PaulP38A.com

Range Rovers and other Big Boy Toys

How EAS Works

How the Range Rover P38 Electronic Air Suspension (EAS) Works

Introduction

The notes below are based on knowledge accumulated through research, P38 enthusiast forums and good old trial and error.

I do not pretend to know everything there is to know about the EAS, and if I have got something incorrect please let me know through the usual channels – PaulP38a at http://www.AULRO.com or Paul Snr Cordwell at the Range Rover P38 group on Facebook https://www.facebook.com/groups/RRP38/.

Basics of Operation

Important stuff to note about the EAS on a Range Rover P38:

- If a door or the tailgate is open, the EAS will not adjust (unless you are moving at more than 8kph);
- If your foot is on the brake pedal, the EAS will not adjust (unless you hold it for more than 3 minutes);
- Pushing in the EAS Inhibit switch on the centre dash will prevent the car from changing height between Standard and Low height settings;
- In automatic mode, the height of the car will drop from Standard to Low (Highway) height when speed is maintained above 80kph for more than thirty seconds. It will return to Standard height when speed drops below 60kph for more than 60 seconds;
- When parked and with the engine off, the car should never raise its height. It will automatically wake up every few hours to check and adjust height, but should only ever adjust down to the lowest height sensor reading.

Fuses and Relays:

Relay RL20 and MF2 30 Amp Maxi-fuse control power to the diaphragm solenoid and

compressor.

F44 (F29 on post-99 models) is a 10 Amp fuse which controls the EAS ECU, the valve driver pack and the pressure switch.

The delay timer under the front left seat maintains power to the EAS after the ignition is switched off, and wakes it up every few hours to adjust downwards to the lowest height sensor reading..

Height Sensors

These are simple potentiometers that have a 5 Volt reference voltage modified by the dial position on the sensor, and fed back to the EAS ECU. Valid readings are between 40 and 255 bits when read by a diagnostics tool. These readings do not necessarily have a direct bearing on actual heights between each corner, so always use a measuring tape or similar to set correct heights.

At the front, the height sensors are connected between the chassis and the radius arms.

At the rear, the height sensors are connected between the chassis and the trailing arms.

Air Compressor

The internal thermal sensor should cut out at approximately 120 DegC, allowing the system to cool down for three minutes. If the thermal switch is still tripped (open path to ground) after three minutes, another three minute period will start and repeat until the thermal switch path to ground is closed.

Air Dryer

Potentially moist air from the compressor passes through the dryer before entering the main body of the valve block to the air lines.

When exhausting from the air springs, air passes back through the dryer in the opposite direction to flush out moisture through the exhaust port on the valve block.

Air Tank/Reservoir

A 9L air tank is mounted to the chassis roughly under the right hand seats. A single 6mm air line is used to supply and exhaust air to/from the tank. The tank has a plug to drain accumulated moisture.

Air Lines

6mm air lines go to the air springs, and the line to/from the tank, plus the short line between the compressor and valve block.

A 4mm vent line exits the diaphragm solenoid.

