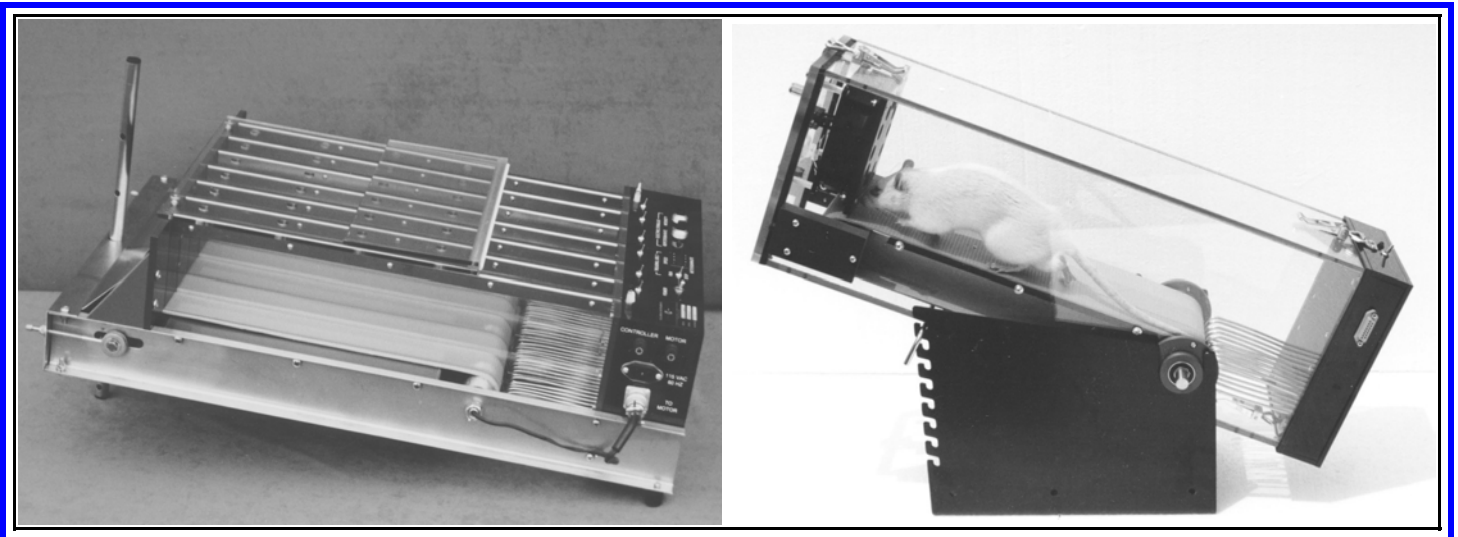


Animal Treadmills

**Rats, Mice, Rabbits, Cats, Dogs
and
other laboratory animals
for
Exercise & Metabolic Research**



Exer-6M Six Lane Treadmill for Mice

One Lane Modular Treadmill for Rats

Columbus Instruments has a long history of being one of the worlds premier suppliers of quality small animal treadmills for research. Our product line in this area has evolved into two standard products with semi custom treadmills being constructed on these basic platforms to meet a wide range of special requirements in animal research. The ability to accommodate special request makes Columbus Instruments your best source for quality treadmills.

All Columbus Instruments treadmills are powered by strong, servo-controlled, motor assemblies with velocity feed-back mechanisms that provide consistent tread speed and smooth operation. Each treadmill offers mechanical control of grade and our special attention to tactile awareness minimizes animal exposure to stimuli employed to promote running by providing the animal with sensory indications of position on the tread.



C o l u m b u s I n s t r u m e n t s

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Features Common to Our Treadmills

Easy Grip Running Surface

Treadmill belts are constructed of PVC on a nylon weave and provide an easily gripped and cleaned running surface. The nylon backing provides a durable belt that does not exhibit stretching and does not require constant adjustment. Belts are woven with a splice that diagonally crosses the running surface to eliminate animal hurdling and provide smooth operation.

High Torque Motor with Speed Control

Columbus Instruments treadmills incorporate motors that develop high torque. High torque insures smooth operation at low speed. Consistent tread speed is maintained by a velocity feedback mechanism that compares actual tread speed with the requested setpoint. The controller makes continuous, automatic, adjustments as needed to maintain the requested speed.

