

GMC Motorhome Jeep HVAC Control Head Modification v3-28-22B

I decided that I had better write this while I still remembered some of the details. My original HVAC system was not working correctly. All of the airflow came out of the dash vents. Mine is a 1977, so it's different from earlier years.

The typical problem with these HVAC systems is lack of vacuum coming from the control head. There is a small disk inside the control head with passages and holes to route the vacuum from the engine source to the various vacuum actuators that control the flaps. The head can be sourced, but the disc is proprietary to the GMC and is no longer available. Some people have successfully sanded these discs carefully to make them flat again, and reinstalled them with silicone grease to restore proper operation. My attempt to do so failed.

I had been told on forums that the HVAC systems default to Defrost mode in failure. That may be true of vehicles now, but was not in a 1977 GMC Motorhome. Total lack of vacuum to the actuators results in dash air flow, as that flap is held open by a spring. All other flaps are held shut by a spring in the GMC as a default condition.

OPTION 1

There are a few options for folks who are not afraid to experiment or get their hands dirty. The first I could think of was the use of vacuum solenoids. The absolute simplest, quickest, and dirtiest is to keep the original GMC control head and add more switches. Typically, the temperature cable is in good shape, needing only some lubrication. This handles the hot/cold. The blower control is either still good, or can be replaced, keeping the original blower function.

It is the mode selection that typically fails to hold vacuum as described above. 12 volt electric vacuum solenoids are readily available for reasonable cost. You can place three switches on a panel at the bottom of the dash, or anywhere you desire. The switches would be simple SPST or SPDT switches.

One marked DASH and DEFROST would be the first one. Running a fused wire from a run position source would go to these switches. One normally closed solenoid would be wired to the on position marked DEFROST, and that outlet from the solenoid would go to the defrost flap. So when the switch is flipped to on/Defrost, vacuum would open the normally closed defrost flap. (With engine vacuum plumbed into the source inlet on the solenoid) A tee inserted into the Defrost line and plumbed to the dash air flap will close the dash air flap. With the switch in off/Dash position, the dash air flap will open, and the defrost flap will close.

The second switch (SPDT) could be marked Heat/Bilevel. In the on/Heat position, power is fed to a normally closed solenoid connected to the heat actuator, and another solenoid connected to the dash actuator. This would open the closed heat flap, and close the open Dash flap. Air will flow out the heat vent.

In BiLevel mode, power flows to the heat flap solenoid only, opening the heat flap, with air going out the head duct and also the normally open dash air ducts.

These configurations could be changed, with BiLevel operating just the Defrost and Heat, however you would like to do it.

The third switch would go to a solenoid connected to the Recirculation door, if your coach has one. This would allow the Recirc door to open under any circumstance you choose and pull in air from inside the coach instead of 100% outside air.

The beauty of this option is that *the dash probably doesn't have to be torn apart*, the original control head can stay in place, and no modifications to the factory airbox or components are needed. However, the airbox most likely needs new weather stripping and foam panels at the least, but it's not absolutely necessary if you're not greatly worried about efficient air flow and routing.

Option 2 would be to remove the original control head, and insert an aluminum plate, painted, covered with vinyl, whatever your choice, with an aftermarket blower fan control, a universal carburetor choke cable to control the temperature, and the switches and solenoids mentioned above. This would work the same as above.

Option 3 would be to use the Jeep control head combined with non-electric vacuum signal solenoids. I have not been able to find these, although I have been told they exist. For the normally closed defrost flap, a normally open solenoid valve would connect to the Jeep head defrost line. Since that line has vacuum in all positions except Defrost, the solenoid would remain closed at all times until Defrost is selected. Then the vacuum signal holding the valve closed would cease, the valve would open, and vacuum would open the defrost flap.

The same thing would be used on the Dash air. Constant vacuum through the solenoid would hold the dash air actuator shut. When Dash is selected, vacuum applied from the control to the signal port would close the solenoid, and the dash air flap would shut by spring pressure.

And again, no airbox modifications would be needed. The solenoids can be mounted under the hoods and all the ends of the vacuum lines are accessible without opening the air box. IF you can find these solenoids. You would, however, have to install the Blend Door Actuator described below.

