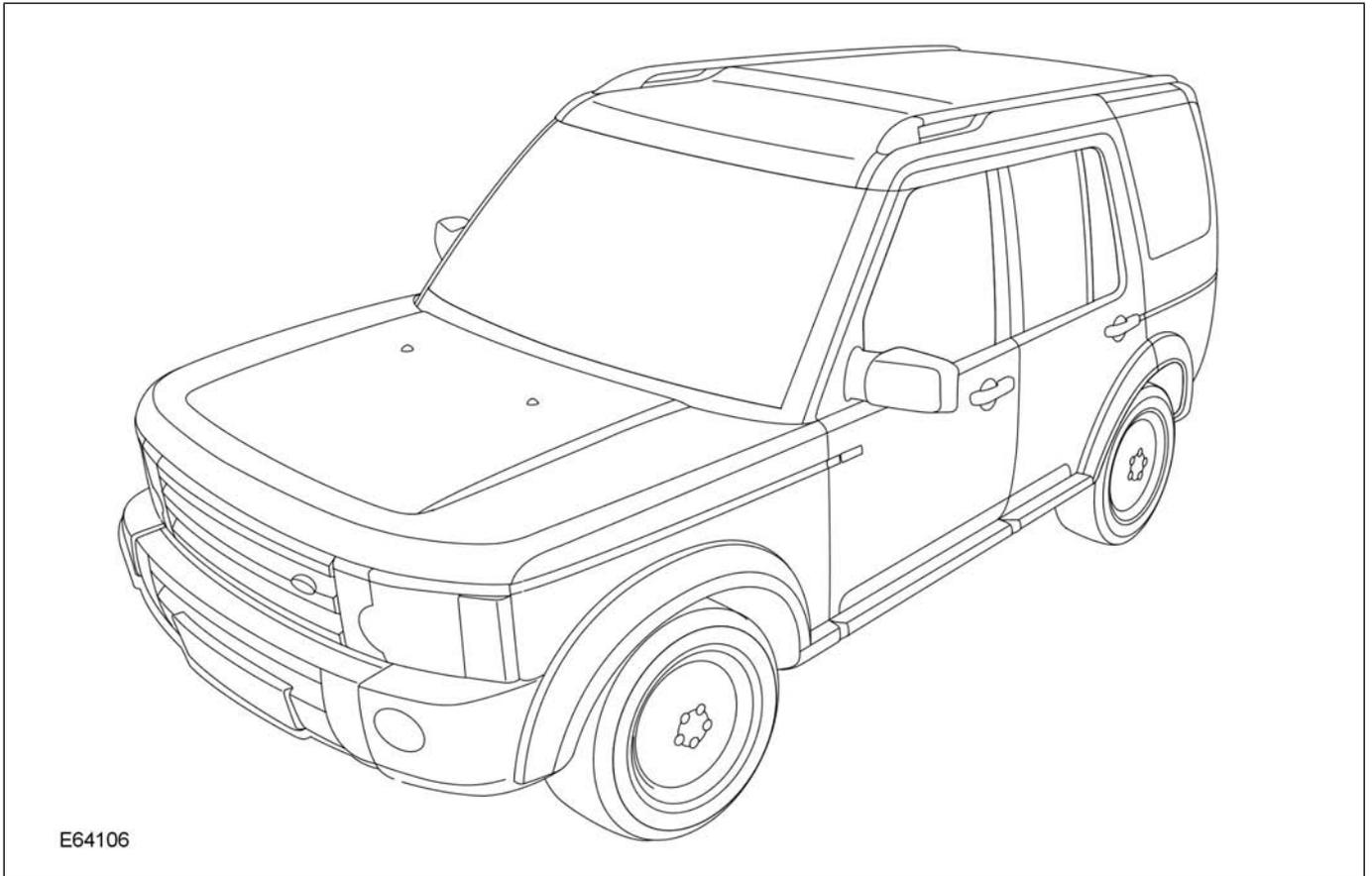
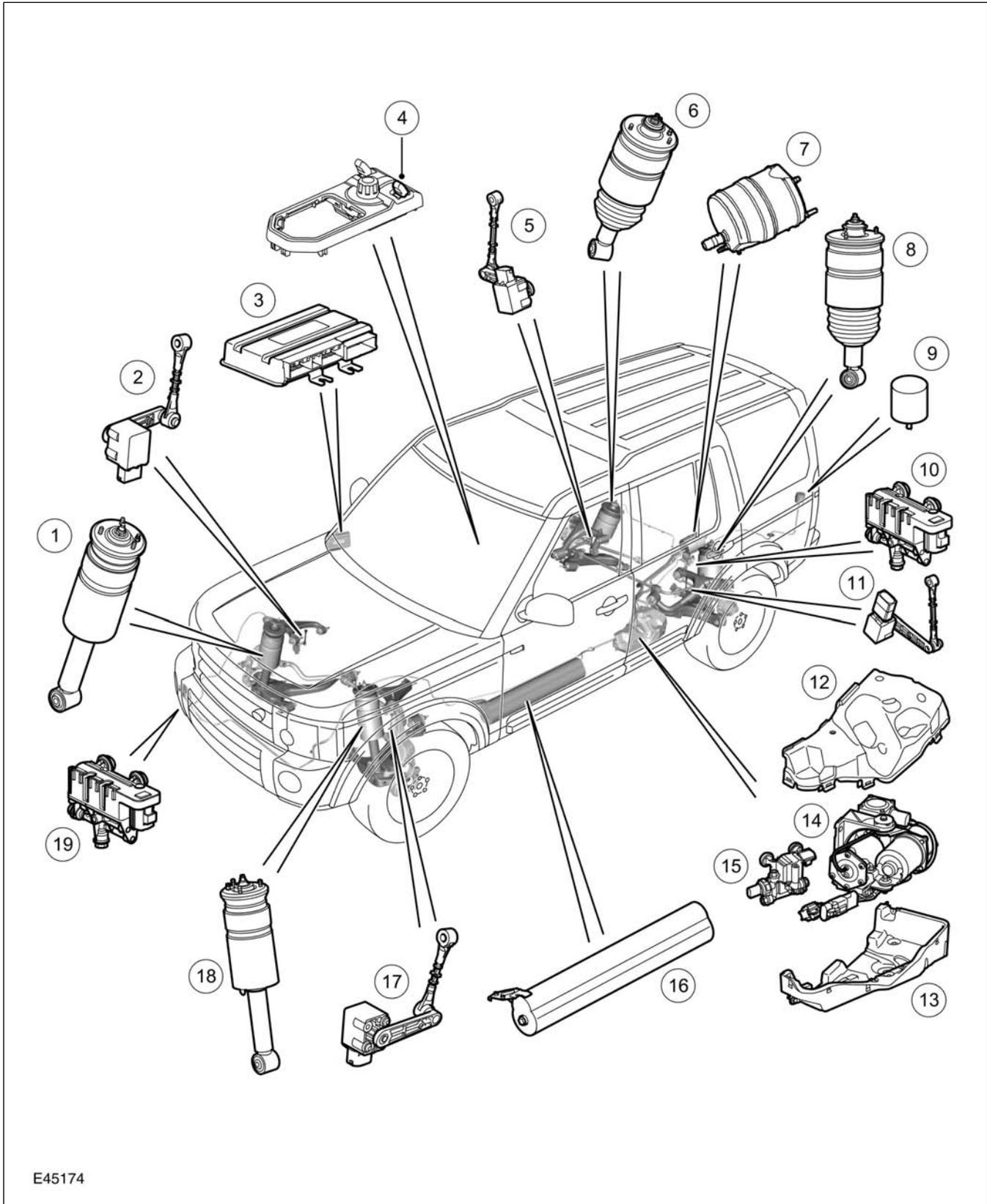


