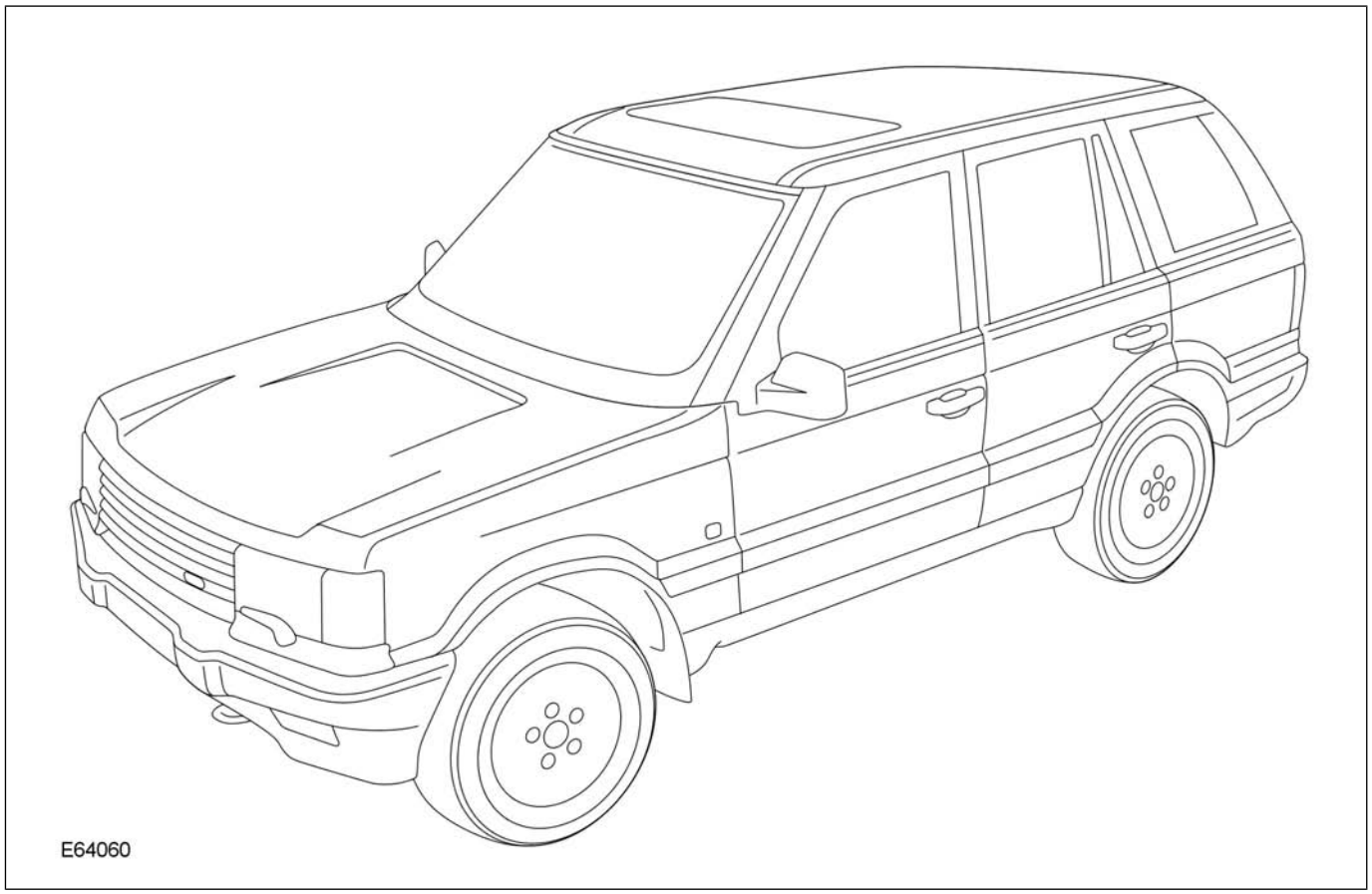
On completing this lesson, you will be able to:

- Follow the recommended route for diagnostics.
- Use the chart to process further diagnosis by eliminating certain scenarios or components.

## RANGE ROVER (LP)




### System Checks

#### Preliminary Checks

This section covers possible air suspension component faults. However a preliminary visual check of the components within the system plus any relevant fuses and relays should be carried out prior to undertaking any detailed fault diagnosis procedures. Full diagnostics are covered by the T4 diagnostic equipment.

#### Hard Ride

| Possible Cause | Remedy |
|---|---|
| Loss of air pressure in the system resulting in the chassis bump stops resting on the front and rear axles | Check air system components for faults and air suspension harness for leaks |
| Incorrect ride height | Re-calibrate the air suspension system. Refer to T4 diagnostic equipment |

**Permanent Standard Ride Height**

| Possible Cause | Remedy |
|---|---|
| Height sensor(s) inoperative due to loose or disconnected multi-plug | Reconnect multi-plug |
| Height sensor linkage disconnected or damaged | Reconnect or renew height sensor linkage |
| Faulty height sensor(s) | Renew height sensor(s) |
| Leaking air supply to air spring(s) | Check air harness connections and pipes for damage or scoring |
| Faulty or leaking air spring diaphragm | Renew air spring assembly |
| Faulty pressure switch | Refer to T4 diagnostic equipment |

**Air Suspension System Faulty or Inoperative**

| Possible Cause | Remedy |
|---|---|
| Blown air suspension system fuse | Check for cause and renew Fuse 44 |
| Blown fuse covering Height Control or Inhibit Switch | Check for cause and renew Fuse 17 |
| Faulty 'Height Control' switch resulting in the vehicle height remaining at last height setting until the engine is switched off | Refer to T4 diagnostic equipment to confirm the fault and renew 'Height Control' switch |
| Faulty 'Inhibit' switch leading to vehicle not operating automatically between standard and low modes | Refer to T4 diagnostic equipment to confirm the fault and renew 'Inhibit' switch |
| Compressor inoperative resulting in no air pressure due to loose or disconnected multi-plug | Check and reconnect compressor multi-plug |
| Blown compressor maxi fuse | Check for cause and renew maxi Fuse 2 |
| Faulty compressor relay leading to the compressor running continuously | Renew relay RL20 |
| Loss of air pressure in the air pressure system | Check the air system components for faults and air harness for leaks |
| Faulty delay relay<br>If the delay relay fails with a short circuit the system will be powered constantly resulting in a flat battery | Renew relay AMR3284 |

**Excessive Front End Body Roll**

| Possible Cause | Remedy |
|---|---|
| Deflated air spring | Check air system components for faults and air harness for leaks. Rectify or renew components where necessary |
| Faulty valve block | Refer to T4 diagnostic equipment |

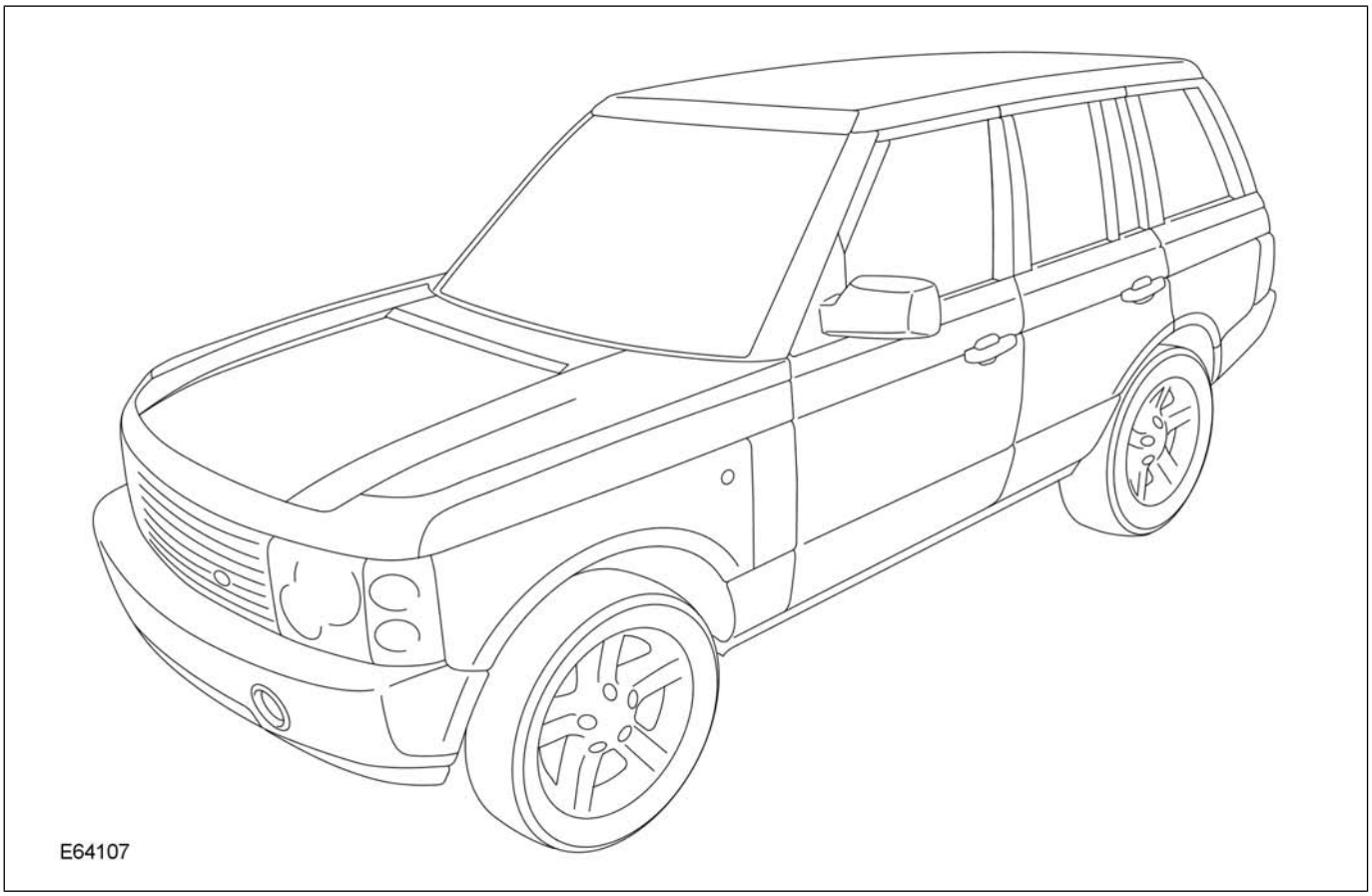
**Vehicle Leaning and Air Suspension Inoperative**