Pulsed Electrical Excitation

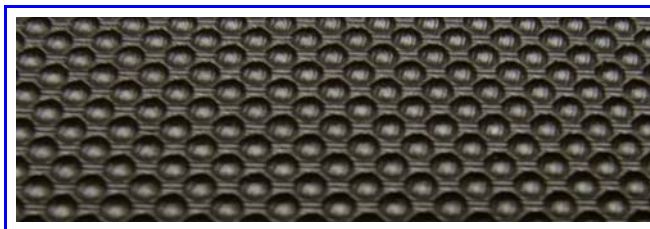
The option to present a mild electric shock, for the purpose of promoting running, is available on all models. Stimulus current is user adjustable and delivered from a regulated (constant current) source. Regulation of the delivered current assures consistent stimulus performance under variable subject impedance. Columbus Instruments treadmills present a pulsed stimulus (200ms burst at a user adjustable rate). Pulsed stimulus presentation provides an opportunity for the animal to return to the tread surface and eliminates concerns of “freezing” the animal to the stimulus grid.

Sensory Awareness to Location on Tread

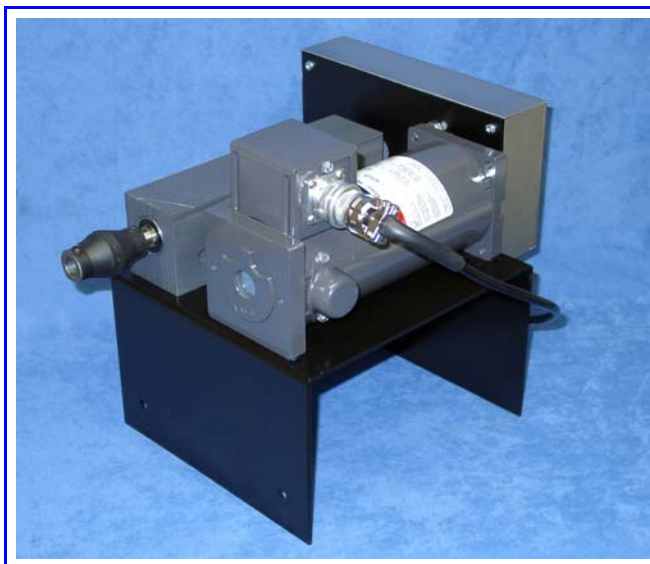
Proximity to the stimulus is often the only notification required by the animal to promote running. Columbus Instruments treadmills are all manufactured with the stimulus (platform) location being lower than that of the tread surface. Approaching the stimulus requires the animal's hind limb to extend over the edge of the rear roller. The sense of “stepping off” the tread surface gives the animal an indication of proximity to the stimulus. Animals will often advance their position on the tread in response to this sensation thereby avoiding undue stimulus exposure.

Ease of Cleaning

Both Exer-3/6 and Modular Treadmills are easily cleaned. Model Exer3/6 includes a tray for the collection of feces and urine. Modular treadmills are designed with removable end caps that allows washing debris throughout the entire length of the assembly. Fitted, absorbent, pads may also be employed that can be removed at the end of each run to facilitate cleaning.



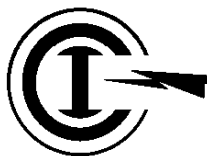
Belt Surface (Exer-3/6 Treadmill)



Motor Assembly (Modular Treadmill)



Stimulus Assembly (Modular Treadmill)



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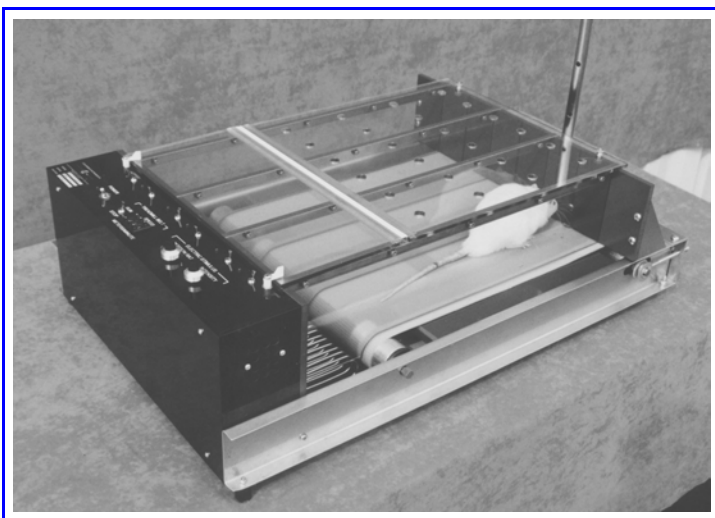
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Exer-3/6 Treadmill Description

