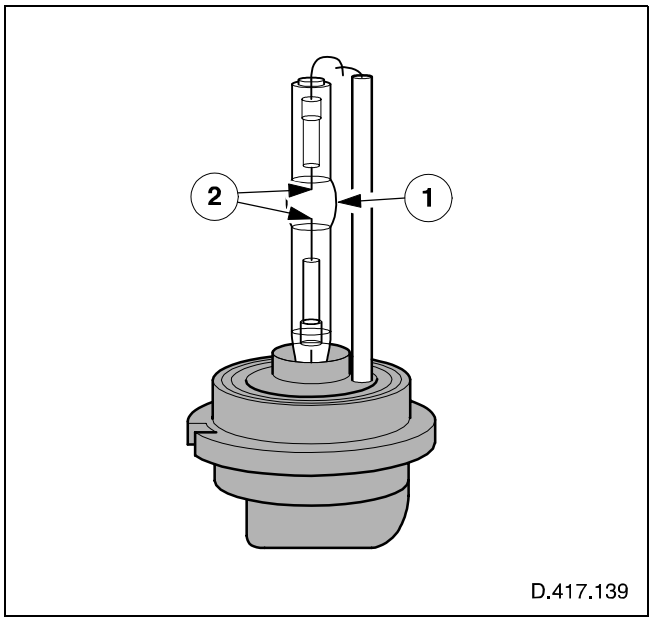

Fig. 110 Xenon lamp

1. Gas-filled chamber
2. Electrodes

Xenon Lamp Control Module

Each high-intensity discharge (HID) lamp assembly has a separate control module, which in addition to regulating start-up and stabilizing output, provides circuit protection by recognizing malfunction conditions such as power supply deviations and short circuits.

NOTE: The high-voltage stage will be deactivated unless all system components are functional and correctly connected.

In addition, a headlamp leveling drive circuit is integral to the xenon lamp control module. The drive circuit monitors input signals received from the air suspension module and outputs a drive signal to the headlamp leveling motor that will correct the position of the lamps.

Automatic Headlamp Leveling

NOTE: After disconnecting any element of the automatic headlamp leveling system, recalibration will be necessary using WDS.

The system comprises:

- Left-hand front, height sensor assembly;
- Left-hand rear, height sensor assembly;
- Air suspension module;
- Left-hand, headlamp leveling motor;
- Left-hand, xenon lamp control module;
- Right-hand headlamp leveling motor;
- Right-hand xenon lamp control module.

Automatic headlamp leveling is operational when the ignition key is at position 'II'.

NOTE: Each time that the ignition key is turned to position 'II', the headlamp levelling motors are recalibrated to ensure that the headlamps are set at the correct height in relation to vehicle attitude.

The headlamp leveling drive circuit is integral to the xenon lamp control module. The left-hand height-sensors (part of the air suspension system) are inductive devices that respond to the vertical position of the vehicle and supply feedback signals to the air suspension module (ASM). The ASM processes the data and supplies a pulse-width modulated (PWM) signal to each xenon lamp control module. The signal is monitored every 10ms, should it deviate from the last stored values, the module will cause the headlamp leveling motors to drive the headlamps to a new, calculated position. A schematic representation of the component interconnections is shown in **Fig. 111**; refer to **New XJ Range Electrical Guide** for detailed connection information.

NOTE: Due to data processing time, there is a delay of approximately 80ms between changes in suspension height and any headlamp adjustments that may be required.

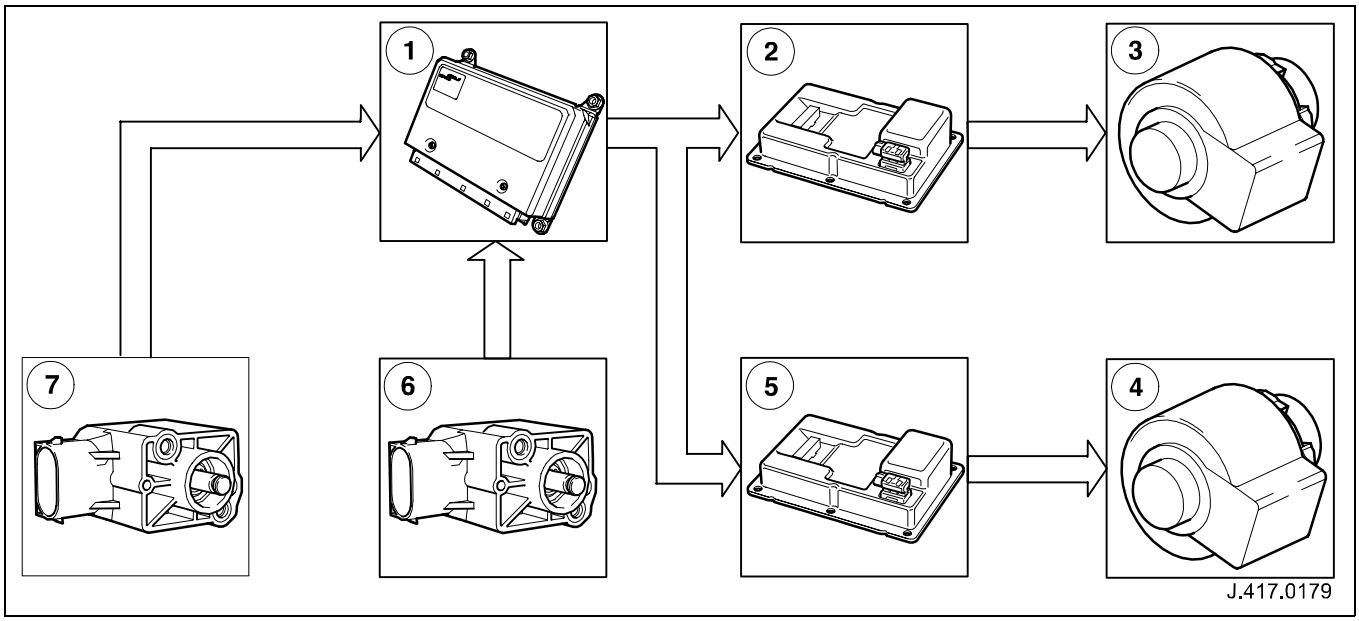

Fig. 111 Automatic headlamp leveling system

1. Air suspension module
2. Left-hand xenon lamp control module
3. Left-hand headlamp leveling motor
4. Right-hand headlamp leveling motor
5. Right-hand xenon lamp control module
6. Left-hand front height sensor
7. Left-hand rear height sensor

Diagnostics

System malfunctions will cause a DTC to be stored in the xenon lamp control module. Retrieval of the DTC and subsequent diagnosis of the system should be undertaken using WDS.

Auxiliary Lighting Switch

The auxiliary lighting switch assembly comprises:

- Dimmer control; refer to **Instrument Cluster and Panel Illumination**.
- Trip computer switches; refer to **Odometer, Trip Odometer / Trip Computer**.
- Front and rear fog switches; refer to **Front and Rear Fog Lamp Switches**.

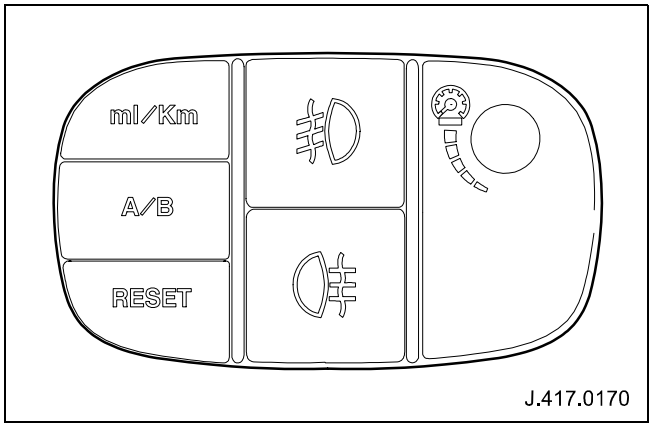

Fig. 112 Auxiliary lighting switch

Autolamp

The operation of the autolamp feature (where applicable) is dependent on ambient light levels, monitored by photo-diodes integrated into the autolamp sensor. The sensor provides feedback to the instrument cluster, which responds by supplying control signals on the SCP network to the front electronic module (FEM) and rear electronic module (REM). Where appropriate, the side lamps and low-beam headlamps will operate automatically providing:

- The ignition key is at position 'II' or 'III'.
- The AUTO option on the main lighting switch is selected.

NOTE: Since the operation of the lamps depends on the sensor, which is located behind the demist grille of the instrument panel, it is important that the windshield be kept clean and that the sensor is not covered.

The sensor is calibrated to monitor ambient light levels as follows:

- Detection of darkness for 3 seconds continuously, will cause the low beam and side lamps to be activated.
- Detection of daylight for 15 seconds continuously, will cause the exterior lighting to be extinguished.
- Detection of semi-darkness for 15 seconds continuously, will cause the low beam and side lamps to be activated.

NOTE: Japanese specification autolamp responds to darkness after 1.5 seconds and daylight after 4 seconds.

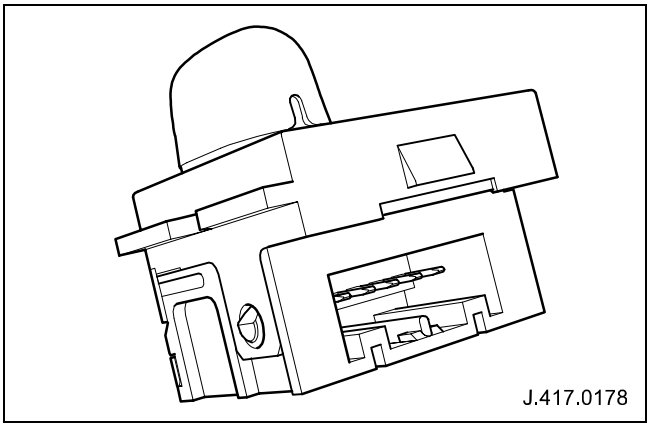

Fig. 113 Autolamp sensor

Rear Lamp Assembly

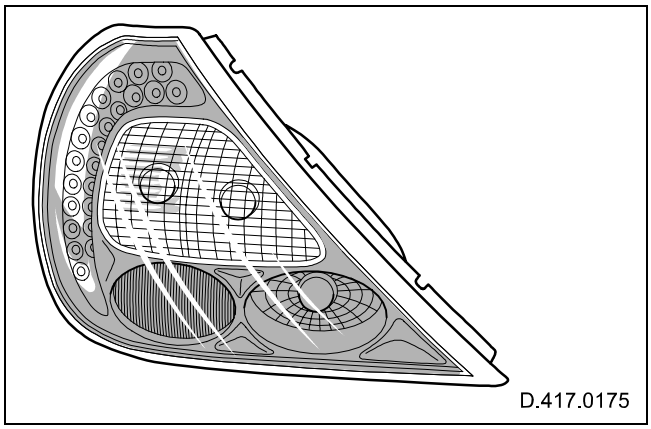

Fig. 114 Lens - rear lamp assembly

The rear lamp assembly uses conventional tungsten bulbs for the turn signal, fog guard and reversing lights.

