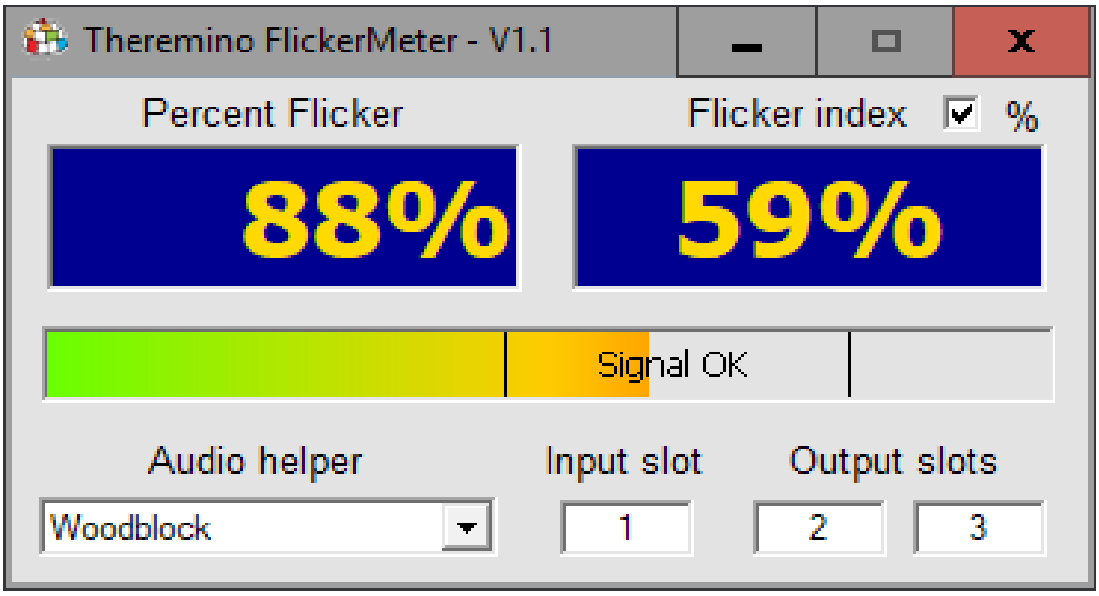
Theremino **System**



Theremino FlickerMeter

Examples of measures on some lamps.

Lamp tests

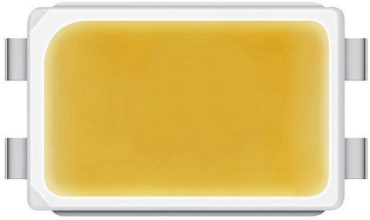
We have prepared this document to give an idea of what you should expect from the lamps that are on the market in recent years.

Everything depends on the electronic circuit that is inside the lamp, whereby from one manufacturer to another, there may be big differences. Also lamps of the same model, and which seem identical views from outside, may have flickering values very different from each other.

The following tests were done on a number of LED lamps, fluorescent, incandescent and halogen lamps, taken at random from among those appeared the most significant in their kind.

We took into account only the flickering, but to choose a lamp there would be other important features to consider. First of all the "lumens per watt" which, for a good lamp, must be at least 80, but better if they are 100 or more.

Only the finest quality LED lamps can achieve these efficiency levels. Fluorescent lamps do not come over 50..70 lumens per watt, incandescent not exceeding 20 (including halogen).



An interesting news is that the milestone of 100 lumens per watt has been far exceeded, the chip LM561B 200 lumens per watt are already purchased by Samsung and will soon be on sale the lamps that use them.

We have not measured the lumens per watt and only some manufacturers specify them. So we will give efficiency data only for some lamps.

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More about lumens per watt and other useful data in the documentation that you download the application "***Theremino Led Calculator***"

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We also measured the frequency of flickering of the lamps shown in this document, and it was 100 Hz for all.

Acceptable flickering levels

Some authors write that all light sources, including sun, have a certain level of flicker. And they conclude that a certain level of flicker is harmless. They would like to pass this with the idea that the flicker of fluorescent and halogen is acceptable.

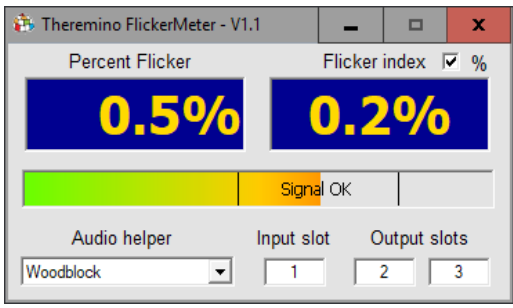
But between these lamps and the Sun there are huge differences. First, the sun never rises above 0.1% "Percent Flicker", while the halogen and fluorescent give values ranging from 10% to 50% (100 to 500 times more).

