



Checking the Vacuum Hubs

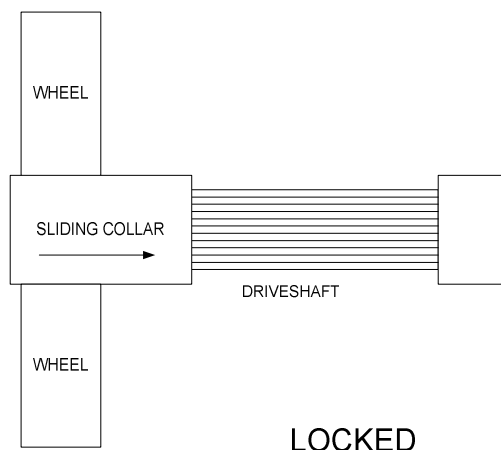
Once you have off-roaded your Jimny a few times you will, inevitably, have had problems with the Vacuum Hubs. Eventually, you may consider changing the hubs to manual ones, that is not covered in this guide.

The hubs sit on the end of the front axles. Their purpose is to lock, or unlock, the wheels from the end of the driveshafts. With them unlocked, the wheels are free to rotate on their own without turning all the bits and pieces in the front axle. This saves fuel and improves performance when in two wheel drive (2WD) as it is pointless turning a lot of gears and metal if they are not required.

In four wheel drive (4WD) you need to lock the wheels to the driveshafts in order to let the engine turn the wheels.

The hubs fitted to the Jimny are "sliding collar" hubs and are operated by the vacuum from the engine. The highly simplified picture below shows the theory. In the top picture the hub is unlocked. The sliding collar is out and is not engaged on the driveshaft splines.

In the picture below the sliding collar is slid across, engaging the splines and locking the wheel to the driveshaft.



As stated, the diagrams are highly simplified and there are a few key points to remember:

1. The vacuum makes the collar slide, but then is NOT required in order to hold the collar in position. Once the collar has slid in either direction it will stay there through the use of magnets and friction.
2. The vacuum is used to make it slide both locked and unlocked by changing the route of the vacuum, removing the vacuum tube from a locked hub will not unlock it.

So now some detail on how the whole thing works.

1. Underneath the car, on the side of the Transfer Box is a small switch operated by a ball bearing inside the Transfer Box. A 12 volt output from 4WD controller is fed along the Blue/Black striped wire. The 4WD switch shorts this 12 Volts to earth and tells the car that you want to select 4WD, so it needs to operate the hubs. **Handy Get You Going Tip:** *If your diagnosis is that the switch has failed then you can short the Blue/Black Striped wire to the car chassis/body. Pull the connector under the car apart and short the pins together with a bit of wire.*
2. If the switch is working properly it has shorted out the 12 volts and the 4WD controller now has been told to operate the hubs. Under the bonnet are two solenoids that Suzuki call VSV1 and VSV2. The picture below shows where the Vacuum system is, it's on the driver's side at the rear of the engine compartment, under the battery mount (UK cars).



Figure 1. Location of Vacuum System

3. The Vacuum for the system is taken from the intake manifold and comes through a check valve to stop faults in the Vacuum hub system affecting the engine intake. The picture below shows the valve and its pipe from the manifold.