The tail and stop lights share twenty-four, pcb-mounted LEDs.

Using LEDs instead of conventional tungsten filament bulbs provides the following advantages:

- Lower energy consumption.
- Reduction in heat generated (allowing the distance between the lens and the light source to be reduced).
- Increased reliability and longer service life.
- Constant light intensity over the life of the LEDs.
- A faster operational response time of approximately 130ms for the LEDs compared with 210ms for a conventional bulb.

NOTE: The LEDs can be replaced only as a complete PCB assembly.

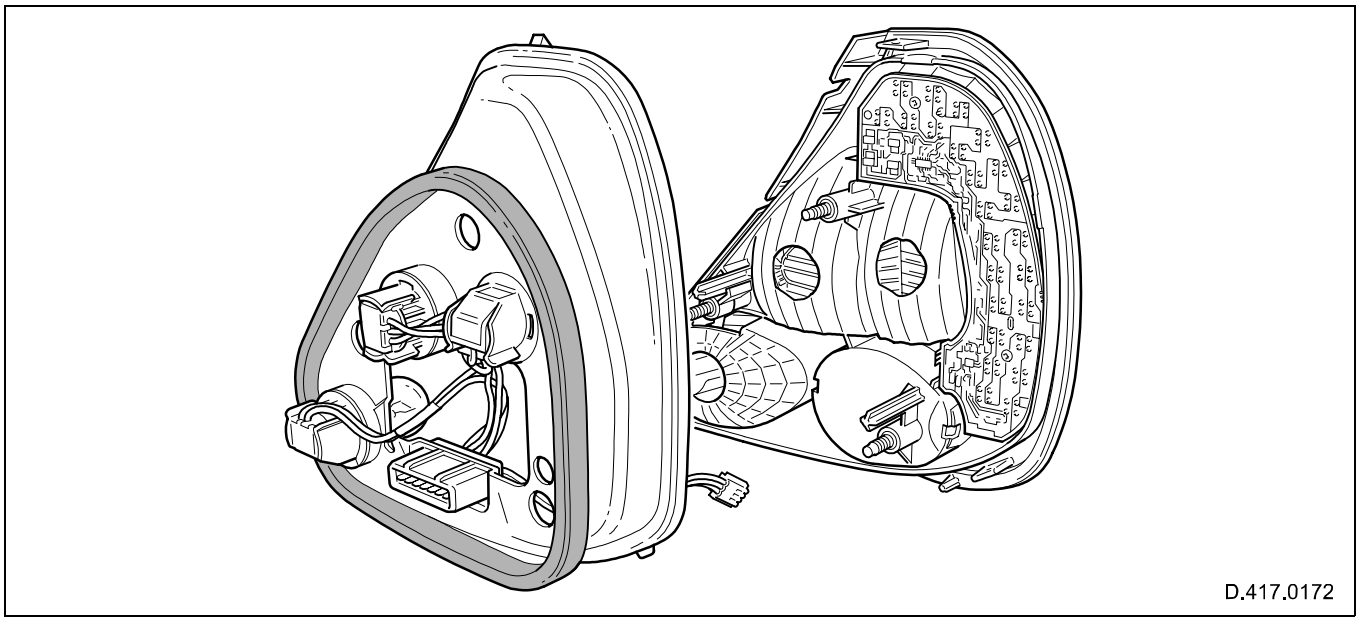

Fig. 115 Rear lamp assembly

When the lighting switch is operated to activate the main vehicle lighting, all LEDs are illuminated at a constant intensity level to provide the tail lights. Subsequent operation of the footbrake pedal will cause all LEDs to illuminate at a higher intensity to provide the stop lights.

NOTE: The high-mounted stop light operates in synchronization with the stop lights.

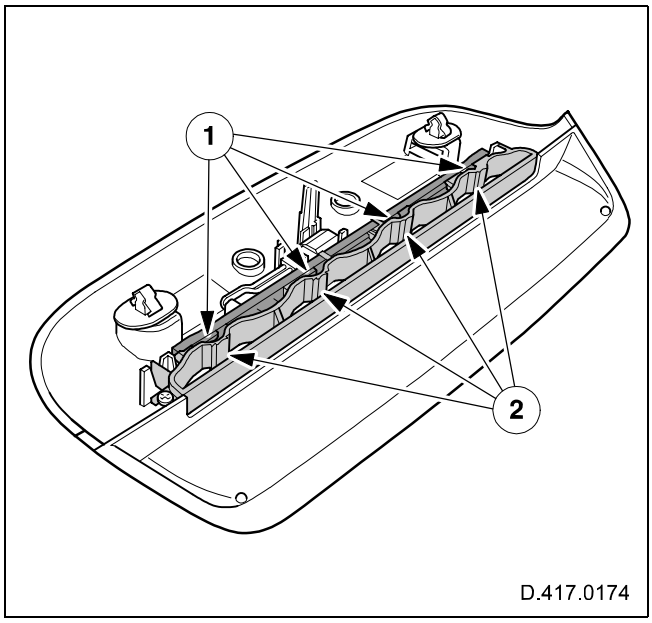

Fig. 116 High-mounted stop light

1. LEDs
2. Fresnel lens

Front and Rear Fog Lamp Switches

The switches are mounted within the auxiliary lighting switch assembly and intended to function as follows:

- Front fog lamps
  - The lamps are activated by 'pressing' the appropriate button, provided the SIDE LAMPS or LOW BEAM has been activated and the ignition key is at position 'II'.
  - The lamps are deactivated by pressing the same button.

NOTE: In some markets the front fog lamps will not operate if main beam is selected.

- Rear fog lamps
  - The lamps are activated by 'pressing'the appropriate button, provided that the LOW BEAM has been activated with the ignition key at position 'II' or the front fog lamps are already active.
  - The lamps are deactivated by pressing the same button.

NOTE: The rear fog lamps are not available for some markets.

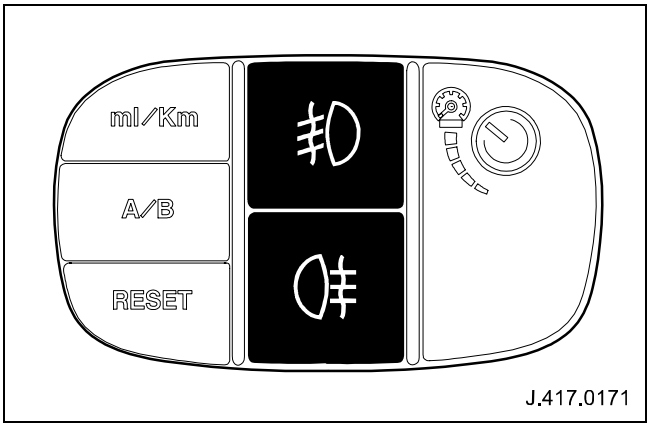

Fig. 117 Front and rear fog lamp switches

Refer to **New XJ Range Electrical Guide** for detailed electrical connection information.

Approach Lamps

Approach lamps are integrated in the exterior mirrors to provide ground illumination for the area around the front doors. Although the lamps are mounted externally, they are controlled by the interior lighting circuit: refer to **Interior Lighting**.

Interior Lighting

The interior lighting comprises:

- Footwell lamps.
- Puddle lamps.
- Courtesy lamps and switch.
- Front map lamps and switches.
- Vanity mirror lamps and switches.
- Rear map lamps and switches.
- Luggage compartment lamps.
- Glove compartment lamp and switch.
- Approach lamps

NOTE: Refer to **New XJ Range Electrical Guide** for detailed connection information.

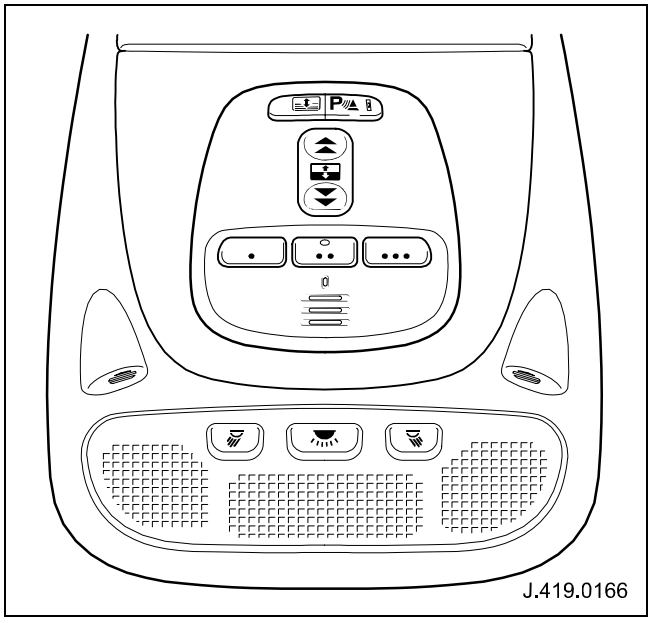

Fig. 118 Front interior lighting

Battery Saver

A timer function within the front electronic module (FEM) and rear electronic module (REM) controls the battery saver feature:

- The timer is initialized when the ignition key is turned to position '0' or removed from the ignition barrel.
- After a 40 minute period, the FEM and/or REM will remove the battery voltage from the interior lighting by deactivating the appropriate relays.

The battery saver feature will be reactivated when:

- The ignition key position is changed.
- Any door (including the luggage compartment door) becomes ajar or is opened.
- An external unlock is activated using either the door lock cylinder or the integrated key transmitter.
- The courtesy lamps' switch is activated.

Courtesy Lighting

The courtesy lamps are controlled by the front and rear electronic control modules in the following circumstances:

- Any of the vehicle's doors are open/closed.
- An external unlock is activated using either the door lock cylinder or the integrated key transmitter.
- The courtesy lamps' switch is activated.

Provided that the courtesy lamps' switch is not activated, the courtesy lighting feature extinguishes the courtesy lamps when all the vehicle's doors are closed and any of the following occurs:

- Fifteen seconds have elapsed since either an external unlock or the last door has closed, whichever occurs last.
- The engine is started.
- An external lock is activated using the door lock cylinder or integrated key transmitter.

