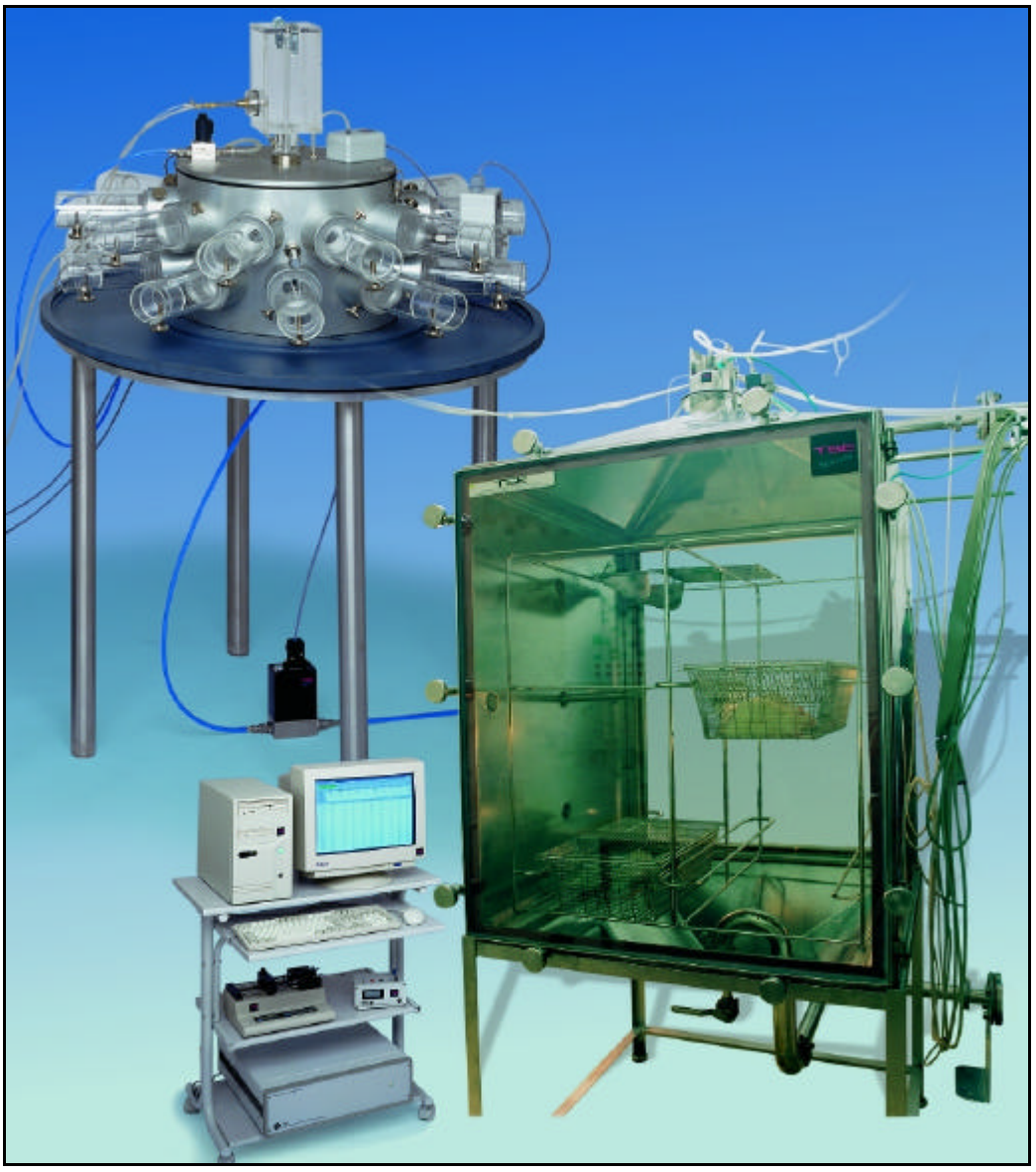
TSE
Technical & Scientific
Equipment GmbH

