Teleopt$^{\alpha}$

Wireless Optogenetic Stimulator

Teleopto

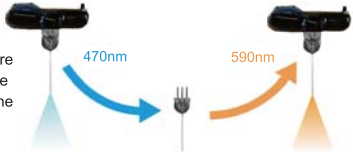
Wireless Optogenetic Stimulator

Best Solution in Optogenetic Stimulation for Freely Moving Animals !

In optogenetics experiment, an optic fiber connected to the head of an animal restricts animal behavior especially in test cages with high walls, gates and other obstacles. Teleopto breaks this wall by enabling complete wireless environment for optogenetic stimulation, using very light receivers sitting perched on animal' s head.

Extra small, extra light recievers even suitable for mice.

High brightness LED and optic fiber cannula are coupled to achieve mW order light power at the tip. Colors can be changed just by swapping the LED cannula component.



Remote controller accepts trigger signals from a stimulator, and sends the signals to the receiver. Synchronized light pulses are generated from the tip of the LED cannula (in pulse mode).

Receiver has two types, pulse and continuous, each for high frequency and continuous stimulation. The remote controller is compatible for both receivers, by switching the mode switch. Pulse receiver flashes at the same timing with trigger pulses, whereas continuous receiver alternates on and off upon a new pulse.

Some opsins are activated by blue light and inactivated by yellow light. Together with the 2 channel receiver and two color LED cannula, you can stimulate by two different colors at the same position. The remote controller accepts two independent triggers.

Receiver can be charged and re-used repeatedly, by a dedicated charger.

Bilateral stimulation is possible.
If you want to stimulate both hemisphere simultaneously please use 1ch receiver.
If you want to stimulate each hemisphere one by one, please use 2ch receiver.

Two color LED probe for surface stimulation

Teleopto Standard Set

model: **Teleopto-set**

- 1x Teleopto remote controller
- 1x Teleopto receiver
  *Please specify receiver type.
  2g/pulse will come without specifying.
- 3x LED cannula
  *Please specify cannula type.
  Blue/10mm/φ250 will come without specifying.
- 1x Infrared emitter
- 1x Teleopto charger
- 1x Cannula insertion tool
- 1x Dummy receiver
- 1x Trigger Cable

Specifications	
Communication	Infrared
Transmission Range	Controller: 1m, directional
	Infrared Emitter: 3m, directional
Receiver	
1g Receiver	approx. 1.4g, standby time: 17h
2g Receiver	approx. 2.0g, standby time: 28h
3g Receiver	approx. 3.0g, standby time: 49h
Controller I/O	
Trgger Input	3~5V TTL, 2ch
	P/2P mode: On@Hi, Off@Lo
	C mode: Toggle On/Off@rising
Ext Port	For extending Infrared emitter or TeleHub6
LED Cannula Size	φ250, 500 or 750μm
Power Source	Controller: DC6V
	Charger: DC5V

Teleopto Receivers

size: 13 x 18 x 7mm
weight (approx.): 1.4g
standby time: 17h

Teleopto receiver 1g / pulse
model: **TeleR-1-P**

size: 17 x 19 x 7mm
weight (approx.): 2.0g
standby time: 28h

Teleopto receiver 2g / pulse
model: **TeleR-2-P**

size: 18 x 22 x 8mm
weight (approx.): 3.0g
standby time: 49h

Teleopto receiver 3g / pulse
model: **TeleR-3-P**

size: 13 x 18 x 7mm
weight (approx.): 1.5g
standby time: 17h

Teleopto receiver 1g / 2ch pulse
model: **TeleR-1-2P**

size: 17 x 19 x 7mm
weight (approx.): 2.1g
standby time: 28h

Teleopto receiver 2g / 2ch pulse
model: **TeleR-2-2P**

size: 18 x 22 x 8mm
weight (approx.): 3.1g
standby time: 49h

Teleopto receiver 3g / 2ch pulse
model: **TeleR-3-2P**

size: 13 x 18 x 7mm
weight (approx.): 1.4g
standby time: 17h

Teleopto receiver 1g / continuous
model: **TeleR-1-C**

size: 17 x 19 x 7mm
weight (approx.): 2.0g
standby time: 28h

Teleopto receiver 2g / continuous
model: **TeleR-2-C**

size: 18 x 22 x 8mm
weight (approx.): 3.0g
standby time: 49h

Teleopto receiver 3g / continuous
model: **TeleR-3-C**

size: 17 x 19 x 7mm
weight (approx.): 2.1g
standby time: 28h

Teleopto receiver 2g / 2ch continuous
model: **TeleR-2-2C**

typical power (tested with **TeleR-2-P, TeleLC, LPM-100**)

Blue / ϕ250μm	4.5mW (≒99.5mW/mm^2)
Blue / ϕ500μm	13.0mW (≒71.8mW/mm^2)
Green / ϕ250μm	1.4mW (≒31.1mW/mm^2)
Green / ϕ500μm	3.0mW (≒16.6mW/mm^2)
Yellow / ϕ250μm	1.0mW (≒22.2mW/mm^2)
Yellow / ϕ500μm	2.8mW (≒15.5mW/mm^2)
Red / ϕ250μm	6.5mW (≒144.3mW/mm^2)
Red / ϕ500μm	16.0mW (≒88.4mW/mm^2)

LED Cannulas

LED cannula
model: **TeleLC-c-l-d**

Single cannula.
Hard enough for insertion without a guide.

