

The ANY-maze Digital interface



Overview

The ANY-maze Digital interface has twelve general purpose ports that can be independently configured to connect to a wide range of equipment typically found in behavioural labs, including: levers, photobeams, running wheels, shockers, pellet dispensers, cue lights, etc.

Ports

- Twelve independent ports, paired across six connectors.
- Ports can be configured as: Switch input, TTL output, TTL input, Photobeam input, Rotary encoder input, Photobeam array input.
- Photobeam input, Photobeam array input and Rotary encoder input configurations use a pair of ports.
- Pluggable, screw terminal blocks used for easy connection.

Switch input

- Connect directly to any simple on/off switch.

- Can detect switch closures such as lever presses, step down from a platform, etc.
- Switches are read at 10kHz and are automatically debounced.

TTL output

- TTL outputs can directly drive LEDs, such as the ANY-maze cue-lights (pictured below), which are available in a range of colours and sizes.



- Can be used to control pellet dispensers and shockers that have TTL inputs.
- Can be used to synchronise ANY-maze with other systems, such as electrophysiology rigs.

- Outputs can be updated at a maximum frequency of 200Hz.

TTL input

- Can be used to read data from equipment with TTL outputs.
- Can be used to synchronise timing between ANY-maze and other systems.
- Inputs read at 10kHz.

Photobeam input

- Connect directly to the ANY-maze infrared photobeams (pictured below).



- Can connect to other phototransistor-based photobeams.
- Photobeams can be used to detect nose pokes, the animal leaving a start box, progress down a corridor, etc.
- ANY-maze photobeams work at up to 150cm separation.
- Photobeams are read at 150Hz.

Rotary encoder input

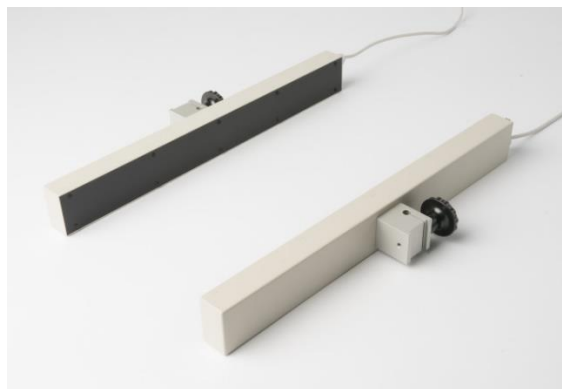
- Rotary encoders detect rotations of an axle.



- If, for example, the axle has a running wheel mounted on it, the encoder will detect rotations of the wheel. If the axle connects to an animal tether, the encoder will detect rotations of the animal.
- Works with the ANY-maze rotary encoder (pictured), as well as most other incremental rotary encoders with quadrature outputs.

Photobeam array

- Photobeam arrays provide a 'curtain' of photobeams, and are often used to detect when an animal rears.
- In ANY-maze, photobeam arrays can also be used as movement detectors, which generate reliable movement 'counts' in circumstances in which video tracking can't be used.
- The ANY-maze Digital interface only works with the ANY-maze photobeam arrays, which are available in lengths of 20cm, 40cm and 100cm.



Power outputs

- 5V power is available on each connector.
- A total of 300mA is available across all the connectors when the interface is USB powered.
- A total of 900mA is available across all the connectors when the interface is connected to an external DC power supply (not included).

Technical specification

Connection to PC and power	
Connection type	USB (USB1.1, USB2.0, USB3.0 compatible)
Data isolation	2500V _{RMS}
Connection indication	LED: Red=Powered; Green=Communicating (note 1)
Power	Powered from USB or external DC power supply
USB powered:	
Maximum current drawn from USB	500mA
USB power isolation	1000V _{DC}
Externally powered:	
Input voltage	9V _{DC} – 32V _{DC}
Input current	1.5A
Connector	2.0mm jack, centre positive or centre negative
Channels	
Number of channels	12
Number of connectors	6 (2 channels per connector)
Connector	4-pin pluggable screw terminal blocks
Channels can be independently configured as	Switch input, TTL input, TTL output
Pairs of channels can be configured as	Photobeam, Rotary encoder, Photobeam array
Switch input	
Read frequency	10kHz
Default debounce interval	20ms (user adjustable)
Pull-up resistor	15k Ω
TTL input	
Type	5V TTL-compatible
Read frequency	10kHz
TTL Output	
Type	5V TTL-compatible
Maximum update frequency	200Hz
Output current source/sink	± 30 mA
Output series resistor	160 Ω
Photobeam input	
Channels	Uses the pair of channels on a single connector
Read frequency	150Hz
Emitter	
Built-in emitter current limiting resistor	160 Ω
Typical emitter current	22mA
Receiver	
Built-in collector pull-up resistor	15k Ω
Rotary encoder input	
Channels	Uses the pair of channels on a single connector
Supported encoder type	Quadrature incremental encoder
Input read frequency	5kHz
Power	5V power available on connector (note 2)

Photobeam array input	
Channels	Uses the pair of channels on a single connector
Compatibility	Only compatible with ANY-maze photobeam array
Read frequency	25Hz
Current used by ANY-maze photobeam array	25mA
Output power	
Availability	Available on pin 2 of each connector (note 3)
Voltage	5V
Maximum current at each connector:	
ANY-maze Digital interface is USB powered	300mA (note 4)
ANY-maze Digital interface is externally powered	900mA (note 4)
Maximum total current across all connectors:	
ANY-maze Digital interface is USB powered	300mA (note 4)
ANY-maze Digital interface is externally powered	900mA (note 4)
Short circuit protection	Built in (note 4)

Notes

1. Indicator LED can be suppressed, which is useful for tests performed in darkness and/or to avoid providing potential cues to the animals.
2. Attention should be given to the current a rotary encoder will draw with respect to the output power available from the interface.
3. When the ports of a connector are configured as a Photobeam input, Rotary encoder input or Photobeam array input, pin 2 is automatically configured as 5V. In all other cases, pin 2 is user-configurable as ground or 5V power.
4. Current is internally limited. Overcurrent or short circuit will cause the current to the outputs to be limited or switched off, but the interface will continue to run. Overcurrent or short-circuit can continue indefinitely without damaging the interface. As soon as the overcurrent or short-circuit is resolved, the outputs will immediately return to normal operation.