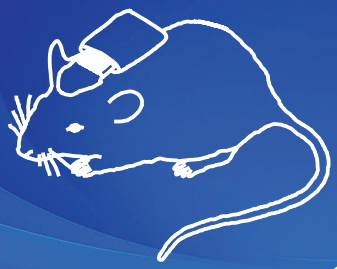
Ultralight wireless OPTOGENETIC stimulators



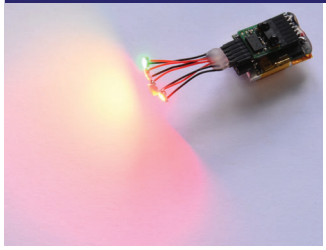
designed by Evolocus®

Battery-powered optogenetic stimulator receives controlling signals from computer in real time through infrared (IR) link. This stimulator can be configured wirelessly to generate desired pattern of stimulation.

Ultralight battery-powered optogenetic stimulator

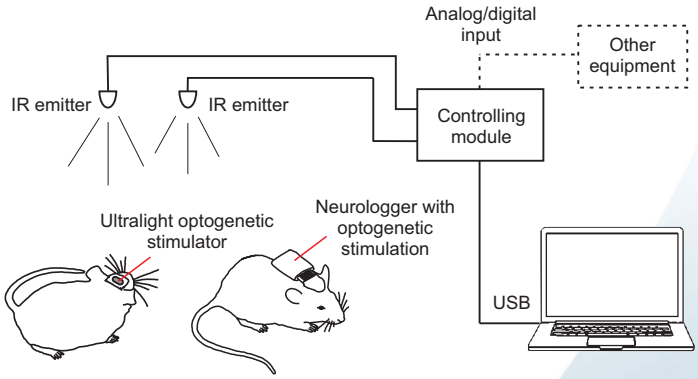
- Only **0.59 g** including battery and one light emitter
- Ideal for small laboratory animals (mice, rats, etc.) and songbirds (zebra finches, canaries, etc.)
- Supports up to 4 independently controlled light emitting diodes (LEDs)

Neurologger 2A/2B with integrated 4-channel optogenetic stimulator



- Records brain activity (4 channels up to 33 kHz sampling) together with activation or suppression of up to 4 brain areas
- Designed for use with mice, rats and other laboratory animals

Optogenetic stimulation system

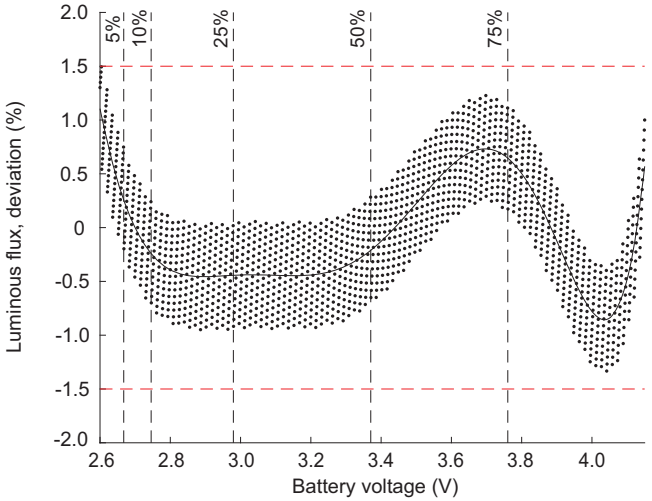


Optogenetic stimulator capabilities

Stimulating capabilities of ultralight and integrated with Neurologger 2A/2B wireless optogenetic stimulators are similar. Their key features are:

- **High illuminating power.** Even with the lightest battery the peak LED input power is ~1 W.
- **Stable light output** (maximal deviation 1.5%). The light output does not degrade with battery discharge. It also does not depend on animal orientation and movements, contrary to systems exploiting energy harvesting.
- No potentially dangerous high-intensity electromagnetic waves like in the energy-harvesting systems.
- **Independent control of several stimulators** attached to different animals in one environment.
- **Reliable wireless connection** between stationary controlling module and head-mounted stimulators.
- Direct transmitter-receiver visibility is not needed. Digital noise-free signal processing.
- Stimulating power is adjusted with 1% step.
- Continuous and pulse stimulation is possible. In pulse stimulation ON/OFF periods are adjusted in large ranges and with a small step.
- **Power is adjusted in up to 4 channels individually and wirelessly in each stimulator.**
- **Individual ON/OFF control of up to 4 channels in each stimulator.**
- Simple control from popular environments (Matlab, Python, LabView, etc.) through USB serial port emulation.
- Direct control through analog/digital input from other equipment.