THE HARDEST OPTION

So my AC compressor worked, my blower fan worked, and my hot and cold temperature control worked, but all air flow was out the dash only. I had vacuum from the engine to the HVAC control head. I found the Recirculation actuator, and I could see the Heat and Dash Air actuators, but I couldn't access them. I decided to remove the dash and see about repairing the system.

Of course, as I had been warned, the 45 year old plastic dash parts crumbled upon my attempts to remove them. After fighting with them for about a half hour, I just began tearing them out. The dash, front and lower, and side panels came out in pieces. I had just embarked on a long and arduous journey to fabricate my own new dash, with much greater accessibility built in. But first, I had to repair the AC system.

Once I had the dash gone, I could disassemble the rear most (toward the rear of the coach) part of the air box. This is a black plastic assembly containing the Heat and Dash Air flaps and actuators which feeds air into the dash air ducts. I also removed the coolant overflow tank, AC dryer, and window washer tank, out front under the hood, and removed the front cover. I found a mouse nest and lots of debris in the air box. The AC evaporator and heater core were in good condition. The AC dryer can be unbolted and hung by a bungee without evacuating the refrigerant. I removed the heater core for better access to everything.

I'm all about making things safe and reliable first, with originality second. I decided to trash the original HVAC control, and search for a readily available replacement. There are still vehicles being made with vacuum actuated HVAC systems, but many are going to electric actuators. The coach has a push-pull steel cable for the temperature control, and for the most part those have gone the way of the dinosaur in today's vehicles.

I decided to go with an HVAC control that was available, familiar, and cheap. I selected a 1999-2004 Jeep Wrangler HVAC control. There are also other models that will work. I bought a new Chinese copy on ebay for \$45.00 to test proof of concept. Better ones can be had at all prices up to \$150.00 or more.



While bench testing, I discovered that the Jeep control applied vacuum on the defrost port in all positions except one-Defrost. The GMC defrost flap is held shut by a spring located on the driver's side exterior of the air box. So with no vacuum in the Defrost position, the GMC defrost flap would remain shut. I've since been told by some folks on the forum familiar with air and vacuum servos that an electric/vacuum servo is available to fix this issue, but I looked for a solution within the capabilities of my limited expertise and resources.

DEFROST FLAP MOD

I removed the spring from the defrost flap. The actuator is located in the air box directly behind the heater core, in the top half of the box. You have to remove the black plastic rear air box assembly to access this. In stock form, it pulls the defrost flap downward against the spring pressure when vacuum is applied to it. I removed the actuator from the air box. It was spot welded to the box with four heavy spot welds. It was a pain to get off. Once it was off, I fabricated a little post, an aluminum rocker bar, and some odds and ends to reverse the action of the actuator. Now when the actuator pulled, it pulled downward on my rocker bar which pushed *UP* on the defrost flap. Since the Jeep control kept vacuum

on the Defrost port at all positions EXCEPT Defrost, this means that the defrost flap stays shut when it should and open when it should.



Removing the defrost actuator bracket



Modified defrost actuator with bell crank and stand welded on.

In the picture above right you can see the ½” square tube stand and the aluminum bell crank and link I fabricated to pull down the defrost door. Not shown is the piece I welded on the end of the bracket to replace the one I destroyed in the picture above left. It was never, ever coming apart there! You can see the heater core directly in front of the actuator bracket.

The next photo shows the as-yet unmolested factory installed defrost actuator assembly and flap. The spring, holding the flap shut, is on the outside of the air box.



I then reinstalled the modified defrost actuator in about the same place, but moved it as needed for the linkage to work properly. I pop riveted it in place with 3/16" pop rivets. Evidently I neglected to take a photo of the modified actuator installed.

DASH AIR ACTUATOR MOD

The next item to modify was the dash air flap. It too was spring loaded, with a torsion type bar which acts as a hinge and a spring. This spring kept the door open unless vacuum is applied to it from the GMC control head. Hence, the Default Dash Air in failure mode. Since the Jeep control applies vacuum at the Dash position, this would actually close the dash flap. So I removed the spring/hinge rod from the flap and replaced it with a piece of 1/4" steel round stock. I next elongated the mount holes for the dash actuator about 5/8" so that I could relocate the pull point to the other side of the 1/4" rod, reversing the action when the actuator pulled. I installed a spring on the outside of the air box to keep the dash flap closed when Dash Air is not selected.



Rear part of air box. Left actuator is Heat, right one is Dash Air.