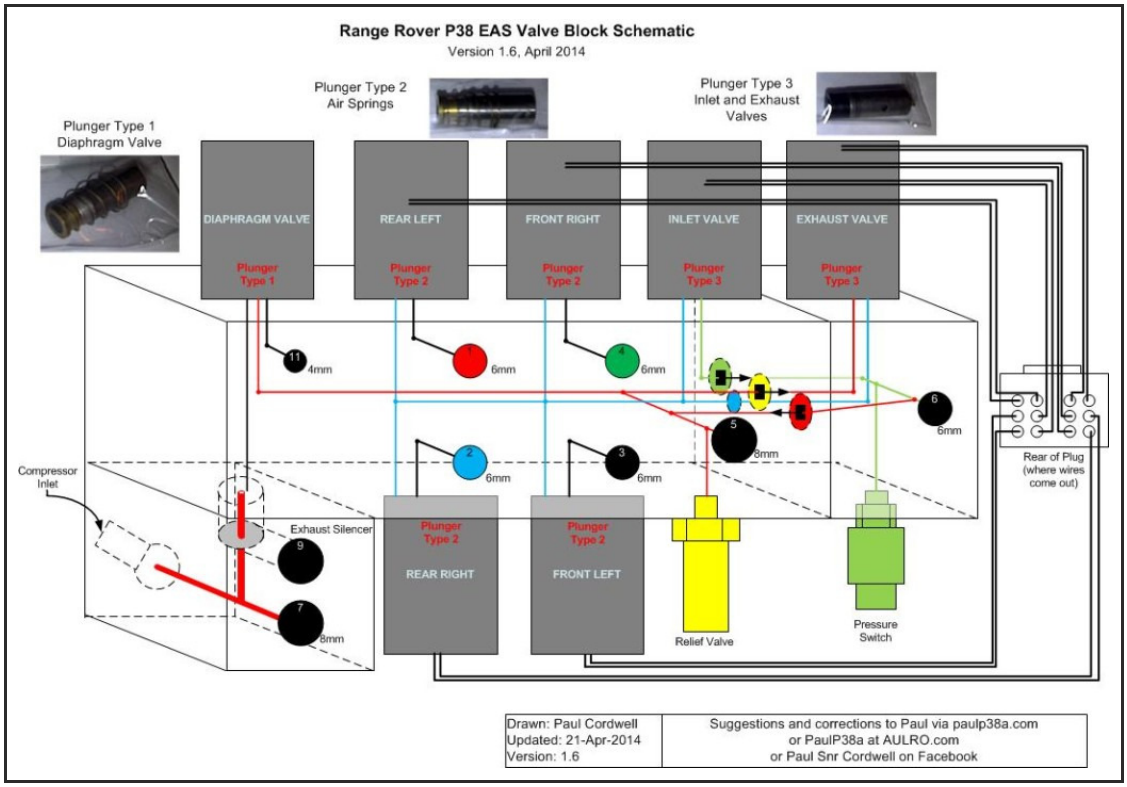
8mm air lines are used for the two lines between the valve block and air dryer.

Valve Block Components Overview

Main components are:

- A solenoid for each air spring to allow air in or out, operated by the driver unit (aka Valve Driver);
- A solenoid for air ingress, and one for air egress/exhaust, operated by the driver unit;
- A solenoid to operate the diaphragm which controls the direction of air flow, activated by the compressor relay;
- A pressure switch controls operation of the compressor. Below approximately 115psi (790kpa) the compressor should operate, and cut out at approximately 150psi (1030kpa).
- A relief valve vents excess pressure inside the valve block at approximately 180psi (1240kpa).
- A silencer is screwed in to the smaller block to quieten exhausting air.
- The driver unit (aka Valve Driver, the black epoxy casing at the side of the valve block) controls the current to the six solenoids (the diaphragm solenoid is operated by the compressor relay) to give a pulsed voltage, which prevents the coils within the solenoids from burning out

