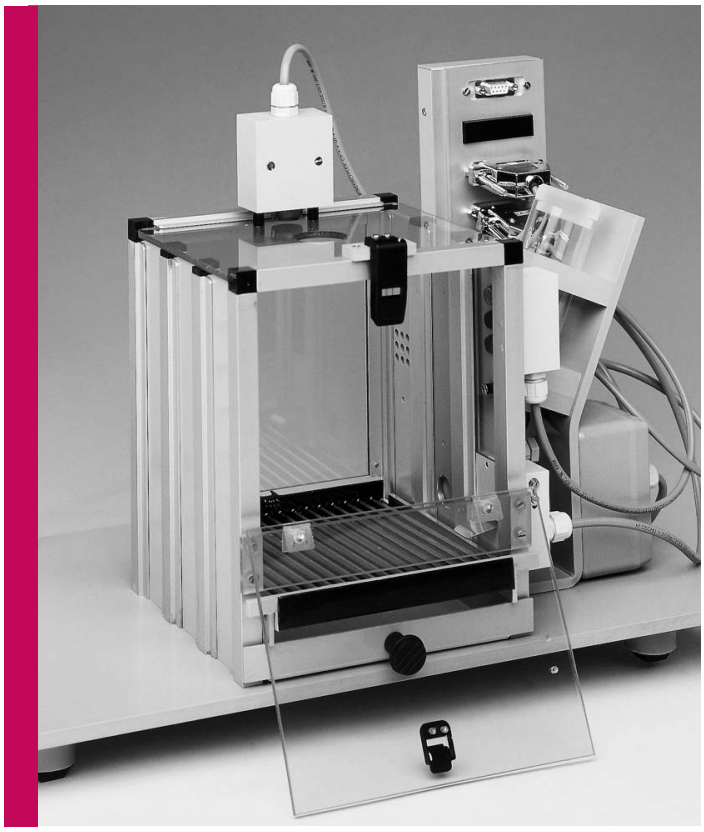
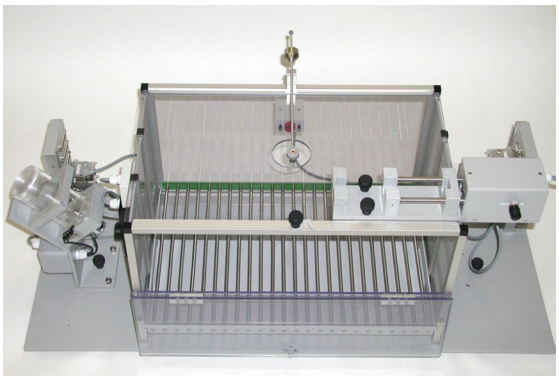
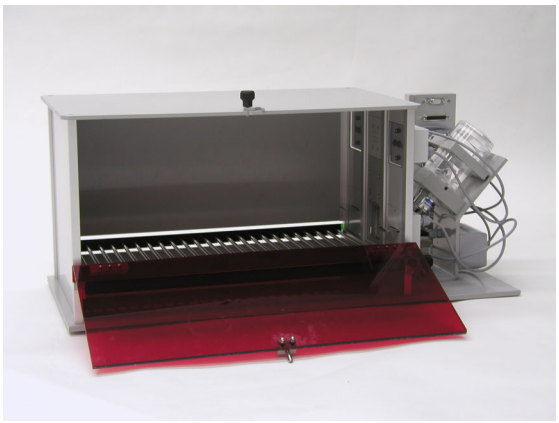
Product Overview

Sophisticated Life Science Research Instrumentation







TSE Operant Behavior Systems

Sophisticated solutions for mice and rats

www.TSE-Systems.com

Specifications subject to change without notice

TSE Operant Behavior Systems

TSE Operant Behavior Systems are designed for carrying out operant behavior tasks with small rodents in a high-quality environment.

Completely independent operation of up to 32 Skinner boxes is provided.

Our fully computerized Skinner boxes available for rats and mice are modular systems built together from a wide choice of individual components to meet your specific requirements. We provide a variety of different function modules that are easily mounted into the box base construction.

A Skinner box comes complete with one or two multi-function panels each featuring 3 or 4 slide-in elements. For a quick change in setup simply pull the modules out and switch them around.

A standard test box typically contains one or two levers that the animal can press. The levers can be motorized to move them out of reach of the animal. Nose-poke modules can be used instead of levers as response elements.

The reward is delivered via pellet dispensers (new design!) or liquid dispensers. The food or liquid receptacle can be equipped with infra-red sensors in order to register animal approach; alternatively a flap in combination with a microswitch is used as head entry detector. Different models of liquid dispensers allow you to configure flow rate and target volume as required.

A choice of colored lights (red, green, white) serve as discriminative stimuli. A light can also be integrated into the lever itself.

If desired, audio and noise generators provide auditory stimulation or generate background noise. Alarm sounds (sonalert) can also be used if required.

For application of electrical stimuli we provide shockable floors. Alternatively we also offer non-shockable mesh floors or custom-floor inserts.

Box control and data acquisition is made easy with our comprehensive OBS software package.

All Skinner boxes can run one of the predefined standard procedures; alternatively individually designed schedules can be created employing our unique free programming option. Analysis includes cumulative recorder graphs as well as test-specific results tables that can always be modified on request. Export files are generated for further statistical calculations.

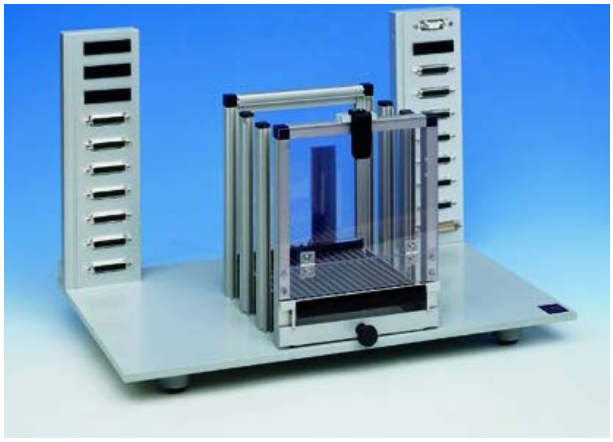
The TSE Operant Behavior System is undergoing continuous development in cooperation with our users and new functions are being added at frequent intervals. If you are interested in hardware modifications or in a new type of analysis please contact us and we will discuss your specific needs!

For ordering please refer to the detailed product list included in this brochure.

Base Construction

A Skinner box basically consists of a light-weight base construction made of aluminium and PVC. The modular profile system is combined to form **one** (on the right side) or **two** (on both sides) multi-function panels each accepting **three** or **four** slide-in function modules. This allows you to quickly change the setup by simply pulling the elements out, placing them into another position of the panel(s) and connecting them to any of the plug-in connectors mounted to the multi-purpose adapters.

All modules can be individually inserted into any of the slots available. Blank modules are available to fill unused spaces.