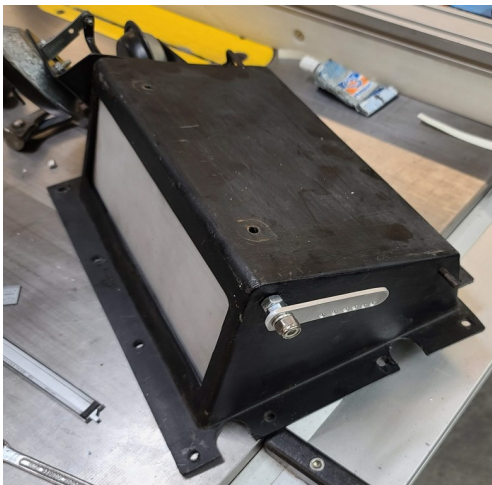


Modified. Notice bend in top hinge rod is reversed from left picture and position of actuator.

This mod was pretty easy. I had to remove the original torsion spring hinge rod and replace it with a straight rod. I welded some steel sleeves to the Dash flap. This let me slide the rod into the air box and flap sleeves for assembly. Two socket head screws in the sleeves tighten against the hinge rod. An aluminum lever on the driver's side of the rod gives the spring something to pull on the Dash Air flap to keep it shut. The Heat flap did not require any changes.



Elongating the Dash Air actuator pull rod hole, and drilling two new mount holes to reverse the action on the hinge rod



Air Box with spring lever



Original hinge rod with flap removed



New hinge rod, sleeves, air flap

I installed new foam weatherstripping and foam sheeting on the flaps as needed for sealing. All of the old material was pretty much gone.

TEMPERATURE CONTROL MOD

This mod was a little more work. It would be best to have access to a metal lathe to make the adapter if possible. It's not hard to make, and could probably be done with only a drill press and files if necessary. The Jeep control head uses an electric actuator, called a Blend Door Actuator, to change the temperature. In the GMC, there is a flap in the air box that causes the air flow to either go through the AC evaporator, or the heater core, or both, depending on the mode selected.

In order to use the Jeep control head, the blend door actuator, (I'll call it the BDA, out of laziness) the original push-pull cable had to be removed and the BDA fitted to the end of the temp door hinge rod. The hinge rod has a pressed on cast arm with a little nipple for the cable to be attached. Rather than destroy the factory cast arm (at this point, why not, right?) I fabricated an adapter that would friction fit into the BDA shaft and cap over the temp door arm. This worked really well after a couple of iterations of the adapter. I then fabbed a piece of ¼" plate as the BDA support bracket. The BDA was rotated around until I got the range of motion I wanted. The BDA will move about 90 degrees in its travel, so you need to make sure that the flap and the BDA are properly synched and positioned for fully open/fully closed. I used some aluminum spacers and long 8-32 machine screws to mount the BDA to the plate. The BDA adapter is a friction fit into the plastic actuator recess on the BDA. The Jeep BDA has a little white nylon or plastic fitting that fits into the BDA and interlocks with the Jeep blend door. You can use this piece to get the dimensions you need for your adaptor. The adapter has a recess drilled into it, maybe ½", and a slot cut into the side of the recess to grip/capture the cast arm on the GMC blend door.



BDA to temperature flap arm adapter



Blend Door Actuator from the Jeep mounted to the 1/4" aluminum mount bracket.



BDA as installed in the coach

The BDA's are available new from about \$20.00 on up. I bought a new one and one from a junk yard. There are some small differences in the years listed, but they all can be made to work. The critical thing

is to get both ends of the wiring going from the control head to the BDA from a wrecked Jeep, as I could not find anyplace to buy them new.