To get to exceed 10%, the sun should be helped by the leaves moving in the wind. But would always low frequencies, which could reach at most a few variations per second. It would be random variations and always variables. A completely different thing with respect to the constant pounding, 100 variations per second, of the lamps flickering.

Natural variations are to be considered as variations of the illumination that as flicker. They do not produce stroboscopic effects and they are definitely well tolerated by living beings, who have become accustomed to them in all their evolution.

So in our opinion we should measure values:

- Less than of 1% (with the "Percent Flicker" method)
- Less than 0.5% (with the "Flicker Index" as percent)



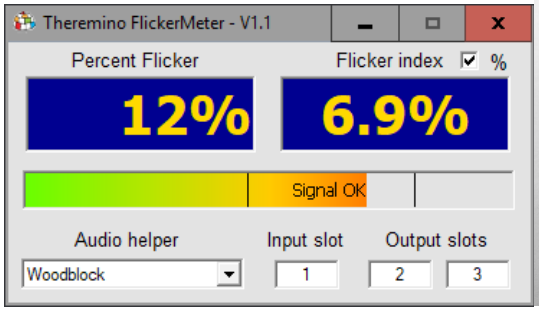
By now there are economic integrated circuits, and simple schemes to build power supplies with zero or almost zero flickering. So all the lamps that exceed these values are to be discarded.

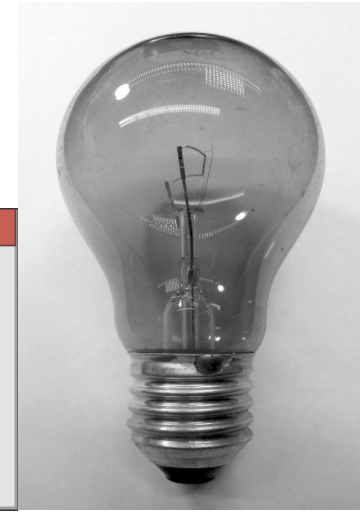
By this we convince manufacturers to use only LED with constant current power supplies.

If we would tolerate a "certain degree of flicker" we would be forced to fight on the acceptable limits for the next ten years and to measure each lamp we will buy.

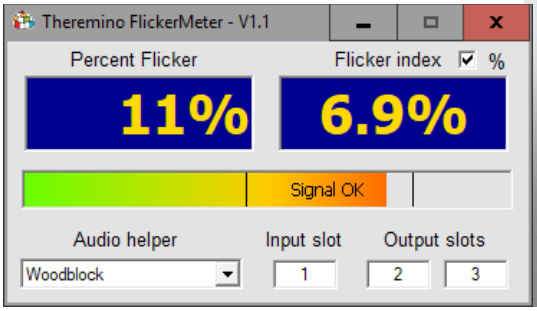
Incandescent lamps

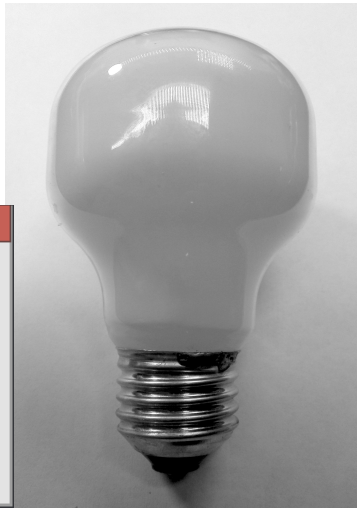
Classical incandescent lamp 100 watts.



