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http://wolfstone.halloweenhost.com/IdeaFile/clsclb_CheapLightningBox.html

Cheap Lightning Box

There are many ways to simulate lightning, but our favorite uses a thunderstorm sound track and something like a color organ to synchronize lightning flashes to the sound.

There are plenty of commercial lightning boxes that operate this way.

This page describes a cheap and simple high-power color organ.

History

This project has a long and tortured history, and history repeats itself.

From reading other portions of this web site, you can easily form the impression that I get a kick out of lightning storm simulation, which is often implemented with color organs and/or strobes.

And you wouldn't be wrong about that.

But products go through a commercial life cycle, and the color organs that were so popular in the 1970's became scarce in the 1980's. The strongly motivated haunter could always dig up the schematics and build a color organ on his own, but the designs tended to be complex.

I wanted to come up with a color organ designed especially for lightning use:

- high power
- inexpensive
- simple to build
- uses commonly available parts
- not necessarily frequency-sensitive

It seems that every year or two I get the idea to build this thing, and I never get around to it. In August of 2003, I drew up a GIF file with a schematic, but never got around to building it. And then in January of 2004, I stumbled on a scrap of paper that was at least three years old, containing essentially the same schematic.

I still haven't slapped this thing together, but perhaps one of my readers with a technological frame of mind, and the burning need for a cheap lightning box would like to give it a shot.

Design

They key to the cheap and easy color organ is the use of solid state relays. I must also admit to being inspired by the Velleman MK110 single-channel color organ kit. I looked at that puppy and said, "that's nothing more than a SSR, built from scratch!"

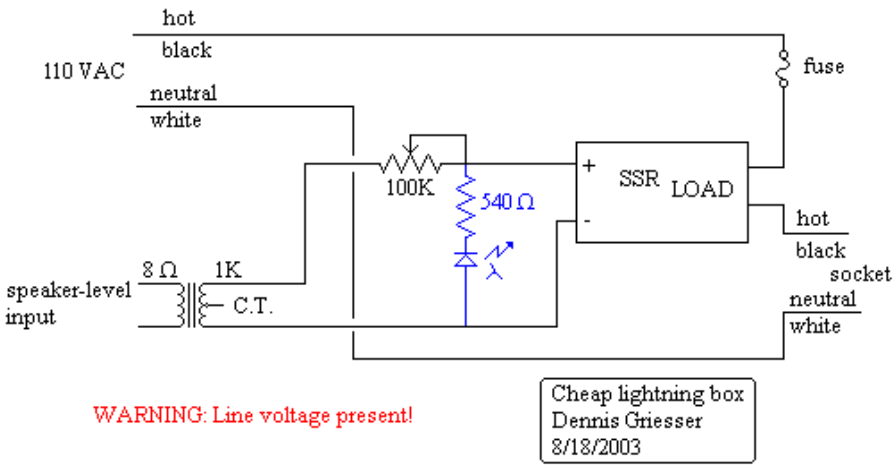
The problem with optocoupler-based color organs is that they relatively insensitive - you need to really crank up the sound to get the lights to flash. The reason for this is pretty simple: when driving something from the speaker-level signals, the voltage that we see depends on the sound volume.

signal type	***voltage***	***current***
.1W into 8-ohm speakers	.894V	.112A
1W into 8-ohm speakers	2.83V	.354A
10W into 8-ohm speakers	8.94V	1.12A
100W into 8-ohm speakers	28.3V	3.54A