Exer-3/6 is an open treadmill in which a common belt measuring 15" (38.1 cm) in width provides the running surface for a number of animals. Suspended over the surface of the belt are a series of dividing walls that create a lane for each animal. When employed with rats, the treadmill provides three lanes, each 4.825" (12.25 cm) in width. Six lanes for mice can be accommodated in the same space providing a lane width of 2.25" (5.7 cm). The lane length is the same for each configuration: 18" (45.7 cm) as measured from the top of each roller. Each lane provides 5" (12.7 cm) of inside height. Alternative lane widths (for accommodation of other species) are available upon special request.

The incline of **Exer-3/6** is adjustable in 5° increments from 0° to +25°. "Downhill" running is supported by way of a special adapter. Treadspeed is adjustable over the range of 10 to 70 meters per minute with a resolution of 0.1 meters per minute.

The animal contacts PVC, Lexan and UHMW (ultra-high molecular weight plastic) materials within the treadmill. Dividing walls may be either clear (Lexan) or opaque (PVC) as specified by the client. To promote running, **Exer-3/6** may be fashioned with a portion of the lane covered with an opaque material to create a darkened area. Lab animals prefer the perceived 'safety' of a darkened area and this can assist in consistent running behavior.



Exer-3R Three Lane Treadmill for Rats

Modular Treadmill Description

Columbus Instruments' **Modular Treadmill** encloses each animal within a chamber that houses the exercise belt, associated pulleys and optional stimuli. The chamber can be fashioned for free-air ventilation or can be made air-tight by way of suitable end caps for the enclosure. Both free-air and air-tight versions incorporate fans for the circulation of air over the animal. The air-tight 'Metabolic Option' provides 1/4" OD fittings for the connection of ventilation and gas monitoring equipment. **Modular Treadmills** are designed for integration with Columbus Instruments **Oxymax** line of calorimeters for the measurement of VO₂, VCO₂, RER, Heat and other metabolic parameters.

A **Modular Treadmill** system includes one *master* lane and optional *slave* lanes. A master lane is a fully functional treadmill that incorporates an electric motor and speed controller. Slave lanes are identical to master lanes but do not have their own motor/controller assembly. Slave lanes mechanically connect to a master lane (or additional slave lane) drive shaft to provide a multiple lane treadmill. Master unit lanes are manufactured with motors that can support a total of four or eight lanes.

Modular Treadmills are available in two standard sizes: Rat and Mouse. A rat treadmill provides 5.25" (13.3 cm) of headroom and 5.5" (14 cm) of width within the enclosure. The length of the running surface is 14.5" (36.8 cm) as measured from the top of each roller. The volume of the enclosure is approximately 980 cu inches (16 liters). A mouse treadmill provides 1.75" (4.4 cm) of headroom and 2" (5 cm) of width within the enclosure. The length of the running surface is 10" (25.4 cm) as measured from the top of each roller. The volume of the enclosure is approximately 120 cu inches (2 liters).

The incline of each treadmill lane is individually adjustable in 5° increments from -10° to +25°. Treadspeed is adjustable over the range of 6 to 100 meters per minute with a resolution of 0.1 meters per minute.

The animal contacts PVC, Lexan and UHMW (ultra-high molecular weight plastic) materials within the treadmill. To promote running, **Modular Treadmills** may be fashioned with a portion of the lane covered with an opaque material to create a darkened area. Lab animals prefer the perceived 'safety' of a darkened area and this can assist in consistent running behavior.