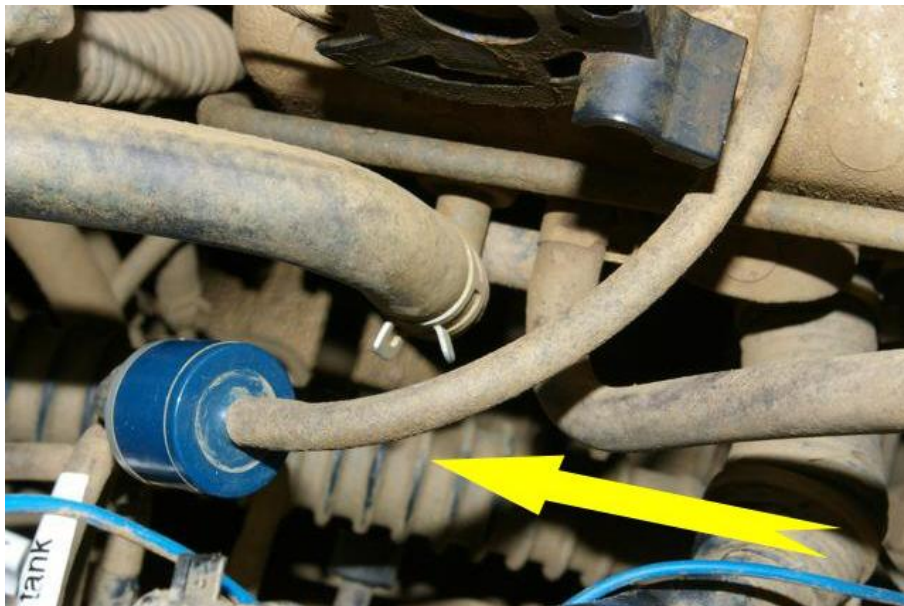


Figure 2. Vacuum Check Valve

4. The vacuum is fed from the Check Valve down to the solenoid block containing VSV1 and VSV2 valves. In the picture below, the green arrow shows the check valve (see previous picture), the yellow arrow points to the Valve block (with pipes marked 1 and 2 exiting one end) and the red arrow points to the pipe leading to the Vacuum tank.

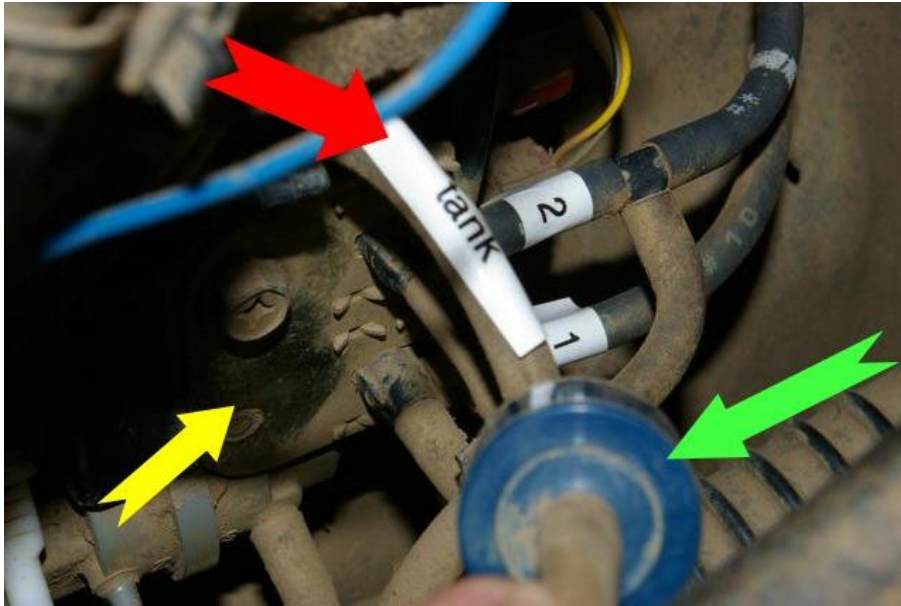


Figure 3. Valve block

5. The Vacuum Tank is located under the front wing and stores the Vacuum so that the hubs can be operated without the engine running.



Figure 4. Vacuum Tank

6. So back to how it operates. Having got the signal the 4WD controller sends a signal to VSV2, its the top valve in the valve block with the pipe marked "2" coming out of it (note: yours will not have the handy labels I have added to mine!) The second Solenoid (VSV2) is the solenoid that locks the hubs. The controller sends a pulse of 12 Volts for 5 seconds only, opening the valve for 5 seconds. This sends the vacuum down the "lock" tubes to the hubs.