Bilateral LED cannula
model: **TeleLCD-c-l-d-i**

For bilateral stimulation.

Two color LED cannula
model: **TeleLCT-c/c-l**

Two 250μm cannulas are bundled like one cannula.

LED probe
model: **TeleLP-c**

LED without cannula.
For brain surface stimulation.

Two color LED probe
model: **TeleLPD-c/c**

Two colper version of the LED probe.

Note: how to identify specifications from the model number:

c: color. **B** (blue 470nm) / **G** (green 525nm) / **Y** (yelow 590nm) / **R** (red 630nm) ...for other colors please contact us.
l: Length. Specify in mm.
d: Fiber diameter. **250** (φ250μm) / **500** (φ500μm) / **750** (φ750nm)
i: Fiber interval. Specify in mm. **-Glass**: Glass fiber instead of the regular plastic fiber. Only available for φ250μm Fiber.

Accessories

Teleopto Charger
model: **TeleCharger**
TeleCharger-4 (4ch)
Additional chargers would be useful if you use several receivers.

Infrared Emitter
model: **TeleEmitter**
Longer transmission, 3m.

Infrared Emitter (Clip type)
model: **TeleEmitter-C**
1m transmission.

Cannula Insertion tool
model: **TeleTool**
For use with a steleotaxic for insertion. ϕ1.3mm.

Dummy Receiver
model: **TeleDummy**
For habituation.

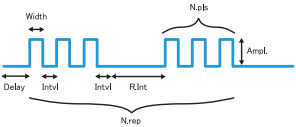
STOmk-II
STIMULATOR FOR OPTOGENETICS

Stimulator for optogenetics

model: **STOmk-2**

Specification	
Stim Channel	2ch (Independent)
Trigger In	2ch (Independent)
Parameter	
Delay	100μs - 999s
Width	100μs - 999s
Interval	100μs - 999s
Pulse number	1 - 999
Repeat interval	100μs - 999s
Repeat number	1 - 999
Amplitude	0.1 - 5.0V
Memory	Yes
Endless Repeat	Yes
Power	DC5V

STO mk-II is a pulse generator developed for optogenetics. By connecting the STO mk-II to TRG port on the Teleopto Remote Controller via a trigger cable, you can control the timing of light stimulation by TTL pulses. Pulses are defined by the parameters illustrated below.



LPM-100
LIGHT POWER METER FOR OPTOGENETICS

Light power meter

model: **LPM-100**

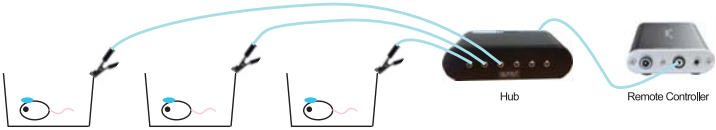
Specification	
Wavelength	470nm (blue) 525nm (green) 590nm (yellow) 630nm (red)
Display	Liquid crystal
Resolution	0.01mW
Analog out	0 - 5V
Power	2x AA batteries

In optogenetics, it is important to measure the light power at the tip of optic fiber cannula, and the LPM-100 is best suited for this purpose. LPM-100 covers three colors, blue, green, yellow and red which are commonly used in optogenetics.
Easy to use, mobilable by the battery-powered design.

6 channel Hub

model: **TeleHub6**

By connecting the TeleHub6 to the EXT port on the Teleopto Remote controller, you can use up to 6 infrared emitters at the same time so that you can increase the throughput of your experiment. This device is also useful if you use a maze with many branches or high walls which block infrared signal and prevent a good transmission. By putting several infrared emitters at several positions, it ensures more stable light stimulation.
Note: All infrared emitters send a signal at the same timing.



Video Tracking Stimulator

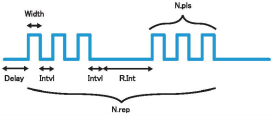
NEW model: **VTS-4**

VTS-4 Video Tracking Stimulator is literaly a USB stimulator equipped with a video tracking function, developed for optogenetics experiment. By defining Zones on the video image from a general USB camera, it tracks an animal and outputs pulse trains defined by a dedicated software. Pluse trains can be easily designed by manipulating the stimulation parameters (Delay, Width, Interval, Number of Pulses, etc.) This also can be used as a PC controlled universal 4 channel stimulator. You can establish closed-loop optogenetic stimlation system by combining Teleopto or wired optogenetics system from any third parties.

● Software

Control Window: Controls for stimulation and video tracking

Stimulator Panel: Defines stimulation parameters.