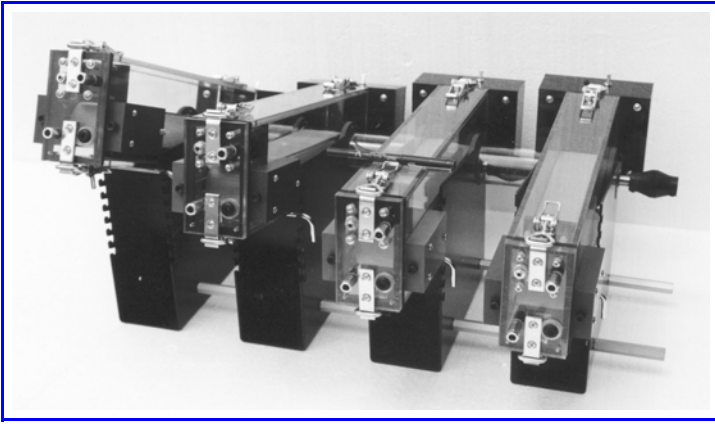
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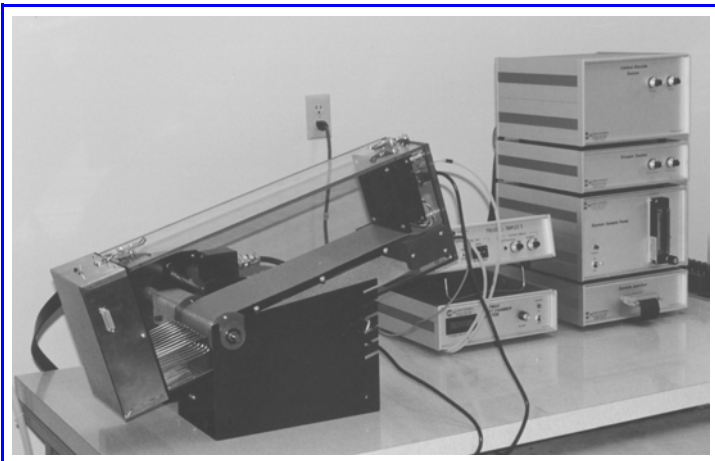
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Custom Treadmills

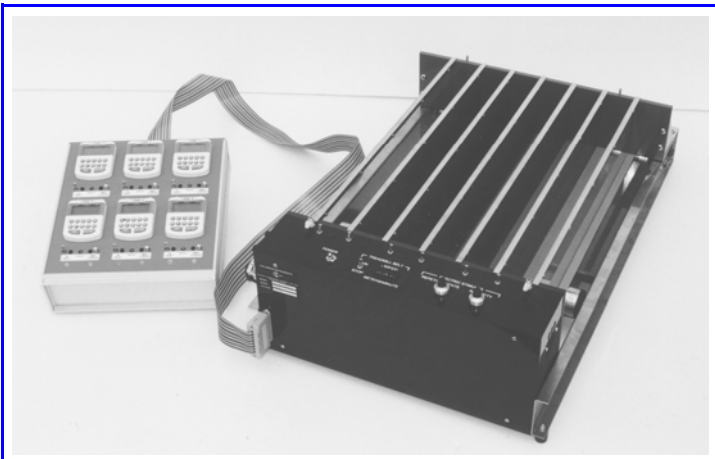
Columbus Instruments also supplies custom treadmills for specialized research applications. Custom treadmills may be based on either of our standard products or constructed as full custom items. Below are some of the many custom treadmills manufactured for clients' with special research requirements.



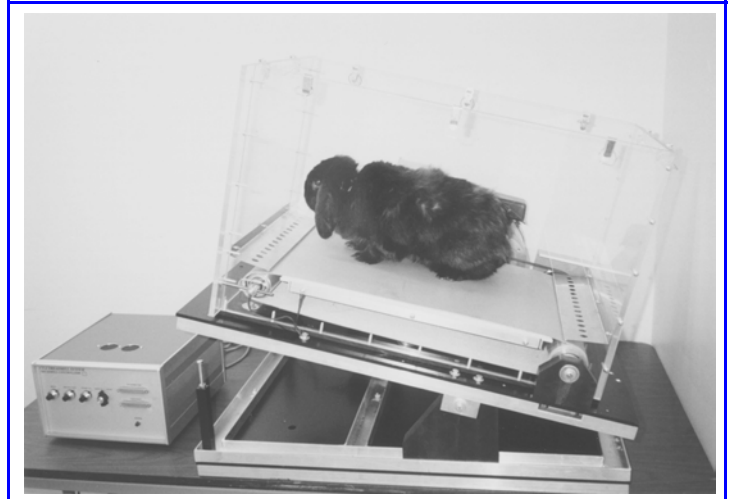
Four Lane Modular Treadmill for Mice
(shown without motor assembly)