TSE Inhalation Systems



Aerosol Generation, Process Control and Analysis

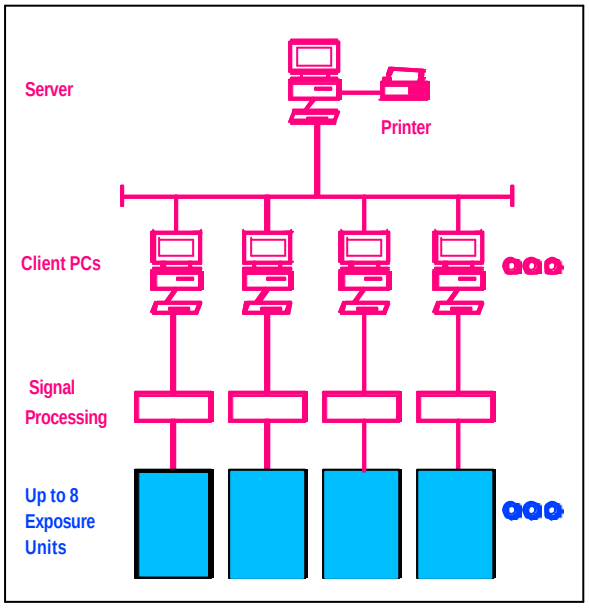
♦ TSE Inhalation Systems

The exposure systems we present in this brochure have been in use for many years in pharmaceutical research and industry. They are highly rated for every conceivable application and have been improved by continual developmental inputs.

During development our chief attention was given to system features for ensuring a uniform reproducible test atmosphere and planning, control, and analysis features which are in conformity with GLP requirements.

The systems feature different exposure designs for the investigation of aerosols delivered to the respiratory tract in controlled inhalation exposure tests. The main designs are **whole body** and **nose-only exposure**. For special approaches **mask** and **tracheo lung exposure** are also provided.

The sophisticated ExpoSys software handles **single** and **multi-exposure** systems. Multi-exposure systems are the perfect solution for high-throughput screenings.



TSE Multi-Exposure System

Server: planning, supervision and analysis
Client: performing and monitoring
Option: communication with higher networks (exchange of planning data and experimental results)

Main Features

- Complete system solution
- Single or multi-exposure configuration (up to 8 exposure units)
- Nose-only, whole body, mask and tracheo lung exposure
- ExpoSys software comes with a maximum of automation and safety.
- In conformity with GLP-requirements
- Sophisticated aerosol monitoring management by impactors, photometers, optical particle analyzers, etc.

Aerosols

Modular design; the systems can handle all aerosol/medium types such as

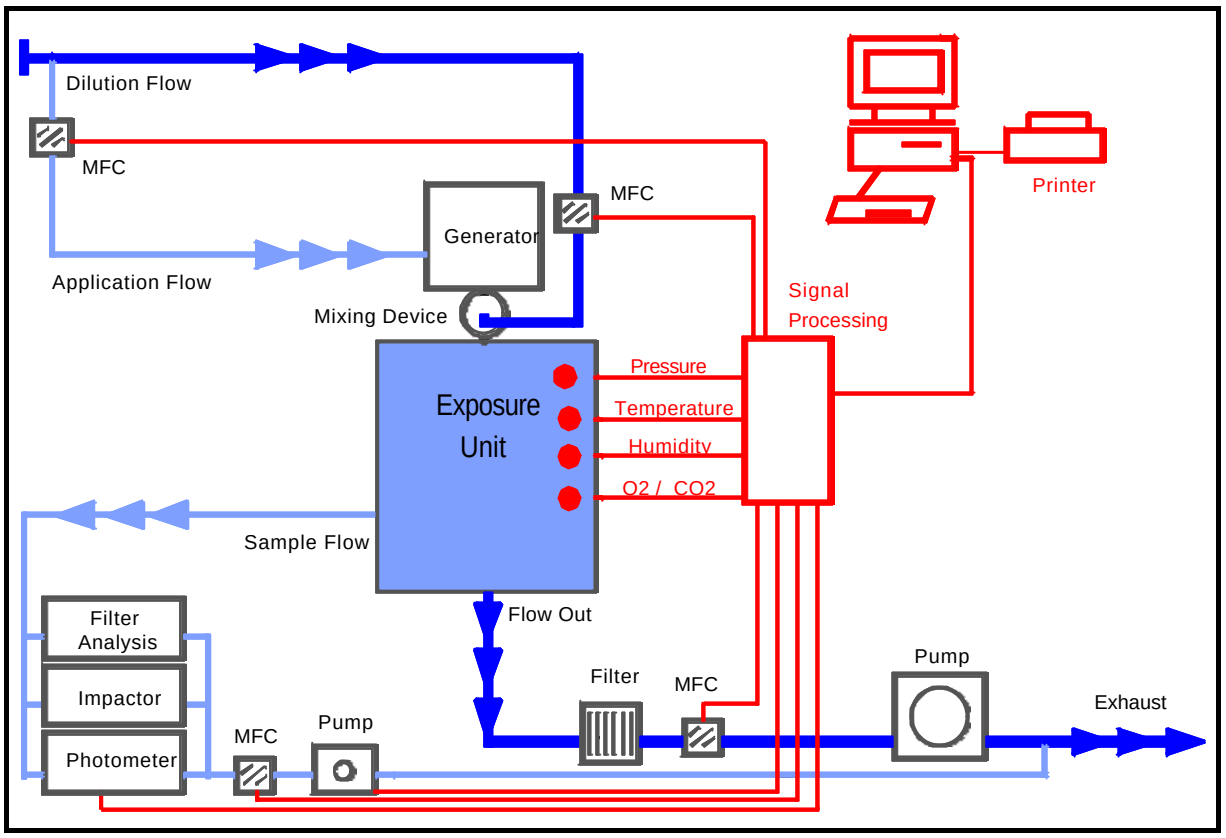
- liquid aerosols
- dust aerosols
- vapors
- gases and
- aerosols generated by MDIs or spray cans.