Click the image below to open it in a new window



How the Valve Block Operates

WHEN FILLING THE AIR TANK

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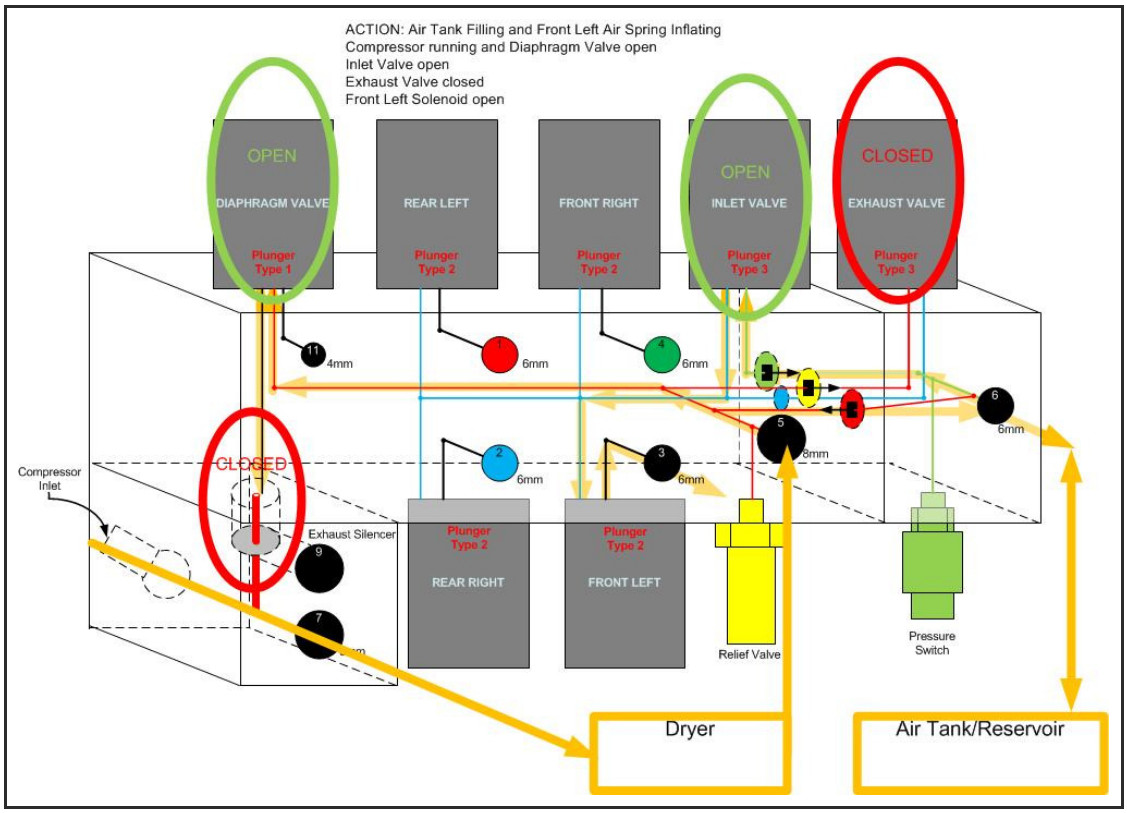
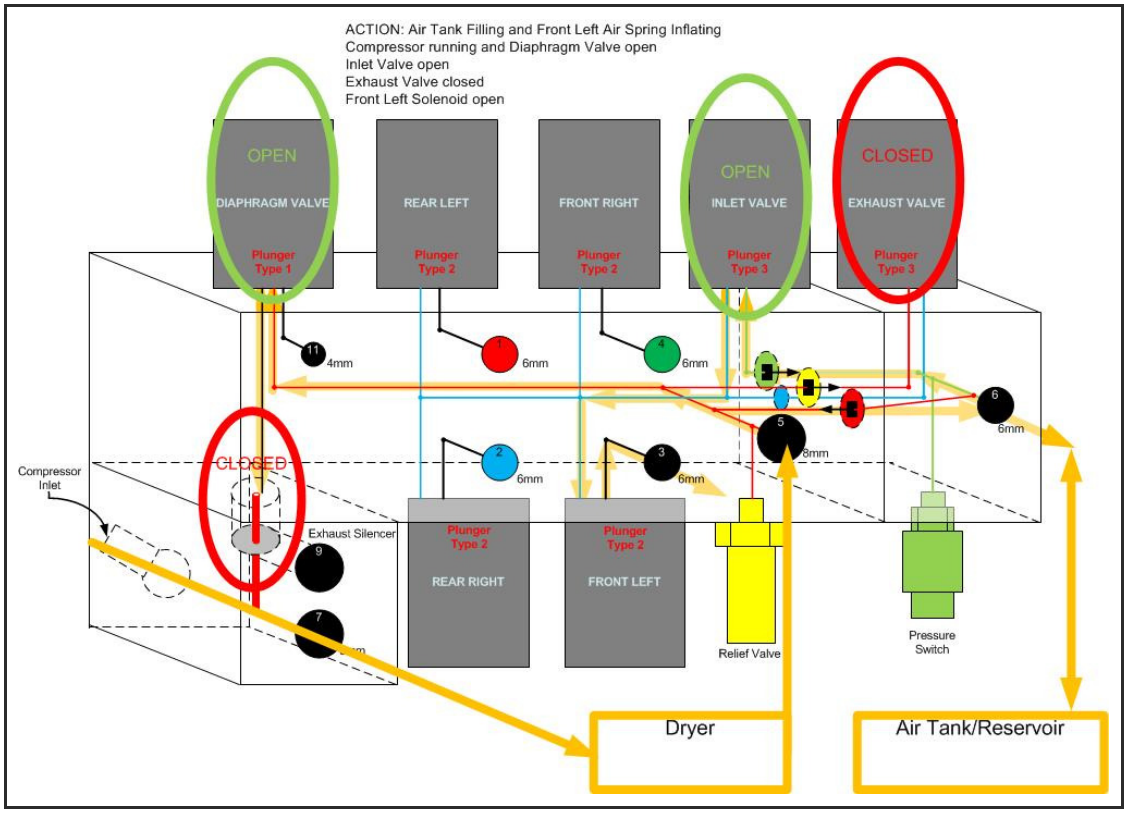