CONTROL HEAD MOD

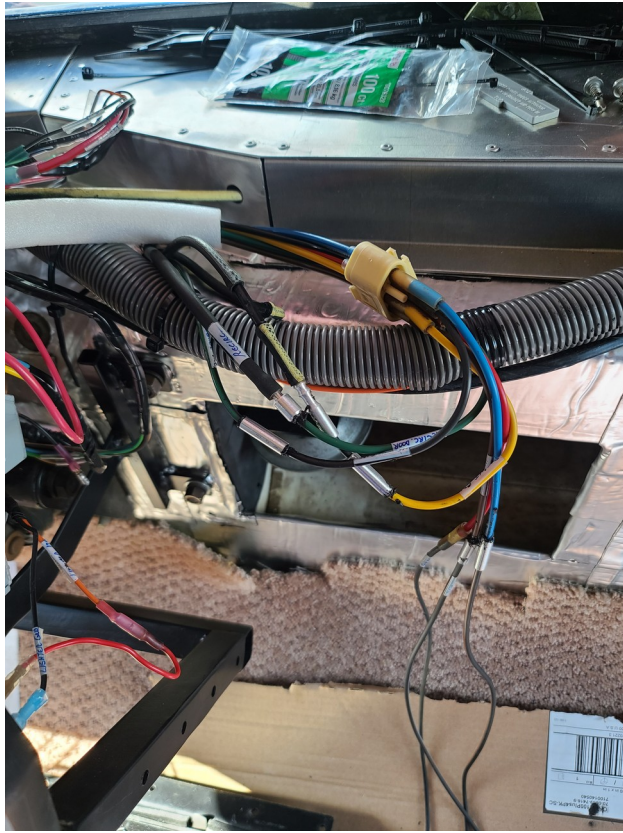
I checked the Jeep control head against the factory dash, and I think that you can fit it in the stock location if you enlarge the steel dash plate opening, and the plastic bezel opening less than ¼". I didn't do this as I was building my entire dash from scratch, but there's no reason you can't use the Jeep head in the factory dash assembly, provided you can get the dash apart enough to do all these mods without destroying it.

As stated previously, you can buy new Jeep control heads on ebay, Amazon, Auto Zone, etc, or you can get a used one from the junk yard. They are hard to find, as many people get them there. Out of 10 Jeeps I have looked at, only 2 had these controls still in place. But the connectors will probably be there. The BDA is located under the dash on the passenger side, and only has two screws holding it. The control head has about four screws, and you can access that by popping the dash cover off.

So when you go the junk yard, you will need the wire connectors that go into the back of the Jeep control head. There are three separate connectors. I originally used female spade connectors to connect to the blower control terminals, but that just doesn't work well. Grab the right connectors if you can. One is for the blower speeds, one for the BDA, and one for power and lights. The Jeep head lights up nicely at night, if you connect the correct wires to your dash lights.

So, get out your wiring diagrams, and make careful notes. The high, medium, medium high, and high speed wires on the coach will transfer to the Jeep head. I cut off the GMC connectors and soldered/heatshrink tubing to the appropriate Jeep connectors. The BDA connectors, I soldered to longer pieces of wire and ran them from the control head to the BDA. Easy peasy. The other connector needs 12 volt run position power, ground, instrument lights. Once you have all this figured out by checking the wiring diagrams and the GMC control head, I suggest you twist the wires together with wire nuts (TEMPORARILY, ONLY!) to check proper operation, then splice, solder, crimp, whatever your preference for the permanent installation. The Jeep control will give you a real honest to goodness blower OFF, that the coach did not provide.