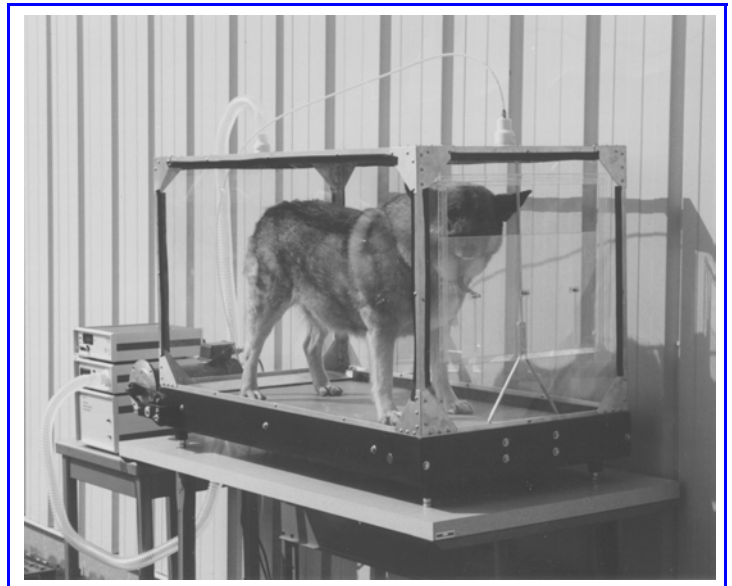
One Lane Modular Treadmill for Rats
(shown with Columbus Instruments Oxymax Calorimeter)



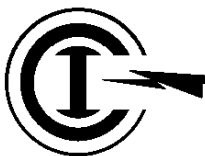
Exer 6M with Stimulus Detection Option



Custom Treadmill for Rabbit
(for use with Columbus Instruments Oxymax Calorimeter)



Custom Treadmill for Large Dogs
(for use with Columbus Instruments Oxymax Calorimeter)



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Stimulus Options

Optional Electrical Stimulus

Optional stimulus grids are offered to promote running. A scrambled electrical stimulus is presented as a series of 200 millisecond pulses with a user adjustable pulse repetition rate of 1 to 4 per second. The intensity is also user adjustable from 0.35mA to 3.4mA. LED lamps indicate stimulus grid excitation and switches are provided to engage or terminate stimulus presentation to each lane.

The stimulus grid assembly is constructed as a series of parallel bars running front to rear. The bars measure 0.125" (0.3175 cm) in diameter and are on 0.4375" (1.11 cm) centers. The bars protrude from the rear wall of the enclosure and approach the rear roller leaving a gap of 0.3125" (0.794 cm). The top surface of the stimulus grid assembly is 0.875" (2.22 cm) below the tread surface. It is the location of the stimulus grid assembly relative to the tread surface that provides the animal with an indication and opportunity to avert contacting the stimulus grid assembly.

The edge of the stimulus assembly bars proximal to the tread are curved downward and are re-secured to the rear wall of the treadmill. The bars have lateral flex to reduce wedging of animal limbs and allow easy extrication by the animal should entanglement occur. The vertical support afforded by the stimulus grid assembly and the associated lateral flexure is a special property of Columbus Instruments treadmills.