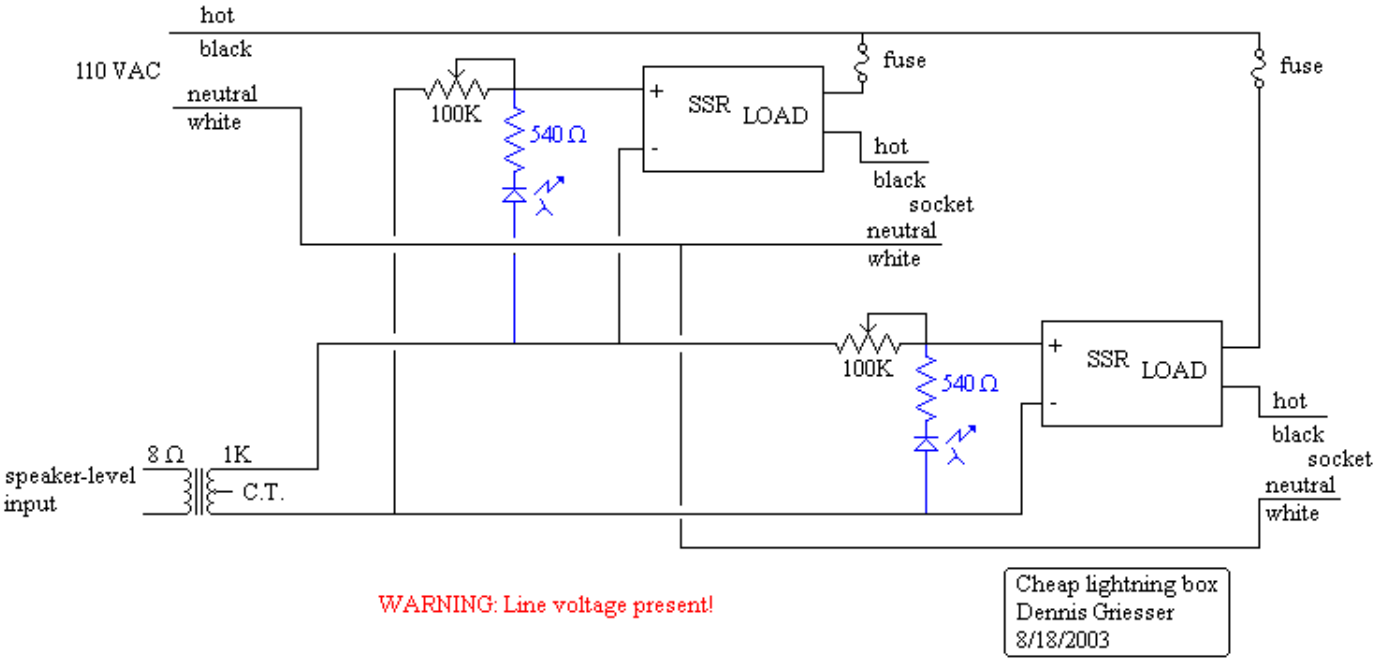
Velleman specifies input sensitivity as 2W to 60W. At lower power levels, the amplifier's output voltage is too low to light the LED in the optoisolator. At higher levels, the LED burns up from excess voltage.

We'll have the same problem with commercial SSRs. I think that a transformer will help by boosting the incoming signal.

Untested!



Components in blue are optional, but highly recommended. The transformer output is AC and the SSR input is DC. Half the time, the LED will be reverse-biased. The optional LED, in addition to serving as a pilot light, gets rid of the reverse bias on the LED inside the SSR.



quantity	*component*	*estimated cost per unit*
1	1k:8ohm transformer	
1	audio input jack or binding posts	$.50
1	110 VAC line cord	$1
1	10A fuse	
1	fuse holder	
1	110 VAC power outlet	
1	10A solid state relay	$5, surplus
1	100k potentiometer	

Here's a two-channel version:
Untested!

Components in blue are optional, and not recommended. Since the two SSRs are connected to opposite phases of the transformer output, they protect each other from reverse bias.

quantity	*component*	*estimated cost per unit*
1	1k:8ohm transformer	
1	audio input jack or binding posts	$.50
1	110 VAC line cord	$1
2	10A fuse	
2	fuse holder	
2	110 VAC power outlet	
2	10A solid state relay	$5, surplus
2	100k potentiometer	

As I have already said, this design is untested. But it is a very obvious design, from basic principles that should work. Any problems with this are probably due to individual component selection:

- The value of the potentiometer is probably much too high, but it's adjustable, right?
- I specified 10A SSRs, but you can use anything. Just size the fuse accordingly.
- I like conservative designs, so the SSRs should be derated a little. With 10A SSRs, I would plan to draw less than 8A each, and go for a 8A fuse. Perhaps a 7A slow-blow fuse.
- Note that the two-channel design has two fuses. This allows you to blow the fuse when one of the SSRs draws more power than expected. If you used a single fuse, it would not be able to detect this condition, because the fuse must be large enough to accommodate normal operation of two SSRs.