

# How To Control The Fan Behavior Manually

- Operation confirmed with testing in our Ubuntu Minimal on kernel **4.14.32**.

- This guide helps from our forum[1][2].

## Concept: A trip point and the fan speed

ODROID XU4 supports 3 cooling levels for thermal control, **0, 1, 2**.  
 Level 0, which is the lowest level for thermal control and comes with the slowest fan speed.  
 And level 2, which is the highest level for thermal control and comes with the fastest fan speed.

Refer to this table.

Trip point	-	0	1	2
Temperature	0	60°C	70°C	80°C
Fan speed	0	120	180	240

This tables shows the default values that how the fan behaves. As this table shows, when the temperature reaches to **60°C**, the target trip point will be changed to **level 1** and the fan starts to run at **120** PWM value(0~255).  
 In the same vein, the target trip point will be **level 3** and the fan runs at **240** PWM value when the temperature reaches to **80°C**.

**You can adjust** the target trip points and its each fan speed as you want.  
 And even **you can fix** the fan speed at the constant speed you set.

## Modify the trip points

You can check current trip points.

```
$ cat /sys/devices/virtual/thermal/thermal_zone{,1,2,3}/trip_point_{,1,2}_temp
# results
60000
70000
80000
60000
70000
80000
60000
```

```
70000
80000
60000
70000
80000
```

Yes there're the other trip points named 3, 4, 5. But you can ignore them that we don't use. Same on thermal\_zone4.

As we can see, each trip point at each thermal zone has same value **60000, 70000, 80000**. That means each trip point is activated on **60°C, 70°C, 80°C**.

Each trip point is editable by writing a custom value to the each trip point files set.

For example, if you want to set trip point 1 to be activated at **30°C**, you can **just write a value** on them.

```
$ echo 30000 | sudo tee
/sys/devices/virtual/thermal/thermal_zone{,1,2,3}/trip_point_0_temp
$ cat /sys/devices/virtual/thermal/thermal_zone{,1,2,3}/trip_point_0_temp
# results
30000
30000
30000
30000
```

Then the fan starts **spinning up at 30°C**.

If you want to do that automatically, write some code in the **/etc/rc.local** file. Copy the following codes and paste.

```
# Target temperature: 30°C, 50°C, 70°C
TRIP_POINT_0=30000
TRIP_POINT_1=50000
TRIP_POINT_2=70000

echo $TRIP_POINT_0 >
/sys/devices/virtual/thermal/thermal_zone0/trip_point_0_temp
echo $TRIP_POINT_0 >
/sys/devices/virtual/thermal/thermal_zone1/trip_point_0_temp
echo $TRIP_POINT_0 >
/sys/devices/virtual/thermal/thermal_zone2/trip_point_0_temp
echo $TRIP_POINT_0 >
/sys/devices/virtual/thermal/thermal_zone3/trip_point_0_temp

echo $TRIP_POINT_1 >
/sys/devices/virtual/thermal/thermal_zone0/trip_point_1_temp
echo $TRIP_POINT_1 >
/sys/devices/virtual/thermal/thermal_zone1/trip_point_1_temp
echo $TRIP_POINT_1 >
/sys/devices/virtual/thermal/thermal_zone2/trip_point_1_temp
```

```
echo $TRIP_POINT_1 >
/sys/devices/virtual/thermal/thermal_zone3/trip_point_1_temp

echo $TRIP_POINT_2 >
/sys/devices/virtual/thermal/thermal_zone0/trip_point_2_temp
echo $TRIP_POINT_2 >
/sys/devices/virtual/thermal/thermal_zone1/trip_point_2_temp
echo $TRIP_POINT_2 >
/sys/devices/virtual/thermal/thermal_zone2/trip_point_2_temp
echo $TRIP_POINT_2 >
/sys/devices/virtual/thermal/thermal_zone3/trip_point_2_temp
```

Reboot and check if the changes applied.

## Modify the fan speed

- You always have to **reboot to apply the changed fan speed** for now.

- More detailed document here.
  - [CPU Fan control](#)

You can check current fan speed scaling.

```
$ cat /sys/devices/platform/pwm-fan/hwmon/hwmon0/fan_speed
# results
120 180 240
```

You can adjust these values by writing value set to the file.