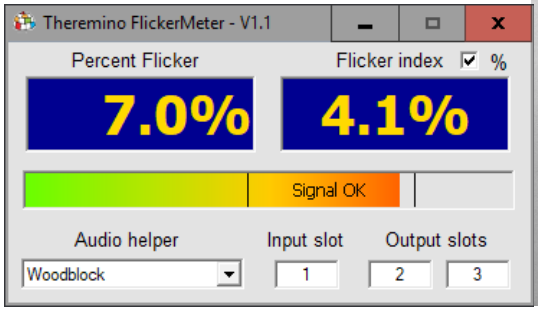


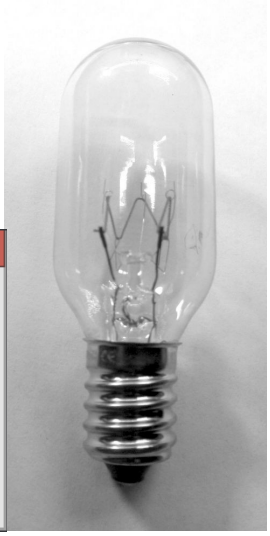
A 60-watt lamp with the opal glass





A 10 watt incandescent lamp with a small attack

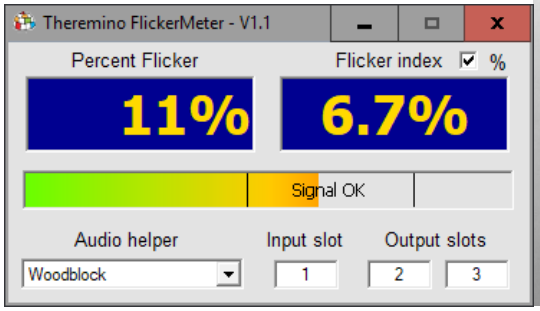




Fluorescent lamps

The CFL (fluorescent energy saving) give values of "Percent Flicker" from 10% to 30%.

This particular lamp is particularly good, do not expect that they are all around 11% like this, on average, the CFLs are around 20%.

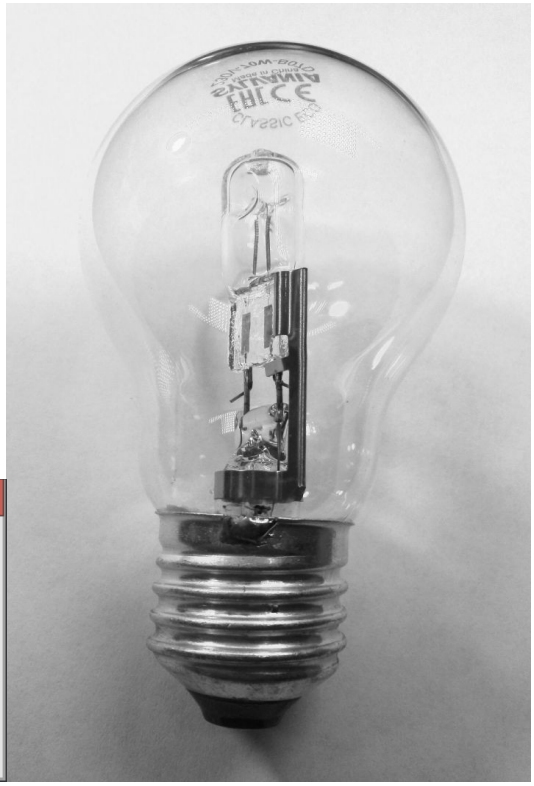


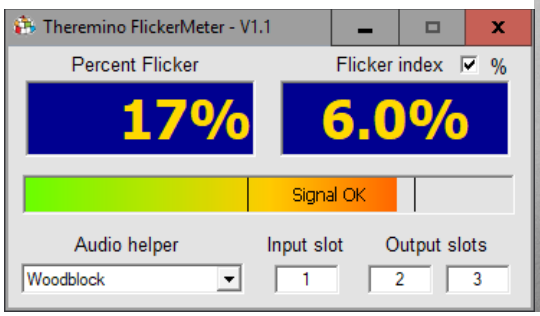
However the old "neon tubes" were even worse. They could even get more than 30%.

The fluorescent lamp technology does not allow to get better. In the next few images you see that even a specially designed lamp to have a low flicker, and declaring "no flickering," manages to go below 10%.

