

The ANY-maze Optogenetic interface



Overview

The ANY-maze Optogenetic interface independently controls up to four optogenetic lasers during behavioural tests performed with ANY-maze. The interface can either pulse a laser with very high precision, at a specific frequency and duty cycle for a set duration, or can 'play' a series of arbitrary pulses. For lasers that support it, the interface can also dynamically adjust the laser's intensity.

Channels

- Four entirely independent channels.
- LEDs indicate when a channel is active.
- Channels connect directly to lasers with TTL or analogue (max 5V) inputs.
- Outputs use BNC connectors (adaptors are available for other types of connector).

Laser intensity

- Can control the intensity of lasers by adjusting the trigger voltage (not all lasers support this feature).

Repetitive pulse output

- Output pulse frequency from 0.01Hz to 10KHz.
- Output pulse duty cycle from 1% to 99%.
- Frequency and duty cycle can also be specified as 'duration on' and 'duration off'.
- Pulse output can be programmed to end after a specific duration.
- All timing accurate to ± 100 nanoseconds.
- Supports 'continuous' mode, i.e. not pulsing at all.

Arbitrary pulse output

- Can play 'pulse files' which define a series of pulses of arbitrary duration and intensity.
- Pulse files are CSV files which can be created in Microsoft Excel or any text editor.
- Pulse files define when each pulse is switched on, when it is switched off, and optionally, its intensity.
- Up to 10,000 pulses can be included in a file.
- Pulse files use millisecond resolution.
- Files can play once or repeatedly.

Technical specification

Connection to PC	
Connection type	USB (USB1.1, USB2.0, USB3.0 compatible)
Power	Powered from USB
Maximum current drawn from USB	300mA
Isolation:	Power and data fully isolated
Data isolation	2500 V _{RMS}
Power isolation	1500 V _{DC}
Connection indication	LED: Red=Powered; Green=Communicating (note 1)
Channels	
Number of channels	4
Connector	BNC
Channel active indication	4 x green LED; LED on when channel active (note 1)
Outputs	
Digital output	5V TTL-compatible
Analogue output:	
Resolution	8-bit
Maximum output voltage	5V
Minimum output voltage	0V
Output resolution	0.02V
Output accuracy	±0.03V
Current sink/source from output	±40mA
Output timing	
Minimum frequency	0.01Hz (100s cycle time)
Maximum frequency	10kHz (100µs cycle time)
Minimum duty cycle	1%
Maximum duty cycle	99% (note 2)
Shortest active period	1µs (10kHz, 1% duty cycle)
Timing accuracy	±100ns
Rise/fall time (±5V)	230ns
Pulse file output	
Minimum pulse on time	1ms
Minimum pulse off time	1ms
Maximum pulse on time	60s recommended (note 3)
Maximum pulse off time	60s recommended (note 3)
Maximum number of pulses in a pulse file	10,000 (note 3)
Pulse file playback timing accuracy	±100ns

Notes

1. All indicator LEDs can be suppressed, which is useful for tests performed in darkness and/or to avoid providing potential cues to the animals.
2. Continuous output mode also available.
3. The actual number of pulses available depends on their durations. Pulses longer than 255ms use multiple slots in a pulse file; the number of slots required can be calculated using the formula: **(Pulse duration in milliseconds + 254) / 255**. For example, a 10 second pulse duration would use 40 slots in the pulse file.