Base construction
2-panel box – mouse / standard size (3 rows)

Box Dimensions

"Mouse" Standard (3 rows)

Inner box size:	159 x 165 x 175 (LxWxH)
1-panel:	base plate 300 x 300 mm (LxW)
2-panel:	base plate 500 x 300 mm (LxW)

"Mouse" Extra-large (4 rows)

Inner box size:	270 x 218 x 175 (LxWxH)
1-panel:	base plate 500 x 300 mm (LxW)
2-panel:	base plate 700 x 300 mm (LxW)

"Rat" Standard (3 rows)

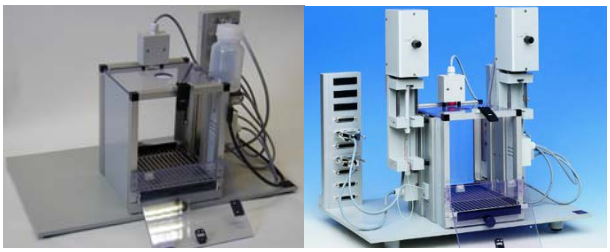
Inner box size:	284 x 268 x 220 (LxWxH)
1-panel:	base plate 500 x 300 mm (LxW)
2-panel:	base plate 700 x 300 mm (LxW)

"Rat" Extra-large (4 rows)

Inner box size:	485 x 358 x 220 mm (LxWxH)
1-panel:	base plate 700 x 400 mm (LxW)
2-panel:	base plate 900 x 400 mm (LxW)

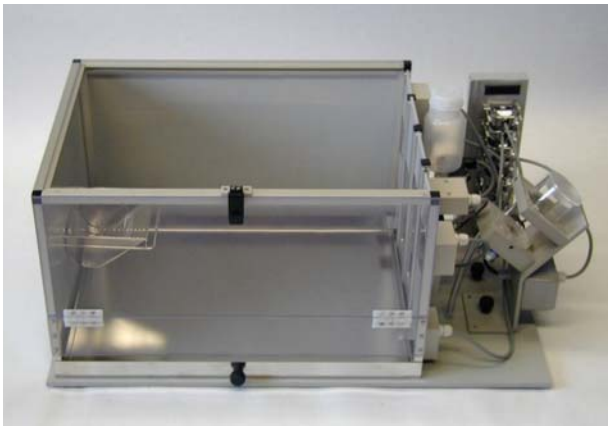
Multi-function panel – 3 rows (mouse)

Multi-function panel – 4 rows (rat)



Fully equipped mouse boxes
Left: 1-panel box, ***Right:*** 2-panel box

Each basic unit is completed with your choice of function elements such as liquid or pellet dispensers, response levers or stimulus lights.



1-panel rat box – fully equipped

After removing the function elements the basic construction can be easily cleaned.

Box Floors

A variety of box floor types is available to meet your requirements. The **grid floor** type is the most common floor type.

Shockable floor grid (rat)

Shockable Grid Rod Floor

Material:	stainless steel
Mouse:	rod ∅ 4 mm, distance* 8.9 mm
Rat:	rod ∅ 6 mm, distance* 19.5 mm

** distance rod center to rod center*

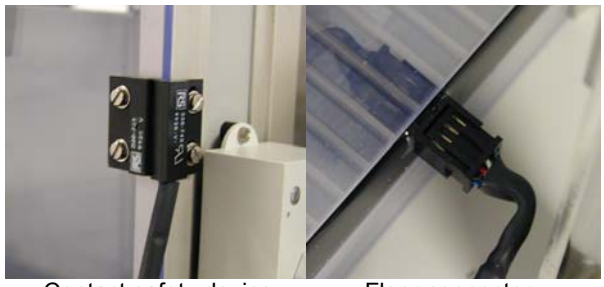
The grid floor allows you to apply an **electrical stimulus** if negative reinforcement is required. The control unit is then equipped with a microprocessor-controlled shocker (scrambler) module to produce these foot shocks. The module ensures a constant current with a high degree of accuracy. If the experimenter requires, a pulsating stimulus current can also be applied.

Programmable Shock Generator

Current type	constant / pulsating (50 Hz)
Current strength	0.1...3.1mA (in steps of 0.1mA) (up to 4.5mA on request)

The module always carries out a so-called current flow check, i.e. a check is made if current is really flowing. If the animal is standing on the grid rods so that the same potential is received by all paws, then a grid repoling takes place so that the animal again receives a stimulus current.

The electrified grid floor can be easily removed for cleaning purposes by simply unplugging the connector on the rear side.



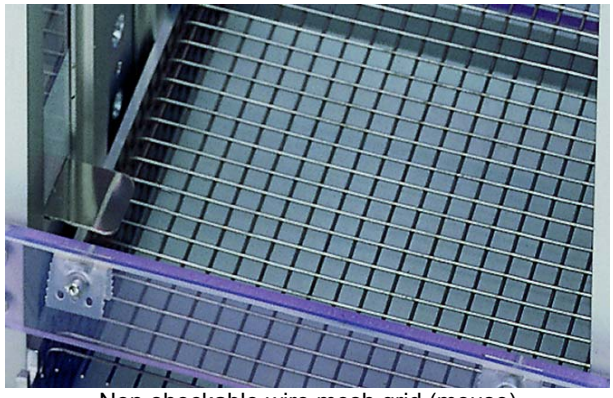
Contact safety device | Floor connector

A **contact safety device** mounted at the box door guarantees that any electrical stimulus is switched off when the door is opened.

The **mesh floor** type is a non-shockable alternative to the grid floor.

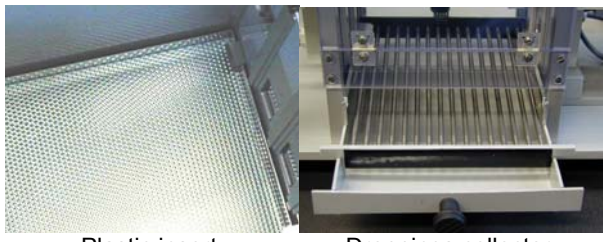
Non-Shockable Wire Mesh Floor

Material:	stainless steel
Mouse:	∅ 1mm wire mesh, 6mm square
Rat:	custom made (animal weight required)



Non-shockable wire mesh grid (mouse)

Each box is equipped with a waste pan underneath the grid or mesh floor. These droppings collectors are made from stainless steel.



Plastic insert | Droppings collector

Instead of using stainless steel floors special floor inserts that are placed into the droppings collector are available. These inserts feature a structured surface in order to provide a grip for the animal.

We also manufacture special floor plates to meet your specific needs.

Stimulus Elements

Stimulus Lamps

Left: Triple-stimulus lamp set
Center: Single red cue lamp
Right: Red stimulus LED

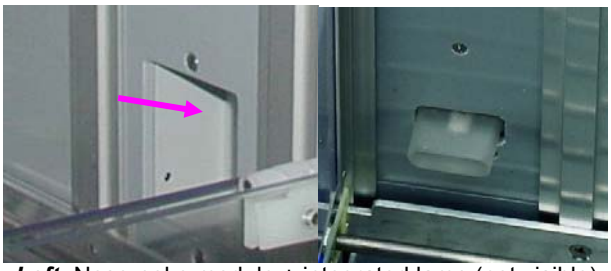
Stimulus lamps (or cue lights) are available in a variety of configurations. The triple modules contains 3 lamps: red, green and white. The single lamp module is available in any of the 3 colors (please specify when ordering). All lamps are mounted behind protective plastic covers.

Stimulus Lamps	
Color	green, red or white
Diameter	9 mm
Output	1.2 watt

Stimulus lamps are usually combined with response levers for general cueing and discrimination.

Triple stimulus lamp sets mounted over response levers
Left: Mouse - vertically, ***Right:*** Rat - horizontally

The stimulus light can also be mounted **inside** a nose-poke response module or a special lever if close proximity of stimulus and operandum is required.



Left: Nose-poke module + integrated lamp (not visible)
Right: Rat lever with integrated light

Small LEDs are also available. Please tell us the color and the intensity you need.

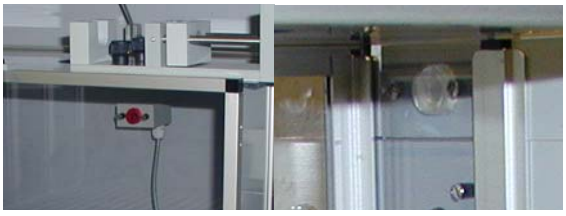
Stimulus LEDs	
Color	green, red or white
Diameter	5 mm
Intensity	standard or bright

Olfactory Stimulus Module

Olfactory stimulus modules are available as single channel or triple-channel units. They allow to deliver olfactory stimuli to the animal.