DISCOVERY 3 / LR3



Component Review

System Components



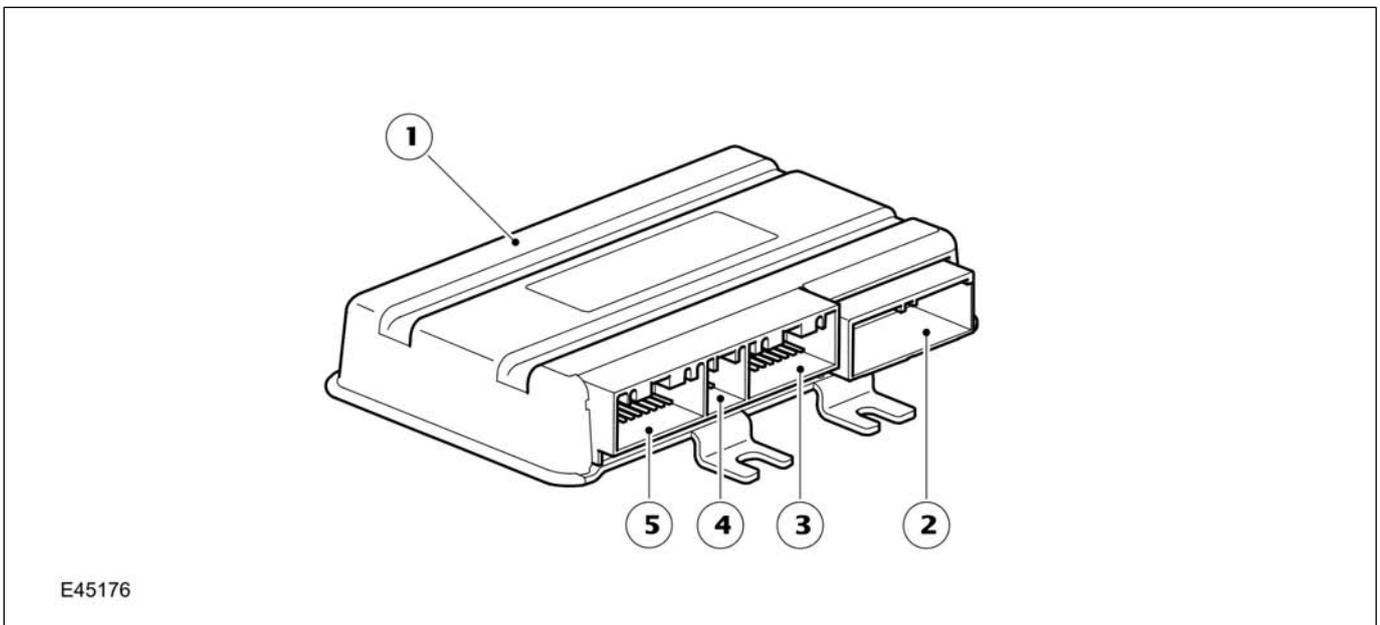
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Component Location

Item	Description	Item	Description
1.	Front RH air spring damper module	11.	Rear LH height sensor
2.	Front RH height sensor	12.	Upper acoustic cover
3.	Air suspension control module	13.	Lower acoustic cover
4.	Air suspension control switch	14.	Air supply unit
5.	Rear RH height sensor	15.	Reservoir valve block
6.	Rear RH air spring damper module	16.	Air reservoir
7.	Air supply unit silencer	17.	Front LH height sensor
8.	Rear LH air spring damper module	18.	Front LH air spring damper module
9.	Air intake filter	19.	Front valve block
10.	Rear valve block		

Control Module

Air Suspension Module



Item	Description	Item	Description
1.	Air Suspension Control Module	4.	Connector C2030
2.	Connector C0867	5.	Connector C2321
3.	Connector C2320		

Control Module Location

The air suspension control module is located behind the instrument panel, on the driver's side 'A' post.

Attachment to the 'A' post is via a single fixing and two plastic clips.

Calibration

A calibration routine is performed using the T4 diagnostic equipment to access the position of each corner of the vehicle and record the settings in the ECU memory.

Once set, the calibration is not required to be performed again unless:

- Air suspension control module is removed or replaced
- Height sensor is removed or replaced
- Suspension arm to which the sensor is connected is removed or replaced

If the removed height sensor is subsequently refitted, the calibration procedure will have to be performed to ensure the integrity of the system.

If the air supply unit, the reservoir, a valve block, a damper module or the air harness is removed or replaced, the system will not require recalibration.

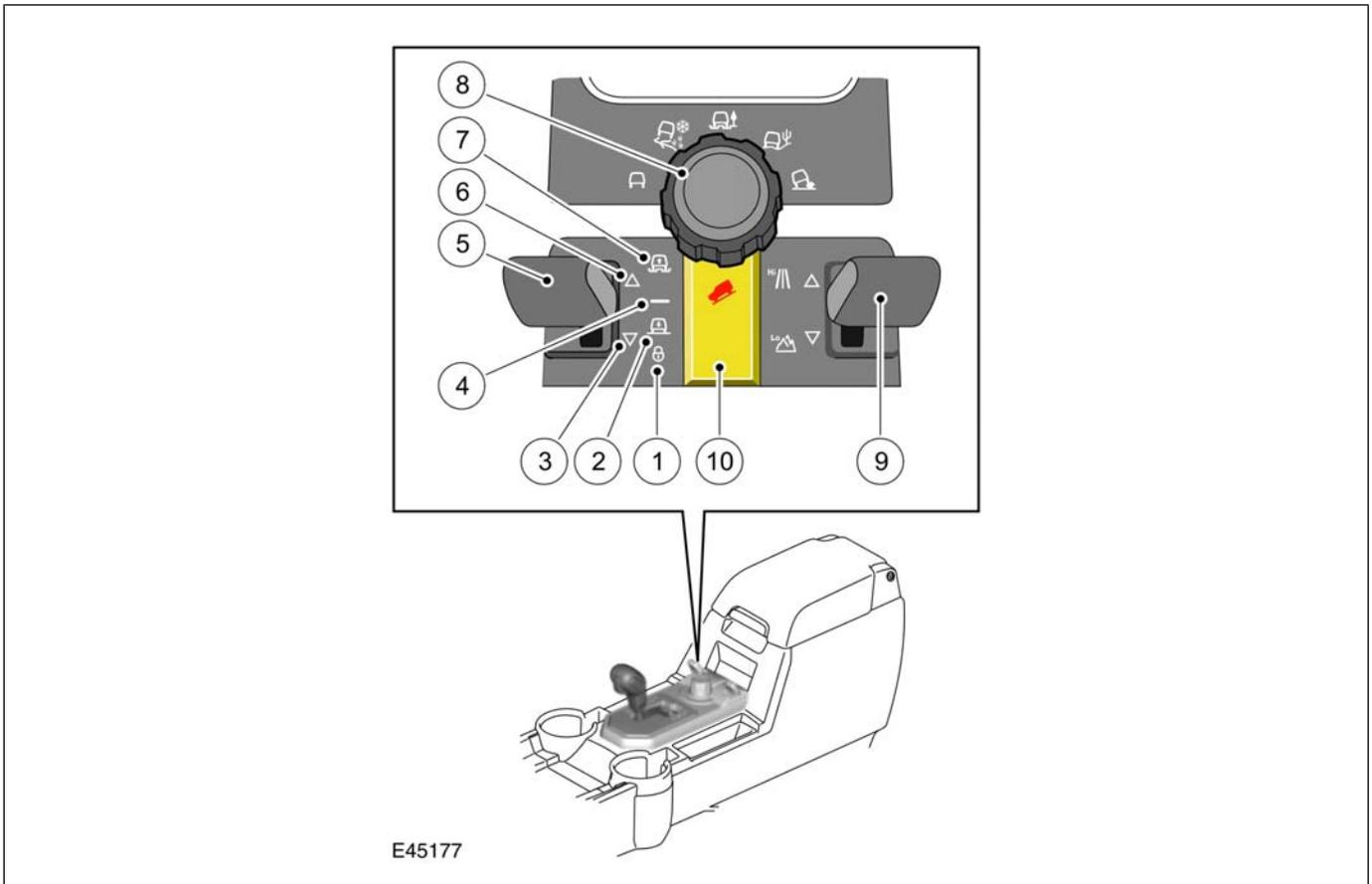
Inputs and Outputs

Four harness connectors are used by the air suspension control module for all inputs and outputs.

The following tables show the details of the signals or electrical supplies on each connector pin.

Air Suspension Control

Air Suspension Control Switch



Control Switch

Item	Description	Item	Description
1.	Crawl mode lamp	6.	Raising lamp
2.	Access mode lamp	7.	Off-road mode lamp
3.	Lowering lamp	8.	Terrain Response™ rotary control
4.	On-road mode lamp	9.	Transfer box range switch
5.	Air suspension switch	10.	Hill Descent Control (HDC) switch

The air suspension control switch is located in the center console, behind the manual or automatic transmission selector lever.

The switch is a three position, non-latching switch which allows selection of the following driver selectable modes.

Selection Modes:

- On-road mode
- Access mode
- Crawl (locked at access) mode

The air suspension switch can be moved forwards or backwards from its central position.