| Possible Cause | Remedy |
|---|---|
| Faulty height sensor | Refer to T4 diagnostic equipment to locate faulty height sensor. Renew height sensor and re-calibrate air suspension system |
| Incorrect height sensor calibration | Re-calibrate the air suspension system |

**Message center Warnings - Requiring Driver Response**

| Message | Meaning | Solution |
|---|---|---|
| **EAS MANUAL** | Vehicle locked in Access | EAS warning! The vehicle is being driven on its bump stops |
| **SLOW 20 MPH MAX** | Road speed is too high for current ride height | Slow down to less than 20 mph |
| **EAS FAULT** | There is a fault with the air suspension | Consult your Land Rover dealer |
| **SLOW 35 MPH MAX** | Air suspension fault | Slow to 35 mph and seek qualified assistance |

## RANGE ROVER (LM)




### System Checks

The air suspension system calibration must be carried out after the following components have been replaced:

- Air suspension ECU
- Height sensors
- Body panel incorporating suspension fixing points

To calibrate the air suspension system connect the T4 diagnostic equipment and follow the on-screen instructions.

**Calibration Notes:**

The vehicle can be calibrated laden or un-laden, but Gross Vehicle Weight (GVW) must not be exceeded.

Tires must be all the same size and at the correct tire pressures.

Ensure the floor used as the calibration area is level and smooth in all directions to enable calibration to be carried out successfully.

### Diagnostics

The air suspension ECU can store fault codes which can be retrieved using the T4 diagnostic equipment.

The diagnostic information obtained through the diagnostic socket which is located in the fascia, in the driver's stowage tray.

The fascia secured socket is protected by a hinged cover.

The diagnostic socket allows the exchange of information between the various ECU's on the various bus systems and the T4 diagnostic equipment or a diagnostic tool.

This allows fast retrieval of diagnostic information and programming of certain functions using the T4 diagnostic equipment or suitable diagnostic tool.

### Fault Detection

The air suspension ECU performs fault detection and plausibility checks.

Fault detection is limited to faults that the ECU can directly measure.

These faults are as follows:

- Sensor hardware faults
- Valve hardware faults
- Sensor faults
- Actuator faults
- Bus failure
- ECU hardware errors

### Plausibility Checks

Plausibility checks are checks on signal behavior.

These are as follows:

**Average height does not change correctly:**

- Height changes slowly
- Suspension moves in the wrong direction

**Reservoir pressure:**

- Does not increase when reservoir filling requested
- Does not decrease when reservoir used to lift vehicle
- Does not decrease when reservoir is vented
- Pressure varies too much when inactive

**Compressor temperature:**

- Increases when compressor inactive
- Does not increase when compressor active

**'Energy' used to change height of corner:**

- Too much energy used
- Height change takes too long
- Long term filtered height does not reach target

**Sensor activity:**

- Signal floating
- Inconsistent signal characteristic (signal on one axle is varying but the other side remains static
- Constant articulation when moving

### Ride Quality

When a fault is detected, the ECU will attempt to maintain a comfortable ride quality whilst maintaining a restricted functionality of the air suspension system.

### System Functionality

The system functionality when a fault exists depends on the severity of the detected fault.

Faults are defined as minor or major.

**Minor faults:**

- Most sensor faults (hardware or plausible faults)
- Cross link valve failure
- Reservoir valve failure

For most minor faults, height changes are inhibited except for a return to the standard height setting.

If the air suspension system is not in standard height mode, the air suspension ECU will respond with a request for a manual or automatic height change to return the vehicle to the standard ride height setting.

The air suspension ECU will continue to level the vehicle at the current ride height.

**Major faults:**

- Compressor faults
- Plausibility errors, for example:

- Average height does not increase when lifting and vehicle is moving. This could be caused by a compressor fault or fault in the reservoir valve.
- Reservoir pressure decreases when filling requested. This could be caused by a leak in the common gallery of the valve block or connecting air harness pipework.

For major system faults, the air suspension ECU will not level the vehicle at the current ride height.

The air suspension ECU freezes all height changes until it receives a manual or automatic request for height change.

The ECU will return to standard height and freezes once standard height is achieved.

### Speed Signal Loss

If the air suspension ECU loses information regarding vehicle speed, the ECU cannot determine if the current ride height is suitable for the vehicle speed.

The ECU immediately returns to a 'Default Height', which is 20 mm below stand ride height (Motor way ride height).

Once at the default height setting, the air suspension ECU will continue to level the vehicle at this height setting.

The loss of speed signal could be due to a fault in the CAN bus network or the ABS ECU.

A speed signal fault is unlikely to be a fault in the air suspension ECU.

This fault could be caused for example, by disconnecting the battery and not re-calibrating the steering sensor immediately upon battery re-connection.

In this case a CAN bus fault is recorded in the error memory.

If this fault is seen, other ECU's using the CAN bus should also be checked for fault codes.

When the fault is repaired, the air suspension ECU will resume full functionality, but the CAN error remains in memory.

### ECU Hardware Fault

If the suspension is above standard ride height and the ECU cannot lower the suspension or cannot determine the vehicle height, all height changes will be frozen.

The ECU will issue a message on the CAN bus which is received by the instrument pack, which displays a maximum advisable speed in the message center of '35MPH'.

An immediate freeze of the vehicle height is caused by the following:

- Failure of more than one height sensor
- Implausible articulation detected
- Valve or solenoid failure (does not include reservoir valve)
- Stuck corner or whole vehicle diagnosed used plausibility of sensor inputs

If the air suspension ECU has a hardware fault, the ECU will disable all air suspension functions.

Detectable hardware errors include memory error, ECU failure or calibration errors.

### Fault Messages

The air suspension has two methods which it can use to inform the driver of a fault in the air suspension system.

The methods used are as follows:

- Instrument pack message center
- Rotary control switch LED's

**LED's**

When minor faults occur and the air suspension ECU is able to level the vehicle to the 'current ride height', the rotary control switch LED's will display the current ride height.

When the vehicle returns to the standard ride height all further height changes are disabled, the 'Hold LED' in the rotary control switch will be permanently illuminated.

If the air suspension ECU suffers a major failure and there is no air suspension control, all the rotary control switch LED's will remain unlit.