Light output maximal deviation 1.5% in the range of battery voltages from 2.6 V to 4.15 V*

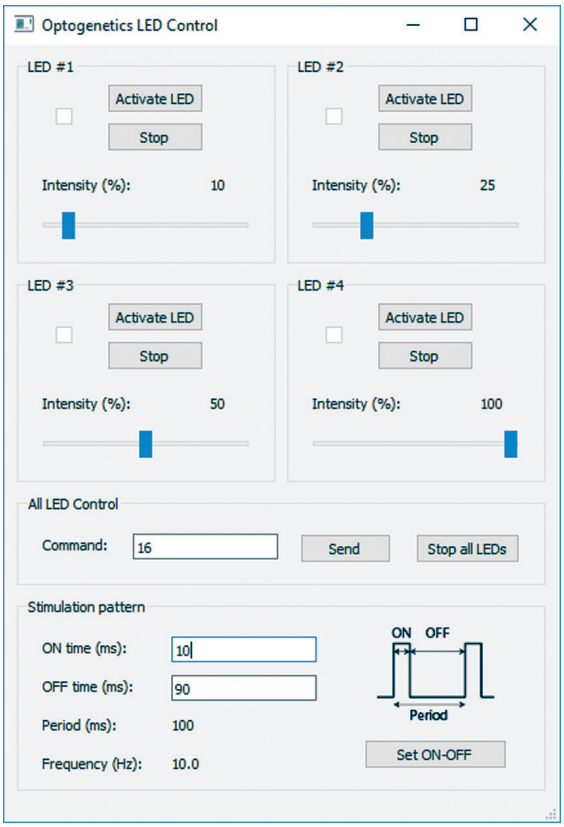


Solid black line shows luminous flux approximation error. It is below 1%. Dotted cloud around this line (±0.5%) represents discretization error caused by 1% step of power adjustment. The total error is always below 1.5% in the displayed range of battery voltages.

*Minimal battery voltage that is capable to keep stable LED output depends on illumination intensity configured. It is expressed in % of maximal possible output derived from fully charged (up to 4.15 V) lithium-polymeric battery. If LED output is set at 75% of maximal value, the minimal battery voltage allowed for the output stabilization will be 3.76 V. This border is marked by a vertical dashed line.
For outputs 50%, 25%, 10% and 5% the minimal voltages will be 3.37, 2.98, 2.75 and 2.67 V respectively. Chart is plotted for blue LED (460 nm, 1W input peak power) powered from a source with the output impedance 577 mΩ.

Included software allows easy configuration and control of ultralight wireless optogenetic stimulator.

Provided code examples are helpful for integration of optogenetics into different behavioral experiments.



Maximal duration of experiment with ultralight optogenetic stimulator

Longevity of experiments with batteries of different capacity and weight was estimated for ultralight single-channel optogenetic srtimulator in two modes:

- Waiting for incoming commands without stimulation.
- Optogenetic stimulation with 10 ms ON / 90 ms OFF schedule with 25% of maximal output power.

Stimulator consumes 345 µA in waiting mode and on average 5.5 mA in the above-mentioned stimulation mode.

Battery capacity (mAh)	Battery weight (g)	Total weight (g)	Duration of waiting mode (days)	Duration of stimulation (h)
12	0.36	0.59	1.45	2.18
20	0.63	0.86	2.42	3.64
40	1.05	1.28	4.83	7.27
50	1.58	1.81	6.04	9.09

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