Figure 5. Vacuum Tubes

7. It is handy to note that the “lock” tube is the upper one, marked “2” in my picture.
8. The 4WD controller leaves nothing to chance and there is another switch in the circuit, the Vacuum Monitoring switch. This is connected in the vacuum pipe work and operates when it detects the correct level of vacuum. Therefore after commanding VSV2 to open, the controller monitors the switch which is normally shorting the grey lead to earth checking for it to open ie. no longer short out the grey wire. If the Vacuum detection switch does not detect enough vacuum then the controller flashes the 4WD light on the dashboard. The Vacuum monitoring switch has a small “air filter” on the side (shown with the yellow arrow below). This filter clogs with mud and can stop the system working – it simply pulls off and washes clean.



9. Assuming everything is working correctly, the vacuum is transferred down the “lock” tubes and both hub sliders slip nicely into the lock position.
10. After 5 seconds of vacuum VSV2 is released, removing the vacuum from the “lock” tubes. The vacuum is “released” through a small plastic filter located on the side of the solenoid block (see above)
11. Down at the wheel hub the lock and unlock tubes come either along the trailing arm (early models) or along the axle (later models). The “lock” tube enters the top of the hub, hidden under the brake calliper. The Unlock tube enters the side of the hub.



Figure 6. Lock tube (with brake calliper removed)



Figure 7. Both lock and unlock tubes (black braided tubes) - the unlock tube is the lower tube that comes down to the front of the hub.

12. To some extent the unlock process is the reverse process, once the 4WD signal from the transfer box has disappeared the 4WD controller sends a signal to VSV1, its the lower valve in the valve block with the pipe marked "1" coming out of it. The controller sends a pulse of 12 Volts for 10 seconds only, opening the valve for 10 seconds. This sends the vacuum down the "unlock" tubes to the hubs.



Figure 8. Vacuum Tubes

13. It is handy to note that the “unlock” tube is the upper one, marked “2” in my picture.
14. That, in a nutshell is the system. In simple terms a valve bank send the vacuum down one pipe or the other for a short duration to pull the slider in the hubs in either direction as appropriate. Sadly this process does not always work so the usually issue is that you need to go through a fault finding process.

Fault Finding

15. The table below shows the typical faults:

Status	Problem Area
4WD is selected on the transfer box but the 4WD light is not on.	(i). 4WD Switch on transfer box has failed (ii). the Switch wiring has broken (iii). Fuse has gone (iv). 4WD controller has failed
4WD is selected on the transfer box but the 4WD light flashes.	The flashing is caused by the 4WD Controller thinking that the vacuum system has failed. This can be due to: (v). Vacuum leaks from the system (vi). Valve solenoid failure (VSV2) (vii). Pressure switch failure
4WD is selected on the transfer box, 4WD light is on but the front hubs do not seem to be locked OR hubs are locked and will not unlock.	(viii). Locking hub stuck (ix). Vacuum pipes blocked

Checking the system

16. Before progressing through fault finding the system it is worth checking whether the system is really working ok.
 - a. Put the handbrake on, put the gearbox in **Neutral**, start the engine.



- b. Jack up ONE front wheel, make sure all the other wheels are on the ground.
 - c. Put the transfer box in 4WD, listen for a loud click from the hub and try and turn the car wheel by hand. If the wheel turns then it has not locked.
 - d. If it has locked then move the transfer box out of 4WD, listen for a loud click and try and turn the wheel by hand. If the wheel turns then it has unlocked ok.
 - e. Repeat for other front wheel.
17. The above test gives you a good idea what is and isn't working in the system. Using this information the rest of the diagnostics are:

Problem Area (i) – 4WD Switch has failed.

18. You need to get under the car for this. On the back of the transfer box is the 4WD switch. It has a Blue/Black and a Black wire going to it, via a plastic plug. The plastic plug pulls apart by lifting the small tag with your fingernail. Use a piece of wire to short out the connectors on the end of the wire/plug that disappears up into the car. If this makes the 4WD system light come on then the 4WD switch on the transfer is suspect.

Problem Area (ii) – Switch wiring has broken.