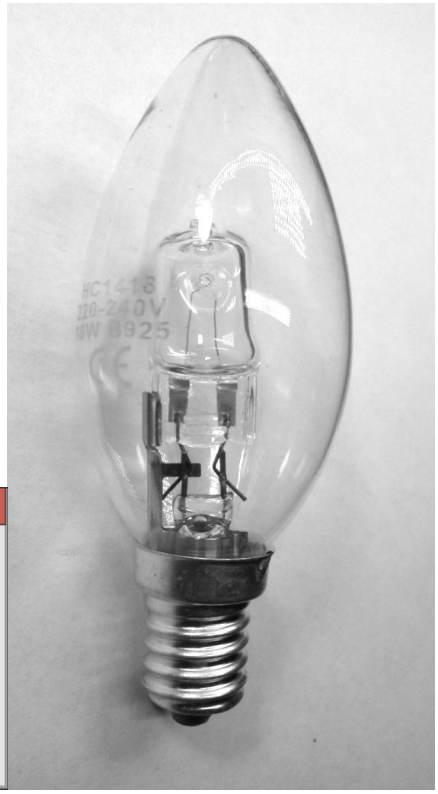
Halogen lamps

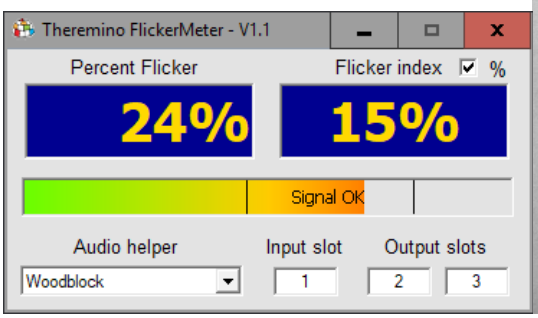
A halogen 70 watt





A halogen 18 watt with small attack

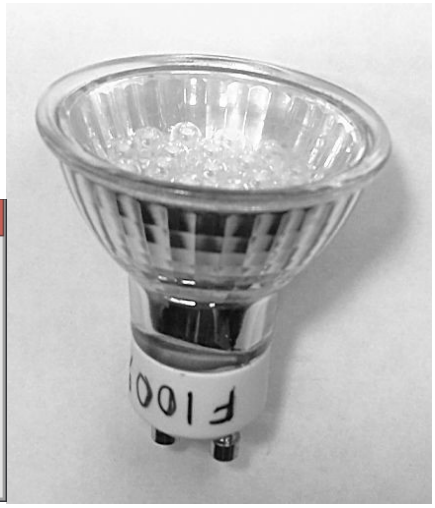


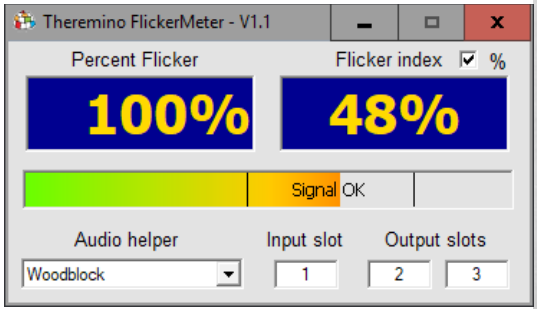


The worst LED lamps

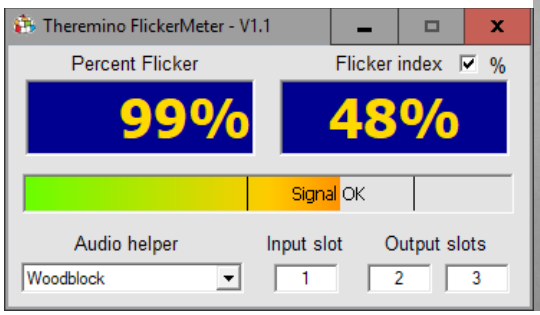
We start from the absolute worst. This lamp does not even know what a filter capacitor.

You can not open it but it definitely contains a diode bridge and no capacitor.

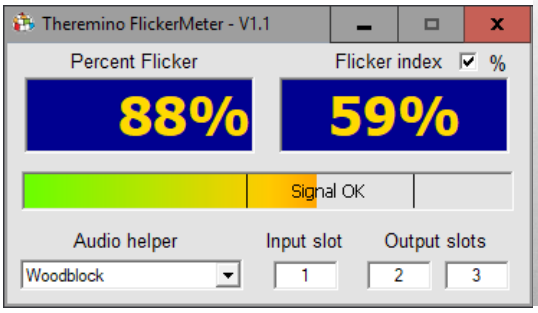




This fails to arrive at 100% but it tries.