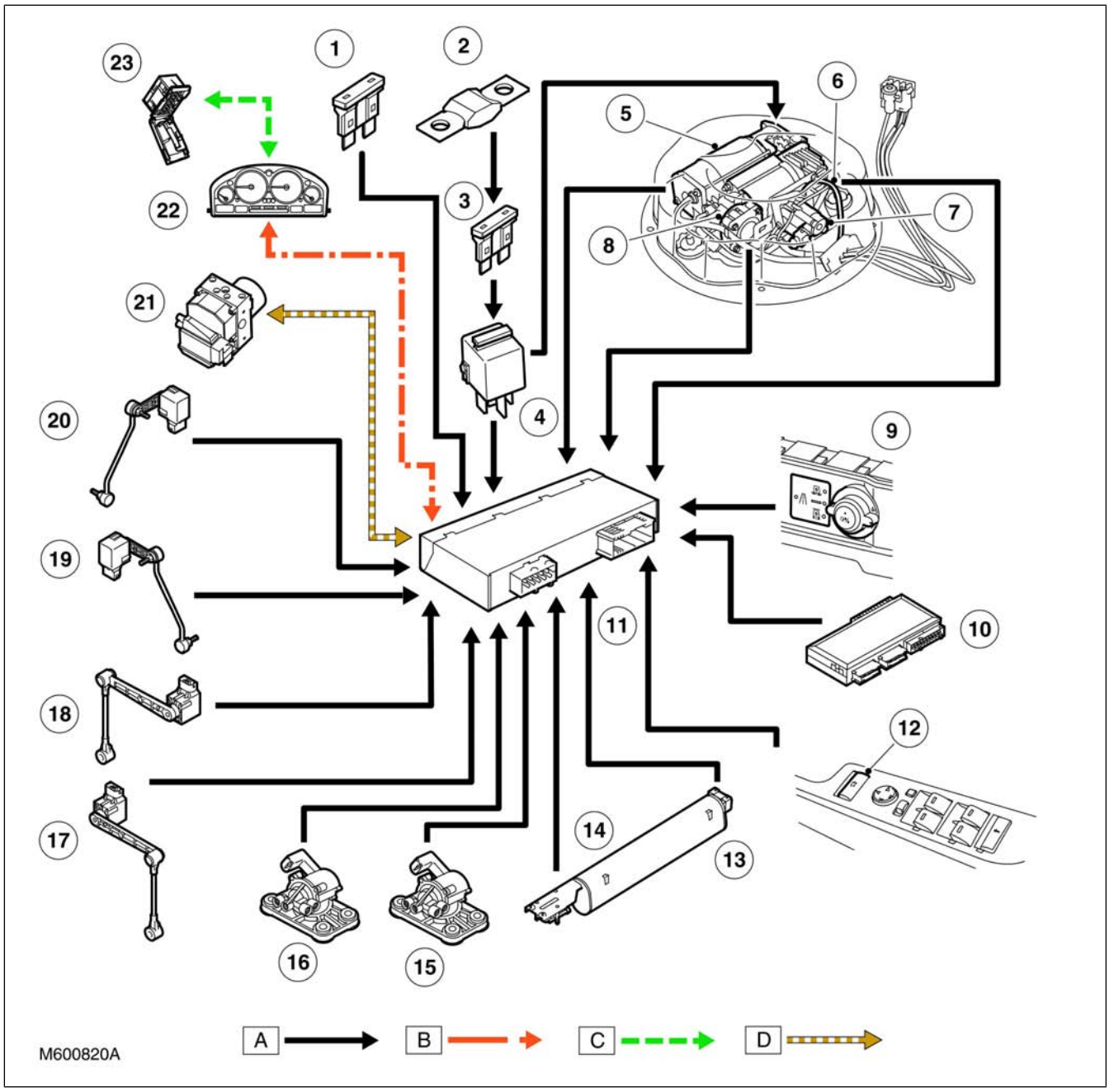
**Messages**

If a fault occurs and the ECU can determine the ride height and the vehicle is not above the standard ride height setting, the driver will be notified by an 'AIR SUSP. INACTIVE' message in the message center.

If the air suspension ECU cannot determine the ride height of the vehicle the 'AIR SUSP. INACTIVE' message is accompanied with an alternating 'MAX 35MPH' message.

## Bus Network

### Bus Network Connection



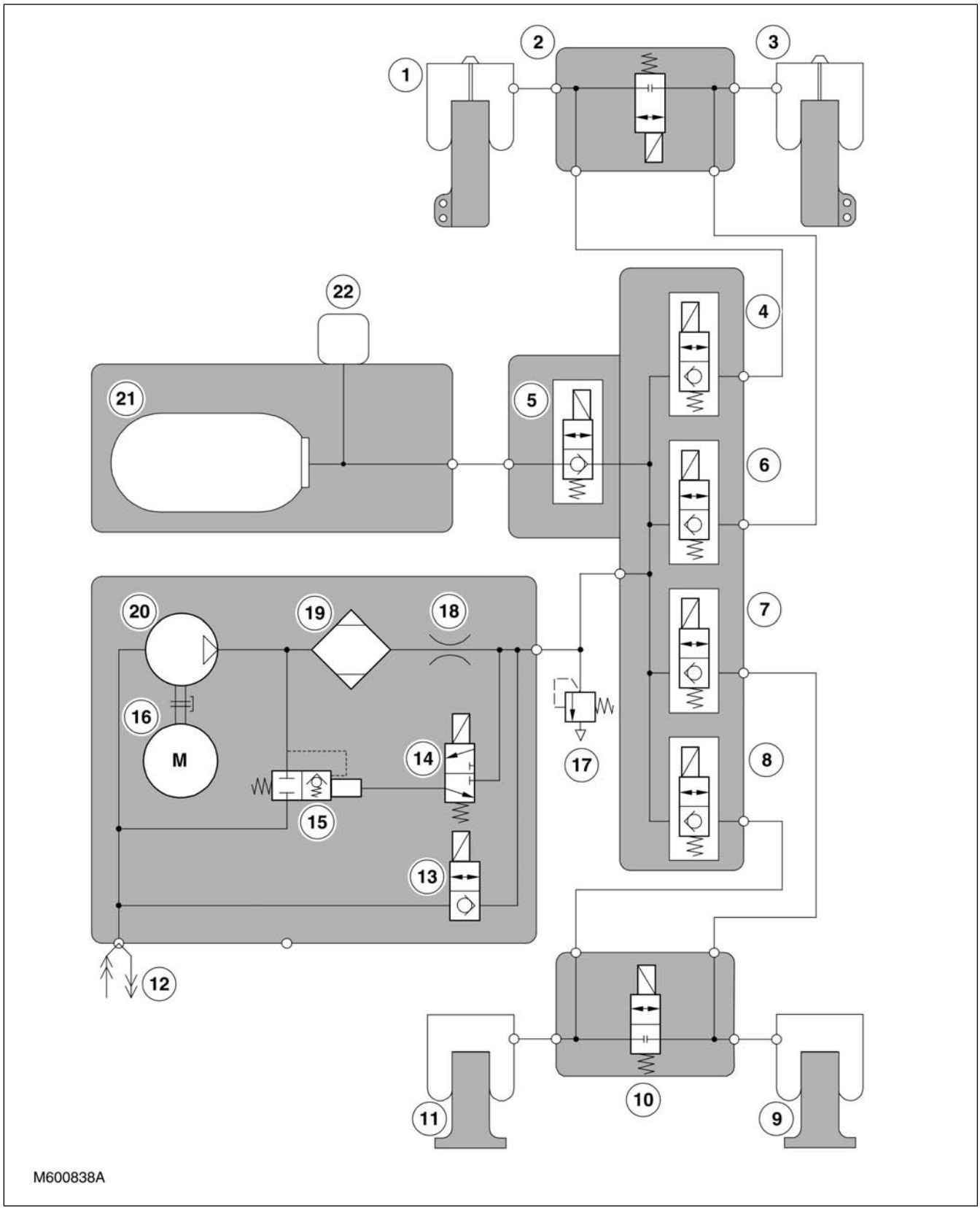

**Bus Network Connection**

Connection Type:

- A = Hardware
- B = 'K' Bus
- C = Diagnostic bus
- D = CAN bus

| Item | Description | Item | Description |
|---|---|---|---|
| 1. | Fuse 15A - Permanent supply | 13. | Reservoir pressure sensor |
| 2. | Fusible link 100A | 14. | Valve block |
| 3. | Fuse 50A | 15. | Front cross link valve |
| 4. | Air suspension relay | 16. | Rear cross link valve |
| 5. | Compressor and motor | 17. | LHR height sensor |
| 6. | Temperature sensor | 18. | RHR height sensor |
| 7. | HP exhaust valve | 19. | LHF height sensor |
| 8. | Exhaust valve | 20. | RHF height sensor |
| 9. | Control switch | 21. | ABS ECU |
| 10. | Body Control Unit (BCU) | 22. | Instrument cluster |
| 11. | Air suspension ECU | 23. | Diagnostic socket |
| 12. | Driver door module (access mode switch) | | |

**Pneumatic Circuit**



**Pneumatic Circuit**

| Item | Description | Item | Description |
|---|---|---|---|
| 1. | LHF damper /air spring | 12. | Compressor inlet /exhaust valve |
| 2. | Front cross link valve | 13. | HP exhaust valve |
| 3. | RHF damper /air spring | 14. | Exhaust pilot valve |
| 4. | LHF corner valve | 15. | Pressure limiting valve |
| 5. | Reservoir valve | 16. | Electric motor |
| 6. | RHF corner valve | 17. | Pressure relief valve |
| 7. | RHR corner valve | 18. | Restriction |
| 8. | LHR corner valve | 19. | Drier unit |
| 9. | RHR air spring | 20. | Compressor |
| 10. | Rear cross link valve | 21. | Reservoir |
| 11. | LHR air spring | 22. | Pressure sensor |

## ECU Diagnosis

On a number of occaisions it has been found that the Air Suspension ECU is being change when no fault exists with the ECU.

The ECU stores fault codes for numerous air suspension system component failures.

In the majority of cases, changing the ECU will re-activate the system and may appear to have rectified the fault, but it will not solve the root cause of the problem.

Therefore an Air Suspension ECU Diagnosis procedure has been implemented to prevent this occurence from being repeated.

## ECU Fault Reasons

There are only four reasons for changing the Air Suspension ECU:

1 . T4 Fault Code 52 (ECU Memory Fault)

2 . T4 Fault Code 53 (ECU Fault)

3 . T4 Fault Code 55 (ECU Calibration Fault)

4 . Communications to the EAS ECU have failed.

## Bulletin LM204-001 04 2005

Bulletin LM204-001 04 2005 details the way that these four Fault Codes should be diagnosed before replacing an ECU.