In addition, the courtesy lighting feature extinguishes the courtesy lamps when the battery saver timer has expired; refer to **Battery Saver**.

During normal operation the courtesy lamps:

- Progressively illuminate when activated.
- Progressively extinguish when deactivated.

NOTE: When the battery saver feature is active the lamps will extinguish immediately.

Approach Lamps

Approach lamps are integrated in the exterior mirrors to provide ground illumination for the area around the front doors. The lamps are activated when:

- the vehicle is unlocked using the key, the key transmitter or the master locking switch;
- the headlamp convenience button on the key transmitter is pressed;
- reverse is selected.

NOTE: The approach lamps will not illuminate if the ambient light, as determined by the autolamp sensor, is above a predetermined level.

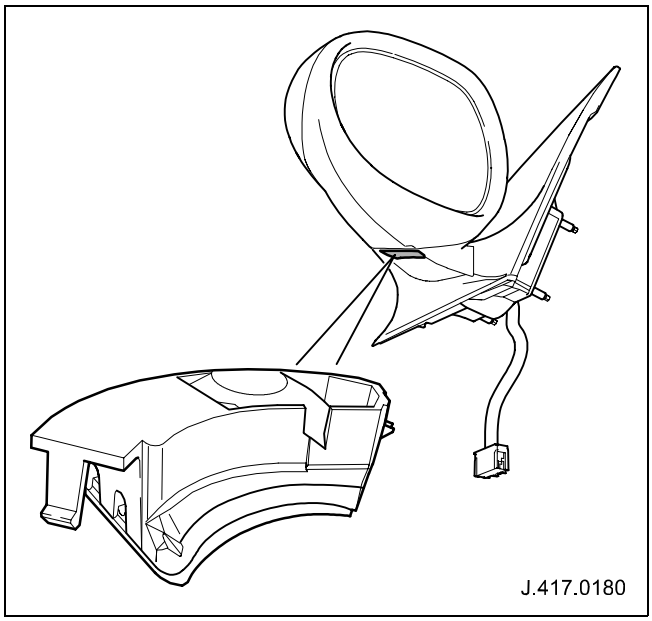

Fig. 119 Approach lamp

Electrical Distribution

Module Communications Network

The most significant change to the XJ distribution system is the introduction of optical fiber cables, which accommodate the transfer of very high-speed, real-time audio data.

The optical fibers provide an optical network that interfaces to the SCP network via the audio unit; refer to **D2B network** for detailed information.

NOTE: The optical network currently uses a transfer protocol known as D2B. Although this protocol may change in the future, the optical network will be referred to as 'D2B' throughout this and other Jaguar technical publications.

SCP, CAN and ISO9141 networks

The standard corporate protocol (SCP), controller area network (CAN) and ISO9141 networks are configured in a similar way to current Jaguar models to accommodate different data types and flow rates as required for the various vehicle features; refer to **Table 5**.

Network	Communication between	Speed (kbps)
CAN	Engine, Transmission, Braking System	500
SCP	Lower Speed Body Systems	41.6
ISO9141	Diagnostic connector and ECM; control modules with self-diagnostic capability not connected to CAN or SCP	10.4
D2B	Very high-speed, real-time audio data.	5500

Table 5 Network communication

Fig. 120 provides a representation of the major network interconnections; refer to **New XJ Range Electrical Guide** for detailed information.

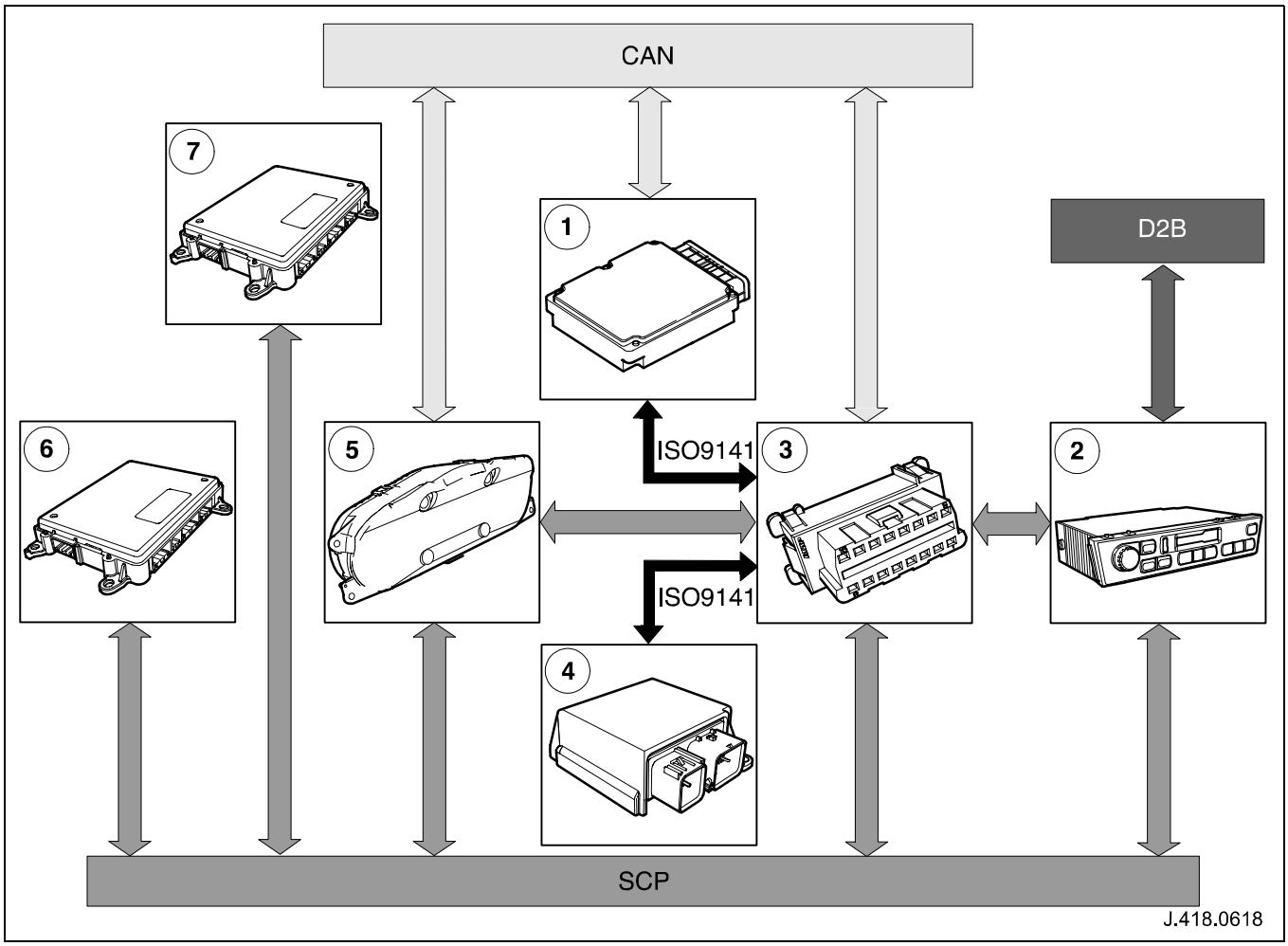

Fig. 120 Network interconnections

1. Engine control module
2. Audio unit
3. Diagnostic connector
4. Restraints control module
5. Instrument cluster
6. Front electronic module
7. Rear electronic module

Controller Area Network (CAN)

Fig. 121 provides a schematic representation of the CAN interconnections; refer to **New XJ Range Electrical Guide** for detailed information.

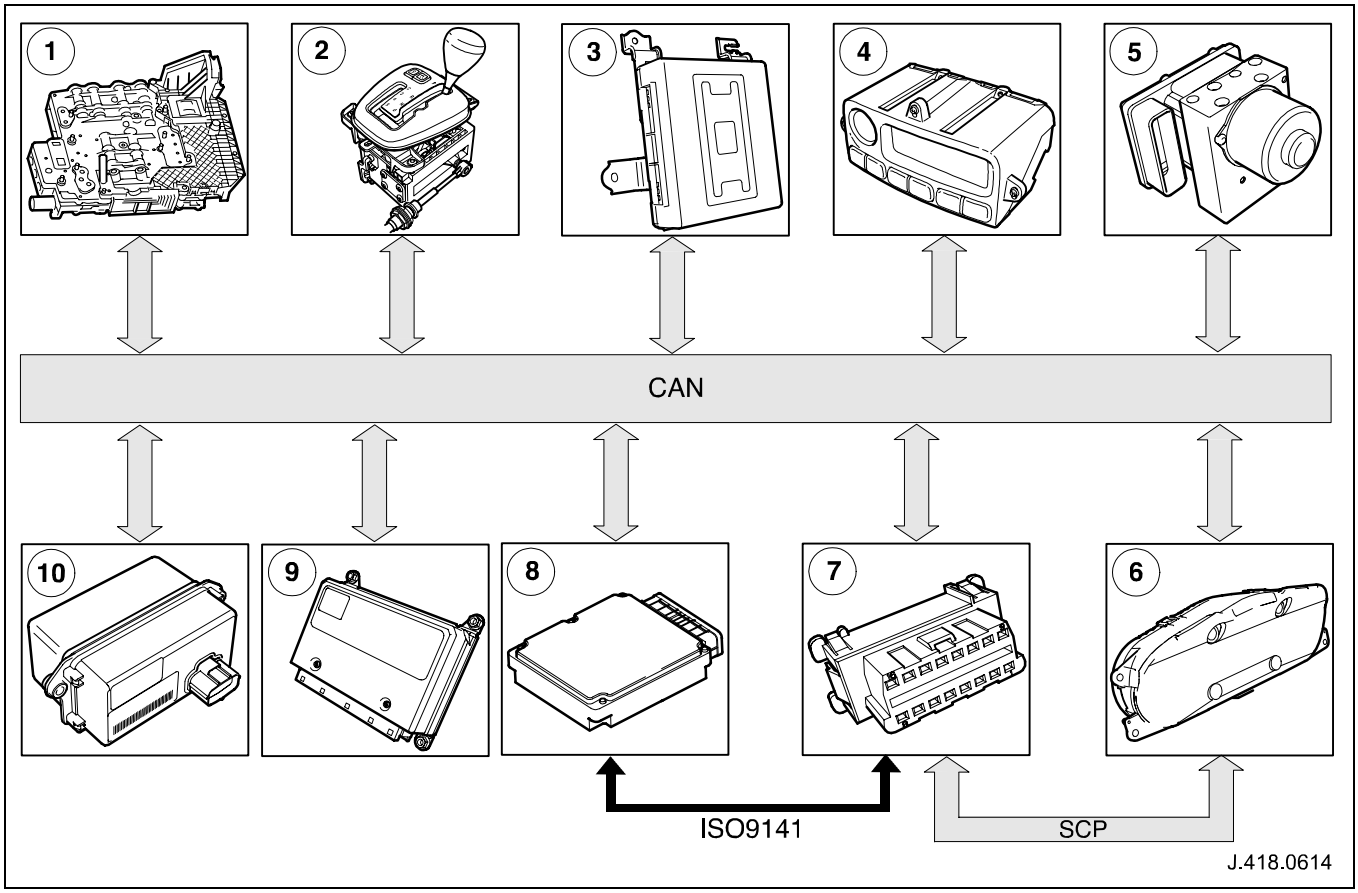

Fig. 121 Controller area network (CAN)

1. Transmission control module (and main control valve body)
2. J-gate module
3. Remote climate control module (telematics only)
4. Rear climate control panel
5. ABS module
6. Instrument cluster
7. Diagnostic connector
8. Engine control module
9. Air suspension module
10. Adaptive speed control module

Standard Corporate Protocol (SCP) Network

Fig. 122 provides a schematic representation of the SCP network interconnections; refer to **New XJ Range Electrical Guide** for detailed information.