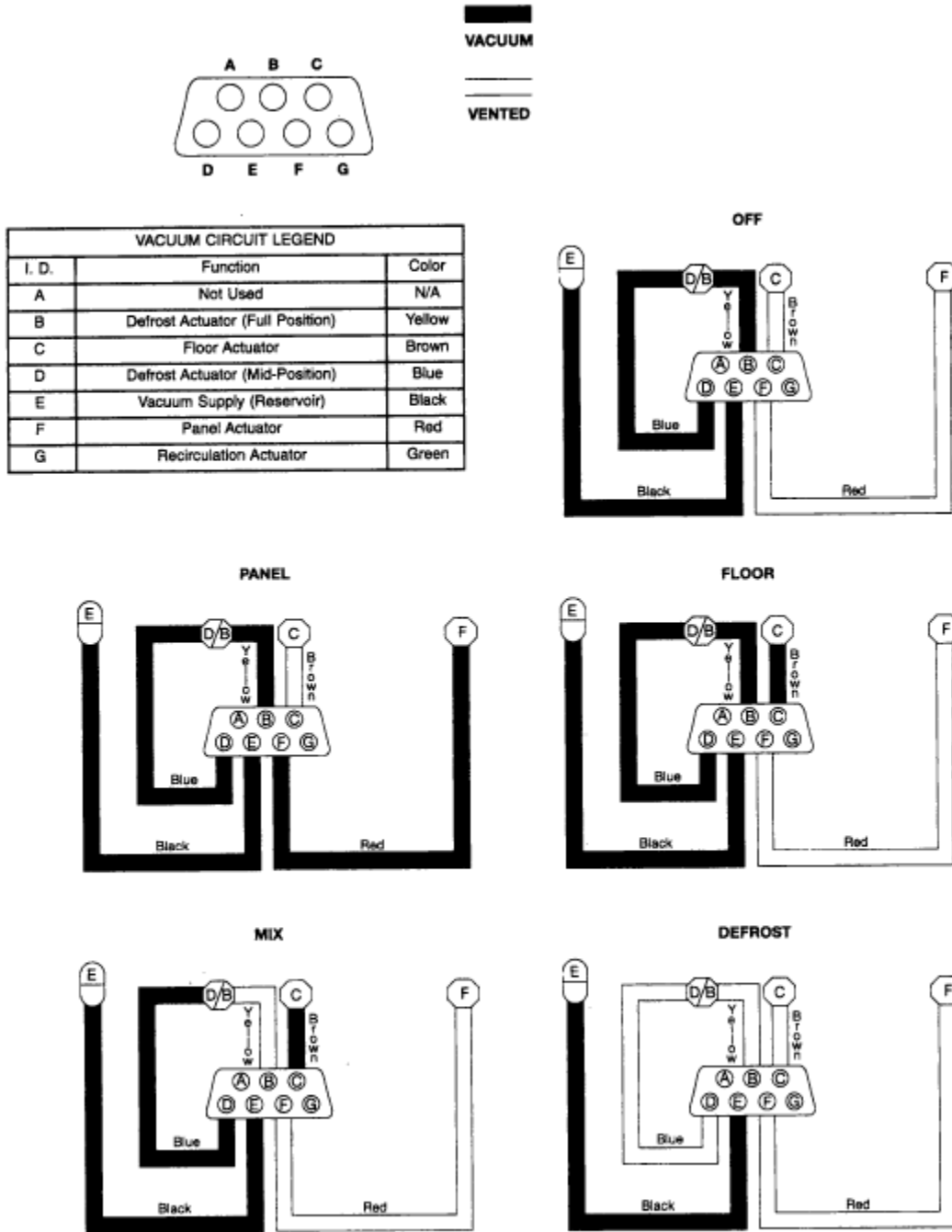
Once the electrical is sorted, proceed to the vacuum. The new Jeep head I bought on ebay came with the vacuum line plug and vacuum pigtail. This was great, as there was plenty of vacuum line to work with for connection. I used my Mity Vac hand pump to provide vacuum so I could identify which line was associated with which mode. I did the same thing with the coach to verify the color codes. I then made some little sleeve adapters to connect the Jeep vacuum lines to the coach vacuum lines. Several of the coach lines were hard plastic, and not the same size as the Jeep vinyl tubing. I made these adapters on my lathe. I put a drop of glue on the coach lines and inserted them into the adapters and repeated the process for the Jeep lines. These worked great. You might be able to find something ready made, or you can make them from ¼" aluminum rod with a drill press and a file. It's just a piece of aluminum rod with a hole drilled through it.



Vacuum lines from Jeep control head going into GMC lines via the aluminum sleeves.



Jeep Head with lights on



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Fig. 11 Vacuum Circuits - Heater Only

Jeep TJ Vacuum Diagram

Above are the vacuum and electrical diagrams for the Jeep control head. It takes some study to figure out what does which, but it's not difficult.

The GMC wiring diagrams are available on line, as well as the vacuum diagrams.

So, it's a lot of work. It works, and it works well. I don't regret doing it, but it was only a small portion of the total work required to build a whole new dash. I also built all new air and defrost ducts from fiberglass. But that process is to be documented later. Maybe.

Good luck, and don't get discouraged. None of this is rocket surgery, it just takes time. It'll be worth it.

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Nearly finished dash. Still need a panel under glove box and left and right side panels. AC vents now blow on your face, not your belly, and speakers are directly in front for stereo separation, with added 8" speakers in the side panels for lower frequencies. Oh, and cup holders will be on the side panels! The blank dash panel directly in the center is backed by 1/4" aluminum plate for mounting a flexible arm to hold a navigational lap top or tablet.