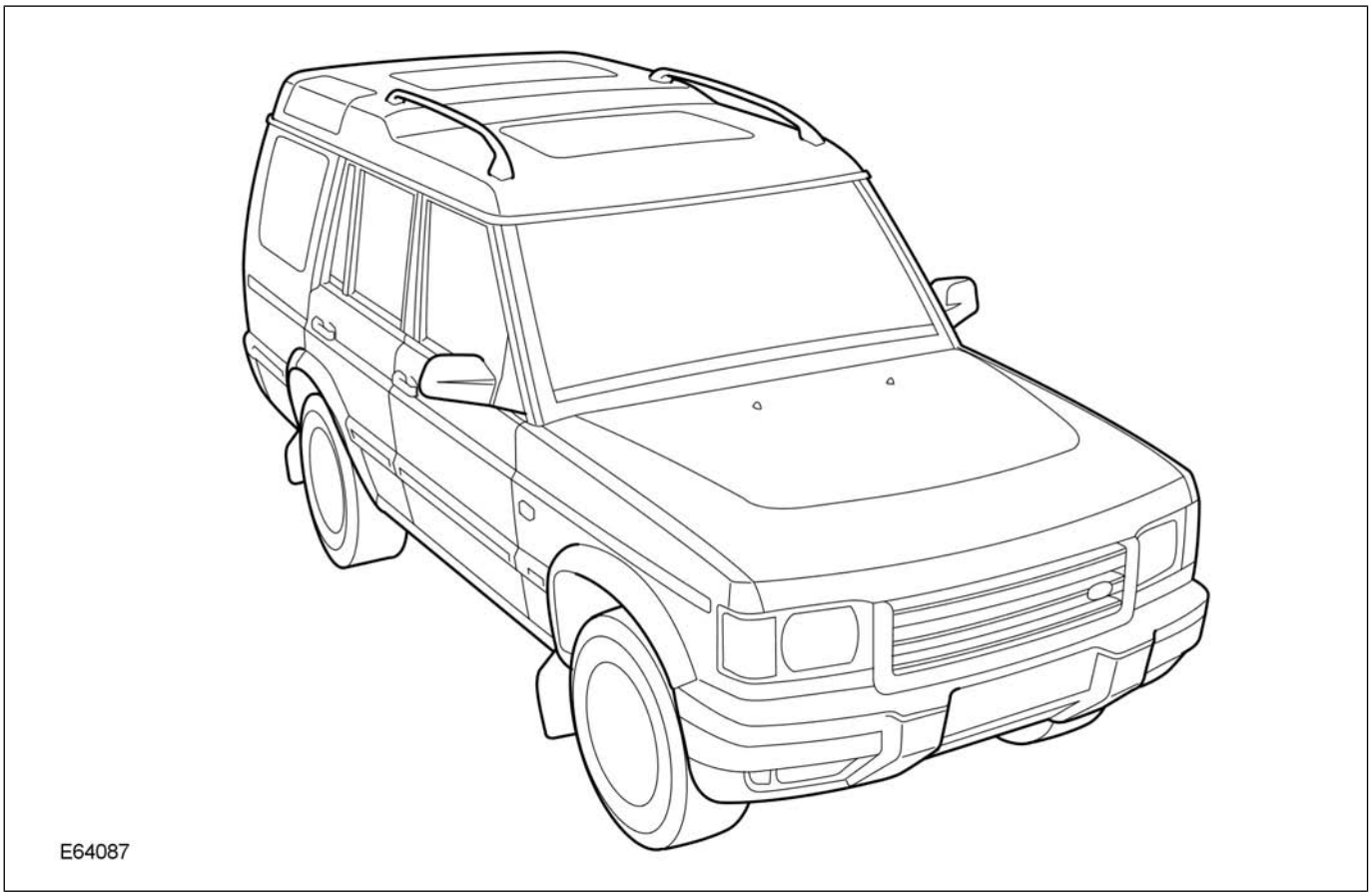
All other problems that appear to be ECU related are due to other components and/or wiring/air harness faults.

Normal fault diagnosis should be used for component and harness faults.

The solving of height sensor problems should always be accompanied by re-calibrating the vehicle trim heights.

Should a customer express concern regarding air suspension, refer to the Diagnostic Procedure detailed in the bulletin for correct system diagnosis before changing the ECU.

## Discovery Series II




### System Checks

Failures are indicated by the SLS warning lamp in the bottom left corner of the instrument pack illuminating continuously in an amber color.

The SLABS ECU can be interrogated via T4 diagnostic equipment to:

- Diagnose faults stored in the ECU memory, current or historic
- Test individual parts of the system
- Initialize a SLABS ECU for operation and configuration of functionality
- T4 diagnostic equipment will also be required to calibrate the settings of new height sensors and configure the remote transmitter (if applicable).

The following tables show the type of system failures and their effects on the system operation.

**Height Sensors**

| Failure | Effect |
|---|---|
| Sensor output stuck at 5v | Vehicle will not level |
| Sensor output stuck at 0v | Vehicle will not level |
| Mechanical link between radius arm and sensor broken | Vehicle will not level |

**Door Switch Inputs**

| Failure | Effect |
|---|---|
| Harness leads for open doors are broken or shorted to VBatt | Air suspension levels when one or more doors are open |
| Harness leads to door(s) shorted to earth | Air suspension will not level |

**SLS off-road mode switch**

| Failure | Effect |
|---|---|
| Fault in wiring harness | Off-road mode cannot be selected |
| Failure of off-road mode switch | Off-road mode is activated when switch has not been selected |

**Air supply unit air control valves**

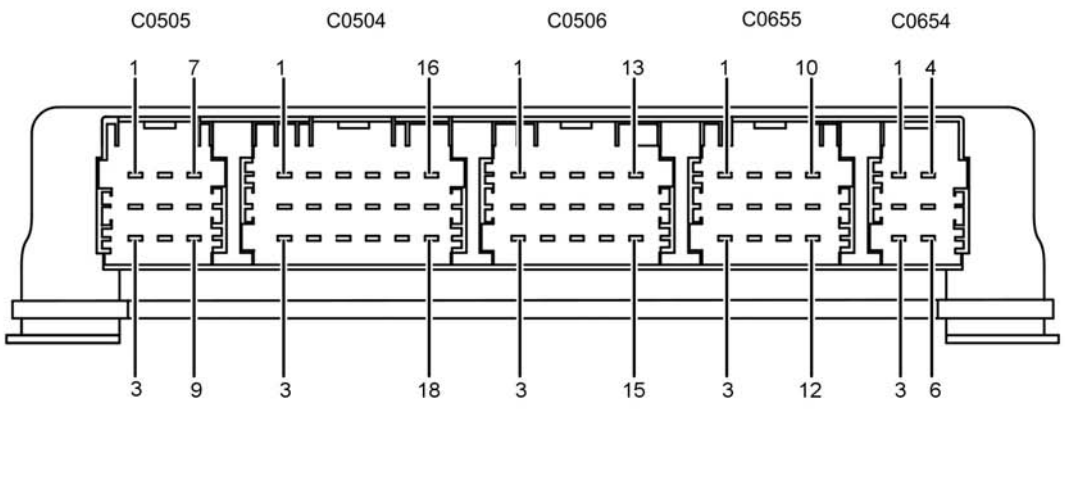
| Failure | Effect |
|---|---|
| Valves open or short circuit | Vehicle does not level or levels unevenly |

**Air supply unit compressor**

| Failure | Effect |
|---|---|
| Faulty relay, harness fault or compressor fault | Vehicle does not level upwards |

## Connector Details

### ECU Connectors




## Connector Information

### Connector Pin Detail - C0504

| Pin No | Description | Input or Output |
|---|---|---|
| C0504–1 | Battery supply | Input |
| C0504–2 | Ignition supply | Input |
| C0504–5 | 'K' line (diagnostics) | Input/Output |
| C0504–12 | Ground | Input |