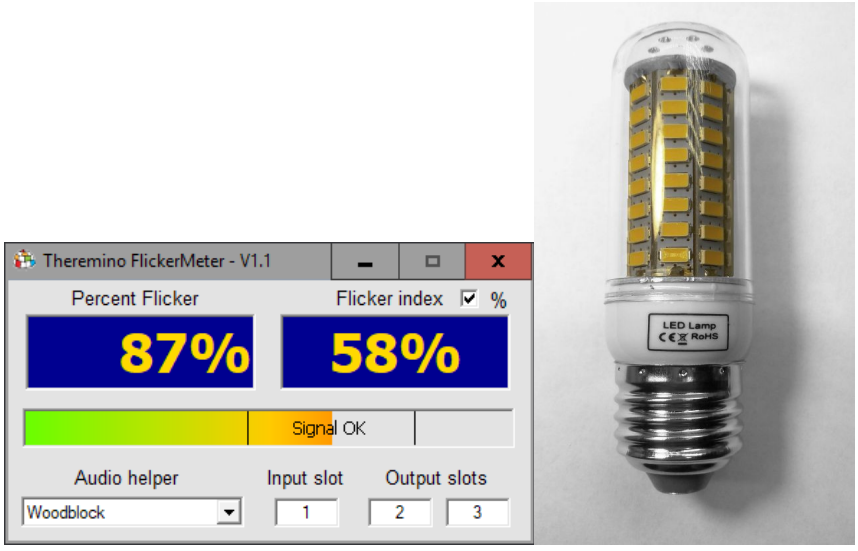


Third place on the max flickering podium.

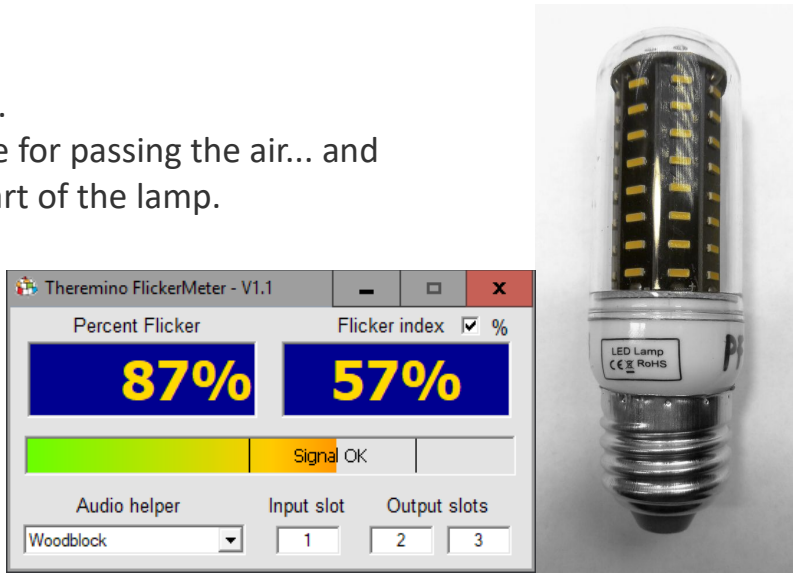


The worst LED lamps (continued)

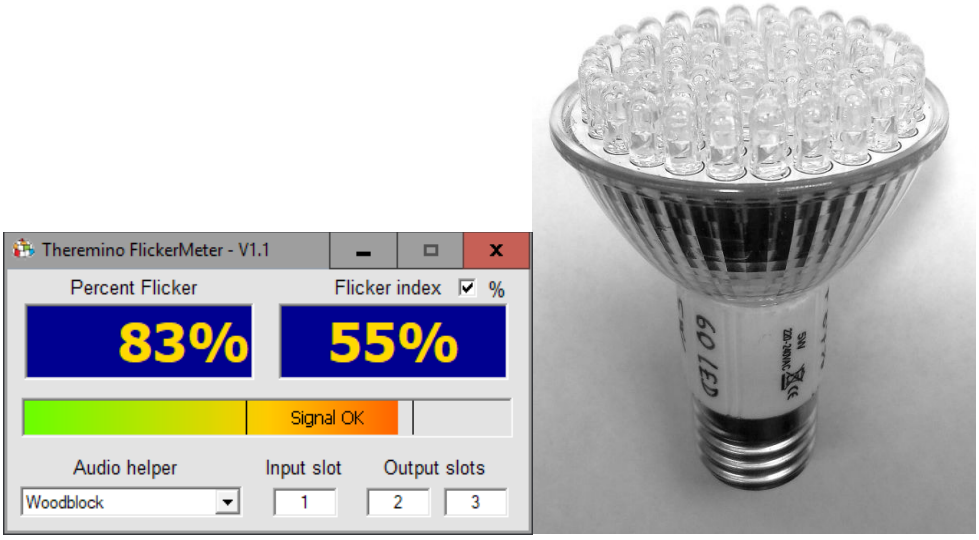
Even this is no joke.



Difficult to find adequate words.
There are also small holes above for passing the air... and irreparably smudge the inner part of the lamp.



No comment...