Info, Implementation and Service

Please ask for further information or for a detailed quotation which takes your own requirements into account.

During system design all components, parameters and features will be specified to your individual requirements. Our service team, with the benefit of many years of experience, will provide support during design, installation, upgrading and maintenance.

General System Overview



Options

- Our **Tracheo Lung Exposure System** is designed for very critical applications. The aerosol is delivered directly to the respiratory tract of the anesthetized animal. Radioactive substances may be used, e.g. for the investigation of aerosol distribution, deposition and absorption.

- The **CO-LOAD Unit** (Complex loading systems for ozone and aerosol-induced damage) combines the advantages of exactly dosing both ozone and nebulized agents. Ozone improves the penetration of substances through the tracheo-bronchial barrier and thus mimics noxious environmental conditions.

- The **TSE-Telemetry System** allows physiological parameters such as ECG, blood pressure, temperature, etc. to be monitored during the exposure. Unique miniature transmitters are provided.

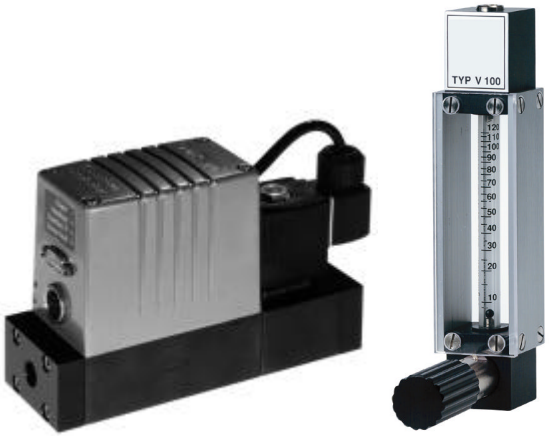
- With our comfortable radio-frequency **Identification System** small animals can be reliably identified. The ID number coded into a subcutaneously implanted micro-chip is read using a hand-held battery-operated scanner.

- Our **Bronchospasm Measuring Unit** is designed to assess pulmonary airflow, e.g. in determining the efficiency of spasmodic or spasmolytic drugs. Changes in airway resistance are easily measured.

Flow Generation

High performance electronic flow controllers are responsible for the accurate implementation of the predefined flows and the continuous measurement of the actual flow.

Mechanical flow controllers are provided for manual set-ups. Mechanical flow controllers consist of a high precision valve for the manual setting and a floating sphere showing the actual measuring value.



Further necessities are an air supply system or a compressor. We also provide a wide choice of sample and exhaust pumps.

Aerosol Generation and Modification

Liquid Aerosol Generators

A dosing unit is used to inject the substance preparation into the Luer-Lock cone of the nozzle.

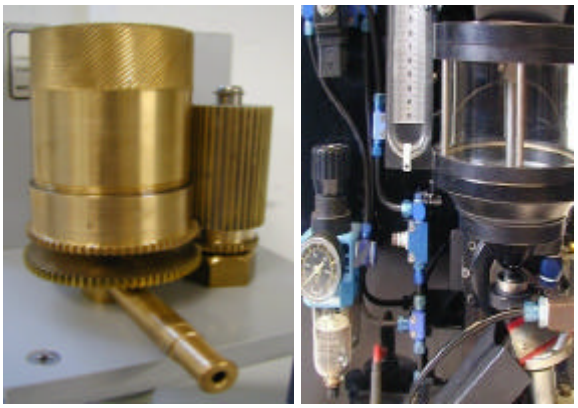
The air flow through the nozzle is adjusted by a flow controller (10…15 l/min). Unique mechanical features effectively improve aerosol generation which is implemented by high speed air flows inside the nozzle.

Alternatively vaporizers are available. A range of models for different aerosol amounts is provided.

Dust Aerosol Generators

TSE dust generators are designed to produce solid aerosols with concentrations between 0.01g and 3g/m^3.

A rotating reservoir for pre-compressed dust and a scraper are the basic components of the standard model according to WRIGHT. The generator shown left features primary dust collection in the grooves of a dosage plate; this is sucked in by the application flow.