The olfactant, usually in form of a liquid, is put into a small reservoir equipped with an inlet and an outlet port. This chamber is connected to a suitable air supply so that the olfactant evaporates into the air in the chamber. A software-controlled valve allows to deliver the gas for a user-defined duration during the experiment.

House Light



The house light is available with red or white cover (easily exchangeable). It can be mounted on top of the box lid, fixed to the box side or configured as slide-in function module (please specify when ordering).

House Light	
Color	red or white
Diameter	21 mm
Output	2 watt

Audio Elements

Left: Rat box – partial speaker module
Right: Mouse box - stand-alone speaker module

In order to present auditory stimuli (sound, noise) a speaker module in combination with an audio and/or noise generator that is built into the control unit is required.

Left: Control unit knobs for amplitude setting
Right: Sonalert slide-in module

Control knobs at the control unit front panel allow the selection of the desired amplitude for both audio signals independently.

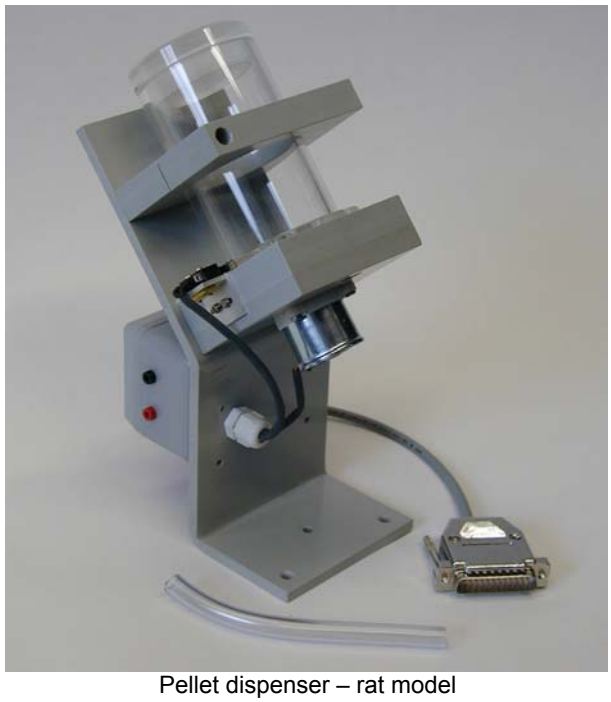
A low-cost version to produce cueing sounds is the stand-alone **Sonalert®** audio module that does not require an audio generator. The high-pitched continuous tone is generated with a fixed frequency in 2 different magnitudes. Combine several modules for high-low tone discrimination.

Audio Elements	
Noise Generator:	White noise with adjustable amplitude.
Sound Generator:	Sound (sine) at a fixed standard frequency of 10 kHz with adjustable amplitude. Optional variable frequency setting (2 ... 20 kHz).
Sonalert®:	Alarm sound with 1.8, 2.3, 3.3, 3.5, 3.7, 4.0, 4.2 or 4.6 kHz frequency (specify when ordering). Manually adjustable amplitude (2 settings).

Reinforcer Elements

Pellet Feeder

Our newly constructed pellet feeders are suitable for use with all standard dust-free pellets (3 models for **14mg** or **20mg** or **45mg** pellet size).



Pellet dispenser – rat model

The durable construction ensures reliable performance for many years. Activation is performed with a short impulse from the PC; pulses longer than the time required for the pellet disk to move one step (=1 pellet) will result in dispensing multiple pellets.

A pellet dispenser is combined with a **pellet receptacle module**. In the rat version the entry port of the delivery tube is located at the back wall of the module; in the mouse box the tube connects to the top of the receptacle.

Left: Rat pellet through with flap door
Right: Mouse pellet through

The rat food receptacle may be equipped with an optional **flap** door.

Liquid Dispenser

We offer 2 varieties of liquid dispensers:

- the **Advanced** model and
- the **Ultra-precise** model

1. Advanced Model

This is a drop-type liquid dispenser featuring a software-controlled magnetic valve that is opened for a user-defined length allowing you to deliver liquid with a minimum volume of app. **50 µl**. It is suited for any non-viscous liquid such as water or aqueous drug solutions. Standard dispenser filling volume is 150ml. Larger bottles for long-term experiments are available on request.

Left: Liquid dispenser mouse
Right: Liquid receptacle for rats - with flap

Liquid receptacle for mouse - without flap

The fluid is delivered into a central cup surrounded by overflow holes in order to allow surplus liquid to flow into a container that is placed below.

The rat liquid receptacle may also be equipped with an optional **flap** door.

2. Ultra-Precise Model

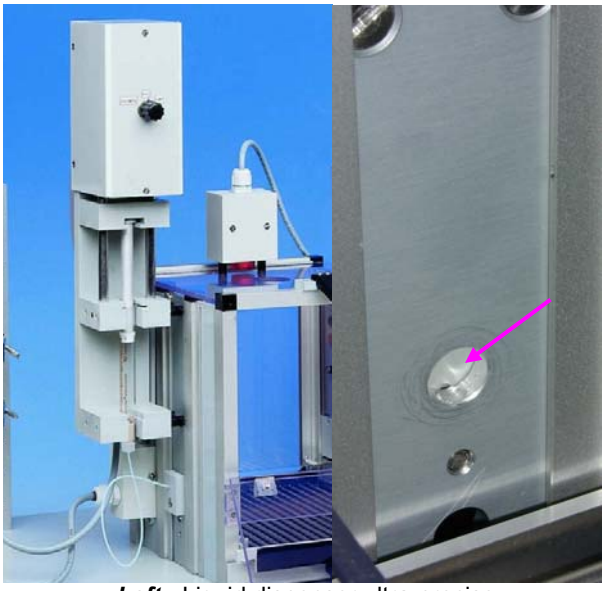
This dispenser type has been designed for applications where very **small** and **accurate** amounts (<50µl) of liquids are to be delivered. It is mainly used for mouse conditioning experiments to deliver small volumes of liquid orally (e.g. 2 µl per response), but can also be manufactured for rat applications.

Depending on the syringe size volumes as small as 0.4 µl can be administered per step.

A software-controlled micro-stepper motor drives a microliter syringe that is mounted in a special holder. Rat and mouse models differ in holder capacity (i.e. syringe sizes) and therefore in achievable flow rates.

The fluid is delivered into a specially designed micro-reservoir and can be easily licked off by the animal.

We also provide suitable syringe models in a variety of sizes.



Left: Liquid dispenser ultra-precise
Right: Mini-reservoir

Due to its very low flow rates the ultra-precise liquid dispenser is also suitable for **intravenous drug administration** experiments (see section **Options**).

Head Entry Detectors for Reinforcers

Head entry into the reinforcer receptacle can be registered if desired (i.e. to detect food and liquid removal).

If the **rat** food and liquid receptacles are equipped with a **flap door** this can be combined with a micro-switch in order to monitor the animal´s actions. Alternatively the opening my be equipped with an **infra-red sensor beam** to monitor animal approach. This detector is available for rat and mice food receptacles and liquid dispenser “Advanced“ configurations.

Response Elements

Response Levers

Response levers for mice and rats are usually used in conjunction with stimulus lights mounted above the lever.

The standard lever is made of chew-proof stainless steel but can be made of eloxated colored aluminium if desired.

Left: Rat lever module
Right: Rat lever with integrated light

Special levers with integrated lights are also available.

Mouse lever mounted into a panel

Response levers may be equipped with a **motor** to retract the lever during certain time intervals.