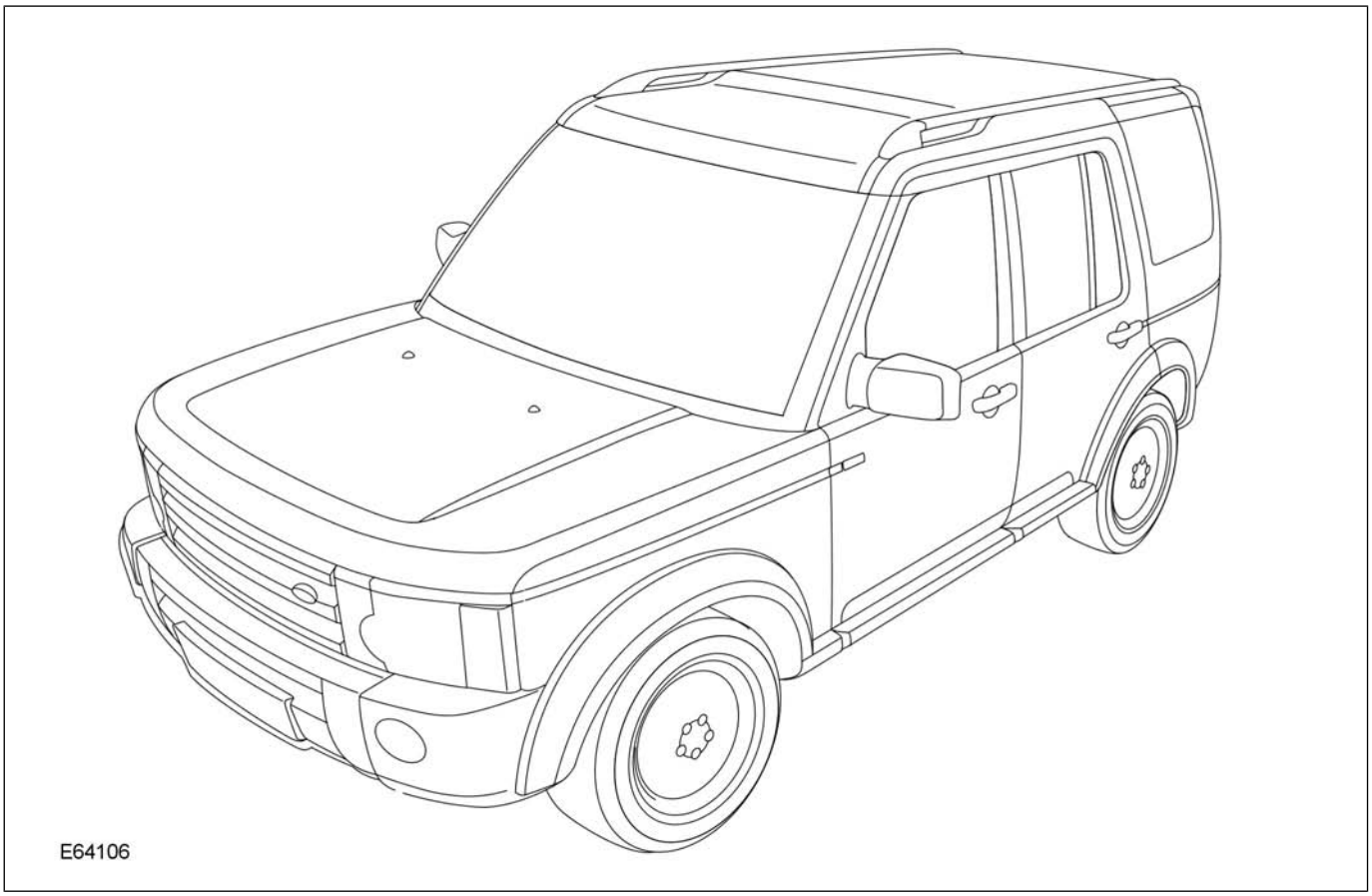
### Connector Pin Detail - C0654

| Pin No | Description | Input or Output |
|---|---|---|
| C0654–1 | Left height sensor supply | Output |
| C0654–2 | Left height sensor ground | Input |
| C0654–3 | Left height sensor feedback signal | Input |
| C0654–4 | Right height sensor supply | Output |
| C0654–5 | Right height sensor ground | Input |
| C0654–6 | Right height sensor feedback signal | Input |

**Connector Pin Detail - C0655**

| Pin No | Description | Input or Output |
|---|---|---|
| C0655–1 | Driver's door switch | Input |
| C0655–2 | Passenger and tailgate door switches | Input |
| C0655–3 | Left air valves | Output |
| C0655–4 | Right air valve | Output |
| C0655–5 | Exhaust valve | Output |
| C0655–6 | Air compressor (SLS relay) | Output |
| C0655–7 | Audible warning | Output |
| C0655–8 | SLS warning lamp | Output |
| C0655–11 | ORM switch /ORM warning lamp | Input/Output |
| C0655–12 | Remote handset raise /lower signal | Input |

## DISCOVERY 3 / LR3




### System Checks

The air suspension control module can store fault codes which can be retrieved using the T4 diagnostic unit.

Diagnostic information is obtained via the diagnostic socket which is located in the lower instrument panel closing panel, on the driver's side, below the steering column.

The diagnostic socket allows the exchange of information between the various control modules on the bus systems and T4 system or diagnostic tool.

This allows the fast retrieval of diagnostic information and programming of certain functions using the T4 system.

### Fault Detection

The air suspension control module performs fault detection and plausibility checks.

Fault detection is limited to faults that the control module can directly measure:

- Sensor electrical hardware faults
- Valve electrical hardware faults
- Sensor and actuator supply faults
- Bus failures
- Control module hardware errors

Plausibility checks are checks on signal behavior, as follows:

**Height Changes**

- Average height does not change correctly
- Height changes too slowly

**Gallery Pressure**

- Does not increase fast enough when reservoir filling requested
- Increases when system is inactive
- Too low when lifting is requested
- Increases too rapidly when filling reservoir
- Does not decrease when gallery is vented
- Pressure varies too much when inactive

**Compressor Temperature**

- Sensor voltage too large - head and brush sensors (short circuit to battery)
- Takes too long to be readable after suitable compressor run time - head and brush sensors
- Does not increase when compressor active - head sensor only

**Sensor Activity**

- Signal floating
- Constant articulation when moving

When a fault is detected, the air suspension control module will attempt to maintain a comfortable ride quality and where possible will retain as much functionality as possible.

The system functionality depends on the severity of the fault.

## Fault Categories

Faults are categorized into order of severity and effect on the system as follows:

- 1 = Minor fault
- 5 = Major fault

**Height sensor faults (hardware faults) and reservoir valve block failure**

- Retain full functionality with no 'refinements'
- Cross-link valves inoperative
- No compensation for uneven surfaces

**Pressure sensor faults, compressor faults, corner valves stuck shut**

- Road speed signal not available
- Vehicle returns to on-road mode height when next requested
- Levels at 'current' height

**Reservoir valve stuck open, exhaust valve stuck shut if below on-road mode height, corner valves stuck open if above on-road mode height**

- Vehicle returns to on-road mode height when next requested
- Does not level at 'current' height

**Failure of multiple height sensors, cross-articulation when driving, calibration corrupted**

- Vehicle lowers to bump stops

**ABS module failure, CAN bus failure**

- If the air suspension control module loses communications with the ABS module or the ABS module reports a fault, the air suspension control module immediately returns to the 'default' height, which is below the on-road ride height
- Once at the default height, the control module will continue to level the vehicle at this height
- It is unlikely that the fault will be in the air suspension control module
- When the fault is repaired, the air suspension control module will resume full functionality but the error will remain in the control module memory

For major faults the control module will not level the vehicle at the 'current' ride height.

The control module freezes height changes until it receives a manual or automatic request for height change.

The control module will return to standard height if possible and freezes once standard height is achieved.

If the suspension is above the on-road height and the air suspension control module cannot lower the suspension, all height changes will be frozen.

### ABS / CAN Failures

The control module will issue a message on the high speed CAN bus which is received by the instrument cluster which displays a maximum advisable speed in the message center.

An immediate 'freeze' of the vehicle height is caused by the following:

- Failure of more than one height sensor - vehicle on bump stops
- Implausible articulation symptoms detected - vehicle on bump stops
- Valve or solenoid failure - corner valve stuck open below on-road height or exhaust valve stuck shut above on-road height
- Stuck corner or whole vehicle (diagnosed using plausibility of the sensor inputs)

If height change is not possible, e.g. exhaust valve failed closed at off-road height or compressor failed at access height, the control module will not level or change height.

If the air suspension control module has a hardware fault, the control module will disable all air suspension functions.

Detectable hardware errors include memory error, control module failure and calibrations errors.

### Fault Messages

The air suspension has two methods which it can use to inform the driver of a fault in the air suspension system; the air suspension switch LED's and the instrument cluster message center.

When minor faults occur and the air suspension control module is able to level the vehicle to the 'current' ride height, the air suspension switch LED's will display the current ride height.

If the air suspension control module suffers a major failure and there is no air suspension control, all the control switch LED's will remain off.

If a fault occurs and the air suspension control module can determine the ride height and the vehicle is not above on-road height, the driver will be notified via an 'air suspension fault max speed 18.6 mph (30 km/h)' warning in the message center.

If the control module cannot determine the height of the vehicle, or the vehicle is above on-road height, cannot be lowered and the vehicle speed is too high, an air suspension fault message is displayed.

If the vehicle is restricted to on-road height an air suspension fault normal height only message is displayed.