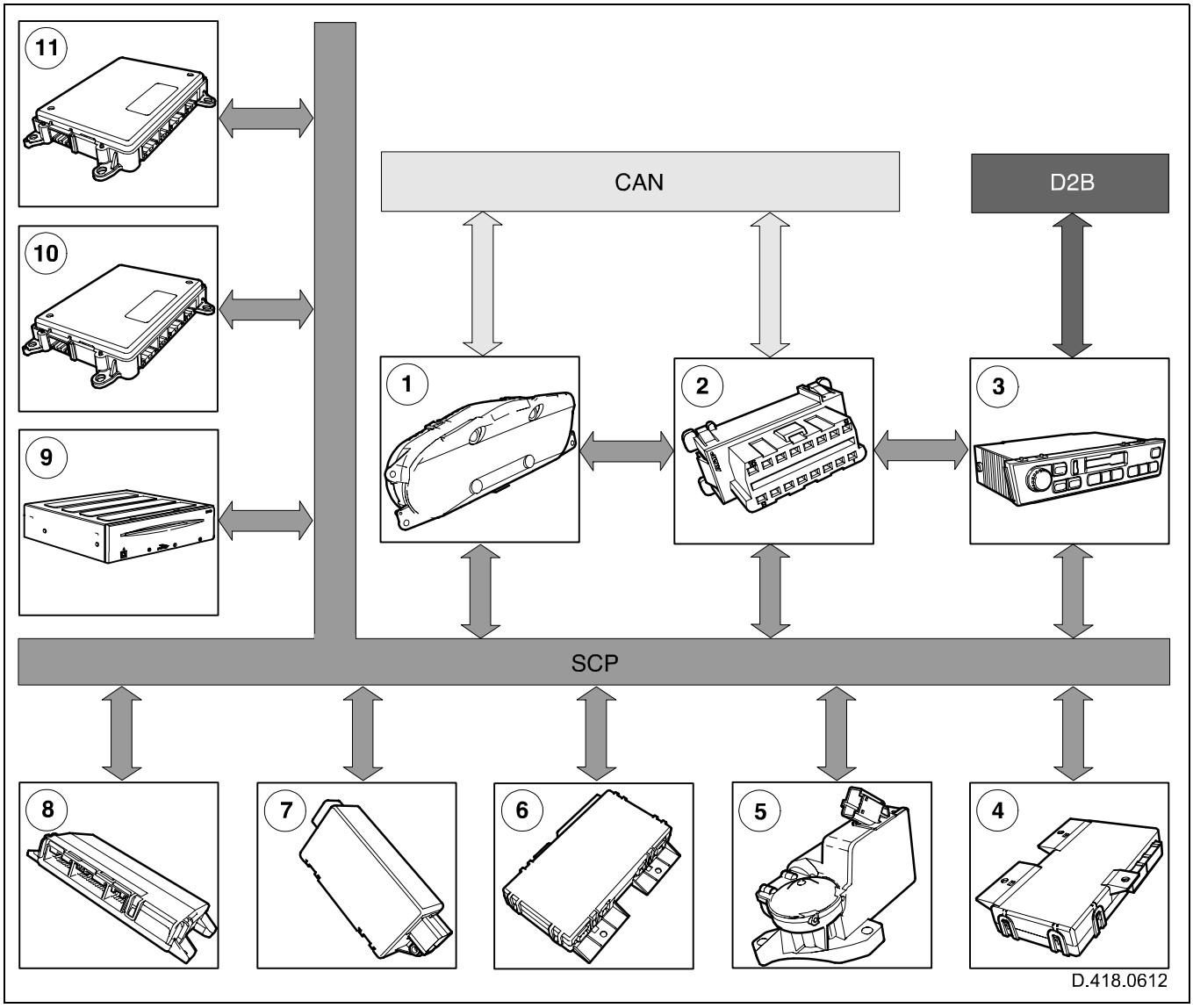

Fig. 122 SCP network

1. Instrument cluster
2. Diagnostic connector
3. Audio unit
4. Driver seat module
5. Steering column lock module
6. Rear memory module
7. Parking brake module
8. Driver door module
9. Navigation control module
10. Front electronic module
11. Rear electronic module

Network modules

Fig. 123 shows the main modules and locations; refer to the appropriate section and to **New XJ Range Electrical Guide** for detailed information.

NOTE: Refer to **Navigation System** for location of Navigation Control Module.

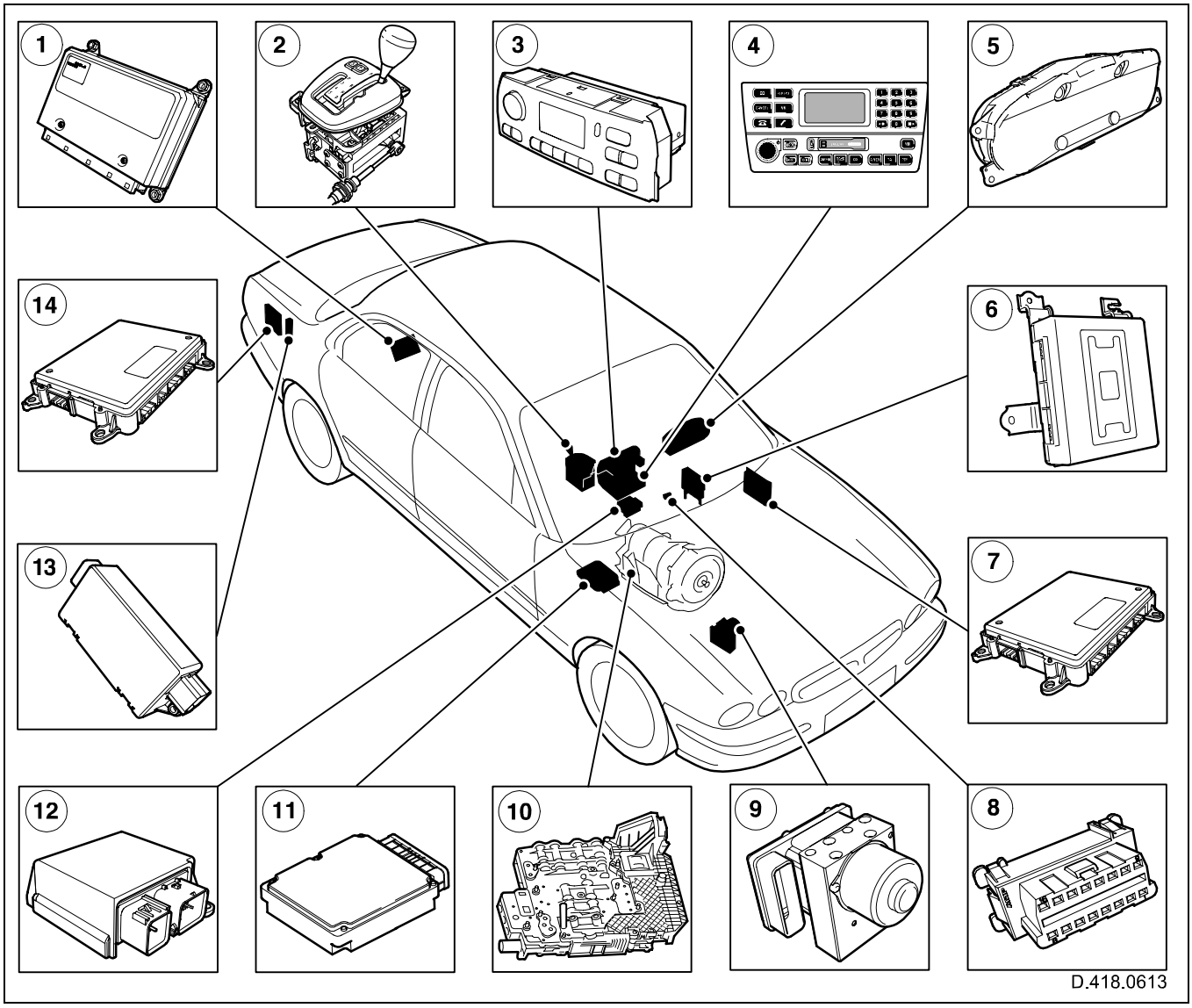

Fig. 123 Location of network modules

1. Air suspension module
2. J-gate module
3. Climate control module (non-telematics)
4. Audio unit (non-telematics)
5. Instrument cluster
6. Remote climate control module (telematics only)
7. Front electronic module
8. Diagnostic connector
9. ABS module
10. Transmission control module (and main control valve body)
11. Engine control module
12. Restraints control module
13. Parking brake module
14. Rear electronic module

D2B network

The D2B network comprises:

- Optical fiber.
- Wake-up wire.
- Master module (audio unit).
- Slave module(s).
- Intermediate connectors.

The network:

- is structured as a unidirectional ring;
- uses plastic optical fiber to transport data from one module to another in ring order.