The switch is non-latching and returns to the central position when released.

The switch completes an earth path to the air suspension control module when operated.

This earth path is completed on separate wires for the raise and lower switch positions, allowing the control module to determine which selection the driver has made.

The air suspension switch has six symbols which illuminate to show the current selected height and the direction of movement.

The raise and lower symbols will flash and a warning tone will be emitted from the instrument cluster sounder when a requested height change is not allowed, i.e. vehicle speed too fast.

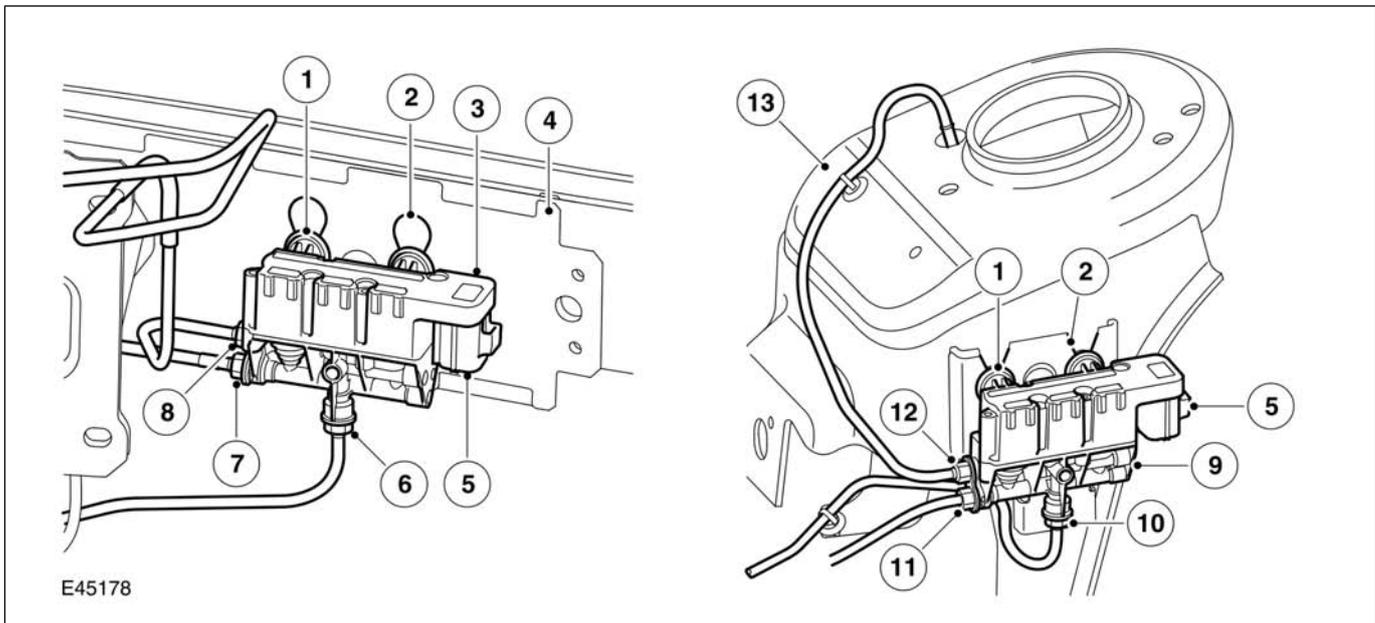
A flashing symbol indicates that the air suspension system is in a waiting state or that the system will override the driver's selection because the speed threshold is too high.

The driver can also ignore the system's warnings signals and allow the height to change automatically.

For example, increasing the vehicle speed to more than 25 mph (40 km/h) will cause the control module to automatically change the ride height from off-road mode to on-road mode.

Valve Blocks

Front and Rear Valve Blocks



Item	Description	Item	Description
1.	Isolation rubber mounts (x3)	8.	RHF air spring, air harness connection
2.	Location slots	9.	Rear valve block, valves and solenoid assembly
3.	Front valve block, valves and solenoid assembly	10.	RHR air spring, air harness connection
4.	Front bumper	11.	Air inlet /outlet connection
5.	Electrical connector	12.	LHR air spring, air harness connection
6.	LHF air spring air harness connection	13.	Rear suspension turret
7.	Air inlet /outlet connection		

The front and rear axle valve blocks are similar in their design and construction and controls air supply and distribution to the front or rear pair of air spring damper modules respectively.

The difference between the two valve blocks is the connections from the valve block to the left and right hand air spring damper modules and the valve sizes.

It is important that the correct valve block is fitted to the correct axle, otherwise leveling will be impaired due to the different valve sizing.

Fitting valve blocks incorrectly would not actually stop the air suspension from functioning. But will result in slow raise and lower times and uneven raising and lowering between the front and rear axles.

Valve Block Location

The front valve block is attached to the right hand end of the front bumper.

The rear valve block is located on the forward face of the left hand suspension turret.

Connection

Valve blocks are fitted with isolation rubber mounts to reduce possible operational noise from being transmitted.

The front and rear valve blocks each have three Voss type air pipe connection fittings.

One connection is an air pressure inlet / outlet from the reservoir block.

The remaining two connections provide the pressure connections to the left and right air spring assemblies.

Each valve block contains three solenoid operated valves: two corner valves and one cross link valve.

Each solenoid valve is controlled individually by the air suspension control module.

The solenoids have a resistance value of 2 Ohms @ 20°C (68°F).

Corner Valves

The corner valves control the flow of air into and out of the individual air springs.

When the solenoid is de-energized, the corner valves are held in a closed position by internal springs.

When the solenoid is energized, the valve armature moves and allows air flow into or out of the air spring.

Cross Link Valves

The cross link valves provides a connection between the two air springs on the same axle.

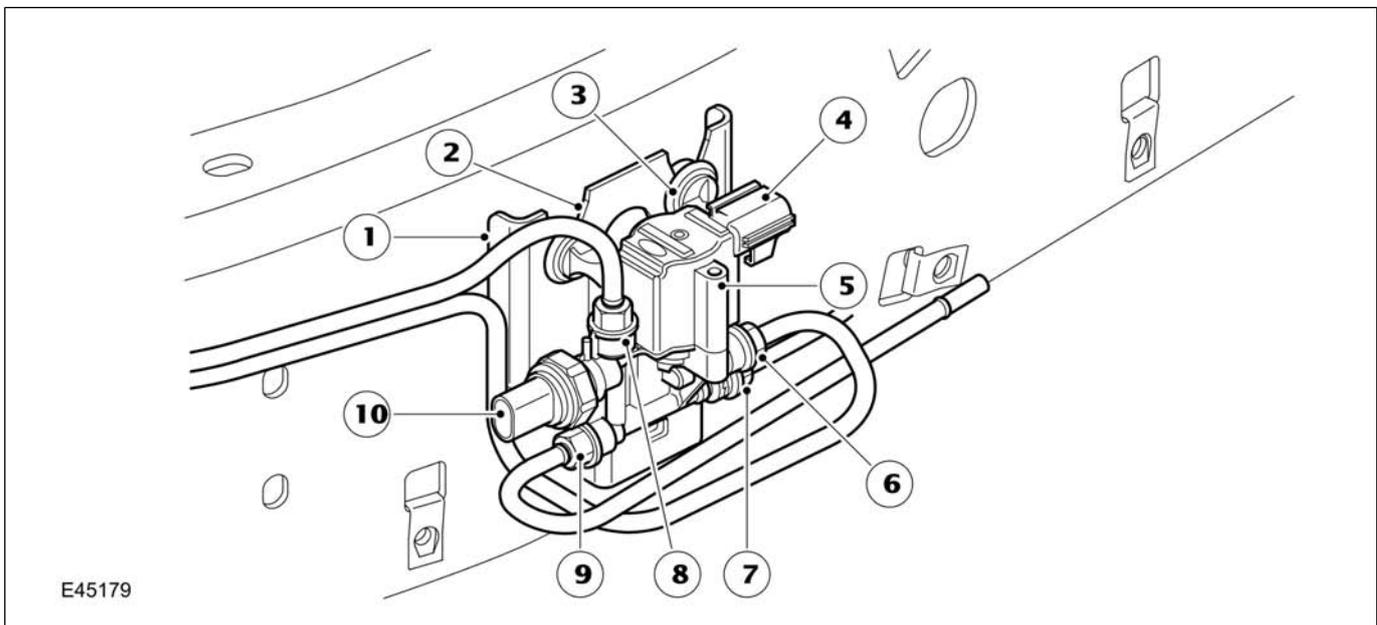
When de-energized, the cross link valve prevents air passing from one air spring to another.