Response Levers – Minimum Actuating Force

Mouse:	3 – 5g
Rat:	15g

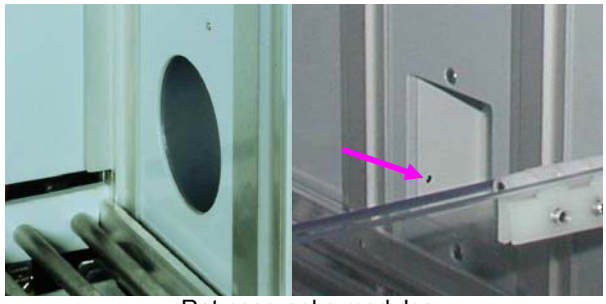
Response Levers – Height above Grid

Mouse:	20 mm
Rat:	40 mm

Nose-Poke Modules

Instead of pressing a lever the animal may be required to exhibit a nose-poke response for reinforcement delivery.

The nose-poke module registers the entry of the animal´s head into a circular or rectangular hole (please specify type and size when ordering) by means of an infrared sensor mounted across the opening (the light (950nm) is invisible to the animal).



Rat nose-poke modules
Left: Circular - diameter 26mm
Right: Rectangular with infra-red sensor (arrow)

A stimulus lamp (cue light) can be added to the back wall of the unit (red, green or white).

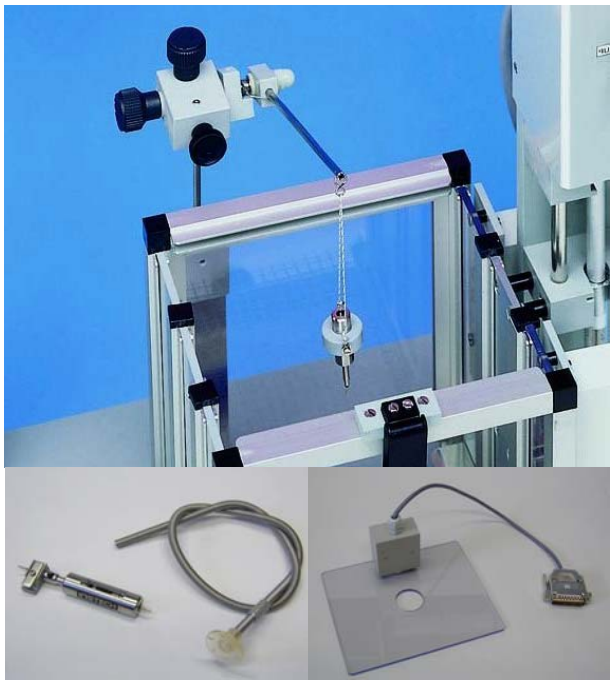
Options

- In the 1-panel box configurations an additional **food crib** can be mounted to the box side wall for long-term experiments. It holds all standard food pellets. Please specify food type and filling volume when ordering.

Food crib

◆ In **self-administration experiments** drug infusion is performed as positive reinforcement. Fluid can be administered with a low-flow syringe pump or alternatively employing our **ultra-precise liquid dispenser**. A swivel/tether combination is required for these applications. A counterbalance arm is mounted to the box top or the base plate (mouse & rat models available) for mounting the swivel that holds the tube. The swivel holder is available in a variety of sizes to hold fluid swivels of different brands.

Special cage lids with a central cutout are provided to give access to the inner cage.



▪ We also provide mounting devices for **Plastics One** swivels. In this configuration no counterbalance arm is required.

▪ All our syringe pumps combine very low flow rates (down to 0.001µl/h) with simple operation. All models can be operated with any type of syringe and may be controlled via the OBS software

Liquid dispenser ultra-precise, mounted horizontally

Rat box configured for drug-infusion

◆ A multi-channel software-controlled external **stimulator** may be integrated into the system if electrical stimulation via intracranial electrodes with very short impulses is required for positive reinforcement.

The stimulator features:

⇒ variable current amplitude: 20 µA ... 1020 µA adjustable in steps of 4 µA
⇒ rectangular pulses
⇒ pulse width: 0.07 ms ... 65025 ms adjustable in steps of 0.07 ms
⇒ selectable type of stimulation: constant (non-pulsed) current or pulsed constant current
⇒ if pulsed constant current is selected generation of pulse sequences with
- 2 … 255 impulses per sequence
- impulse interval: 4 ... 1020 ms in steps of 4 ms (*can be changed if required*)
- selectable current polarity (positive or negative)
- pole reversal of pulses via relays with reversal time of approx. 30 ms

◆ If you want to monitor overall activity during the experiment an **Infrared Activity Sensor** unit may be mounted to the box ceiling. This system registers activity by sensing the body-heat image of the subject underneath.

◆ We also provide for monitoring and VCR recording during the experiment using low-light CCD miniature **cameras** mounted in a slide-in module (for horizontal view) or to the box ceiling (for full floor area view). If used with 880nm LEDs the cameras can be operated in total darkness.

Example for Box Configurations - Mouse

Dual-Liquid Dispenser Box

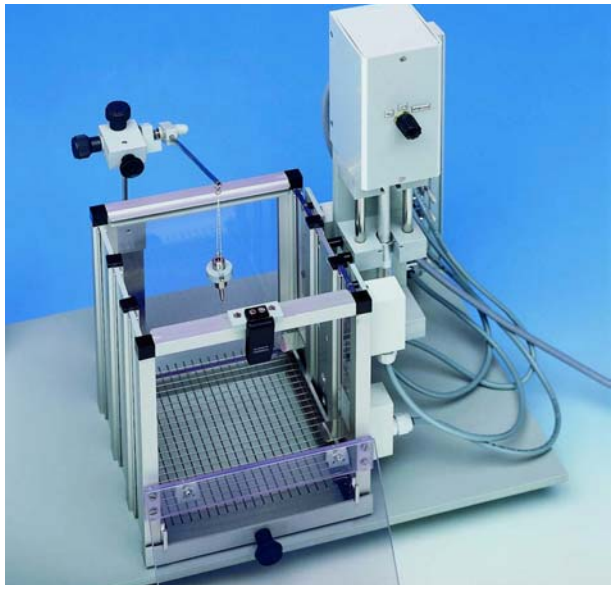
For preference tests

- 2-panel box - standard size (3 rows)
- 2 ultra-precise liquid dispensers with micro-reservoir
- 2 response levers, ultra-sensitive
- 2 stimulus-lamp triple-sets
- 1 speaker module
- 1 house light (red)
- 1 blind plate
- Shockable floor grid
- Optional syringes & tubing

Self-Administration Box

For intravenous self-administration of drugs

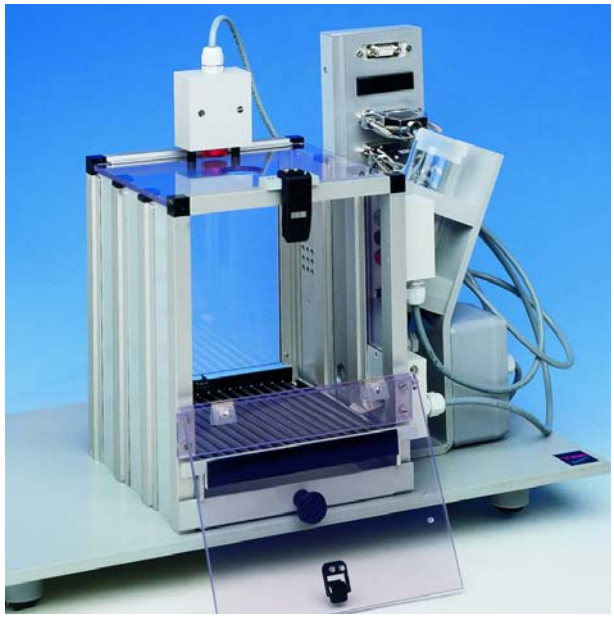
- 2-panel box - standard size (3 rows) *
- 1 ultra-precise liquid dispenser
- 2 response levers, ultra-sensitive
- 2 stimulus-lamp triple-sets
- 1 house light (not shown) mounted on lid with swivel opening
- 3 blind plates
- Floor mesh (non-shockable)
- 1 counter-balance arm
- Optional swivel, tether & tubing