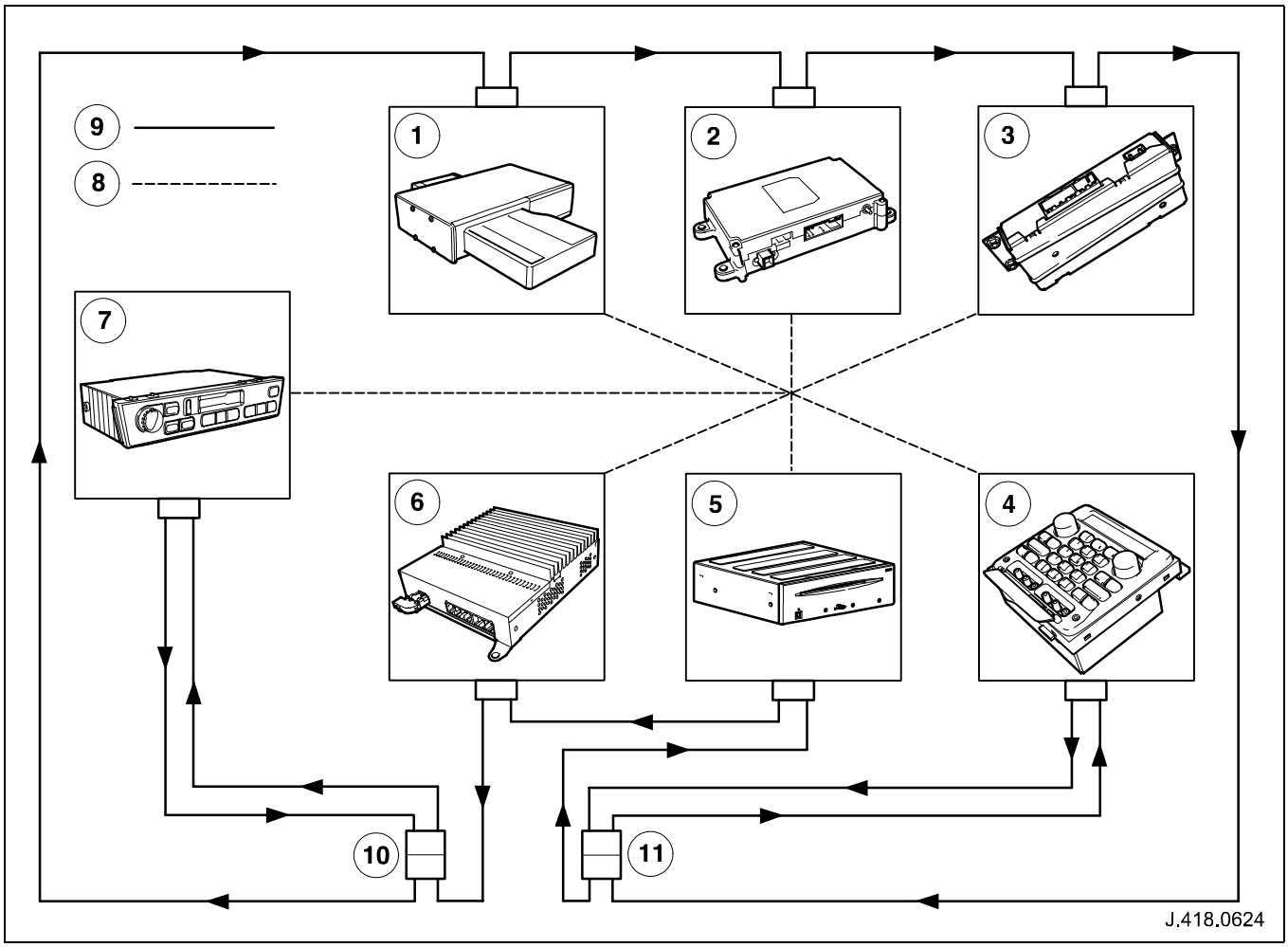

Fig. 124 D2B network

1. CD changer
2. Cellular phone control module
3. Voice activation control module
4. Passenger entertainment control panel
5. Navigation control module
6. Power amplifier (premium entertainment system)
7. Audio unit (master module)
8. Wake-up wire
9. Optical fiber
10. Intermediate connector 1
11. Intermediate connector 2

Optical Fiber

The fiber comprises a 1mm polymer core with a 3.5mm diameter outer protective jacket.

The fiber facilitates the transport of data in the form of pulses of light which are too fast to be seen by the eye, at a data bit rate of approximately 5.5M bits per second.

Wake-up Wire

The wake-up wire comprises copper wire configured in a star-like arrangement that connects to a single pin on each of the modules; refer to **Fig. 124**.

- The audio unit sends a wake-up command (an electrical pulse) via the copper wire to initialize the slave module(s).
- The wake-up pulse is sent when the ignition key is turned to position 'I'.
- The pulse triggers slave modules to look at the preceding module for a 'light signal' (originated by the audio unit) and to participate with the audio unit in network initialization.
- At the end of this initialization procedure, the modules are ready for full network operation.

NOTE: Any malfunction during the initialization stage will cause a DTC to be stored by the audio unit.

Master Module

The master module is the audio unit; it manages the D2B network and provides the gateway to the SCP network.

Slave Module(s)

A slave module is any other system module that is connected to the D2B network and includes:

- Navigation control module
- CD changer
- Cellular phone control module
- Voice activation control module

Intermediate Connectors

There are two intermediate connectors, one close to the j-gate (providing connection to the audio unit) and one located in the luggage compartment to the left-hand side (item 1, **Fig. 125**) that provides the interconnection point for the slave modules. Vehicles installed with rear multimedia system have two additional intermediate connectors, one close to the passenger entertainment control panel and one located in the luggage compartment to the left-hand side (item 2, **Fig. 125**) that provides the interconnection point for the slave modules.

NOTE: To install slave modules, follow the detailed **accessory fitting instructions** supplied with the modules.

Modules that connect to the D2B network, use special optical fiber assemblies which interface with the D2B intermediate connector in the luggage compartment; the assemblies may vary depending on the particular combination of modules connected to the network.

NOTE: Optical fibers are incorporated into the instrument panel and cabin harnesses during manufacture to support dealer installation of the CD changer, voice control and cellular phone systems.

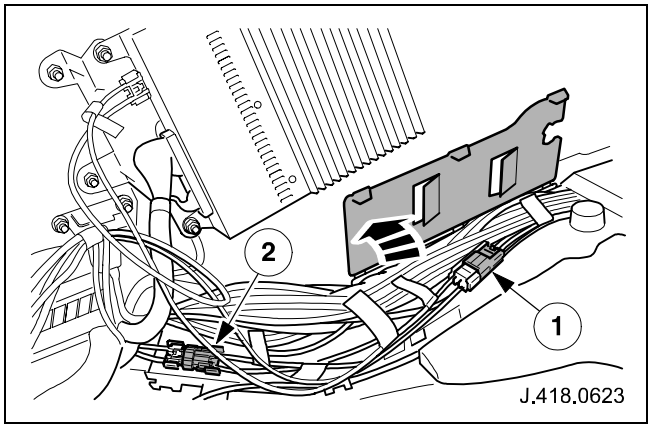

Fig. 125 Slave module intermediate connectors

1. Intermediate connector 1
2. Intermediate connector 2

Differences Between D2B and CAN or SCP

- D2B provides multiple communications channels instead of one channel.
- D2B has a control channel (which operates in a similar way to CAN or SCP) but in addition has three source data channels which can be used to transport up to three separate streams of 16-bit digital stereo data.

Optical Fiber Cables and Connectors

Under normal installation conditions, the system is robust and failures should not occur, however since the optical fibers convey data using light, it is vital that the passage of light down the fiber is unobstructed. Obstruction of light can be caused by:

- contamination of the fiber ends;
- damage to the fiber ends;
- bending, kinking or damaging the cable.

NOTE: Fibers damaged by kinking or exposure of the optical core due to abrasion must be replaced.

Handling

Take special care to avoid damage or contamination when handling or working in the vicinity of fiber optical cables and connectors.

NOTE: Damage or contamination includes scratches to the cable ends and pollution caused by dust, dirt or oil.

CAUTION: When handling optical fibers, cleanliness is of paramount importance. The fiber ends should not be touched even with clean bare hands, as the natural oils deposited from the skin may penetrate the fiber or may cause dirt to adhere to the fiber end.

System malfunctions and unnecessary warranty claims can be minimized by following these guidelines:

- After disconnection of any cables, carefully install an appropriate dust cap to protect the mating face of the connectors from damage or contamination.
- Avoid introducing tight bends (less than 25mm radius) or kinks into the optical fiber during service or repair. Tight bends or kinks could:
  - impair system operation;
  - cause immediate system failure;
  - cause future system failure.
- Avoid excessive force, strain or stress on the fibers and connectors, especially permanent stress after reinstallation.

Optical Network Diagnostics

Unlike the other networks that communicate with WDS via the diagnostic connector, the optical network interfaces with the diagnostic connector via the audio unit and the SCP network.

NOTE: Diagnosis and Testing is quite complex and specific; refer to **JTIS** for details.

Electronic Feature Group

Anti-Theft

NOTE: Refer to **New XJ Range Electrical Guide** for detailed electrical connection information.

Anti-theft options vary according to market and vehicle specification; typical options include:

- a perimeter alarm system;
- an intrusion sensing system;
- a passive anti-theft system (PATS).

Module Functionality

The anti-theft system incorporates the following modules, which all communicate via the SCP network:

- front electronic module (FEM);
- instrument cluster (IC);
- rear electronic module (REM);
- driver door module (DDM);
- steering column lock module (SCLM).

NOTE: Whenever a new REM or DDM is installed, in order to maintain correct communications between modules, the modules should be re-configured using WDS (follow ID transfer process).

In addition, where appropriate, the engine control module (ECM), based on messages exchanged via CAN, provides PATS security by disabling the starter relay, fuel injectors, ignition coils and the fuel pump module.

Front Electronic Module

NOTE: For functions not associated with anti-theft refer to **Multifunction Electronic Control Modules**.

The FEM monitors, depending on vehicle specification, the status of the following inputs:

- front passenger-door ajar switch;
- hood ajar switch;
- audio unit (anti-theft sensing line);
- telematics display (anti-theft sensing line);
- master lock switch;
- valet mode switch;
- luggage compartment-lid release switch (internal);
- fuel filler-flap release switch;
- glove compartment switch.

Depending on market specification and the alarm status, where appropriate, the FEM provides the necessary electrical output signals to the:

- vehicle horns, via the horn relay;
- front turn-signal indicator lamps, pilot lamps, side marker lamps.

NOTE: When commanded to do so by the instrument cluster, the FEM also provides the ground supply line for the SCLM.

Rear Electronic Module

NOTE: For functions not associated with anti-theft refer to **Multifunction Electronic Control Modules**.