## Connector Information

**Connector Pin Detail - C2030**

| Pin No | Description | Input or Output |
|---|---|---|
| 1 | Rear control valve - Cross link valve - positive (+) | Output |
| 2 | Not used | Not used |
| 3 | Not used | Not used |
| 4 | Not used | Not used |
| 5 | Air supply unit - Motor temperature sensor signal | Input |
| 6 | Not used | Not used |
| 7 | Air supply unit - Motor temperature sensor - Ground | Input |
| 8 | Switch pack display - Raising LED | Output |
| 9 | Switch pack display - Lowering LED | Output |
| 10 | Switch pack display - On-road mode LED | Output |
| 11 | Rear control valve - Cross link valve - negative (-) | Input |
| 12 | Not used | Not used |
| 13 | Not used | Not used |
| 14 | Not used | Not used |
| 15 | Not used | Not used |
| 16 | Not used | Not used |
| 17 | Switch pack display - Crawl mode LED | Output |
| 18 | Switch pack display - Access mode LED | Output |
| 19 | Not used | Not used |
| 20 | Input Switch pack - Raise switch signal | Input |

**Connector Pin Detail - C2320**

| Pin No | Description | Input or Output |
|---|---|---|
| 1 | Air supply unit voltage signal input from Air supply unit relay | Input |
| 2 | Reservoir control valve - Pressure sensor - 5 volt supply | Output |
| 3 | Reservoir control valve - Pressure sensor - Signal | Input |

| Pin No | Description | Input or Output |
|---|---|---|
| 4 | Reservoir control valve - Pressure sensor - Ground | Input |
| 5 | Air supply unit - Exhaust valve - Negative (-) | Input |
| 6 | Air supply unit - Exhaust valve - Positive (+) | Output |
| 7 | Not used | Not used |
| 8 | Not used | Not used |

**Connector Pin Detail - C2321**

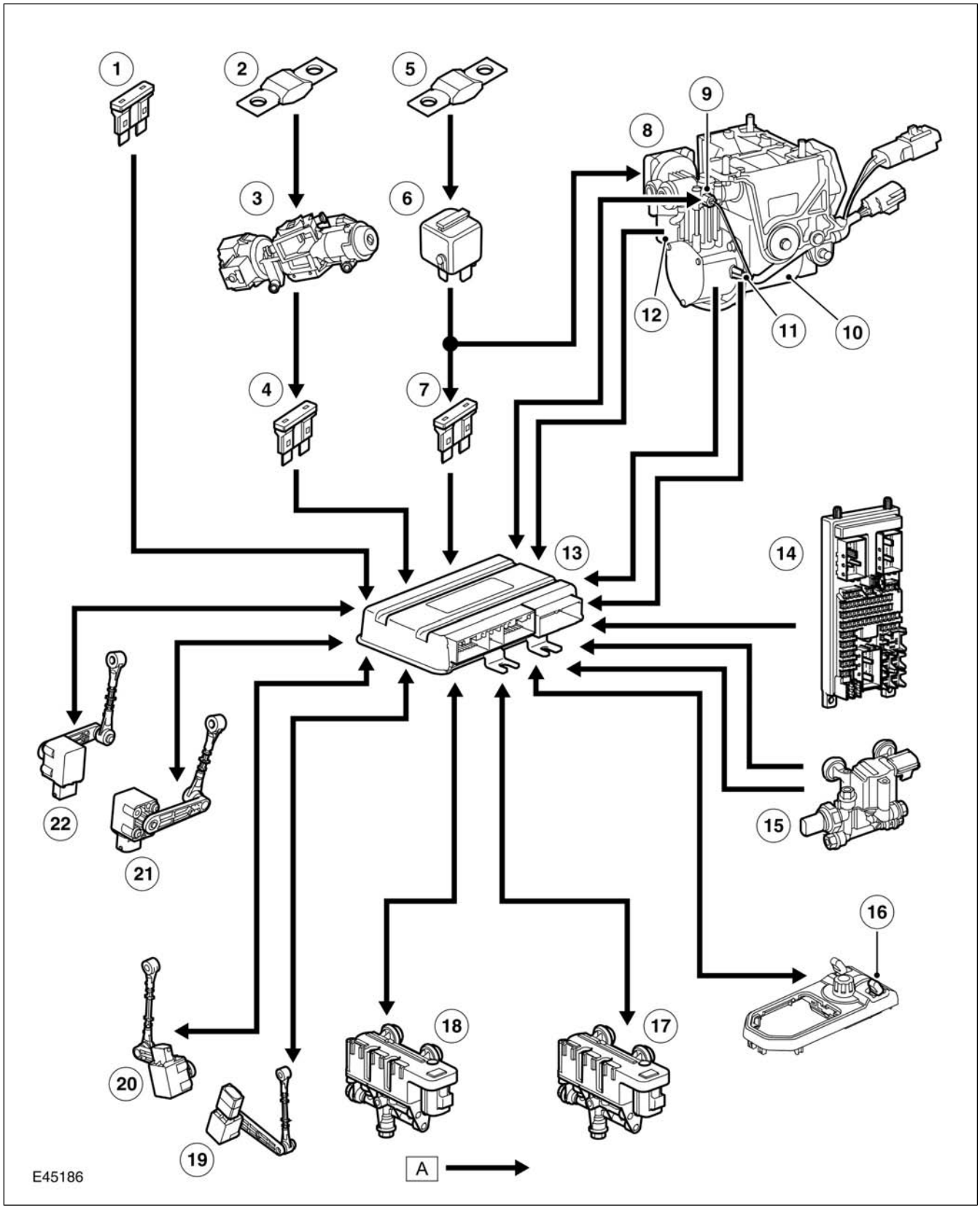
| Pin No | Description | Input or Output |
|---|---|---|
| 1 | 12V Permanent battery supply | Input |
| 2 | Compressor temperature sensor - Signal | Input |
| 3 | Front LH height sensor - 5 Volt supply | |
| 4 | Front LH height sensor - Signal | Input |
| 5 | Front LH height sensor - Ground | Input |
| 6 | Air supply unit relay coil - positive | |
| 7 | Air supply unit relay coil - ground | Input |
| 8 | Reservoir control valve coil - positive (+) | |
| 9 | Front control valve - RH corner valve - negative (-) | Input |
| 10 | Front control valve - RH corner valve - positive (+) | |
| 11 | Front control valve - LH corner valve - negative (-) | Input |
| 12 | Front control valve - LH corner valve - positive (+) | |
| 13 | Not used | Not used |
| 14 | Front RH height sensor - 5V supply | |
| 15 | Front RH height sensor - signal | Input |
| 16 | Front RH height sensor - ground | Input |
| 17 | Compressor temperature sensor - ground | Input |
| 18 | Not used | Not used |
| 19 | Not used | Not used |
| 20 | Not used | Not used |

| Pin No | Description | Input or Output |
|---|---|---|
| 21 | Reservoir control valve coil - negative (-) | Input |
| 22 | Front control valve - cross link valve - positive (+) | |
| 23 | Front control valve - cross link valve - negative (-) | Input |
| 24 | Ground | Input |

**Connector Pin Detail - C0867**

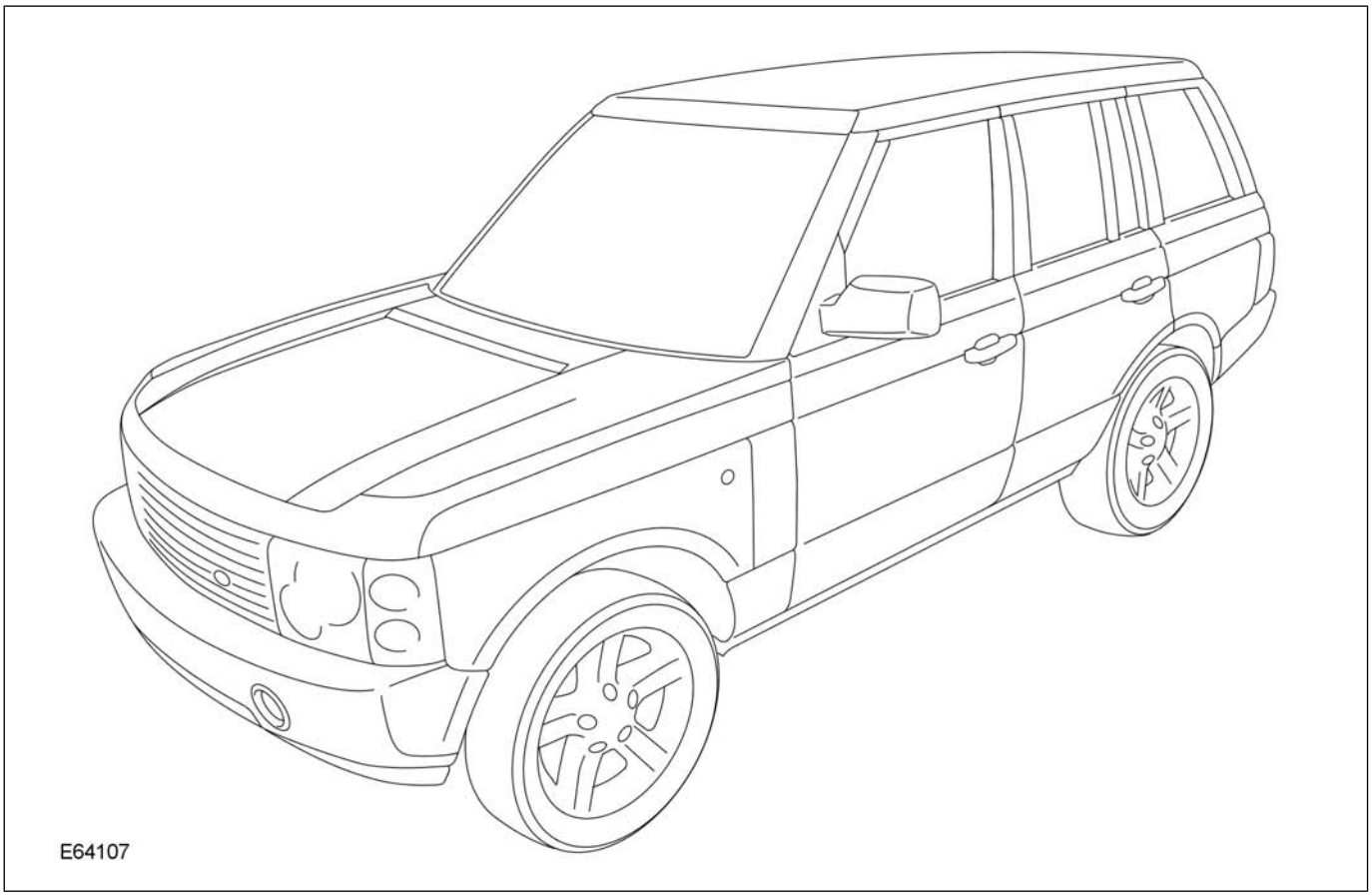
| Pin No | Description | Input or Output |
|---|---|---|
| 1 | Rear control valve - LH corner valve positive (+) | Output |
| 2 | Rear control valve - LH corner valve negative (-) | Input |
| 3 | Door status signal from CJB | Input |
| 4 | Switch pack - Lower switch signal | Input |
| 5 | Rear LH height sensor - 5v supply | Output |
| 6 | Rear LH height sensor - Signal | Input |
| 7 | Rear LH height sensor - Ground | Input |
| 8 | Rear RH height sensor - 5v supply | Output |
| 9 | Rear RH height sensor - Signal | Input |
| 10 | Rear RH height sensor - Ground | Input |
| 11 | Rear control valve - RH corner valve positive (+) | Output |
| 12 | Rear control valve - RH corner valve negative (-) | Input |
| 13 | Air suspension control - CJB signal | Input |
| 14 | Switch pack display - LED ground | Input |
| 15 | Switch pack display - LED high | Output |
| 16 | CAN IN positive (+) | Input |
| 17 | CAN OUT positive (+) | Output |
| 18 | CAN OUT negative (-) | Input |
| 19 | CAN IN negative (-) | Output |
| 20 | 12v ignition switch supply | Input |