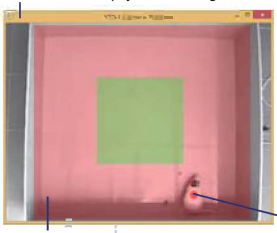


Video Tracker Panel: Zone, snapshot, detection threshold and erosion settings, tracking on/off etc.

Stimulation Assignment: Assign stimulation for each Zone.

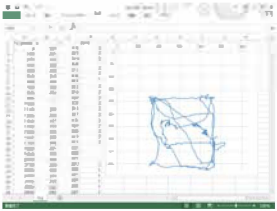
Mix Mode: Uses only one output port for stimulation, and stimulation will be swiched in each zone by refering the stimulation parameteres from the same number of channel.

Camera Window: Display for camera images and Zones



Zones: Up to 4 zones can be defined as polygon by clicking the Camera Window.

Track Mark: A red dot is put on the center of the animal detected by background subtraction



Elapsed time, X & Y axis, Zone data can be recorded by ASCII. Tracks can be visualized by XY plot in Excel etc.

4ch Teleopto NEW model: **Teleopto-4**

Teleopto 4

Teleopto-4 is newly designed wireless optogenetics platform utilizing 2.4GHz RF. The receiver is capable of controlling 4ch optogenetic stimulation independently, whereas the size and weight are comparable to our regular Teleopto receivers. PC software defines stimulation parameters which are sent to the receiver via a transmitter box connected to the PC by USB. You can trigger the stimulation by softwere, 4 trigger buttons or 4 trigger in BNCs on the transmitter box.
The typical application of this device is for controlling bilateral two color stimulation in completely independent manner. However, we can provide any probe / cannula holding 4 LED sources on request.

Receiver
Weight: 3g
Size: 18 x 20 x 8mm

Transmitter box

Quad LED probe
model: **TeleLPQ**

Bilateral two color LED cannula
model: **TeleLCDT**

* contact us for detailed probe / cannula specifications.

Teleopto 4 Software

■ Selected publications using Teleopto

Science

Top-down cortical input during NREM sleep consolidates perceptual memory

Miyamoto D, Hirai D, Fung CCA, Inutsuka A, Odagawa M, Suzuki T, Boehringer R, Adaikkan C, Matsubara C, Matsuki N, Fukai T, McHugh TJ, Yamanaka A, Murayama M

Science (2016) 352(6291):1315-8

Cell

Htr2a-Expressing Cells in the Central Amygdala Control the Hierarchy between Innate and Learned Fear

Isosaka T, Matsuo T, Yamaguchi T, Funabiki K, Nakanishi S, Kobayakawa R, Kobayakawa K

Cell (2015) 163(5):1153-64

Neuron

A Top-Down Cortical Circuit for Accurate Sensory Perception

Manita S, Suzuki T, Homma C, Matsumoto T, Odagawara M, Yamada K, Ota K, Matsubara C, Inutsuka A, Sato M, Ohkura M, Yamanaka A, Yanagawa Y, Nakai J, Hayashi Y, Larkum ME, Murayama M

Neuron (2015) 86:1304-16

Molecular Brain

The lateral parabrachial nucleus is actively involved in the acquisition of fear memory in mice

Sato M, Ito M, Nagase M, Sugimura YK, Takahashi Y, Watabe AM, Kato F

Molecular Brain (2015) 8:22

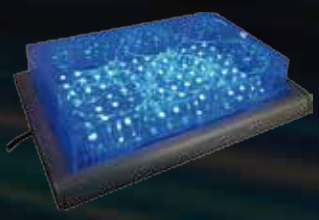
LED Array System NEW

Optogenetics became explosively popular for controlling animal behavior in-vivo, however, recently this technology was applied for in-vitro cells or tissues for controlling gene expression. For this purpose, long-term and time-controlled light stimulation in a culture incubator is required. This incubator-compatible LED array fulfills all the requirements for the in-vitro optogenetics experiments.

LED Array
model: **LEDA-x**
x: coler code, see bottom-left of this page

LED Array Driver
model: **LAD-1**

• Fits perfectly for multi-well plate



With 6 well plate

Upper view with 96 well plate

It' s designed for any of commercial multi-well plates so can be used together with e.g. 6, 12, 24, 48 and 96 well plates. Especially it' s perfectly fits for 96 well plate because each LED element comes just under each well.

• Trigger input

By the mode switch of LAD-1 LED Array Driver you can choose constant mode or trigger mode. In trigger mode, the Trg In BNC on the back panel is used for receiving trigger TTL pulses from a stimulator so that it enables time-controlled pulsed stimulation in-vitro.

• Many color options

470nm

530nm

590nm

630nm

Color code

* contact us for other colers

B: 470nm / **G**: 530nm / **Y**: 590nm / **R**: 630nm / **I**: 940nm

Two coler LED Array model: **LEDA2-BY**

It emits 470nm and 590nm lights from the same LED element. Two LAD-1 are required.

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Toll Free: (888) 680-7775 Fax (858) 560-8040

Other Countries:

Bio Research Center

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