Pseudo Fan

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The aim of this circuit is to trick a so-called 'intelligent' fan controller that a fan is connected to it when it is not. This may sound like madness, yet there is method in it.

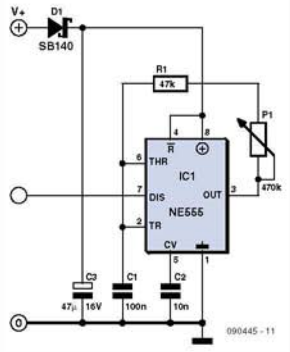
The author was so pleased with his small private server (a network attached storage, or NAS, device) that he recommended it to a friend. The friend had found a good source of low-cost SSDs (solid state disks) and replaced the spinning hard disks with semiconductor memory, with the aim of saving power. With the drives replaced, it became apparent that there was an opportunity to make the unit quieter still. Since the SSDs only dissipated a total of 5 W, surely it would be possible to disconnect the noisy internal 60 mm fan?

Characteristics

- simulates a fan of any size(!)
- pseudo-rotation frequency adjustable from 15 Hz to 150 Hz
- current consumption less than 5 mA
- operating voltage from 4 V to 15 V
- low noise!

Unfortunately it was never going to be that easy. The moment the fan was disconnected an annoying buzzer started to sound continuously: the electronics in the NAS box does not just control the fan speed to maintain a reasonable temperature inside the unit, it also checks that the fan is indeed spinning. If the controller thinks the fan has stopped, it sounds the alarm. The author was called in to see if he could solve the problem.

It immediately became clear that the fan had a standard three-pin connector. The cable carried a voltage of between +5 V to +12 V on the red wire and ground on the black wire; on the yellow wire the fan produced a square-wave signal with a frequency of about 35 Hz. To fool the controller into thinking that the fan is turning we simply needed to generate a square wave!



Old hands will no doubt be able to guess what comes next: the 555 timer, one of the best-selling ICs ever, is ideal for this task. It can cope with the range of supply voltages, and conveniently features a traditional open-collector output.

The circuit diagram contains no great surprises. Rather than using the standard astable configuration of the device, the frequency-determining resistance (comprising the series connection of R1 and P1) is wired to pin 3, which is normally used as the output. This has the twin advantages of leaving pin 7 free to use as an open-collector output and of giving a 50 % duty cycle. With the component values suggested the output frequency can be adjusted from approximately 15 Hz to approximately 150 Hz, which should be more than enough for any application.

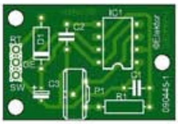
It is of course possible to build a simple circuit like this on a small piece of prototyping board. However, a much more professional look can be achieved using the printed circuit board we have designed for the job. The layout file can, as usual, be found on the Elektor website on the pages accompanying this article [1].

The pseudo-fan is of course not limited to being used in small servers. It is becoming more and more popular to build PCs that are quiet, especially if they are to be used as media centres. This means using passive cooling wherever possible. Unfortunately in some cases the BIOS throws its spanner in the works by not allowing the fan rotation sensors on the motherboard to be disabled individually. The pseudo-fan provides a simple and quick solution to this problem and avoids complicated BIOS patches. Some fans use a four-wire cable, and these too can be 'virtualised' using this circuit by ignoring the fourth wire and connecting the remaining three in the way described above.

If it will not be necessary to adjust the pseudo-fan speed P1 can be replaced by a wire link and R1 chosen appropriately. The frequency is then given by $f = 1.44 / (2 \times R1 \times C1)$.

(090445-I)

COMPONENT LIST



Resistors
R1 = 47kΩ
P1 = 470kΩ, small, upright

Capacitors
C1 = 100nF
C2 = 10nF
C3 = 47µF 16V

Semiconductors
D1 = SB140 (Schottky diode)
IC1 = NE555

Miscellaneous
Branched cable with 3-way plug
PCB # 090445-1

Internet Link

[1] www.elektor.com/090445

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090445-1: PCB design (.pdf), from [1]