**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 |

## 2006MY Range Rover (LM)




### System Checks

The air suspension control module can store fault codes which can be retrieved using T4.

The diagnostics information is obtained via the diagnostic socket which is located in the instrument panel, in the drivers stowage tray.

The socket is secured in the instrument panel and protected by a hinged cover.

The diagnostic socket allows the exchange of information between the various control modules on the bus systems and T4 or a diagnostic tool.

This allows the fast retrieval of diagnostic information and programming of certain functions using T4.

The air suspension control module performs fault detection and plausibility checks.

Fault detection is limited to faults that the control module can directly measure, as follows:

- Sensor electrical hardware faults
- Valve electrical hardware faults
- Sensor and actuator supply faults
- Bus failures
- Control module hardware errors.

Plausibility checks are checks on signal behaviour, as follows:

- Average height does not change correctly
- Height changes too slowly
- **Gallery Pressure**
  - Does not increase fast enough when reservoir filling requested
  - Increases when system is inactive
  - Too low when lifting is requested

  - Increases too rapidly when filling reservoir
  - Does not decrease when gallery is vented
  - Pressure varies too much when inactive.
- **Compressor Temperature**
  - Sensor voltage too large - head and brush temperature sensor (short circuit to battery)
  - Takes too long to be readable after suitable compressor run time - head and brush temperature sensor
  - Does not increase when compressor is active - head temperature sensor only.
- **Sensor Activity**
  - Signal floating
  - Constant articulation when moving.

When a fault is detected, the control module will attempt to maintain a comfortable ride quality and where possible will retain as much functionality as possible.

The system functionality depends on the severity of the fault.

**Faults**

Faults are categorised into order of severity and effect on the system as follows:

- Height sensor faults (hardware faults) and reservoir valve block failure
  - Retain full functionality with no 'refinements', e.g. cross-link valves inoperative, no compensation for uneven surfaces.
- Pressure sensor faults, compressor faults, corner valves stuck shut
  - Road speed signal not available
  - Vehicle returns to on-road height when next requested
  - Levels at 'current' height.
- Reservoir valve stuck open, exhaust valve stuck shut if below on-road height, corner valves stuck open if above on-road height
  - Vehicle returns to on-road height when next requested
  - Does not level at 'current' height.
- Failure of multiple height sensors, cross-articulation when driving, calibration corrupted
  - Vehicle lowers to bump stops.
- ABS module failure, CAN bus failure
  - If the air suspension control module loses communications with the ABS module or the ABS module reports a fault, the air suspension control module immediately returns to the default height, which is below the on-road height. Once at the default height, the control module will continue to level the vehicle at this height. It is unlikely that the fault will be in the air suspension control module. When the fault is repaired, the air suspension control module will resume full functionality but the error will remain in the control module memory.

For major faults the control module will not level the vehicle at the 'current' ride height.

The control module freezes height changes until it receives a manual or automatic request for height change.

The control module will return to on-road height and freezes once on-road height is achieved.

If the suspension is above the on-road height and the air suspension control module cannot lower the suspension, all height changes will be frozen.

The control module will issue a message on the high speed CAN bus which is received by the instrument cluster which displays a maximum advisable speed in the message center.

An immediate 'freeze' of the vehicle height is caused by one of the following:

- Failure of more than one height sensor - vehicle on bump stops
- Implausible articulation symptoms detected - vehicle on bump stops
- Valve or solenoid failure - corner valve stuck open below on-road height or exhaust valve stuck shut above on-road height
- Stuck corner or whole vehicle (diagnosed using plausibility of the sensor inputs).

If height change is not possible, e.g. exhaust valve failed closed at off-road height or compressor failed at access height, the control module will not level or change height.

If the air suspension control module has a hardware fault, the control module will disable all air suspension functions. Detectable hardware errors include memory error, control module failure, calibrations errors.

**Fault Messages**

The air suspension has two methods which it can use to inform the driver of a fault in the air suspension system; the air suspension control switch LEDs and the instrument cluster message center.

If the air suspension control module suffers a major failure and there is no air suspension control, all the control switch LEDs will remain unlit.

If a fault occurs and the control module can determine the ride height and the vehicle is not above on-road height, the driver will be notified via a message in the message center.

If the control module cannot determine the height of the vehicle, or the vehicle is above on-road height and cannot be lowered, a message is displayed and accompanied with a maximum speed message.

The following table shows messages related to the air suspension system.

| Message | Other Warnings | Meaning |
|---|---|---|
| SUSPENSION FAULT<br>NORMAL HEIGHT ONLY | One chime | A fault has been detected in the air suspension system and only on-road (normal) height is available. |
| SUSPENSION FAULT<br>MAX SPEED 30MPH (50KPH) | Two chimes repeated every 30 seconds if speed exceeded | A major fault has been detected in the air suspension system and it is unable to control the height correctly. |
| SLOW DOWN OR VEHICLE WILL RAISE | Two chimes | Vehicle will automatically raise to on-road height if speed increases. |
| SLOW DOWN OR VEHICLE WILL LOWER | One chime | Vehicle will automatically lower to on-road height from off-road height if speed increases. |
| SUSPENSION WILL LIFT WHEN SYSTEM COOLED | None | Air suspension compressor is cooling. Lifting will resume when compressor has cooled. |

| Message | Other Warnings | Meaning |
|---|---|---|
| VEHICLE LIFTING SLOWLY | None | Vehicle is lifting slowly from compressor only because reservoir is empty. Only displayed if lift time exceeds 12 seconds. |
| EXTENDED MODE | One chime | Vehicle body has become grounded on an obstacle. |
| RESET HEIGHT IF CLEAR OF OBSTACLE | None | Press air suspension rotary control switch downwards to exit the extended mode. |
| SUSPENSION LOCKED AT ACCESS HEIGHT | None | Crawl mode has been selected. |
| CLOSE DOORS TO CHANGE HEIGHT | One chime | Re-select height if door was open for more than 90 seconds or air suspension height change is restricted because a door is open. |
| SPEED TOO HIGH TO CHANGE HEIGHT | One chime | A height change has been requested that is not allowed, e.g. vehicle speed to high to select off-road height. |
| SUSPENSION FAULT | One chime | A fault has been detected in the air suspension system. |
| START ENGINE TO RAISE VEHICLE | None | The vehicle height can only be raised if the engine is running. |
| SUSPENSION LOWERED | None | The vehicle has lowered to access height because of a failure of another vehicle system. |

### Reservoir

The reservoir supplies pressurised air to the four air springs, via the reservoir valve block, to enable the air suspension system to raise the vehicle more quickly.