When the solenoid is energized, the valve spool moves and allows air to pass from one air spring to the other.

This increases wheel articulation and improves ride comfort at low vehicle speeds.

Reservoir Valve Block

Reservoir Valve Block



Item	Description	Item	Description
1.	Chassis mounting bracket	6.	Reservoir connection
2.	Location slot	7.	Rear valve block connection
3.	Isolation rubber mounts (3 off)	8.	Front valve block connection
4.	Electrical connector	9.	Air supply unit connection
5.	Reservoir valve block, valves and solenoid assembly	10.	Pressure sensor

The valve block also contains the air suspension system pressure sensor.

Reservoir Valve Block

The reservoir valve block controls the storage and distribution of air to and from the reservoir.

Valve Block Location

The reservoir valve block is attached to a bracket on the outside of the left hand chassis rail.

Position of the valve block is between the reservoir and the air supply unit.

The valve block is located within the air supply unit acoustic box to protect it from dirt ingress and damage from stones.

Valve Block Attachment

The valve block has three attachment lugs which are fitted with isolation rubber mounts which locate in the chassis bracket which has three slotted holes.

The isolation rubber mounts locate in the 'V' shaped slots and are pulled downwards into positive location in the slots.

Connections

The valve block has four air pipe connections which use 'Voss' type air fittings.

The connections provide for air supply from the air supply unit, air supply to and from the reservoir and air supply to and from the front and rear valve blocks.

The connections from the air supply unit and the front and rear control valves are all connected via a common gallery within the valve and therefore are all subject to the same air pressures.

Operation

The reservoir supply is utilized as much as possible to aid speed of response from the system.

However, the system will alternate between reservoir and compressor supply as dictated by system pressures.

The reservoir valve block contains a solenoid operated valve which is controlled by the air suspension control module.

The solenoid valve controls the pressure supply to and from the reservoir.

The solenoid has a resistance value of 2 Ohms at a temperature of 20°C (68°F).

When energized, the valve spool moves allowing air to pass in or out of the reservoir.

Reservoir Pressure

The reservoir valve block also contains a pressure sensor which can be used to measure the system air pressure in the air springs and the reservoir.

The pressure sensor is connected via a harness connector to the air suspension control module.

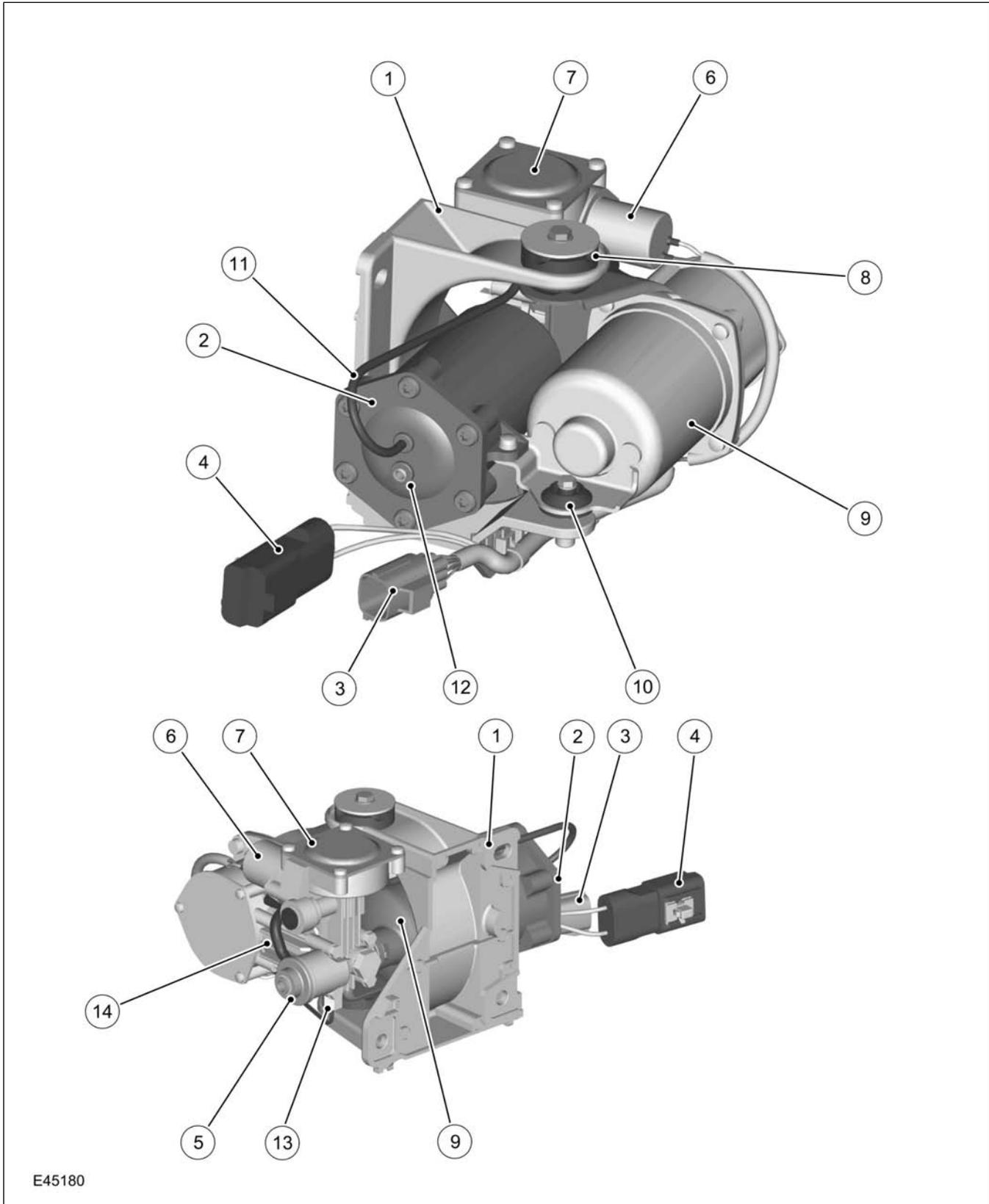
The control module provides a 5v reference voltage to the pressure sensor and monitors the return signal voltage from the sensor.

Using this sensor, the control module controls the air supply unit operation and therefore limits the nominal system operating pressure to 16.8 bar (244 lb in²).

Maximum pressure is a nominal 23 bar (333 lb in²), however the reservoir is tested to a maximum of 35 bar (507 lb in²).

