

# How to Control FAN Speed via CPU Temperature



- This howto has been confirmed in the following environments.
  - OS: Ubuntu 22.04 LTS
  - Kernel: 6.5.0-15-generic kernel from Ubuntu repository
  - BIOS: [ADLN-H4 1.00](#)
- We cannot confirm all other Linux distributions.



Note that the temperature values are the CPU package temperature.

## Smart Fan Mode in BIOS

You should know that there is two smart fan mode in BIOS.

Checking by going into BIOS setting mode, moving Advanced tab, Hardware Monitor, Smart Fan Function, Fan Setting, and then Smart Fan Mode.

(Refer to [How to control the PWM Fan on ODROID-H4](#))

### 1. Automatic Mode

You can set the FAN speed in advance depending on previously set the temperature in BIOS. Once you set a PWM value and three-step temperatures, the FAN will be turned on and controlled by the temperatures.

It is not possible to update/control the speed of the FAN. but possible to read via the **lm-sensors** package, how fast the FAN turned appeared by RPM.

### 2. Software Mode

It has only a Manual PWM setting that turns the FAN permanently by that one PWM value in BIOS. But this mode allowed you to control the speed of the FAN by software in userland.

## Fan Speed control via CPU temperature



These steps are assumed you have set **software mode** in BIOS

### Step 1. Download, build, and install the it87 module.

```
odroid@odroid-h4p:~$ git clone https://github.com/alwong/it87.git
odroid@odroid-h4p:~$ cd it87
```

```
odroid@odroid-h4p:~$ make
odroid@odroid-h4p:~$ sudo make install
```

## Step 2. Load the module it87.

```
odroid@odroid-h4p:~/it87$ sudo modprobe -a it87
odroid@odroid-h4p:~/it87$ lsmod | grep it87
it87                90112  0
hwmon_vid           16384  1 it87
```

## Step 3. Find pwm2 node which can control the FAN speed.

```
odroid@odroid-h4p:~/it87$ cd /sys/class/hwmon
odroid@odroid-h4p:/sys/class/hwmon$ ls -l | grep it87
lrwxrwxrwx 1 root root 0 Apr  7 14:50 hwmon3 ->
../../../../devices/platform/it87.2608/hwmon/hwmon3
odroid@odroid-h4p:/sys/class/hwmon$ cd hwmon3
odroid@odroid-h4p:/sys/class/hwmon/hwmon3$
```

## Step 4. Check the current PWM value of the BIOS.

```
odroid@odroid-h4p:/sys/class/hwmon/hwmon3$ cat ./pwm2
127
```

## Step 5. Check the current temperature in the CPU package.

```
odroid@odroid-h4p:/sys/class/hwmon/hwmon3$ cd /sys/class/hwmon
odroid@odroid-h4p:/sys/class/hwmon$ ls -l | grep coretemp
lrwxrwxrwx 1 root root 0 Apr  7 14:27 hwmon1 ->
../../../../devices/platform/coretemp.0/hwmon/hwmon1
odroid@odroid-h4p:/sys/class/hwmon$ cd hwmon1
odroid@odroid-h4p:/sys/class/hwmon/hwmon1$ cat temp1_input
49000
odroid@odroid-h4p:/sys/class/hwmon/hwmon1$
```

## Step 6. Control FAN speed by writing PWM value.

```
odroid@odroid-h4p:/sys/class/hwmon/hwmon3$ echo 255 | sudo tee ./pwm2      #
255 is maxium.
odroid@odroid-h4p:/sys/class/hwmon/hwmon3$ echo 0 | sudo tee ./pwm2      #
0 is off
```

## Step 7. Make a program.

As shown in the above steps, you can make a program base on them.

