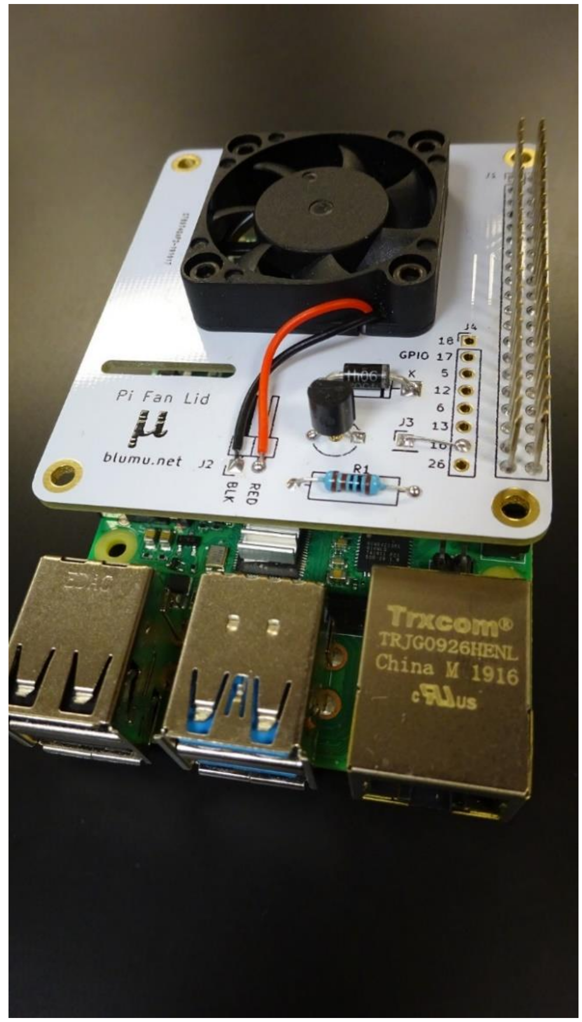
BluMu.net Pi Fan LID
Assembly and Software Installation



The photo to the right shows the fully assembled unit installed on a Raspberry Pi 4. There are no standoffs in the picture. I recommend them, but it works OK without as long as you don’t handle it too roughly.

Make note of a few things:

1. The orientation of the diode
2. The orientation of the transistor
3. The fan; which side is up
4. The jumper from J3 to the hole marked “16”

This is what you’ll need:

- PCB
- 30mm × 30mm fan, 5V, 0.2A (Adafruit 3368 or equivalent.)
- M2.5x10mm screws to mount the fan. Your fan may have come with mounting screws. If it did, they might be too long and need to be cut down. You’ll need to decide for yourself.
- PN2222 transistor. (PN2222A or 2N2222 will work.) The ones with the legs spread apart fit better. But you can make the ones with straight legs work too.
- Clamp Diode. Any 1N400x will work. (1N4001, 1N4002, etc.)

- Resistor. Anything from 470Ω to 1kΩ (1kΩ recommended) 1/8, ¼, or ½ watt. Recommended: ¼ watt.
- 40 pin header to plug into the Pi. You have choices here. You need to decide between stacking or non-stacking. The stacking type have long pins that stick up through the Fan LID and allow stacking more boards above it – or just connecting wires or whatever. The non-stacking variety have short pins that are just long enough to solder to the Fan PSB and make it difficult to access the GPIO pins for anything else. Second, you need to decide between normal height and extra tall. The extra tall headers leave a little more room between the Fan and the Pi. I recommend extra tall stacking header (Adafruit PN 1979). Other choices are Adafruit 2223 (normal height, stacking), Adafruit 1992 (extra tall, non-stacking), or Adafruit 2222 (regular height, non-stacking.)
- M2.5 Standoffs. 4 is best. 2 is OK. It'll work with none at all if you handle it carefully. They should be 11mm long with a normal height header, or 16 mm long if you use an extra tall header. That's Adafruit 2336 and 2337 respectively.
- M2.5x6mm screws. These go through the PCB and thread into the standoffs. Get as many screws as you have standoffs. Adafruit, why don't you sell these?

Assembly instructions

1. Solder the resistor in first. Install it from the top of the board, then flip everything over and set it on your work bench with the leads stick up. Solder one pin then check to make sure that the resistor is straight and where you want it. Neatness counts! When you turn the board over, you should see that a little solder has flowed through the hole. The solder should "wet" to the leads on both sides of the board.