Air Supply Assembly

Air Supply Unit

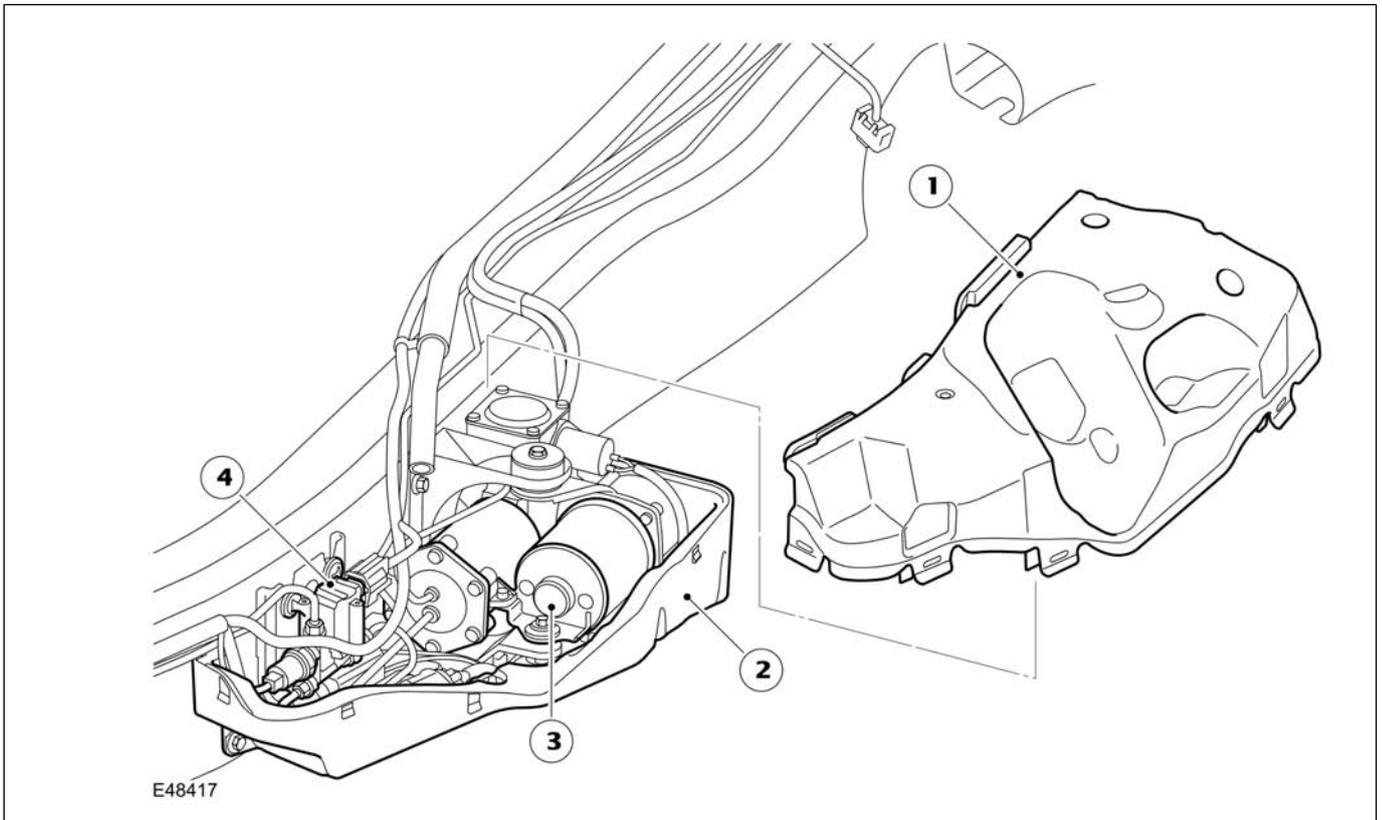


Air Supply Unit - Legend

Item	Description	Item	Description
1.	Mounting bracket	8.	Isolation mounting rubber (2 off)
2.	Air drier unit	9.	Electric motor
3.	Pilot exhaust valve solenoid and temperature sensors harness connector	10.	Isolation mounting rubber (1 off)
4.	Motor harness connector	11.	Pilot air pipe
5.	Intake port	12.	Pressure outlet to pilot exhaust valve
6.	Pilot exhaust valve	13.	Compressor cylinder head temperature sensor
7.	Exhaust valve	14.	Compressor

Acoustic Box

Acoustic Covers



Item	Description	Item	Description
1.	Upper cover	3.	Air supply unit
2.	Lower cover	4.	Reservoir valve block

Component Location

The air supply unit is located on the outside of the left hand chassis rail, forward of the upper control arm.

The unit is attached to the chassis rail and is protected by an acoustic box.

Acoustic Box

The acoustic box, which comprises of two parts; upper and lower and surrounds the air supply unit.

The box is a plastic molding which is lined with an insulating foam which controls the operating noise of the air supply unit.

The reservoir valve block is also located in the acoustic box.

Air Supply Unit

The air supply unit comprises the following major components:

- Piston compressor
- 12V electric motor
- Solenoid operated pilot valve
- Exhaust valve
- Air drier unit

The air supply unit can be serviced in the event of component failure.

Service Components

Servicing is limited to the following components:

- Air drier unit
- Pilot exhaust pipe
- Rubber mounts

Component Attachment

The air supply unit is attached to a bracket which is bolted to the chassis.

The unit is mounted to the bracket with flexible isolation mounting rubbers which assist in preventing operating noise from being transmitted to the chassis.

Air Supply Unit - Depressurization

Removal of the air supply unit does not require the whole air suspension system to be depressurized.

The front and rear valve blocks and the reservoir valve block are normally closed when de-energized, preventing air pressure in the air springs and the reservoir escaping when the unit is disconnected.

Air Supply Unit - System Inhibits

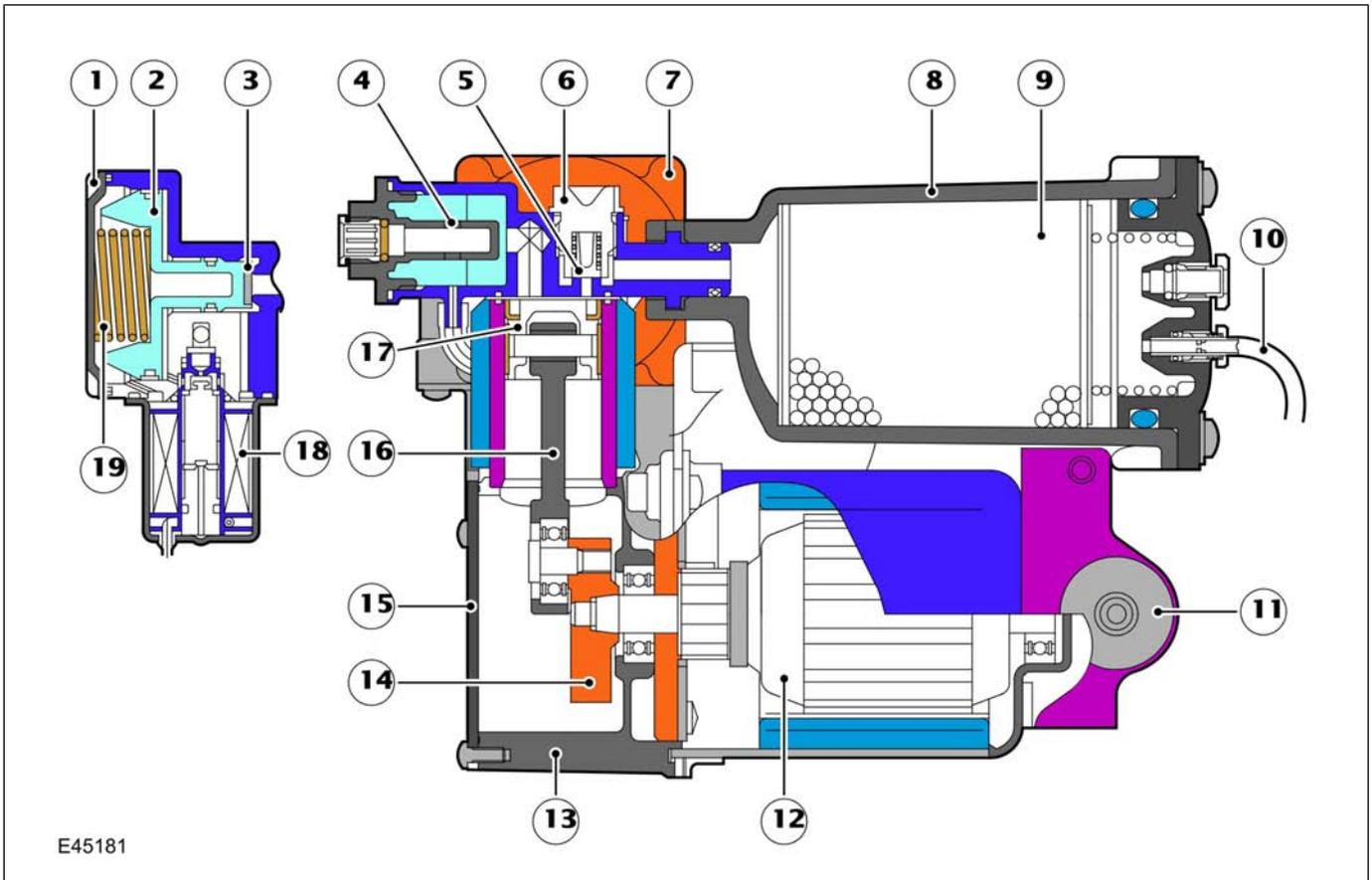
There are a number of conditions that will inhibit operation of the air supply unit.

It is vitally important that these system inhibits are not confused with a system malfunction.

A full list of air supply unit inhibits are given in the air suspension control module section in this workbook.

Air Supply Unit

Air Supply Unit - Sectioned View



E45181

Item	Description	Item	Description
1.	Exhaust valve cap	11.	Isolation rubber mount
2.	Plunger	12.	Motor assembly
3.	Valve seat	13.	Crankcase
4.	Intake silencer port	14.	Crank
5.	Delivery valve	15.	Crankcase cover
6.	Valve guide	16.	Connecting rod
7.	Cylinder head	17.	Piston
8.	Drier case	18.	Piston exhaust valve
9.	Desiccant	19.	Spring - pressure relief
10.	Pilot exhaust line		

Pilot Exhaust Valve

A solenoid operated pilot exhaust valve is connected to the air delivery gallery, downstream of the air drier.