19. You need to get under the car for this. On the back of the transfer box is the 4WD switch. It has a Blue/Black and a Black wire going to it, via a plastic plug. The plastic plug pulls apart by lifting the small tag with your fingernail. Use a voltmeter or 12volt bulb mounted on some wire. Measure between the Blue/Black wire and Ground. If the voltmeter doesn't show 12volts then a wire is broken or the 4WD controller has failed.

Problem Area (iii) – Fuse has gone.

20. The fuse is located in the fuse box under the drivers side of the dashboard, the fuse box changes on different versions of the car.

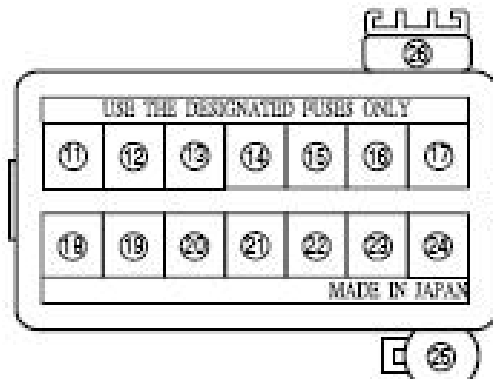


Figure 9. Type 1/2 Fusebox – 4WD is FUSE 21

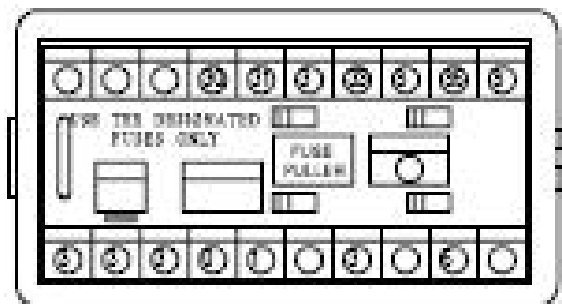


Figure 10. Type 3 Fusebox – 4WD is FUSE 38

Problem Area (iv) – 4WD controller has failed.



21. . The controller is hidden right up under the dashboard on the top right-hand side, you have to pull the fuse wiring to one side and squint up inside the dash. Basically if this is the point of failure you probably should consider fitting manual hubs. However if you have checked the fuses and they are ok and you have a voltmeter then it may be worth measuring some voltage around the controller.
22. If you can prise the connector (E74) from the controller and have a voltmeter you should be able to read the following voltages (with the ignition ON). Only do this with the connector disconnected
 - 1 12 volts (from solenoid – VSV1 – *If you short this to earth the solenoid will operate*)
 - 2 12 volts (from solenoid – VSV2 – *If you short this to earth the solenoid will operate*)
 - 3 12 volts (from dash bulb – *If you short this to earth the dash bulb will come on*)
 - 4 Air conditioning?
 - 5 0 volts (earth)
 - 6 Vacuum switch – Open circuit or earth depending on Vacuum switch
 - 7 4WD switch – Open circuit or earth depending on 4WD switch
 - 8 Air conditioning??
 - 9 Tachometer??
 - 10 12 volts (from fuse)

Problem Area (v). - Vacuum leaks from the system

Problem Area (vii). - Pressure switch failure

Problem Area (ix). - Vacuum pipes blocked

23. . There is no short way around these problems, you need to inspect the system closely. First take a look at the pipework around the solenoids, it is quite common for the plastic connectors/tee pieces to fracture at the joints.

24. The other common problem is to split or pull a hose off of the hubs behind the wheels.

Problem Area (vi) – Solenoid has failed.

25. The solenoids have power applied when the ignition is ON. Pull the grey wire off each solenoid and short the pin on the solenoid to ground. The solenoid should work and you should be able to feel vacuum if you pull of the vacuum tube and out your finger over the end.

Problem Area (vii) – Pressure Switch failed

26. First of all – check the little foam filter on the end of the Pressure Switch is clean. With a voltmeter the vacuum switch should be “open circuit” when nothing is happening and goes to “short circuit” when the pressure is correct BUT remember that the system only pulses the vacuum for 10 seconds! If you have the system powered up and functioning correctly with all connectors in place then the “short circuit” will appear as a 0 volt pulse for about 10 seconds otherwise 12 volts will be across the switch.