

## Re: Hysteresis needed in 741 Op-Amp circuit

**Source:** <http://sci.tech-archive.net/Archive/sci.electronics.basics/2004-06/0491.html>

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**From:** CF (*form\_at\_web.site*)

**Date:** 06/10/04

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Oh wow Bob! What a fantastically helpful, educational and thorough reply. Even a circuit diagram no less.

Unless anyone raises an objection in the meantime, I'll give your suggestions a try either tomorrow or on the weekend, and post a follow-up.

Very gratefully,

Craig

In article <p8Txc.4297\$2i5.3115@attbi\_s52>, "Robert C Monsen" <rurname@comcast.net> wrote:

>Nice problem description!

>

>The way hysteresis works for these kinds of circuits is that you  
>influence the + input by tying it to the output through a resistor,  
>and use another resistor from that node to the reference. Thus, the +  
>input is basically set by a voltage divider which goes from the output  
>to the comparison input.

>

>Say your input is set at 5V, and your output swings from 0 to 10V. If  
>the resistor from output to + and from + to 5V are equal, then its  
>clear that when the output is high, the + input will be at 7.5V. Thus,  
>the - input will have to get up to 7.5V to cause the output to go low.

>

>When the output is low, the + input is at 2.5V. Thus, the - input will  
>have to go down to 2.5V to cause the output to go high.

>

>Because of this, you have a 5V 'guard' region. When the output swings  
>from low to high because the - input has gone below 2.5V, the trigger  
>voltage will immediately go up to 7.5V, meaning that fluctuations  
>around 2.5 won't cause it to turn on and off repeatedly.

>

>Now, for your heater circuit, you are varying the + input using the  
>thermistor, rather than the -. Thus, by putting a resistor from 6 to  
>3, and another one from 3 to where the old 3 was connected, at the  
>node connecting the 10k and the thermistor, you'll add some

>hysteresis.

>

>Adding it to 2 won't be good, because that means that when the output  
>goes low, the negative input will go lower, meaning the + will have to  
>go down even further, thus turning it back on, etc... Not good. Also,  
>you really want your opamp acting like a comparator, not an opamp, so  
>negative feedback is not a good thing.

>

>I'd use a 330k potentiometer between pin 6 and the junction of the 10k  
>and the thermistor in your diagram (the node that used to be attached  
>to pin 3). Then, attach pin 3 to the wiper of the pot, and set it for  
>the proper hysteresis.

>

> 12V

> +-----+  
> |  
> |  
> .-. |  
> 10k |||  
> |||  
> '- ' 330k |  
> | \_\_\_ |  
> +----|\_\_\_|-----+ |  
> | A ||  
> ||||  
> || \ | 3.3k |  
> | +----|+ \ | \_\_\_ |<  
> || >---+---|\_\_\_|---|  
> .-----+---. Vref-|-/ \ |  
> || / |  
> | Sensor | .-----.  
> | 10k |||  
> || | Relay |  
> '-----+---' | Etc |  
> |||  
> === ||  
> GND '-----'

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>

>

>Regarding the value of that resistor from the opamp to the PNP  
>transistor, its value should be such that the current through it is  
>about 1/10 of the current you want through the relay when its on. If  
>you want 30mA, then with about a 10V drop, you want  $10V/3mA = 3.3k$ .  
>That should fully saturate it. If not (if the collector isn't near  
>Vcc), then use a smaller resistor.

>

>Regards,

> Bob Monsen

>

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