The pilot valve, when opened, operates the main compressor exhaust valve.

This allows the air springs to be deflated when required.

When the solenoid is energized, pilot air moves the exhaust valve plunger, allowing pressurized air from the air springs and/or reservoir to pass via the reservoir control valve to the air supply unit.

The solenoid has a resistance value of 4 Ohms at a temperature of 20°C (68°F).

Exhaust Valve

The exhaust valve has three functions:

- It operates in conjunction with the pilot exhaust valve to allow air to be exhausted from the air springs and/or the reservoir as described previously
- The valve protects the system from over-pressure
- It is connected into the main pressure gallery which is subject to available system pressure in either the air springs or the reservoir

The valve is controlled by a spring which restricts the maximum operating pressure to between 319 to 391 lb in² (22 to 27 bar).

The minimum pressure in the system is also controlled by the exhaust valve to ensure that, even when deflated, the air springs contain a positive pressure of around 1.0 bar (14.5 lb in²) with respect to atmosphere.

This protects the air spring membrane by ensuring it can still 'roll' over the piston without creasing.

Electric Motor

The electric motor is a 12v dc motor with a nominal operating voltage of 13.5v.

The motor drives a crank which has an eccentric pin to which the compressor connecting rod is attached.

The motor is fitted with a temperature sensor on the brush PCB assembly.

The sensor is connected to the air suspension control module which monitors the temperature and can suspend motor operation if an overheat condition occurs.

Compressor

The compressor comprises a motor driven connecting rod and piston which operate in a cylinder with a cylinder head.

The motor rotates the crank moving the piston up and down in the cylinder bore.

The air in the cylinder is compressed with the up stroke and is passed via delivery valve, through the air drier into the system.

Air Drier

The air drier is an integral part of the air supply unit.

The air drier contains a desiccant which absorbs moisture contained in the air.

Pressurized air is passed through the air drier desiccant which removes any moisture in the compressed air before it is passed to the reservoir and/or the air suspension system.

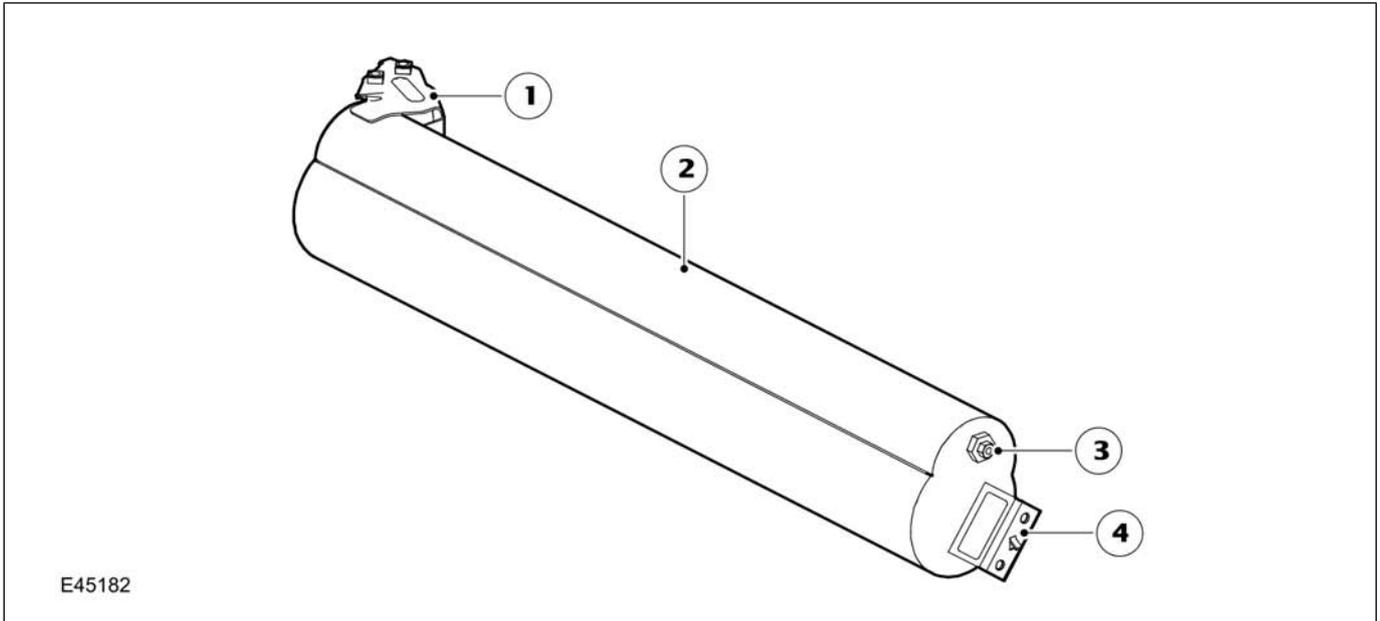
When the air is exhausted from the system, the returning air is passed back through the air drier, regenerating the air drier by removing moisture from the desiccant and expelling it to atmosphere via the exhaust outlet.

The air drier is an essential component in the system ensuring that only dry air is present in the system.

If moist air is present in the system, freezing can occur, resulting in poor system operation or component malfunction/failure.

Air Reservoir

Reservoir Assembly



Item	Description	Item	Description
1.	Front mounting bracket	3.	Air harness connection to reservoir valve block
2.	Reservoir	4.	Rear mounting bracket

The reservoir is an air storage vessel which provides fast air suspension lift times by the immediate availability of pressurized air into the system.

The reservoir is a steel fabrication and is located on the outside of the left hand chassis rail, in front of the air supply unit.

The reservoir has a bracket at each end which attach to the body mounting brackets on the chassis.

The rearward end of the reservoir has a 'Voss' air fitting which provides for the connection of the air hose between the reservoir and the reservoir valve block.

The reservoir has a capacity of 9 liters (550 in³).

The nominal working pressure of the reservoir is 16.8 bar (243.6 lb in²), with a maximum nominal pressure of 23 bar (333 lb in²).

The maximum tested pressure of the reservoir is 35 bar (507 lb in²).

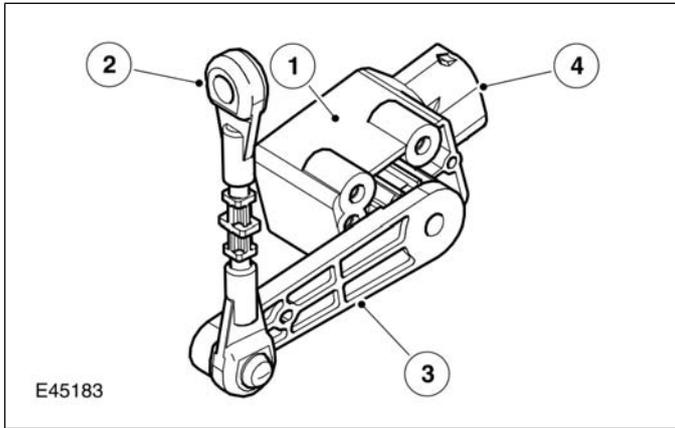
The pump will cut in when the reservoir pressure drops 1.0 bar (14.5 lb in²) below the nominal pressure setting.

Service Reservoirs

Reservoirs are supplied to service (and track) at atmospheric pressure, i.e. not pre-charged with a gas element of any kind .

Height Sensor Assemblies

Front - Height Sensor



Item	Description
1.	Sensor body
2.	Drop link
3.	Lever arm
4.	Electrical connection

Height Sensors

A height sensor is fitted in each corner of the vehicle to monitor the ride height of the vehicle.

The sensor bodies are attached with screws to brackets on the chassis rails.

Each sensor comprises a sensor body which contains a single track rotary potentiometer, a lever arm and a drop link.

The sensor lever arm has a drop link which provides the connection between the sensor and the suspension control arm.

The drop link is a serviceable component and is a push fit to the lever arm and the suspension control arm.