Feeder-Only Box

For all standard tests

- 2-panel box - standard size (3 rows) *
- 1 pellet dispenser (20mg type) with mini-receptacle
- 1 response lever, ultra-sensitive
- 1 stimulus-lamp triple-set
- 1 speaker module
- 1 house light (red)
- 3 blind plates
- Shockable floor grid



*** If the second panel is not required for further extensions you can also order the 1-panel base construction instead.**

Liquid Dispenser Box

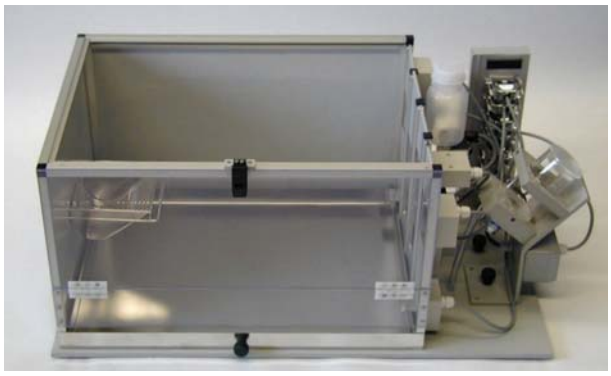
For all standard tests

- 1-panel box - standard size (3 rows)
- 1 liquid dispenser “Advanced” with receptacle
- 1 response lever, ultra-sensitive
- 1 stimulus-lamp triple-set
- 1 speaker module
- 1 house light mounted on lid
- Shockable floor grid

Example for Box Configurations - Rat

Multi-Purpose Box

- 1-panel box – extra-large (4 rows).
- 1 pellet dispenser (45mg) with receptacle, flap & micro-switch
- 1 liquid dispenser “Advanced” with receptacle, flap & micro-switch
- 2 response levers
- 2 stimulus-lamp triple-sets
- 1 house light
- Food crib



Drug Discrimination Box

For drug discrimination procedures

- 1-panel box – standard (3 rows)
- 1 pellet dispenser (45mg) with receptacle, flap & micro-switch
- 2 response levers
- 2 single stimulus lamps (red)
- 1 house light (white)
- Shockable floor grid

Self-Administration Box

For intravenous self-administration of drugs

- 2-panel box – standard (3 rows)
- 1 ultra-precise liquid dispenser
- 2 nose-poke response modules with integrated stimulus lamp
- 2 single-cue-lights (red LED)
- 1 speaker module
- 1 house light, red, side-mounted
- 4 blind plates
- Shockable floor grid
- 1 Counter-balance arm
- Optional syringes, swivel & tubing

Housings

The whole setup is operated in sound-attenuating **housings** equipped with a ventilation fan.

All housings also feature a one-way observation window in the front door to allow monitoring during the experiment. A manually operated house-light is also included.

The housing features a sliding floor plate for easy removal of the test box.

Housing Dimensions - Examples

Mouse	
2-panel box (standard)	530 x 370 x 700 (LxWxH)
Rat	
1-panel box (standard)	620 x 380 x 430 (LxWxH)

Control Unit & PC

The **control unit** provides the connection between the Skinner boxes and the computer. It contains all the electronics for controlling the box components and it transfers the measuring data to the control **interface** built into the system computer. An IBM-compatible computer (Pentium) with the Windows operating system is required.

Software Control

The comfortable “OBS” Windows software that controls the experimental procedure and collects the measuring data is very easy to learn and use.

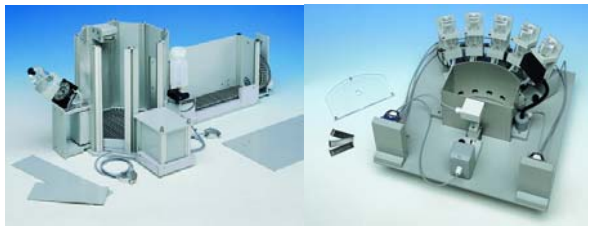
The software languages currently available are English and German. The OBS software currently runs under the operating systems Windows 95, 98, NT and Windows 2000.

The software package can also be purchased separately and adapted to existing operant behavior equipment.

Box Type and Configuration

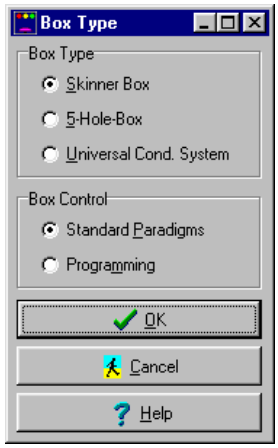
The flexible OBS software is designed to be used in conjunction with a variety of conditioning systems. It can control

⇒ **Standard Skinner boxes,**
⇒ 5-Hole-Boxes and
⇒ Universal Conditioning Boxes (“Universal Mazes”).

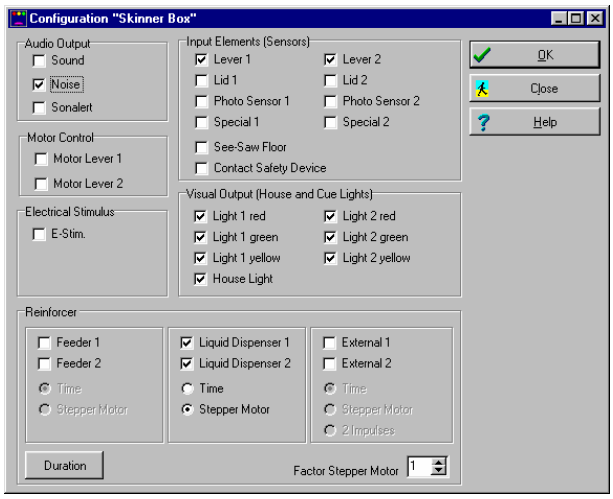


Information about the other box types will be sent to you on request

Simply activate the box type you want to work with and all program functions that are available for this box type are automatically loaded.



Your individual box configuration is preconfigured in the software. These entries can always be changed if the system is upgraded with additional function modules.



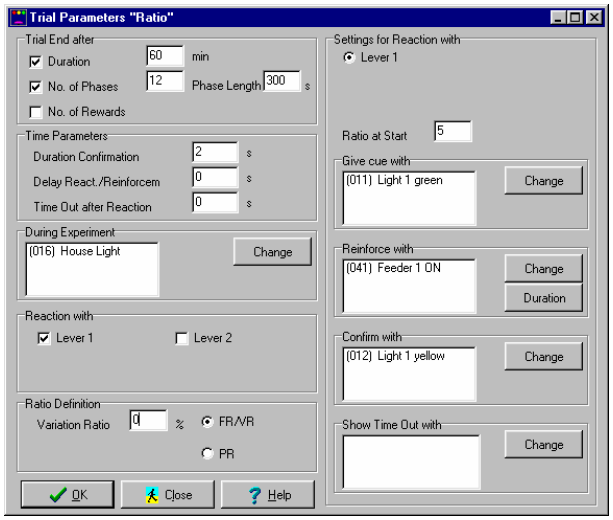
Schedule Selection

The OBS software package offers a number of preconfigured standard tests that are ready-to-use when the software is installed. Choose between

- 3 Ratio schedules (fixed, variable & progressive)
- 3 Interval schedules (fixed, variable & progressive),
- Differential Reinforcement of High & Low Rates (DRH/DRL),
- Geller Conflict tests,
- Active Avoidance & Sidman Avoidance,
- Drug Discrimination

or select between a couple of training modules.