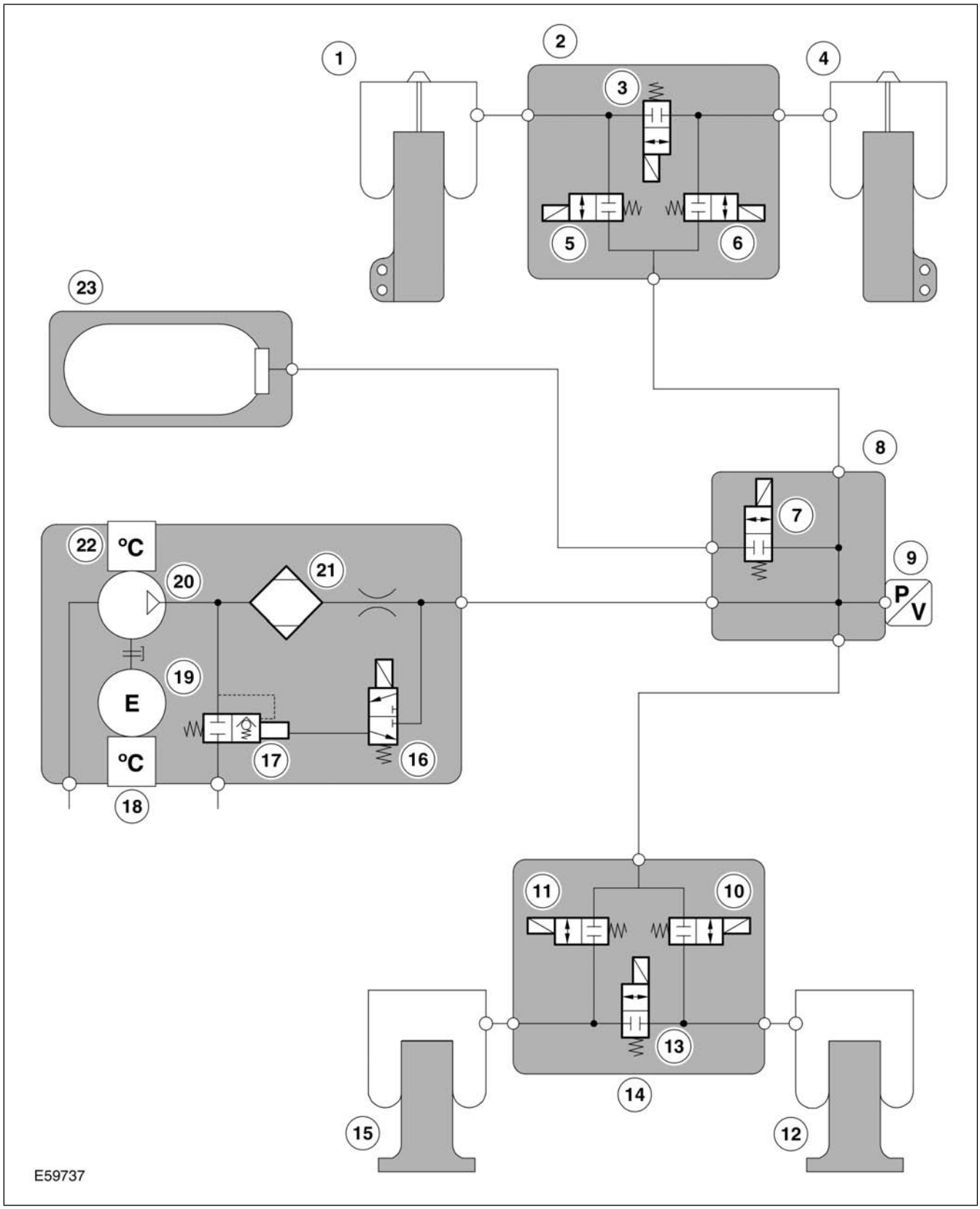
The air suspension control module assumes the reservoir has sufficient pressure, which is measured before a vehicle raise is started.

The control module then uses a software model to operate the compressor as required.

### System Pneumatic Circuit

The following schematic diagram shows the connection relationship between the air supply unit, the reservoir, the reservoir valve block, the cross-link valves and the air springs.

**System Schematic Circuit Diagram**

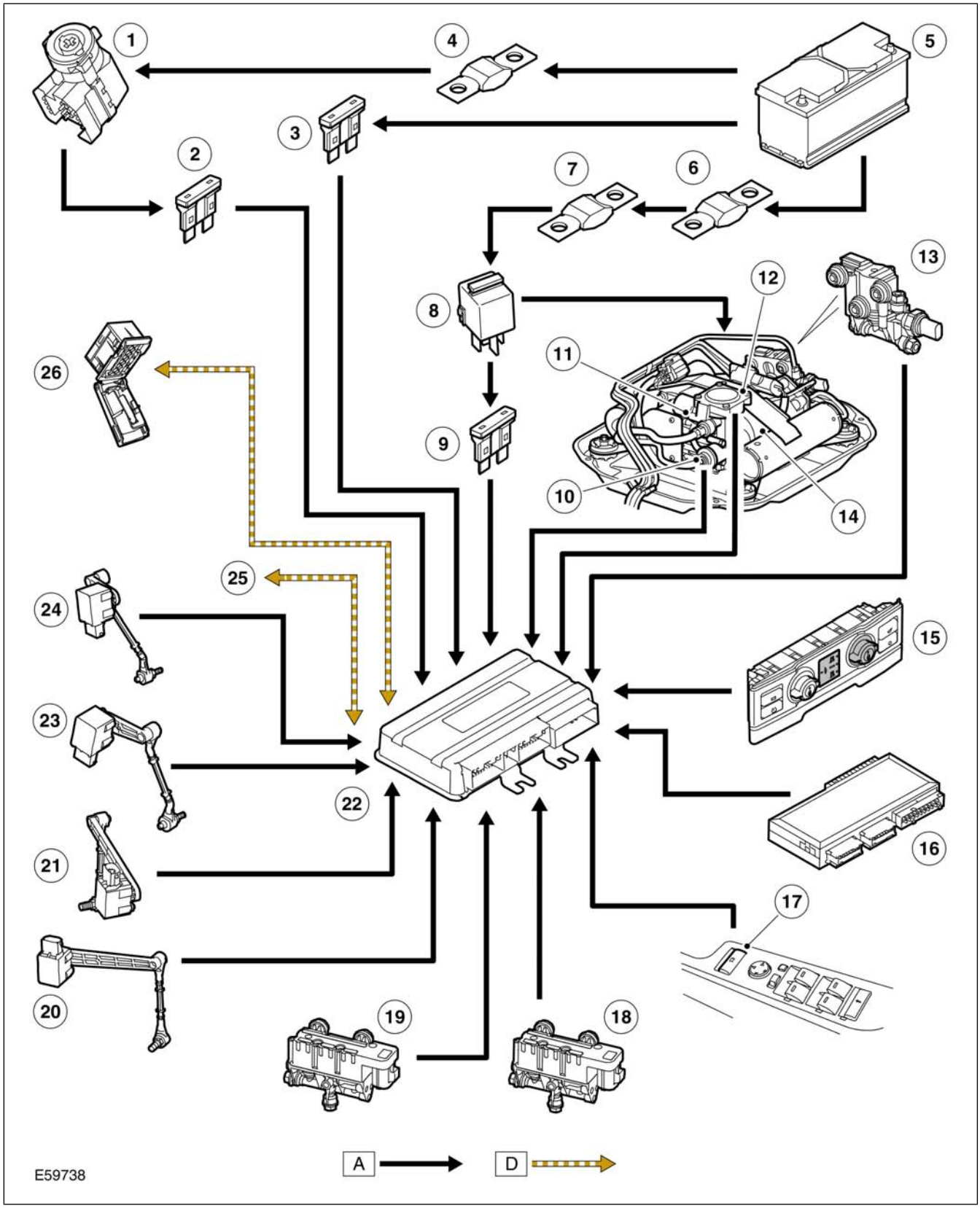


**Schematic Call Out Table**

| Item | Description |
|---|---|
| 1. | Front left hand air spring |
| 2. | Front axle valve block |
| 3. | Cross link valve |
| 4. | Front right hand air spring |
| 5. | Front left hand corner valve |
| 6. | Front right hand corner valve |
| 7. | Reservoir valve |
| 8. | Reservoir valve block |
| 9. | Pressure sensor |
| 10. | Rear right hand corner valve |
| 11. | Rear left hand corner valve |
| 12. | Rear right hand air spring |
| 13. | Cross link valve |
| 14. | Rear axle valve block |
| 15. | Rear left hand air spring |
| 16. | Pilot exhaust valve |
| 17. | Pressure relief valve and exhaust valve |
| 18. | Motor temperature sensor |
| 19. | Electric motor |
| 20. | Compressor |
| 21. | Air drier assembly |
| 22. | Compressor temperature |
| 23. | Reservoir |

**Air Suspension Control Diagram**

**NOTE: A** = Hardwired; **D** = CAN Bus high speed



| Item | Description |
|---|---|
| 1. | Ignition switch |
| 2. | Fuse 7P (5 amp) - CJB Ignition switch position II supply |
| 3. | Fuse 57P (20 amp) - Permanant supply from battery |
| 4. | Maxi fuse 62 (40 amp) - CJB |
| 5. | Battery |
| 6. | Fusible link 5P (100 amp) - Permanant supply from battery |
| 7. | Maxi fuse 22R (60 amp) - Permanant supply from battery |
| 8. | Air suspension relay in rear fuse box |
| 9. | Fuse 13R (5 amp) - Battery voltage signal to control module |
| 10. | Compressor and motor |
| 11. | Pilot exhaust valve solenoid |
| 12. | Compressor temperature sensor |
| 13. | Reservoir valve block |
| 14. | Exhaust valve |
| 15. | Control switch |
| 16. | Generic Electronic Module (GEM) |
| 17. | Driver's door module access mode switch |
| 18. | Rear valve block |
| 19. | Front valve block |
| 20. | Left hand rear height sensor |
| 21. | Right hand rear height sensor |
| 22. | Air suspension control module |
| 23. | Left hand front height sensor |
| 24. | Right hand front height sensor |
| 25. | CAN bus interface with other control modules |
| 26. | Diagnostic socket |