2. Trim the excess leads from the resistor and use one of the scraps to make a jumper from J3 to the hole labeled “16”. If you are already using BCM16 for something else, then you can run the jumper from J3 to any of the other available holes. Just remember to change the Python script to use the correct pin. (The numbers are BCM numbers, not header pin numbers.)
3. Solder in the diode paying special attention to its orientation. The graphic on the PCB suggest which way the band on the diode should be pointing.
4. Solder in the transistor. Again, the graphic printed on the PCB shows how the part should be oriented.
5. Insert the header from below and solder all 40 pins from the top. Solder one pin first, then check to make sure the header is seated tightly against the board and is straight. If not, you can melt the solder on that one pin and move the header around before soldering all of the other pins. It might help to put something under the board so that it’s level.

If you want to wash the flux off the board, do it now before installing the fan. It is not necessary to clean the flux in most solders. The exception is some solders that contain “water wash” flux. If you do decide to clean the board, make sure it is completely dry before installing the fan.

6. Install the fan. You want to orient it so that it blows down onto the Raspberry Pi. Sometimes fans are marked with an arrow showing the direction of air flow. The fans that I’ve seen for this application (including the ones from Adafruit) blow towards the side with the label, so should be mounted with the label down as in the photo. Realize that if you do accidently put the fan on upside down, you can always fix it later.

If you need to cut existing screws, thread the nut on first. That way, after cutting, when you back the nut off it will help clean up the threads. Avoid using wire cutters meant for copper wire to cut screws as you will likely damage the cutters. Some wire strippers include holes meant for cutting small screws. The ones designed for 4-40 screws are a little loose, but they will work with M2.5 screws. Tin snips can be used. Cut part way through, then rotate the screw 90 degrees and cut all the way through. You'll mangle the threads less that way. Clamp the screw down somehow, or be prepared to go searching for wherever it flew off to when cut.

7. If you have standoffs, you'll want to install them on your Pi now. Put the threaded portions through the mounting holes in the Pi and thread on the nuts. They don't need to be super tight, just tight enough that they don't loosen up accidently.
8. Check that all of the pins on the Raspberry Pi are straight, then carefully join the Fan LID and Pi together paying special attention to lining up all of the pins with all of the holes. Double check to make sure that every pin found its corresponding hole in the header and that none are sticking out. It's very easy to be "off-by-one" when mating parts like this. Powering the Pi with a misaligned LID can cause the Pi to be damaged beyond repair.

Software Installation

The file `fan-ctrl.py` contains a Python script that will control the speed of the fan depending on the temperature of the CPU. If you jumpered J3 to hole 16, then the script should work without modification. If you have other hardware that uses BCM16 then you should jumper J3 to one of the other holes and change the following line in fan-ctrl.py.

```
PWM_PIN = 16  # BCM pin used to drive transistor
```

If you want the script to start automatically every time you boot your Raspberry Pi, then there are a few steps you need to follow.

Put both `fan-ctrl.py` and `fan-ctrl.sh` in your home folder `/home/pi`. Open a command prompt and enter the following commands, one at a time:

```
sudo cp /home/pi/fan-ctrl.py /usr/local/bin
sudo cp /home/pi/fan-ctrl.sh /etc/init.d
sudo chmod +x /usr/local/bin/fan-ctrl.py
sudo chmod +x /etc/init.d/fan-ctrl.sh
sudo update-rc.d fan-ctrl.sh defaults
```

The first two commands copy the files to the right folders. The third and fourth commands make those files executable. The last command registers the shell script in `/etc/init.d` with the operating system and says that you want it to run every time the Pi boots.

The shell script `/etc/init.d/fan-ctrl.sh` calls the python script `/usr/local/bin/fan-ctrl.py` to actually control the fan. It might seem overly complicated, but that’s the way it’s done in Linux. It allows the system to start up and shutdown cleanly.

If you decide you want to unregister the script so that it doesn’t automatically start at boot time, then enter the following command at a command prompt:

```
sudo update-rc.d fan-ctrl.sh remove
```

If you want to stop the python script from running during this session, but still want it start up again when you reboot, then use:

```
sudo /etc/init.d/fan-ctrl.sh stop
```

That’s it! Enjoy your cool-running Raspberry Pi.