These standard paradigms are undergoing continuous further development according to the latest research applications!



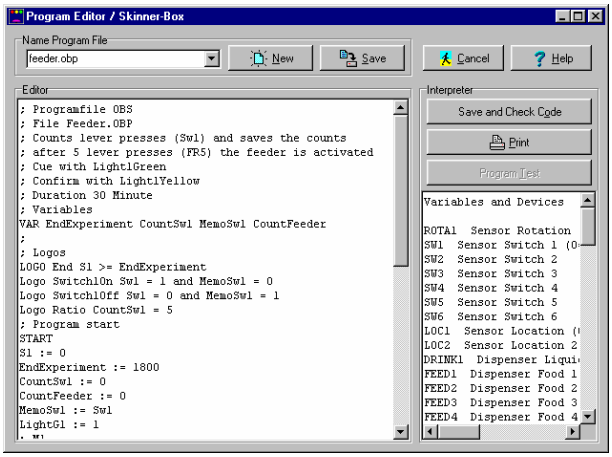
The trial parameter window gives access to all box elements (input and output components) that are available in the schedule selected. You can always vary a schedule and save it under a new name; in this way it will be immediately available at any time required.

Free Programming Option

If you prefer to have complete control over your experimental procedure the brand-new **Free Programming Option** that forms an integral part of the Operant Behavior software package is the first choice for you.

With the easy-to-learn OBS language – it is similar to BASIC - and a maximum of user-support during programming you can build any schedule of reinforcement that is supported by your specific hardware. Create, vary and store your individual schedule to meet your specific needs!

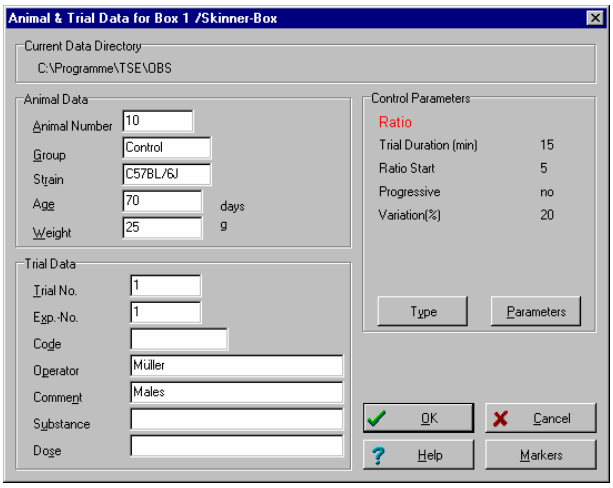
A short tutorial included in the package helps to understand and successfully use the language in very short time.



Preparing & Starting a Trial

To start a trial simply click on the desired box in the so-called trial monitor and select a test paradigm or a self-programmed schedule of your choice.

In order to characterize the experiment various entry fields are available. These identifiers – such as animal, experiment or trial number - later allow easy searching through the data base and are also outputted in the protocols.

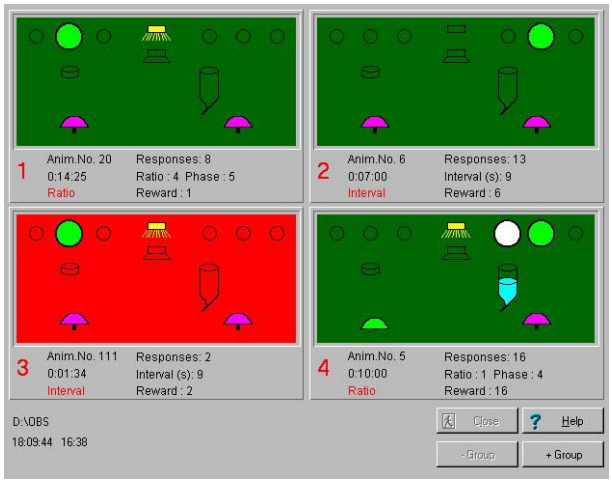


Now the animal is placed into the box. Data acquisition is then started by pressing a single key! All boxes that are connected up can be started and stopped independently in this way - each running a different schedule!

The Trial Monitor

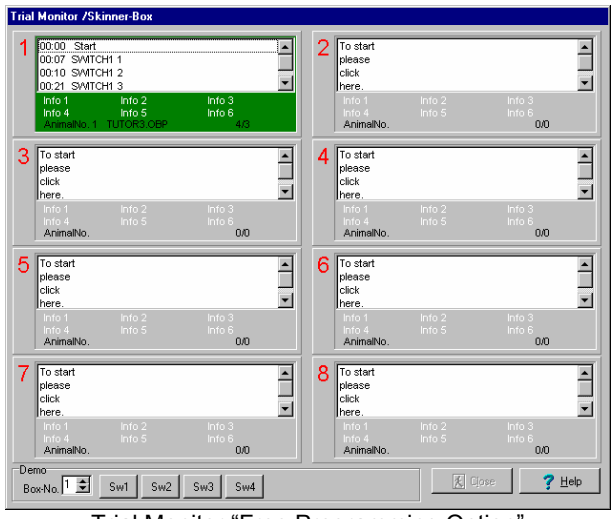
The so-called “trial monitor” allows a rapid overview throughout the course of the experiment.

Colored symbols for all defined response, stimulus and reinforcer elements as well as the output of response and reward events enable the user to see the status of all connected boxes at a glance. If more than 4 boxes are connected up a switch can be made to display these other boxes.



Trial Monitor “Standard paradigms”

If you are running a self-programmed schedule the monitor outputs only that information that has been programmed in the control file giving you total control on what is being displayed.



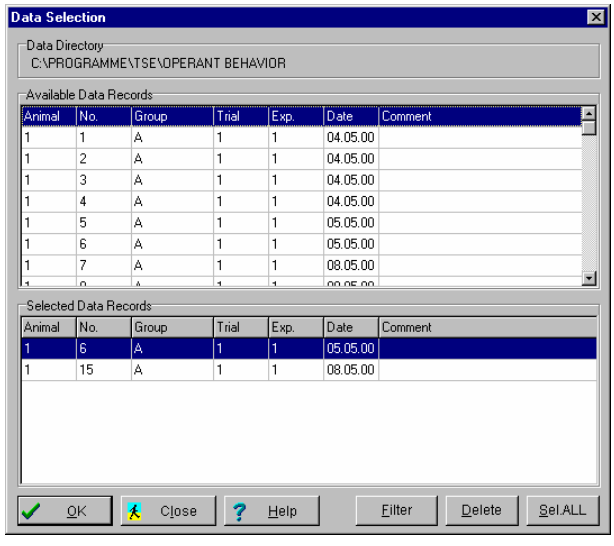
Trial Monitor “Free Programming Option”

Markers can be set in order to document any events that are of importance for the experiment.

A test is automatically ended when the pre-defined termination criterion has been fulfilled. Usually a predetermined test period has elapsed (the total duration is unlimited!), a specific number of responses has been shown or a pre-defined number of rewards has been given.

The TSE OBS software prevents the program being terminated inadvertently when boxes are still active. This procedure is in accordance with the provisions of the Good Laboratory Practice code (GLP).