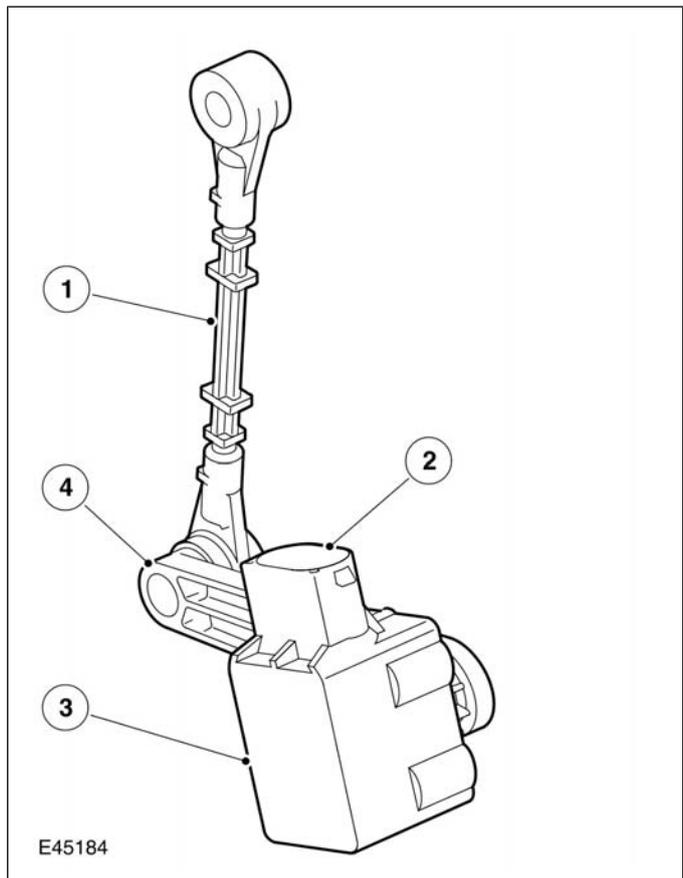
The sensors are connected via their harness connector to the air suspension control module which receives the signal output from each sensor and, using preprogrammed information, converts the signal to a height for each sensor position.

Sensor Identification

The front and rear sensors are handed and are colored coded for identification as follows:

- RH front and rear - black colored lever
- LH front and rear - white colored lever

Rear - Height Sensor



Item	Description
1.	Drop link
2.	Electrical connection
3.	Sensor body
4.	Lever arm

T4 Calibration

A calibration routine is performed using the T4 diagnostic unit.

The position of each corner of the vehicle is recorded and the result is recorded in to the ECU memory.

Once set, the calibration is not required to be performed unless one of the following occurs:

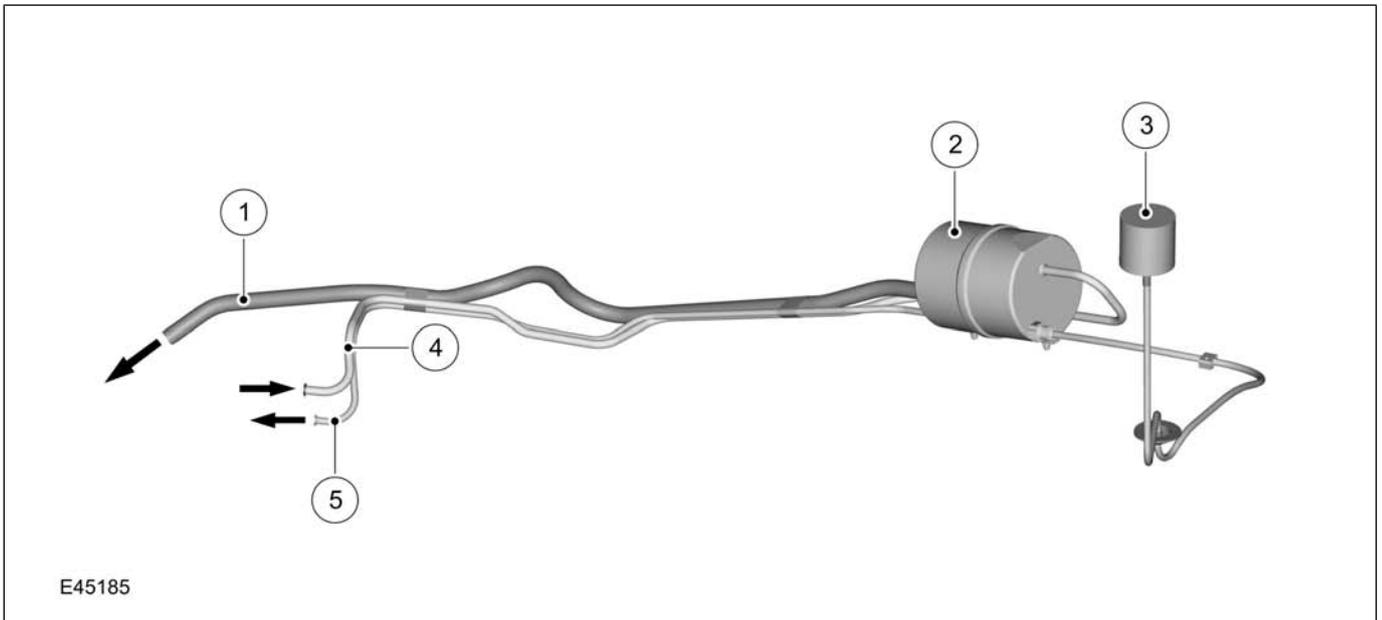
- Air suspension control module is removed or replaced
- Height sensor is removed or replaced
- Suspension arm to which the sensor is connected is removed or replaced

If the removed height sensor is subsequently refitted, the calibration procedure will have to be performed to ensure the integrity of the system.

If a replacement drop link is fitted, recalibration is not required providing the sensor body is not removed from its mounting bracket.

Air Intake Filter and Silencer

Air Intake Assembly



Item	Description	Item	Description
1.	Exhaust to atmosphere	4.	Exhaust air from air supply unit
2.	Inlet and exhaust silencer	5.	Air inlet supply to air supply unit
3.	Air inlet filter		

The air intake filter is connected via a pipe to the intake silencer chamber of the air silencer unit.

The filter is located inside the rear left hand corner of the body, away from possible sources of dirt and moisture.

The filter contains a foam element which removes particulate matter from the inlet air before it reaches the silencer or the air supply unit.

Pipe connections are molded onto each end of the intake silencer and provide for the attachment of the air inlet pipe from the inlet air filter and the air inlet pipe to the air supply unit.

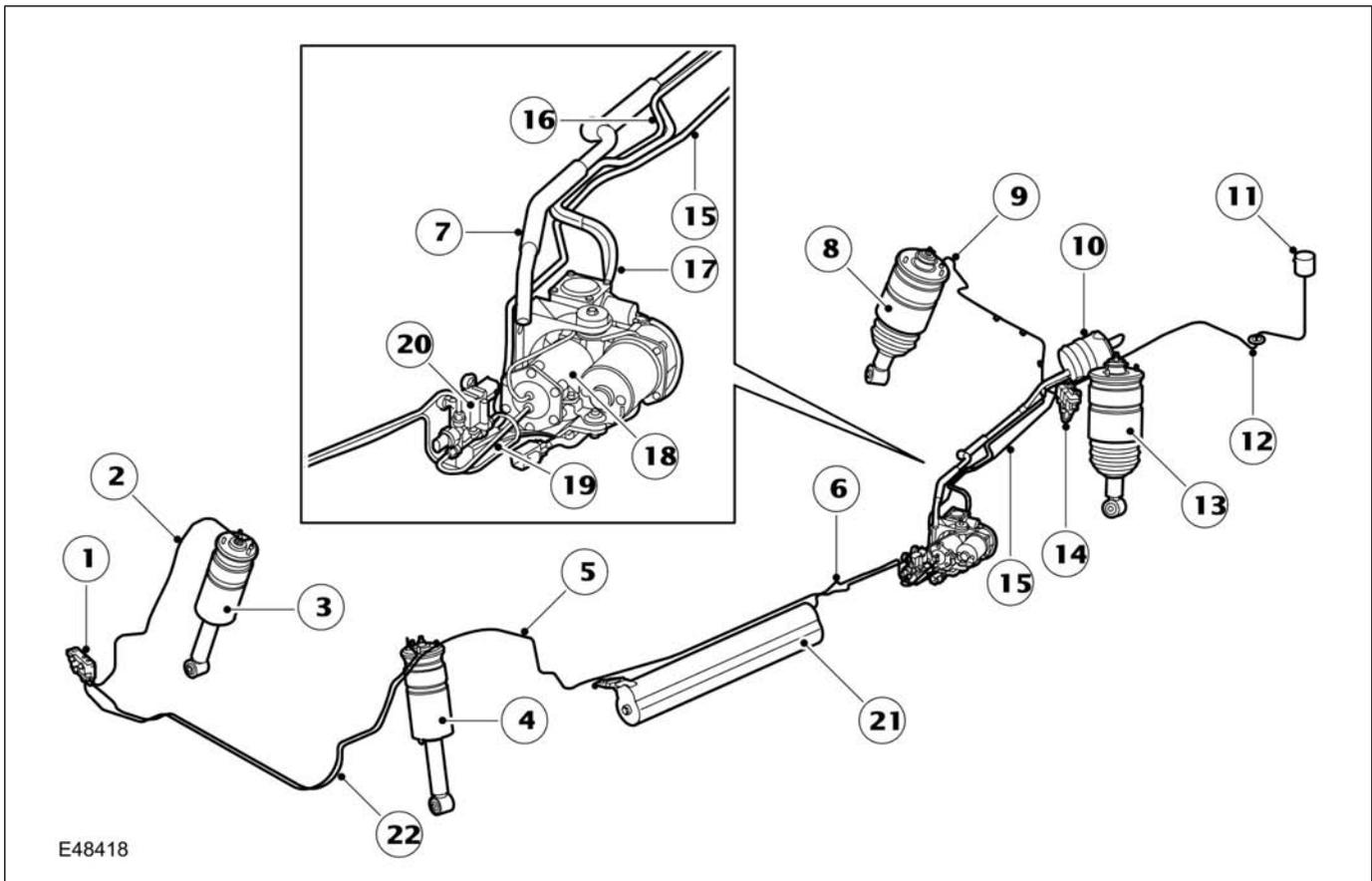
The air silencer is required to limit any noise produced from the air supply unit during inflation or deflation of the air springs.