When the compressor is running, the compressor relay RL20 also operates the diaphragm valve solenoid which forces air down over the top of the diaphragm and holds it closed. This directs all incoming air from the compressor through the dryer via port 7 and back in to the valve block at port 5. With the inlet valve and exhaust valve closed, no air can flow to/from the air spring solenoids, forcing all air to the tank via port 6.

WHEN THE AIR SPRINGS ARE INFLATING (FRONT LEFT SHOWN)



Generally, the compressor will be operating when one or more springs are inflating, but it

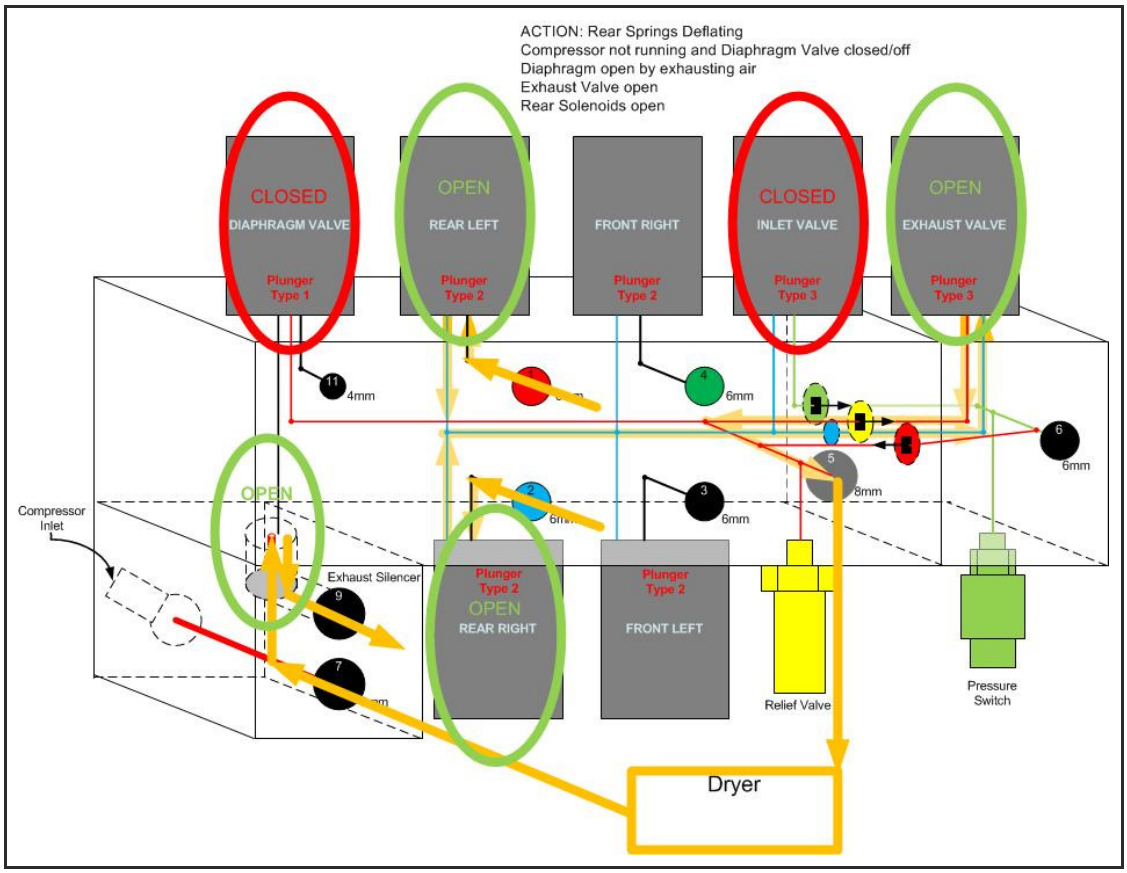
does not have to be.