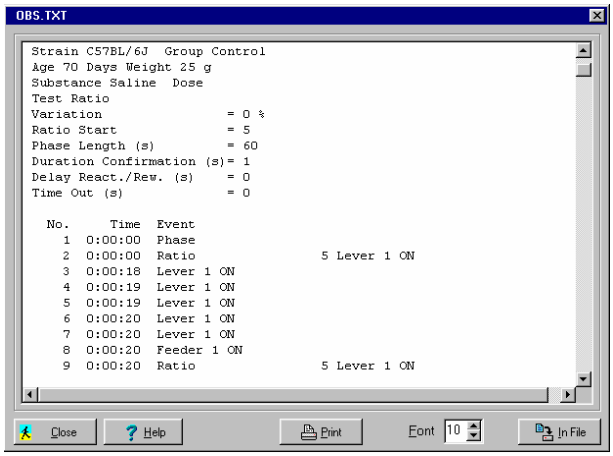
Data Analysis



Search functions allow the easy selection of data records to be analyzed from the data base. A filter function is provided to facilitate data management.

Run Data Table

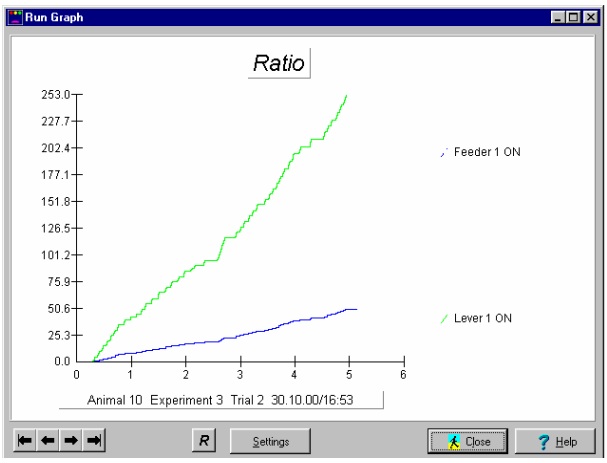
The run data table is a chronological list supplying detailed information about the events in each cage over the course of the experiment. If you are using the free programming option the contents of the table totally depends on your control file – only those events that you have programmed to be saved appear here!



Run Graph

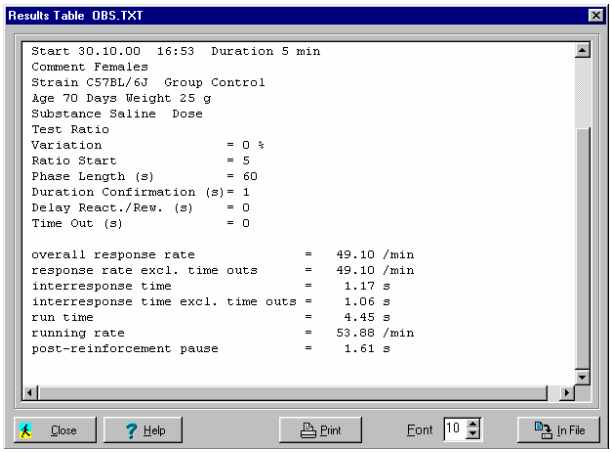
The run graph is available for data collected using the standard paradigms and displays the events in the box graphically.

Data is shown cumulatively with time as the X-axis and the number of events as the Y-axis. Any event combination can be selected to be displayed in the graph. Easily switch between different presentations using the graph tool provided.

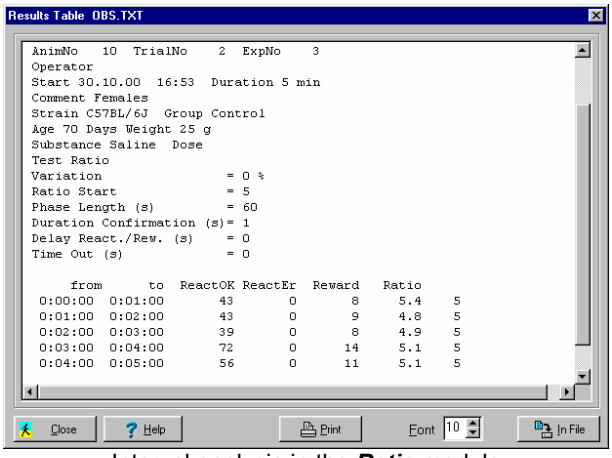


Results Table

Response and reinforcement patterns are also output in paradigm-specific results files. The tables can be modified by selecting analysis intervals or by choosing specific parameters that depend on the schedule used.



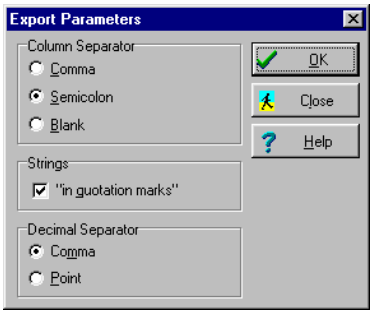
Special parameters calculated in the ***Ratio*** module



Interval analysis in the ***Ratio*** module

This results table is only available for standard paradigm tests. Print the table by simply clicking on the ***Print*** button or save the file as an ASCII file.

Data Export



All data generated by the program can be exported as ASCII files. These files are available for further-reaching statistical calculations in statistics packages (e.g. SAS) or spread sheets (e.g. EXCEL).

◆ Ordering Information

Cat.No.	Description
1. Boxes	***These boxes are to be completed with your choice of OBS slide-in function modules***
Mouse	
259900-SK-MAU-LA/1	**Skinner Box Mouse – extra-large** *1 multi-function-panel with 4 rows* Including floor (please specify type), droppings collector, contact safety device, multi-purpose adapter with plug-in connectors for OBS function modules
259900-SK-MAU-LA/2	**Skinner Box Mouse – extra-large** *2 multi-function-panels with 4 rows* Including floor (please specify type), droppings collector, contact safety device, multi-purpose adapter with plug-in connectors for OBS function modules
259900-SK-MAU-ST/1	**Skinner Box Mouse – standard size** *1 multi-function-panel with 3 rows* Including floor (please specify type), droppings collector, contact safety device, multi-purpose adapter with plug-in connectors for OBS function modules
259900-SK-MAU-ST/2	**Skinner Box Mouse – standard size** *2 multi-function-panels with 3 rows* Including floor (please specify type), droppings collector, contact safety device, multi-purpose adapter with plug-in connectors for OBS function modules
Rat	
259900-SK-RAT-LA/1	**Skinner Box Rat - extra-large** *1 multi-function-panel with 4 rows* Including floor (please specify type), droppings collector, contact safety device, multi-purpose adapter with plug-in connectors for OBS function modules
259900-SK-RAT-LA/2	**Skinner Box Rat - extra-large** *2 multi-function-panels with 4 rows* Including floor (please specify type), droppings collector, contact safety device, multi-purpose adapter with plug-in connectors for OBS function modules
259900-SK-RAT-ST/1	**Skinner Box Rat - standard size** *1 multi-function-panel with 3 rows* Including floor (please specify type), droppings collector, contact safety device, multi-purpose adapter with plug-in connectors for OBS function modules
259900-SK-RAT-ST/2	**Skinner Box Rat - standard size** *2 multi-function-panels with 3 rows* Including floor (please specify type), droppings collector, contact safety device, multi-purpose adapter with plug-in connectors for OBS function modules
2. Housings	
259900-HOU-SK-R	**Sound Attenuating Housing for 1 Rat Skinner Box** With one-way window, ventilator, special closing-fitting and manually operated house-light
259900-HOU-SK-M	**Sound Attenuating Housing for 1 Mouse Skinner Box** With one-way window, ventilator, special closing-fitting and manually operated house-light
3. Function Modules	
Response Elements	
259900-RT-M	**Response Lever Mouse – ultra-sensitive**
259900-RT-R	**Response Lever Rat**
259900-RT-R/L	**Response Lever Rat with integrated lamp** (please specify required color)
259900-RRT-M	**Retractable (automatic) Response Lever Mouse – ultra-sensitive**
259900-RRT-R	**Retractable (automatic) Response Lever Rat**
259900-NP-M	**Nose-Poke Response Module Mouse** Complete with infra-red sensor for registration of nose-pokes (please specify shape and size of hole). With optional stimulus lamp (please order separately and specify lamp color)
259900-NP-R	**Nose-Poke Response Module Rat** Complete with infra-red sensor for registration of nose-pokes (please specify shape and size of hole). With optional stimulus lamp (please order separately and specify lamp color)
Light Elements	
259900-ST-E	**Stimulus Lamp** (please specify: **red, green** or **white**)
259900-ST-S	**Stimulus Lamp Triple-Set (red, green, white)**
259900-ST-E/NP	**Stimulus Lamp for Nose-Poke Response Module** (please specify: **red, green** or **white**)