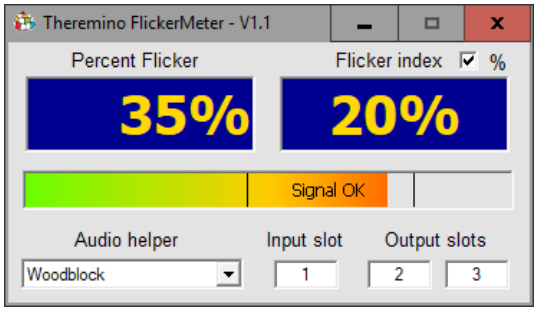


LED lamps of average quality

An applause !

This at least tries.

But it is still at the fluorescent and halogen levels.

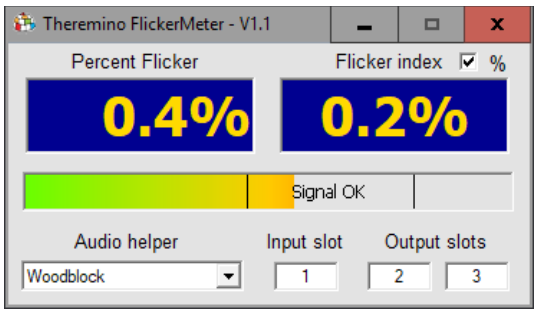


Good quality LED lamps

The V-Tac perhaps are the only ones with well-specified characteristics.

This declares: 15 watts, 1500 lumens and zero flickering.

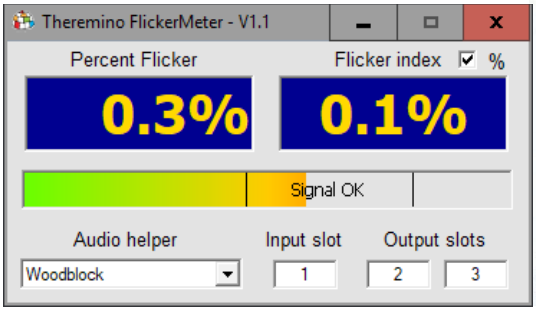
And the measurements confirm that the flickering is very low (any value below one per cent is practically zero).



Also this is a great lamp.

It even has an acronym: "DY76829"
and well-specified characteristics: 15 watt, 1521 lumens.

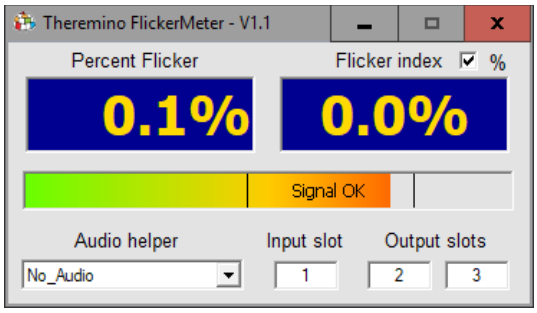
He declares "zero flickering" but the measured values are excellent.



LED strips and power supplies

The LED strips are fed with direct voltage produced by stabilized power supply from 12 or 24 volts.

Using a stabilized power supply the flicker is practically zero.



The strips are easily assembled and there are power supplies from 1 amp to 5 amperes (at 12 volts). With 1 ampere you can supply up to a meter of strip, with 5 amps up to 5 meters.

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Be careful who have type LED 5050 and have 60 LEDs per meter, or for the same price you will sell strips that are half the light.

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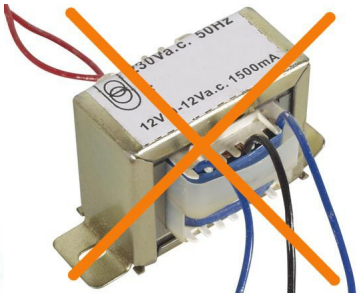
Please note that if they are true type switching power supplies and not simple transformer with a diode bridge and a capacitor, otherwise the efficiency will be strongly degraded.



Conclusions

The LED lamps are the only ones that can reach flickering values under one percent.

In addition, the LED lamps have the following advantages:

- They produce better quality light (the colors are rendered better and the light is more relaxing).
- They consume less power.
- They do not emit ultraviolet.
- They have a longer life.
- They cost less as maintenance.
- They are more robust and do not break falling.
- Breaking emit no mercury or other toxic elements.
- The disposal does not pollute the environment.

But you should be very careful in the selection of lamps,
because some LED lamps are really bad.

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With a FlickerMeter you can discover and discard the flickering LED lamps. Further information ***in this page***.