Other Stimulus Options:

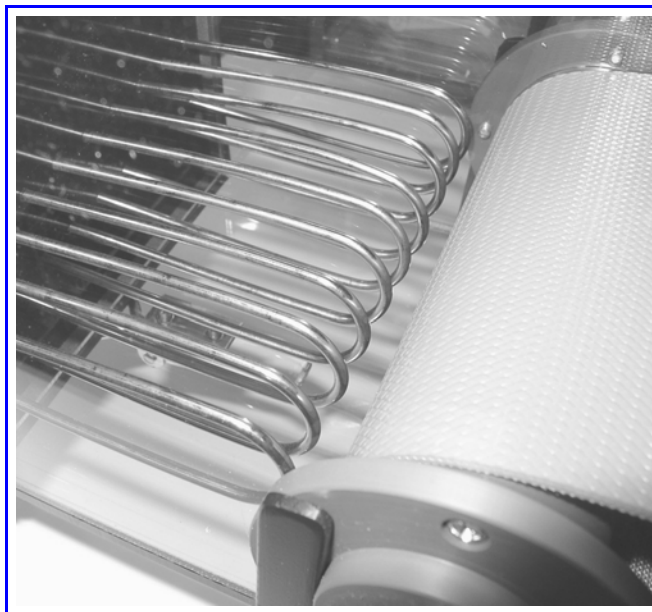
The use of an electrical stimulus may not be suitable in some circumstances. Columbus Instruments offers two additional stimuli: Cold Water and Air-Puff.

The cold water stimulus replaces the stimulus grid assembly with a shallow pool of water held just above freezing by a thermo-electric cooler. The depth of the pool and the configuration are such that the pool does not spill with changes in grade of the treadmill.

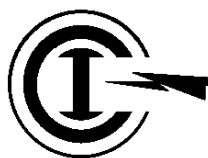
Air-puff is another alternative to the use of an electrical stimulus. In this configuration, the stimulus grid assembly is replaced with a platform that senses animal presence and engages a solenoid operated valve that releases a jet of air from the rear wall of the enclosure. The air is delivered through a small nozzle that creates as much of an acoustic deterrent as it does a physical deterrent. This feature can make use of any compressed air source generating 50-80 PSIG of pressure.



Speed & Stimulus Controls (Exer-6M)



Stimulus Assembly (Modular Treadmill)



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Stimulus Detection Option

Description

The Columbus Instruments Stimulus Detection option provides a means of monitoring and/or controlling the electrical stimulus activity on any electrical stimulus equipped model Exer-3/6 or Modular treadmill. This option can time the duration of stimulus delivered (excitation) or count the amount of seconds the animal is resident upon the stimulus assembly. It can also be employed as a mechanism for controlling the stimulus by terminating delivery in accordance with a user set criteria.

Columbus Instruments treadmills present electrical stimuli as a series of pulses, usually taking the form of 200 mS pulses delivered at a user alterable rate (1-4 pulses per second) with 2pps being typical. Presentation in this fashion helps prevent the animal from freezing on the stimulus assembly (allowing escape). The use of the term 'time' can take on two meanings under this delivery method:

A) The time during which the animal receives stimulus (200mS/episode)

B) The time the animal remains on the stimulus assembly (Seconds)

When employed as a counter, the Stimulus Detection option has two sub-modes of operation:

A) Accumulate- Count the number of whole seconds on the stimuler assembly.

e.g.: Accumulate time, advancing 1 second for each second on the stimuler assembly.

B) Control- Terminate stimulus after a preset amount of time on the stimuler assembly

e.g.: A setting of "5" (seconds) will terminate the stimulus after the animal has accumulated 5 seconds on the stimuler assembly.

The Stimulus Detector option differentiates between these two definitions by operating as a timer, when recording the time during which the animal receives stimulus and as a counter when scoring the duration of time the animal remains on an active stimuler assembly.

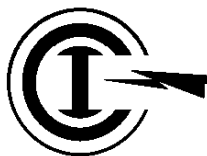
When employed as a timer, the Stimulus Detection option has two sub-modes of operation:

A) Accumulate- Sum the episodes of stimulus delivery

e.g.: 14 episodes of 200 mS stimulus delivery will be scored as 2 seconds ($14 \times 200 \text{ mS} = 2.8 \text{ Seconds}$). Note, increments occur only after whole seconds have accrued. This is a function of the display. Internally, the stimulus Detection option maintains time to 10mS resolution. In the case of the above example, the animal need only incur one more 200mS episode to accumulate 3 seconds of exposure.

B) Control- Terminate stimulus after a preset amount of stimulus delivery

e.g.: A setting of "5" (seconds) will terminate the stimulus after 25 episodes of stimulus exposure. ($5 \text{ seconds} = 25 \times 200 \text{mS}$)



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