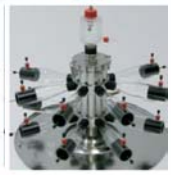
259900-HL	**House Light** (please specify color)
Audio Elements	
259900-LP	**Loudspeaker**
259900-SON	**Sonalert** (please specify frequency)
259900-NG	**Noise Generator -** *to be built into the control unit* 259900-C-0**X** (1 pc. per system required). Used in conjunction with loudspeaker 259900-LP.
259900-AG	**Audio Generator -** *to be built into the control unit* 259900-C-0**X** (1 pc. per system required). Used in conjunction with loudspeaker 259900-LP.
Olfactory Elements	
259900-OLF-1	**Olfactory Stimulus Module, single unit** Consisting of: single valve unit, 1 olfactory chamber with inlet and outlet, single tube set
259900-OLF-3	**Olfactory Stimulus Module, triple unit** Consisting of: triple valve unit, 3 olfactory chambers with inlet and outlet, triple tube set
Reinforcer Elements	
259900-LD-A/M	**Liquid Dispenser "Advanced" for Mouse**
259900-LD-A/R	**Liquid Dispenser "Advanced" for Rat**
259900-LD-P/R	**Liquid Dispenser "ultra-precise" for smallest quantities (µl) for Rat**
259900-LD-P/M	**Liquid Dispenser "ultra-precise" for smallest quantities (µl) for Mouse**
259900-LD/HED-FM/R	**Head Entry Detector for Liquid Dispenser "Advanced" & "ultra-precise" for Rat** Type: Flap/micro-switch
259900-LD/HED-IR/R	**Head Entry Detector for Liquid Dispenser "Advanced" & "ultra-precise" for Rat** Type: Infra-red beam detector
259900-LD/HED-IR/M	**Head Entry Detector for Liquid Dispenser "Advanced" & "ultra-precise" for Mouse** Type: Infra-red beam detector
259900-PD-14	**Pellet Dispenser for Pellets 14mg (Mouse)**
259900-PD-20	**Pellet Dispenser for Pellets 20mg (Mouse)**
259900-PD-45	**Pellet Dispenser for Pellets 45mg (Rat)**
259900-PD/HED-IR/M	**Head Entry Detector for Pellet Dispenser for Mouse,** Type: Infra-red beam detector
259900-PD/HED-FM/R	**Head Entry Detector for Pellet Dispenser for Rat,** Type: Flap/micro-switch
259900-PD/HED-IR/R	**Head Entry Detector for Pellet Dispenser for Rat,** Type: Infra-red beam detector
259901-PEL-14/50T	**Precision Pellets 14 mg, dustless** BioServ Purified Formula for TSE Pellet Dispenser (14mg) and other pellet dispensers. 1 pack = 50.000 pellets.
259901-PEL-20/50T	**Precision Pellets 20 mg, dustless** BioServ Purified Formula for TSE Pellet Dispenser (20mg) and other pellet dispensers. 1 pack = 50.000 pellets.
259901-PEL-45/50T	**Precision Pellets 45 mg, dustless** BioServ Purified Formula for TSE Pellet Dispenser (45mg) and other pellet dispensers. 1 pack = 50.000 pellets.
4. Options	
259900-CBA	**Counter Balance Arm**. Please specify the type of swivel you want to use when ordering or ask for separate information on swivels and accessories.
259900-SHOCK	**Shocker Scrambler Module** (1 pc. per box required) - *to be built into the control unit* 259900-C-0**X**. Standard output: 0.1 ... 3.1 mA (up to 4.5 mA on request), constant or pulsating
259900-FC/M	**Food Crib** for all Skinner Boxes Mouse with 1 multi-function panel. Will be mounted to an empty box side wall.
259900-FC/R	**Food Crib** for all Skinner Boxes Rat with 1 multi-function panel. Will be mounted to an empty box side wall.
259900-SENS-ACT	**Infrared-Activity-Sensor**, mounted on top of Skinner boxes.
259900-CA	**Camera**. Please specify required mounting position.
259900-STIM-01	**Intracerebral Stimulator 1-channel** For intracranial electrical stimulation via intracranial electrodes Complete and consisting of: • Stimulator • Software for integration into OBS software package (a subprogram for testing the function of the stimulator is included) • Connecting cable

	The following parameters can be set: ⇒ the current amplitude: 20 µA ... 1020 µA adjustable in steps of 4 µA ⇒ Rectangular pulses ⇒ Pulse width: 0.07 ms ... 65025 ms adjustable in steps of 0.07 ms ⇒ Type of stimulation: constant (non-pulsed) current or pulsed constant current ⇒ If pulsed constant current is selected generation of pulse sequences with - 2 … 255 impulses per sequence - impulse interval: 4 ... 1020 ms in steps of 4 ms (*can be changed if required*) - selectable current polarity (positive or negative) - pole reversal of pulses via relays with reversal time of approx. 30 ms
259900-STIM-02	**Intracerebral Stimulator 2-channel**
259900-STIM-03	**Intracerebral Stimulator 3-channel**
259900-STIM-04	**Intracerebral Stimulator 4-channel**
259900-STIM-05	**Intracerebral Stimulator 5-channel**
259900-STIM-06	**Intracerebral Stimulator 6-channel**
259900-STIM-07	**Intracerebral Stimulator 7-channel**
259900-STIM-08	**Intracerebral Stimulator 8-channel**
5. Control Unit Packages	***These packages are available for 1 up to 8 Skinner boxes. Please replace X with the desired number of boxes when ordering.***
259900-C-0**X**	**Operant Behavior Control Unit Package, X-Place** Fully automatic. For connection of **X** Skinner boxes, expandable. Complete and comprising: - control unit (complete with power supply and connectors for 1 audio generator, 1 noise generator and a bus for **X** shocker scrambler modules) - special interface system OBS-0**X** - software package OBS-0**X** for Windows Requires: Pentium PC.
259900-C-0**1**	**Operant Behavior Control Unit Package, 1-Place**
259900-C-0**2**	**Operant Behavior Control Unit Package, 2-Place**
259900-C-0**3**	**Operant Behavior Control Unit Package, 3-Place**
259900-C-0**4**	**Operant Behavior Control Unit Package, 4-Place**
259900-C-0**5**	**Operant Behavior Control Unit Package, 5-Place**
259900-C-0**6**	**Operant Behavior Control Unit Package, 6-Place**
259900-C-0**7**	**Operant Behavior Control Unit Package, 7-Place**
259900-C-0**8**	**Operant Behavior Control Unit Package, 8-Place**

A complete system consists of:

1. **N** x boxes, mouse or rat
2. **N** x housings, mouse or rat
3. Your choice of function modules and options
4. 1 control unit package suited for **N** boxes

N= Number of measuring places, max. 32



■ Inhalation

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