The REM monitors the status of the following inputs:

- rear passenger door ajar switches;
- luggage compartment-lid ajar switch;
- intrusion sensors;
- inclination sensor;
- luggage compartment-lid release switch (external).

NOTE: The external luggage compartment lid-release cannot be activated unless the correct status is detected for the driver's door unlock latch, valet mode and transmission park.

Depending on market specification and the alarm status, where appropriate, the REM provides the necessary electrical output signals to the:

- passive sounder or battery-backed sounder (BBS);
- rear turn-signal indicator lamps, tail lamps, side marker lamps.

The REM has hard-wired, anti-theft sense-inputs from the FEM and the DDM. When commanded to do so by the instrument cluster, the REM also provides the power supply line for the SCLM.

NOTE: In addition to the functionality detailed above, on receipt of a request (from the FEM, via the SCP network), to release the fuel filler-flap the REM also provides an electrical output to drive the fuel filler-flap motor, provided the J-gate is in park.

Instrument Cluster

NOTE: For functions not associated with anti-theft refer to **Instrument Cluster**.

The instrument cluster:

- provides multiplex network gateway functionality for CAN and SCP;
- drives the anti-theft system indicator lamp;
- interfaces with the PATS transceiver coil;
- communicates with the ECM and key transponder (stores PATS key codes).
- interfaces with the electronic steering column lock module (SCLM).

Driver door module

NOTE: For functions not associated with anti-theft refer to **Multifunction Electronic Control Modules**.

The DDM where appropriate, monitors the status of the driver's door:

- unlocked switch;
- locked switch;
- ajar switch.

Except for Japan and Korea, the receiver for the remote transmitter is located in the DDM. Japan and Korea use a remote keyless entry (RKE) receiver, which interfaces to the DDM and is located behind the instrument cluster.

NOTE: The RKE receiver may be susceptible to RF interference in areas that have a high density of radio or mobile phone masts.

Steering column lock module

The SCLM is fixed to the upper steering column. Before the module can handle data it must have its power supply activated. When commanded to do so by the instrument cluster, the REM provides the power supply line and the FEM provides the ground supply line for the SCLM. Once activated, the module processes data on the SCP network and when appropriate, activates the motor to lock or unlock the steering column.

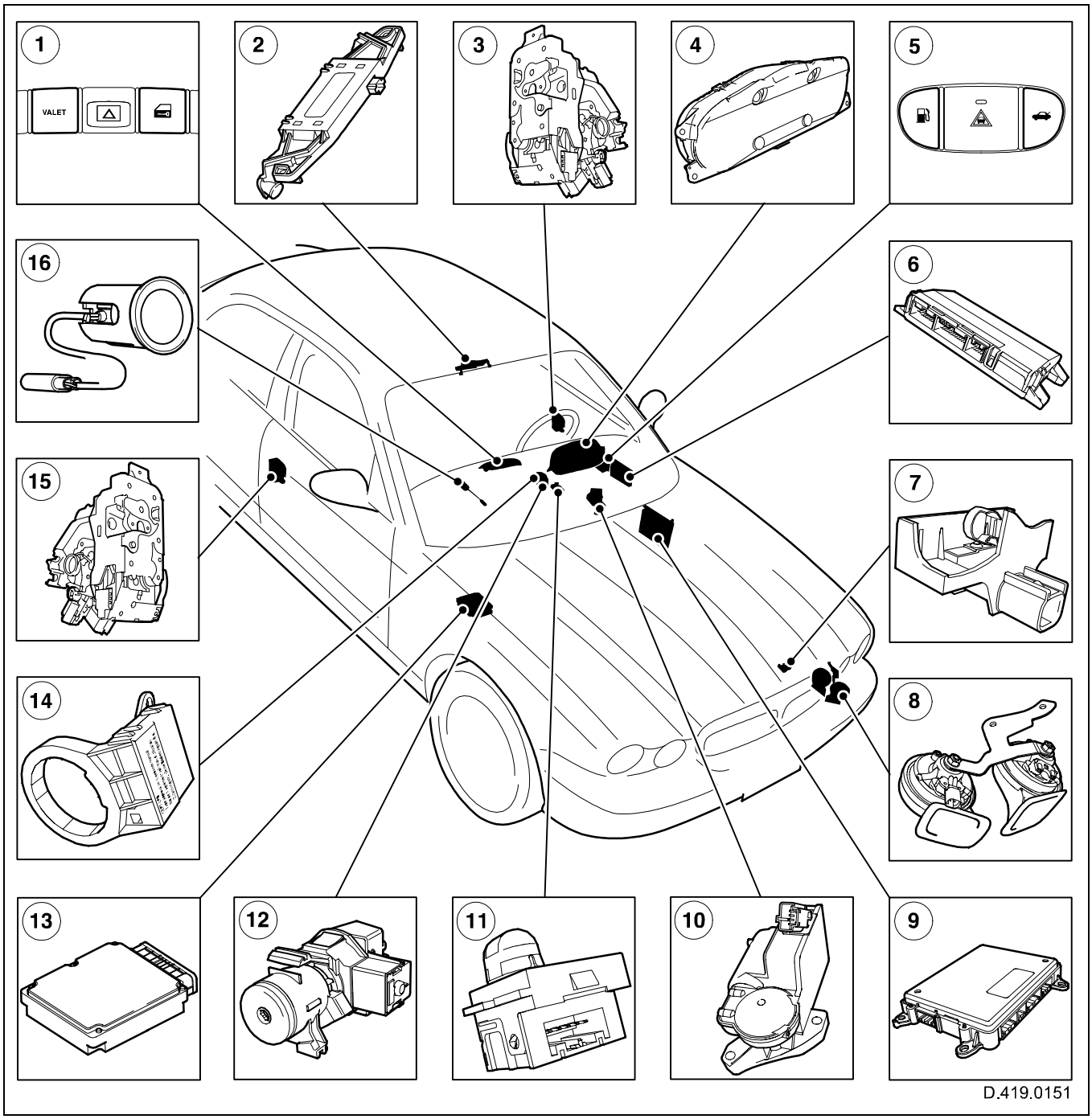

Fig. 126 Anti-theft component locations - front

Key to Fig. 126

1. Valet mode switch and master lock switch
2. Intrusions sensors (where applicable)
3. Driver door ajar switch
4. Instrument cluster
5. Fuel filler-flap release switch and luggage compartment-lid release switch
6. Driver door module
7. Hood ajar switch
8. Horns
9. Front electronic module
10. Steering column lock module (where applicable)
11. Anti-theft system indicator lamp
12. Ignition switch
13. Engine control module
14. Transceiver coil
15. Passenger door ajar switch
16. Glove compartment switch

Although part of the anti-theft system, for clarity of illustration, the following components have not been included:

- Integrated key transmitter.
- Turn signals, pilot, tail and side marker lamps.
- J-gate interlock.
- Driver's door key barrel.
- Remote keyless entry receiver (where applicable).

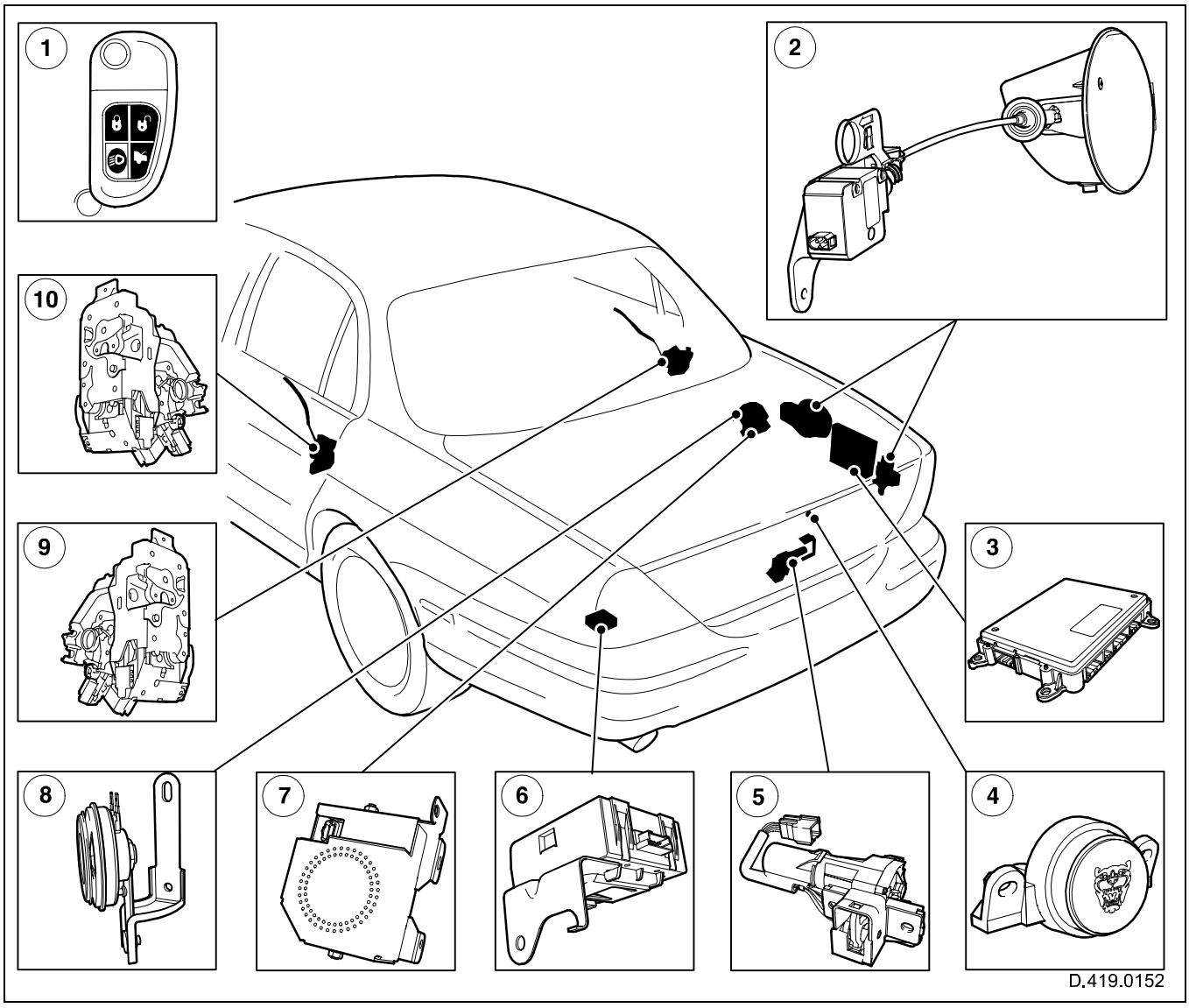

Fig. 127 Anti-theft component locations - rear

1. Integrated key transmitter
2. Fuel filler-flap release assembly
3. Rear electronic module
4. External luggage compartment-lid release switch
5. Luggage compartment lid-ajar switch
6. Inclination sensor (where applicable)
7. Battery-backed sounder (where applicable)
8. Passive sounder (where applicable)
9. RH rear passenger door ajar switch
10. LH rear passenger door ajar switch

System Features

Depending on market specification, the following features may be incorporated as either standard or dealer installed options:

Passive anti-theft system

- Encrypted instrument cluster/engine control module immobilization system, controlled by the ignition key transceiver/transponder.