The diaphragm valve solenoid is open to allow air in the system to hold the diaphragm closed.

The exhaust valve solenoid is closed to prevent air exiting via the diaphragm valve.

The inlet valve solenoid opens to permit air from the tank (port 6) or compressor to flow to whatever air spring solenoid is open.

WHEN THE AIR SPRINGS ARE DEFLATING (REARS SHOWN)



The compressor will not/should not run when the air springs are deflating.

The solenoid for each deflating bag will open to allow air back in to the valve block, and the exhaust valve will open to allow air to flow back through the dryer.

With the diaphragm valve solenoid off, the diaphragm is free to lift and allow air out to atmosphere via the exhaust silencer.

Frequently Asked Questions

DO MY AIR SPRINGS EQUALISE?

Yes sometimes, but just the front. When you drive off from a stop (in gear, foot off the brake pedal) the compressor will stop running for a few seconds to allow the front springs to equalise.

WHY DO I GET THE EXTENDED RIDE HEIGHT SYMBOL ON THE DASH?

This is a design feature intended to lift the body above an obstacle which has grounded the body.

In otherwise normal operation, it is usually due to a problem with a height sensor not being able to register a lowering of feedback within a 10 second period.

You should be able to manually select a lower height setting, or the Extended Ride should cancel itself within ten minutes, or speed increases above 50kph.

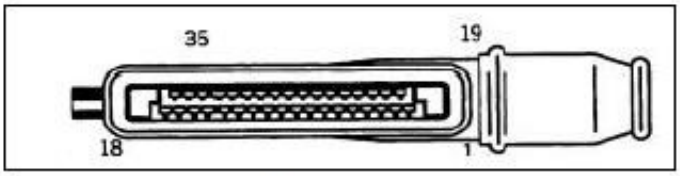
Sometimes you can reset the problem by stopping the car and switching off the engine, open a door and then close it again (causes an EAS check, even with the ignition off). Make sure all doors and the tailgate are closed, wait a minute and then start the engine. The only downside to this is that if it is a “hard fault” you may cause the car to drop to the bump stops.

WHY DOES THE COMPRESSOR NOT RUN AT ALL?

For the compressor to operate automatically, the following conditions must be met:

- Engine speed greater than 500rpm;
- Pressure switch operational (open);
- Thermal switch closed (grounded);
- Exhaust valve solenoid closed;
- Compressor Relay operational (closed) and MF2 not blown.