This example has shown how to control the speed of FAN via the temperature of the CPU package as a simple shell script.

```
#!/bin/bash
```

```
echo "$(whoami)"

[ "${UID}" -eq 0 ] || exec sudo "$0" "$@"

fanSpeedDir=`echo /sys/class/hwmon/$(ls -l /sys/class/hwmon | grep it87 |
awk -F' ' '{print $9}']/pwm2`
cpuTempDir=`echo /sys/class/hwmon/$(ls -l /sys/class/hwmon | grep coretemp |
awk -F' ' '{print $9}']/temp1_input`

while true
do
    fanSpeed=`cat ${fanSpeedDir}`
    cpuTemp=`cat ${cpuTempDir}`
    cpuTemp=`echo ${cpuTemp:0:2}`

    echo "cpuTemp(Celsius):${cpuTemp}"
    echo "fanSpeed PWM value:${fanSpeed}"

    case ${cpuTemp} in
        1[0-9][0-9])
            echo "The temperature in the CPU package is more
than 100 degree Celsius"
            echo 255 | tee ${fanSpeedDir} > /dev/null
            ;;
        9[0-9])
            echo "The temperature in the CPU package is more
than 90 degree Celsius"
            echo 220 | tee ${fanSpeedDir} > /dev/null
            ;;
        8[0-9])
            echo "The temperature in the CPU package is more
than 80 degree Celsius"
            echo 190 | tee ${fanSpeedDir} > /dev/null
            ;;
        7[0-9])
            echo "The temperature in the CPU package is more
than 70 degree Celsius"
            echo 170 | tee ${fanSpeedDir} > /dev/null
            ;;
        6[0-9])
            echo "The temperature in the CPU package is more
than 60 degree Celsius"
            echo 140 | tee ${fanSpeedDir} > /dev/null
            ;;
        5[0-9])
            echo "The temperature in the CPU package is more
than 50 degree Celsius"
            echo 127 | tee ${fanSpeedDir} > /dev/null
            ;;
        *)
```

```
echo "The temperature in the CPU package is lower
than 50 degree Celsius"
echo 0 | tee ${fanSpeedDir} > /dev/null
;;
esac

sleep 5
echo =====
done
```

## Monitoring through the lm-sensors package

**lm-sensors** package is useful to monitor various monitoring chips in the mainboard. One of the useful/frequent commands is **sensors-detect** in the lm-sensors package. The command has found Intel digital thermal sensor(DTS) and Super IO sensor(IT8613E) as shown below.

Another command is **sensors** as well.

The output of **Package id 0:** of the sensors command is the same value as variables `${cpuTemp}` in the above shell script. And the output of **fan2:** RPM is changed by the PWM value the higher value makes fast of the FAN.

```
odroid@odroid-h4p:~$ sudo apt install lm-sensors
odroid@odroid-h4p:~$ sudo sensors-detect
.
.
Intel digital thermal sensor... Success!
(driver 'coretemp')
.
.
Trying family 'ITE'... Yes
Found `ITE IT8613E Super IO Sensors' Success!
(address 0xa30, driver `to-be-written')
.
.
odroid@odroid-h4p:~$ sensors
acpitz-acpi-0
Adapter: ACPI interface
temp1: +27.8°C (crit = +119.0°C)

it8613-isa-0a30
Adapter: ISA adapter
in0: 1.69 V (min = +1.20 V, max = +2.43 V)
in1: 1.30 V (min = +2.79 V, max = +2.28 V) ALARM
in2: 1.68 V (min = +2.79 V, max = +2.78 V) ALARM
in4: 1.61 V (min = +2.72 V, max = +2.41 V) ALARM
in5: 1.52 V (min = +1.03 V, max = +1.33 V) ALARM
```

```
3VSB:      3.30 V (min = +3.96 V, max = +2.09 V)  ALARM
Vbat:      2.99 V
+3.3V:     3.37 V
fan2:      1293 RPM (min = 10 RPM)
fan3:       0 RPM (min = 12 RPM)  ALARM
fan4:       0 RPM (min = -1 RPM)  ALARM
fan5:       0 RPM (min = -1 RPM)  ALARM
temp1:     +68.0°C (low = -99.0°C, high = +127.0°C)
temp2:     -128.0°C (low = -72.0°C, high = -37.0°C)
temp3:     -128.0°C (low = -5.0°C, high = -25.0°C)
intrusion0:  ALARM
```

```
coretemp-isa-0000
```

```
Adapter: ISA adapter
```

```
Package id 0: +68.0°C (high = +105.0°C, crit = +105.0°C)
Core 0:      +69.0°C (high = +105.0°C, crit = +105.0°C)
Core 1:      +69.0°C (high = +105.0°C, crit = +105.0°C)
Core 2:      +69.0°C (high = +105.0°C, crit = +105.0°C)
Core 3:      +69.0°C (high = +105.0°C, crit = +105.0°C)
```

## References

- Kernel driver it87 : <https://github.com/a1wong/it87>
- Related forum thread : [H3+ : Reading Fan Speed ?](#)

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Last update: **2024/04/16 14:00**