Vehicle and passenger compartment security

- Key barrel on the driver's side only.
- Radio frequency remote transmitter (part of integrated key transmitter).
  - Four control buttons (lock, unlock, luggage compartment-lid release, headlamp convenience / panic).
- Double locking by key and remote transmitter (not Japan or NAS vehicles).
- Central locking by key, remote transmitter and interior handle.
- Auto-relocking (dealer programmable).
- Drive-away locking (standard, except Japan).
- Two-stage unlocking (certain markets).
- Steering column lock (certain markets).
- Passive arming (dealer programmable).
- Ignition key-barrel interlock (mechanical or electrical depending on market).
- J-gate interlock.

Master lock functionality

The master lock switch can be used to:

- centrally lock or unlock the vehicle; this feature can also be controlled by the remote transmitter (where applicable) or from the driver's door key barrel;
- initiate global closing or global opening of windows or roof opening panel;
- disable the intrusion sensing and inclination sensing (where applicable).

NOTE: To avoid false alarms when transporting the vehicle particularly by ferry in severe weather conditions, the intrusion sensing and inclination sensing can be disabled for one arm-cycle.

Provided all windows are fully closed and the ignition key is at position '0' or removed from the ignition, the sensors can be disabled by pressing the master lock switch. The anti-theft system indicator lamp will flash five times to confirm the sensors are disabled.

Compartment security

- Electrically secured glove compartment.
- Electrically secured fuel filler-flap.
- Internal luggage compartment-lid release.
- External luggage compartment-lid release.
- Valet mode.

The glove and luggage compartments are secured by remote locking, driver's key barrel locking or by selecting valet mode. Selection of valet mode is confirmed by an audible warning or if the ignition key is at position 'II', the instrument cluster will display a status message. Once valet mode has been selected, a valet chime (or message, depending on the status of the ignition) will confirm that access is denied when any of the following buttons are pressed:

- valet mode;
- glove compartment;
- external luggage compartment-lid release;
- internal luggage compartment-lid release.

The valet mode can only be cancelled by using the:

- remote unlock;
- integrated key or the black-headed key to directly open the luggage compartment.

NOTE: Opening the luggage compartment using the release button on the integrated key transmitter does not cancel the valet mode.

Sensing and indication

- Anti-theft system indicator lamp - indicates system is armed and PATS fault codes.
- Perimeter sensing for doors, hood and luggage compartment lid.
- Removal sensing for audio unit and telematics display (where applicable).
- Intrusion sensing (where applicable).
- Inclination sensing (dealer installation).
- Separate anti-theft horn or battery backed sounder (market dependent).

Remote control features

- Panic alarm - remote transmitter operated (standard for NAS markets, otherwise dealer programmable).
- Remote two-stage toggle (standard worldwide, except Japan).

Definition of terms

- Double-locking - the vehicle cannot be unlocked via the interior door handles.
- Drive-away locking - the doors will lock automatically when the gearshift lever is moved for one second or more, from position 'P' or 'N' into position 'D' or 'R'.
- Auto-relocking - provided the anti-theft feature is enabled and the vehicle has previously been locked and armed, after unlocking the vehicle using the integrated key transmitter, the doors will automatically lock and the system re-arm after 45 seconds providing the:
  - hood, trunk lid or any door, has not been opened;
  - ignition key has not been inserted into the ignition key barrel;
  - key barrel unlock or lock operation has not occurred.

- Two-stage unlocking can be achieved by using either the integrated key transmitter or the key in the barrel lock:
  - the first-stage unlock operation, unlocks only the driver's door;
  - the second-stage unlock operation, unlocks the remaining doors.
- Remote two-stage toggle - allows the vehicle owner to switch the unlocking preference between 'central unlocking' and 'two-stage unlocking'.
  - Simultaneously pressing for 4 seconds, the lock and unlock buttons on the integrated key transmitter, toggles locking from the current condition to the alternative condition. Each repetition of the operation will revert locking to the former condition.

  NOTE: Two-stage unlocking can also be activated or deactivated after accessing the 'vehicle settings' from the 'system setup' menu using the telematics screen (where applicable).

System Arming And Disarming

NOTE: The following details are market dependent.

The anti-theft system is armed by locking the vehicle using the driver's door key or by pressing the 'lock' button on the integrated key transmitter.

- Pressing the 'lock' button on the integrated key transmitter once, or locking the driver's door with the key, activates the perimeter sensing.
- Pressing the 'lock' button on the integrated key transmitter twice, or completing the driver's door unlock and lock operation with the key, within 3 seconds (where applicable):
  - activates the perimeter and intrusion sensing;
  - activates the inclination sensor;
  - invokes double-locking.

NOTE: There is no pre-arm phase when the vehicle is double locked.

Once the pre-arm phase (20 seconds after locking) has passed (or double-locking action occurs) and provided no closures remain ajar, the vehicle becomes fully armed (depending on market and vehicle specification). Once fully armed, any of the following will trigger an alarm:

- Opening a door/hood/luggage compartment lid (unless via integrated key transmitter).
- Turning an invalid PATS ignition key to position 'II'.
- Movement inside the vehicle (providing intrusion sensors are installed and the vehicle is double locked).
- Excessive movement of vehicle (providing inclination sensor is installed and the vehicle is double locked).
- Removal of modules, including audio unit or telematics display.
- Disconnection of the battery-backed sounder.

NOTE: Disconnection or interruption of the battery supply also activates the battery-backed sounder (where applicable).

When the alarm is activated, a visual warning is provided by the turn signals and an audible warning by the vehicle horns. Where installed, the passive sounder or battery-backed sounder, provide an additional audible warning.

NOTE: In some markets, pilot, side and tail lamps provide additional or alternative visual indication.

The anti-theft system can be disarmed by unlocking the driver's door lock (not European or Middle East vehicles), pressing the unlock button on the integrated key transmitter, or inserting and turning a valid ignition key to position 'II'.

Locking Error Codes

Error codes are standard for all vehicles with an anti-theft system installed. The error codes, in the form of tones (two chirps) or flashes (five flashes of the turn signals) are evident when an attempt is made to lock the vehicle using the integrated key transmitter or using the key in the driver's door lock in the following circumstances:

- a door is ajar;
- the luggage compartment lid is ajar;
- the hood is ajar;
- a key is in the ignition.

NOTE: If door key operation occurs (and the key is not in the ignition), the arming sequence will be completed, followed by the error codes. Should the key be in the ignition, the arming sequence will fail and an error code will be transmitted.

Failure of an intrusion sensor or inclination sensor (where applicable) is confirmed when unlocking after double lock, by error tones (two chirps) or flashes (six flashes of the turn signals).

Telematics

Telematics refers to the convergence of telecommunications and information technology within the vehicle, enabling the seamless transport of information and data to provide various services to and from the vehicle (or mobile communications devices).

Telematics Display Module

The telematics display module is the principle user interface for the following subsystems:

- Navigation; refer to **Navigation System**.
- Climate control; refer to **Climate Control System**.
- Entertainment; refer to **In-vehicle Entertainment Systems**.
- Cellular phone; refer to **Cellular Phone**.
- Television (optional); refer to **Video System**.
- Voice training modes (optional): refer to **Voice Activated Control System**.

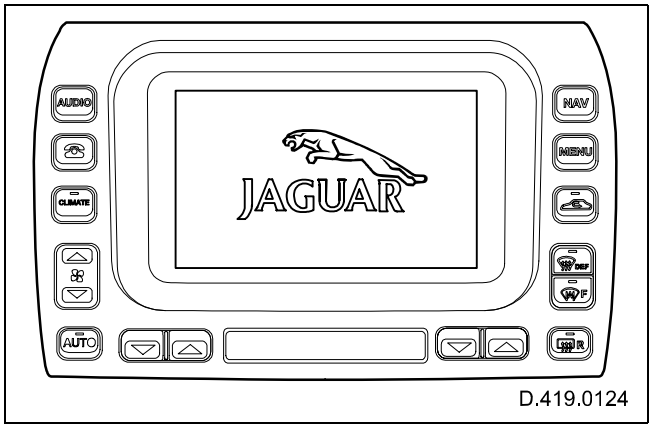

Fig. 128 Telematics display module

When the ignition key is at position 'I' or 'II' the touch-screen will display the Jaguar leaper followed by the last 'top level' menu of the screen used before the ignition key was turned to position '0'. Display of touch-screen options for other systems is obtained by pressing the appropriate perimeter button.

NOTE: The touch-screen and inner bezel must be kept clean to maintain optimum performance. Finger marks and attracted dust should be regularly removed using a soft cloth and a Jaguar approved cleaning agent.

Touch-screen features are designed to be user-friendly and intuitive like a personal computer. The tables show typical examples of the text displayed using the screen menus.

MENU		
Brightness/Contrast	Volume	TV
System Setup	Rear Multimedia	
Screen Off	Logo Screen	

Table 6 Menu text displayed

SYSTEM SETUP	Cancel
Vehicle Settings	
User Settings	

Table 7 System setup text displayed

USER SETTINGS			
Audible Feedback	All	Touch Screen	None
Language	Flag Change		
Navigation units	Metric	Imperial	
			OK

Table 8 User settings displayed

Voice Activated Control System

NOTE: The system will not operate until the audio unit security code has been entered.

The voice activated control system, offers the user the option to activate by voice, certain features for the following systems:

- Entertainment.
- Cellular phone.
- Climate control.
- Television (where installed) and teletext (where available).
- Navigation.

NOTE: The navigation 'Caution Screen' must be cleared after every ignition cycle, before the navigation system will respond to any voice commands issued.

NOTE: Vehicles are pre-wired during manufacture to facilitate, in appropriate markets, the dealer installation of the voice activation control system, as an accessory.

The system components comprise:

- Voice activation module (VAM), located in the luggage compartment to the left-hand side and mounted to the stack-bracket that is shared with the multimedia modules.
- Microphone, shared with the phone and located in the overhead console.
- Push-to-talk button, mounted on the steering wheel, shared with the phone and wired through the audio unit.