If you want to make your fan **more aggressively**, you can write like below.

```
$ echo "0 204 220 240" | sudo tee /sys/devices/platform/pwm-
fan/hwmon/hwmon0/fan_speed
# results
204 220 240
```

This makes fan turns on to **80% (204 == 80 \* 255 \* 0.01)** when the temperature reaches to **trip point 0**.

And when the fan speed is set newly, its kernel message shows up and you can find out by **dmesg** command.

```
$ dmesg
# results
...
```

```
[ 1998.019631] hwmon hwmon0: fan_speeds : set_fan_speed [ 204 220 240]
```

If you want to do that automatically, write some code in the **/etc/rc.local** file.  
Copy below and paste.

```
# Target fan speed (PWM): 0, 204, 220, 240  
echo "0 204 220 240" > /sys/devices/platform/pwm-fan/hwmon/hwmon0/fan_speed
```

Reboot and check if the changes applied.

## Emulate temperature

You don't have to stress your ODROID out to test the new settings.

Check these files.

```
$ ls -l /sys/devices/virtual/thermal/thermal_zone{,1,2,3}/emul_temp  
# results  
--w----- 1 root root 4096 Apr 11 01:55  
/sys/devices/virtual/thermal/thermal_zone0/emul_temp  
--w----- 1 root root 4096 Apr 11 02:05  
/sys/devices/virtual/thermal/thermal_zone1/emul_temp  
--w----- 1 root root 4096 Apr 11 02:05  
/sys/devices/virtual/thermal/thermal_zone2/emul_temp  
--w----- 1 root root 4096 Apr 11 02:05  
/sys/devices/virtual/thermal/thermal_zone3/emul_temp
```

These writable files let us can set the any temperature value to cover the real temperature on the board and finally it makes the fan runs by the settings.

If you want to set to **85°C**, just write to them.

```
$ echo 85000 | sudo tee  
/sys/devices/virtual/thermal/thermal_zone{,1,2,3}/emul_temp  
# results  
85000
```

And check if the changes affect.

```
$ cat /sys/devices/virtual/thermal/thermal_zone{,1,2,3}/temp  
# results  
85000  
85000  
85000  
85000
```

So easy. If you want to get back to normal, write on them.

```
$ echo | sudo tee /sys/devices/virtual/thermal/thermal_zone{,1,2,3}/emul_temp  
# results
```

And check.

```
$ cat /sys/devices/virtual/thermal/thermal_zone{,1,2,3}/temp  
# results  
30000  
30000  
30000  
29000
```

This would be helpful for you to check the new settings you've just set both the trip points and the fan speed scaling.

## Fully manual way to control the fan speed

- This requires kernel **4.14.20 or higher. But Kernel 5.4 doesn't support this feature.**

Most programmatically method to adjust fan speed in totally manual way.

```
# Set fan to manual mode  
$ echo | sudo tee /sys/devices/platform/pwm-fan/hwmon/hwmon0/automatic  
  
# Set speed to 100%  
$ echo 255 | sudo tee /sys/devices/platform/pwm-fan/hwmon/hwmon0/pwm1
```

Then the fan **ignores written scaling files(trip points and fan speed)** and **runs constantly at the same speed.**

You can do that automatically too. Edit **/etc/rc.local** file and reboot to check if the changes applied. This example makes the fan always runs in full speed.

```
# Fix fan speed  
echo | sudo tee /sys/devices/platform/pwm-fan/hwmon/hwmon0/automatic  
echo 255 | sudo tee /sys/devices/platform/pwm-fan/hwmon/hwmon0/pwm1
```

Or you can write an application using the fan.

## Fan control scrip examples

There are some nice script code examples you have to refer.

<https://forum.odroid.com/viewtopic.php?f=77&t=30743>

Last update: 2021/02/25 02:45 odroid-xu4:application\_note:manually\_control\_the\_fan [http://wiki.odroid.com/odroid-xu4/application\\_note/manually\\_control\\_the\\_fan](http://wiki.odroid.com/odroid-xu4/application_note/manually_control_the_fan)

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<https://forum.odroid.com/viewtopic.php?f=146&t=30745>

## References

[1] <https://forum.odroid.com/viewtopic.php?f=52&t=16308>

[2] <https://forum.odroid.com/viewtopic.php?f=99&t=30675>

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