The silencer comprises two plastic molded cans, which are bonded together with a silencing foam filling the large internal chamber which forms the exhaust silencer.

A pipe connection is molded onto each end of the silencer and provide for the attachment of the exhaust air to atmosphere pipe and the exhaust air pipe from the air supply unit.

Air Harness

Air Harness - Layout



Air Harness

Item	Description	Item	Description
1.	Front axle valve block	12.	Air harness - Main inlet
2.	Air harness - Valve block to RHF air spring	13.	LHR air spring and damper module
3.	RHF air spring and damper module	14.	Rear axle valve block
4.	LHF air spring and damper module	15.	Air harness - Reservoir supply to rear valve block
5.	Air harness - Reservoir supply to front valve block	16.	Air harness - Compressor air inlet
6.	Air harness - Reservoir valve block to reservoir	17.	Air harness - Compressor air exhaust
7.	Air harness - Exhaust air outlet	18.	Air supply unit - Desiccant
8.	RHR air spring and damper module	19.	Air harness - Air supply unit to reservoir valve block
9.	Air harness - Valve block to RHR air spring	20.	Reservoir valve block
10.	Air silencer assembly	21.	Reservoir
11.	Air inlet filter	22.	Air harness - Valve block to LHF air spring

Air Harness

Air Harness Diameters

PIPE	PIPE DIAMETER
High pressure pipe	6 mm
Compressor inlet	8 mm
Air intake filter to silencer	8 mm
Compressor exhaust	10 mm
Silencer exhaust	19 mm

The air harness consists of ten separate nylon pipes which are connected between the system components with Voss connectors.

The diameters of the individual pipes are shown in the table above for identification purposes.

If a pipe becomes damaged, an in-line connector is available for repair purposes.

The pipes are secured to the body and chassis via plastic retainer clips.

Air Harness Service

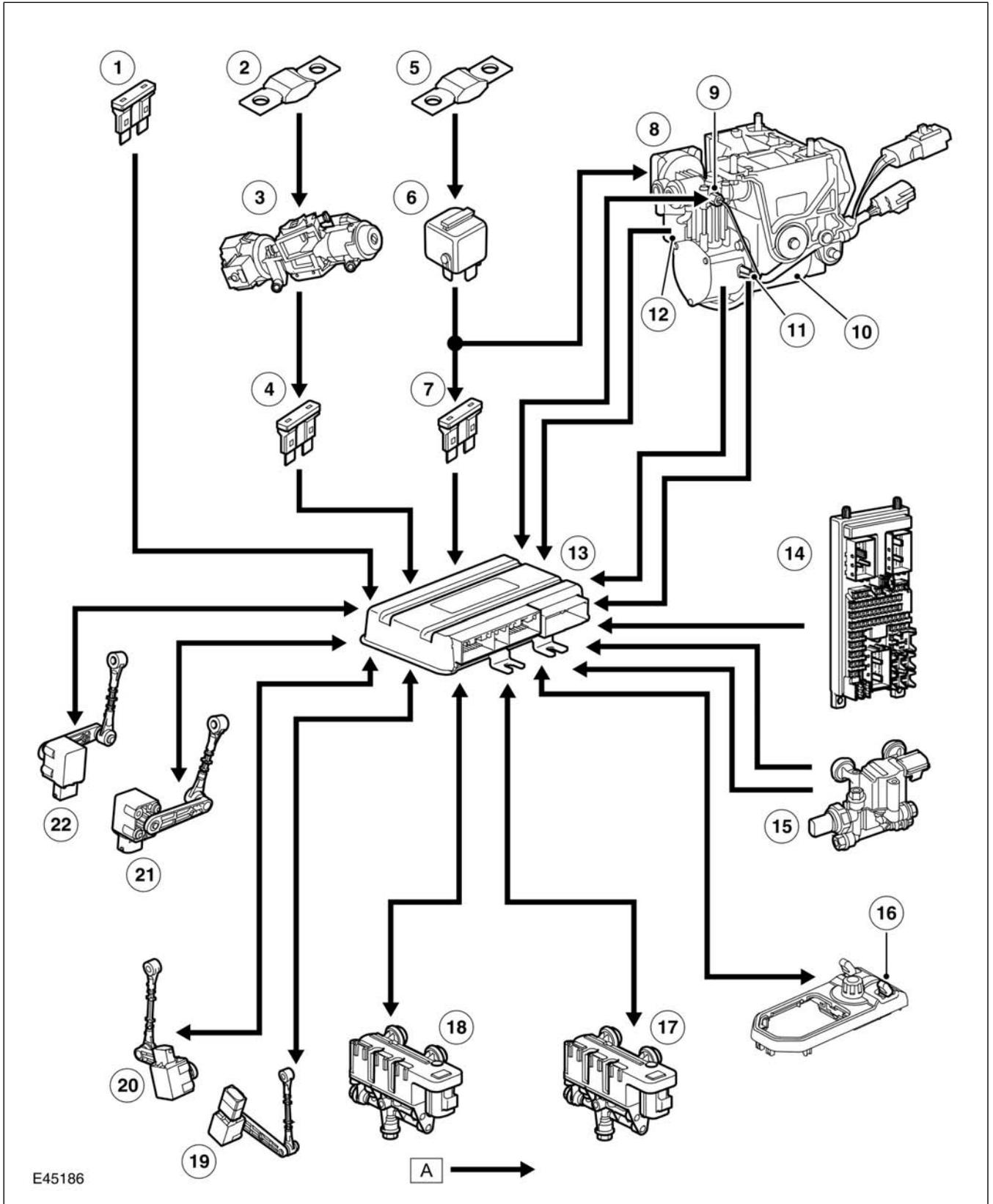
Voss connectors should be replaced when a pipe is removed and the old connector discarded.

Air harness Voss connectors can be reused if they are not disturbed from the pipe.

Installing Voss connectors to components requires careful observation so as not to cross thread components.

System Control Schematic

Control Schematic



Control Schematic

Item	Description	Item	Description
1.	Fuse 26E (20 amp)	12.	Exhaust valve solenoid
2.	Fusible link 11E (30 amp)	13.	Air suspension control module
3.	Ignition switch	14.	Central Junction Box (CJB)
4.	Fuse 35P (5 amp)	15.	Reservoir control valve
5.	Fusible link 10E (60 amp)	16.	Air suspension control switch
6.	Air supply unit relay	17.	Front valve block
7.	Fuse 3E (5 amp)	18.	Rear valve block
8.	Air supply unit	19.	RHR height sensor
9.	Compressor temperature sensor	20.	LHR height sensor
10.	Motor	21.	RHF height sensor
11.	Motor temperature sensor	22.	LHF height sensor