Connectors and Pin-outs for EAS Components

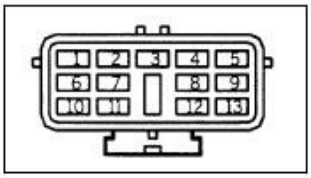


C117 ECU Connector

Position	Color	Description
1.	Slate/Green	Power from Delay relay
2.	Orange/Slate	Rear Left Height Sensor Source 5V
3.	Orange/Blue	Front Left Height Sensor Source 5V
4.	Orange/Pink	Rear Left Height Sensor Input Voltage
5.	Orange/Green	Front Left Height Sensor Input Voltage
6.	-	-
7.	Blue/Pink	Lamp Control and Message to BeCM
8.	Green	Compressor Relay Driver
9.	Green/Slate	Exhaust Valve, 12V to Open Valve
10.	Green/Black	Front Left Valve, 12V to Open
11.	Green/White	Rear Left Valve, 12V to Open Valve
12.	Slate	Engine Speed Input, from BeCM C114
13.	Slate/Blue	Pressure Switch Input, 12V when Switch Closed
14.	Black/Pink	Park/Hand Brake Input, From BeCM C112, Ground to enable Access Mode
15.	Yellow/Slate	Inhibit Switch Input, Ground when pressed
16.	Black/Purple	Thermal Switch Monitor, Open Circuit to Begin Cooling Cycle
17.	White/Pink	Serial Communications RECEIVE
18.	Black	Ground E154
19.	-	-
20.	Orange/Red	Rear Right Height Sensor Source 5V
21.	Orange/Pink	Front Right Height Sensor Source 5V
22.	Orange/Brown	Rear Right Height Sensor Input Voltage
23.	Orange/Yellow	Front Right Height Sensor Input Voltage
24.	Black/Pink	Height Sensor Ground
25.	Blue/White	Lamp Control and Message to BeCM
26.	Green/Orange	Inlet Valve, 12V to Open Valve
27.	Green/Pink	Front Right Valve, 12V to Open Valve
28.	Green/Yellow	Rear Right Valve, 12V to Open Valve
29.	-	-
30.	Yellow	Road Speed Input from BeCM C112, 12V square Wave
31.	Green/Purple	Brake Switch Input, 12V with Brakes Applied
32.	Yellow/Orange	Up Switch Input, Ground when Pressed
33.	Yellow/Brown	Down Switch Input, Ground when Pressed
34.	Purple/Slate	Door Input from BeCM C112, Ground with Door Open
35.	White/L. Green	Serial Communications TRANSMIT

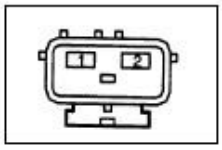
C139 Valve Block to Valve Driver Connector

Position	Color	Description
14	White	Rear Left Valve Hit and Drop Control
15	Red/White	Rear Left Valve 12 Volt
16	-	-
17	Red/Orange	Exhaust Valve 12 Volt
18	Orange	Exhaust Valve Hit and Drop Control
19	Red/Brown	Front Left Valve 12 Volt
20	Red/Black	Inlet Valve 12 Volt
21	Pink	Front Right Valve Hit and Drop Control
22	Yellow	Rear Right Valve Hit and Drop Control
23	Brown	Front Left Valve Hit and Drop Control
24	Slate	Inlet Valve Hit and Drop Control
25	Red/Pink	Front Right Valve 12 Volt
26	Red/L Green	Rear Right Valve 12 Volt



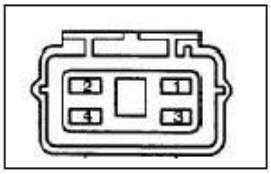
C142 Diaphragm Valve Connector

Position	Color	Description
1.	Green	12V Power from Compressor Relay
2.	Black	Ground to C152, Pin 11



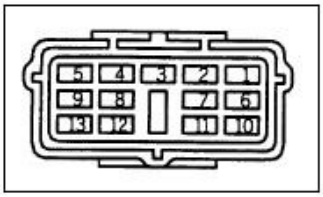
C151 Compressor Connector

Position	Color	Description
1.	-	-
2.	Black/Purple	Thermal Switch Monitor, Open to Enter Cooling Period
3.	Black	Ground, E154
4.	Purple/Lt Green	Power Supply



C152 Valve Block Connector from ECU

Position	Color	Description
1.	Green/White	Rear Left Valve, 12V to Open Valve
2.	Green/Yellow	Rear Right Valve, 12V to Open Valve
3.	Green/Black	Front Left Valve, 12V to Open Valve
4.	Green/Pink	Front Right Valve, 12V to Open Valve
5.	Green/Orange	Inlet Valve, 12V to Open Valve
6.	Green/Slate	Exhaust Valve, 12V to Open Valve
7.	Slate/Green	Delay Relay to Pressure Switch 12V Power
8.	Purple/Lt Green	Diaphragm Valve, 12V to Open Valve
9.	Slate/Blue	Pressure Switch 12V Signal to ECU
10.	Black	Ground, E148
11.	Black	Ground, E148
12.	Slate/Green	12V Power from Delay Relay to Valve Driver
13.	Slate/Green	12V Power from Delay Relay to Valve Driver



Typical Height Sensor-C108, C146, C147, C168

Position	Color	Description
1.	Refer to C117	Height Sensor Source, 5V from ECU
2.	Refer to C117	Height Sensor Wiper, Voltage is Height dependent
3.	Black/Pink	Height Sensor Ground