NOTE: Where applicable, providing the parking brake is engaged, it is possible to initiate a training mode which enables the voice activation control system to fine-tune the voice recognition capability.

The VAM is not serviceable but will need to be reconfigured using WDS if changes are made to the systems it controls; for example, after the installation of a CD changer.

NOTE: VAM is part of the optical network; refer to **D2B network**.

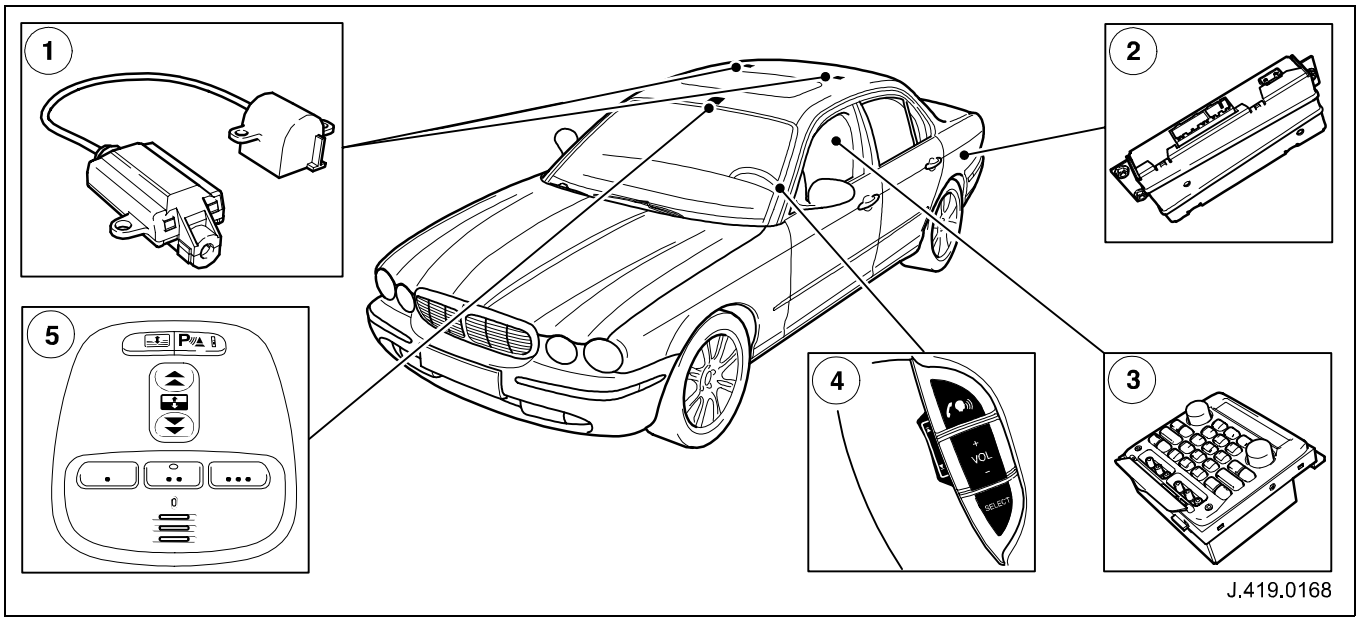

Fig. 129 Voice-activated control - component locations

1. Rear microphone
2. Voice activation module
3. Passenger entertainment control panel
4. Push-to-talk button
5. Front microphone

Provided the multi-zone voice option is installed, voice activated control for most functions may be achieved by rear seat passengers:

- Two microphones are located in the headliner, one above each of the rear passenger seat positions.
- Voice activation can be initialized by pressing one of the 'TALK' buttons on the passenger entertainment control panel.
- For a voice command to be successful, the rear multimedia system must be in the mode that will direct audio to the device selected: 'LEFT' headset, 'CABIN' speakers or 'RIGHT' headset.
- Selection of the mode is confirmed by the illumination of the tell-tale LED on the corresponding button.

NOTE: To allow a voice command to be issued, currently active audio will be temporarily muted.

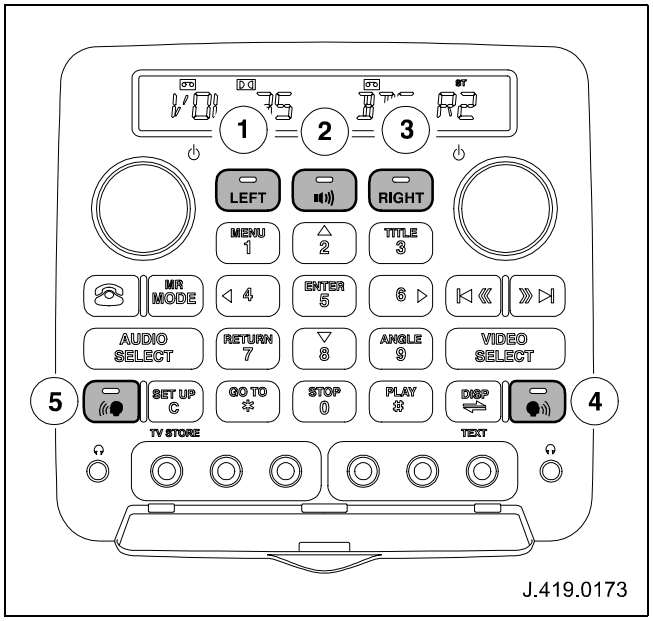

Fig. 130 Rear voice activation - control buttons

1. LEFT headset select
2. CABIN speakers select
3. RIGHT headset select
4. Right TALK select
5. Left TALK select

Navigation System

The navigation system comprises:

- Navigation control module complete with map data DVD reader.
- Navigation system antenna.
- Navigation map data DVD.
- Navigation system display module.

NOTE: The navigation system uses the **Telematics Display Module** as the navigation system display module; refer to the appropriate section for more information.

The vehicle location/direction is determined using the following:

- global positioning system (GPS);
- vehicle speed;
- gyroscope to detect directional changes; refer to **Navigation Control Module**;
- navigation map-matching software integral to the **Navigation Control Module**;
- navigation data stored on the DVD disc.

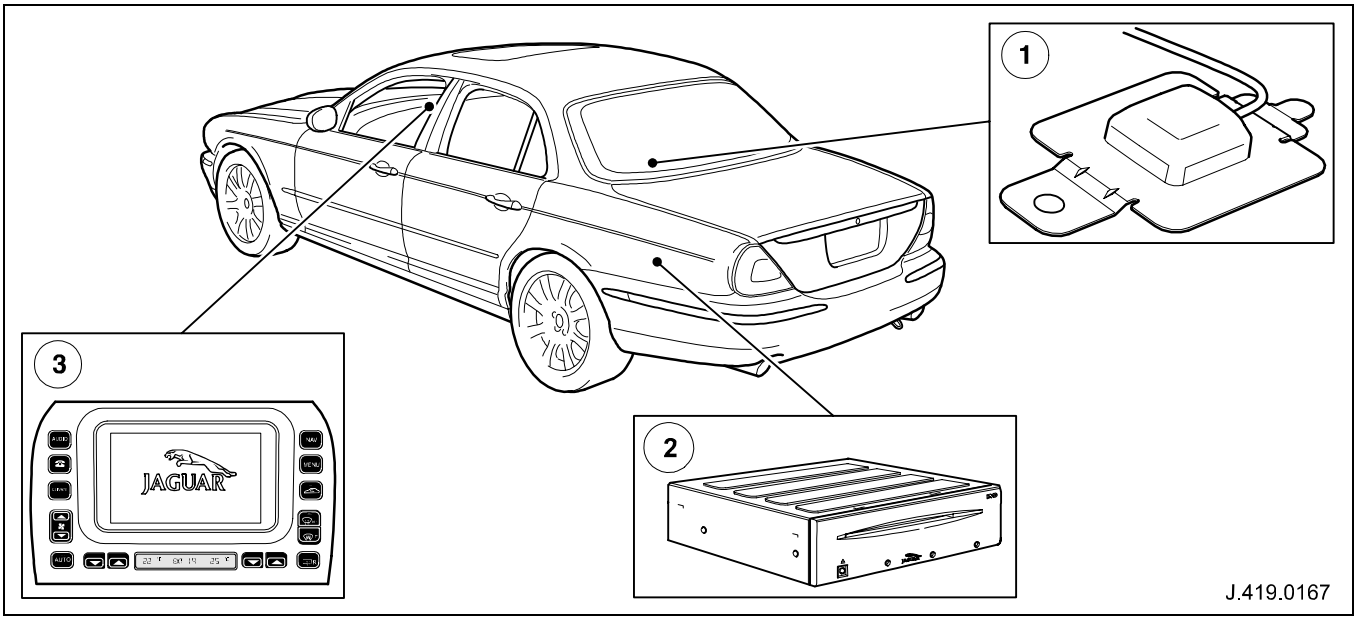

Fig. 131 Navigation system component location

1. Navigation system antenna
2. Navigation control module
3. Telematics display module

Navigation Control Module

The NCM is:

- located in the luggage compartment to the left-hand side;
- fixed to a bracket which also supports (where applicable) other multimedia modules.

The navigation control module (NCM) comprises:

- Navigation software which controls:
  - generation of map display;
  - routing functions.
- Graphics display driver.
- D2B output of audio data for voice guidance and television.
- SCP link for communications between other modules.
- Subsystem control software to generate control screens for other modules and support communications.
- GPS decoder which amplifies and decodes the GPS signal received from the antenna.
- Gyroscope to monitor vehicle direction.
- DVD drive which reads the map database stored on disc.
- Diagnostic software.

NOTE: Japan uses a different NCM that incorporates a Japanese voice activation module (VAM). The module permits extensive recognition of navigation system commands (including the ability to enter full addresses) and the display of traffic information via vehicle information communications system (VICS).

Navigation System Display Module

The display module is a multifunction touch-screen console which comprises on-screen simulated buttons (soft buttons) and perimeter buttons (hard buttons). Unlike some Jaguar models, the display module is not dedicated to navigation, it is also the principal interface for several subsystems; refer to **Telematics Display Module**.

Navigation System Antenna

The navigation system antenna is a satellite GPS type that is mounted on the parcel shelf to optimize reception. A coaxial cable links the antenna module to the NCM and:

- provides 5V dc power from the NCM to the active receiver circuits of the antenna via the inner coaxial conductor;
- transfers incoming signals from the antenna to the NCM.

NOTE: Signal reception may be affected by the presence of: metal objects or foil, on or near the parcel shelf or rear glass; metallic screen-coatings on the rear glass.