In addition, generators for agglomerating dusts are available.

MDI and Spray Can Activation

The TSE MDI-Activator is designed to control up to 16 (!) MDIs independently.

The control software provides all functions for running the hardware unit. Parameters to be entered during the planning are shaking duration, number of activations, interval duration and position(s) to be activated.

The rugged design ensures very efficient mixing which is implemented by a powerful pneumatic shaking mechanism.

In case you want to study aerosols generated by spray cans our **spray can activation unit** will help you to carry out sophisticated studies. Adaptation to all can sizes is included. The activation design (time, number and duration) is user-defined.

Aerosol Modification

To improve the efficiency of aerosol deposition, larger particles are removed by using a **pre-separator**. This ensures complete separation by gravity. Collected droplets can be regained.

Inside the **reverse flow mixing device** the primary aerosol and dilution air are mixed by the turbulences generated. The hardware is optimized to ensure an aerosol of highest homogeneity.

Aerosol Analysis

Offline Analysis

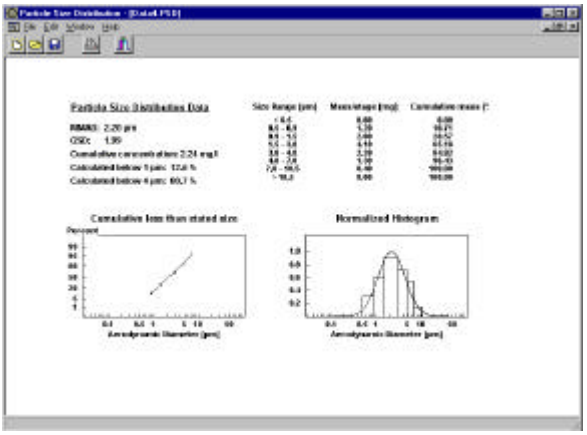
Concentration

The TSE filter system designed for aerosol analysis features filter disks. These are ideally suited for subsequent analytical steps (e.g. gravimetry or HPLC analysis). The filters (cellulose nitrate or PTFE) are placed in the capsules provided.

Particle Analysis

Generating small particles for maximum deposition in the lung is one of the most critical issues during inhalation experiments. Differently designed impactors are provided, e.g. standard 7-stage type or mercer type. Flow rates: 0.1 l/min up to 28 l/min.

PSD (Particle Size Distribution) is a windows software for the subsequent calculation of typical aerosol parameters. After the input of cutoff limits for the impactor stages and measuring results for each stage the software instantly calculates MMAD, GSD, cumulative concentrations and produces graphics.



On-line Monitoring of Environmental Parameters

Sensors for a wide variety of parameters are available. Standard parameters are:

- pressure
- O_2
- CO_2
- temperature, and
- humidity.

Customized parameters are taken into account in order to meet your requirements. We can offer photometric, spectrophotometric, fluorimetric or gas chromatographic methods.

On-line Concentration Analysis

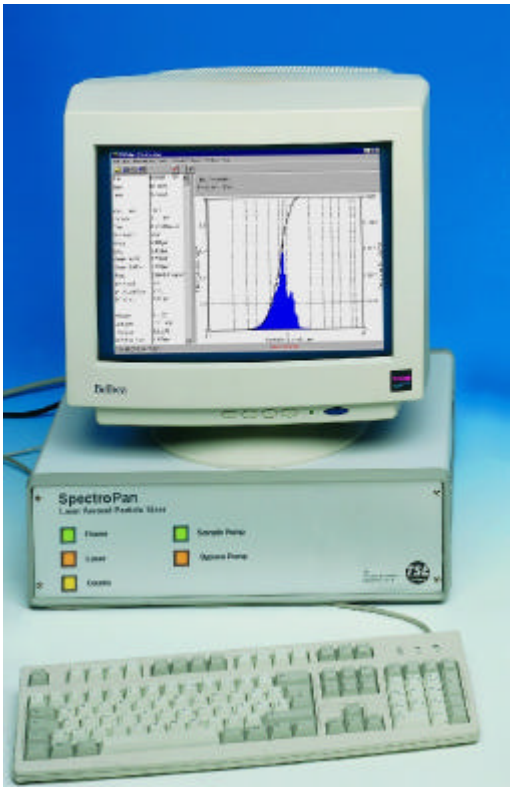
The TSE real-time aerosol monitor is designed to continuously measure the aerosol concentration in all our inhalation systems (range 0.1 – 3000 mg/m³).

The measuring principle is the detection of scattered infrared light. The aerosol monitor is calibrated by offline filter analysis via gravimetry or, e.g., HPLC methods.

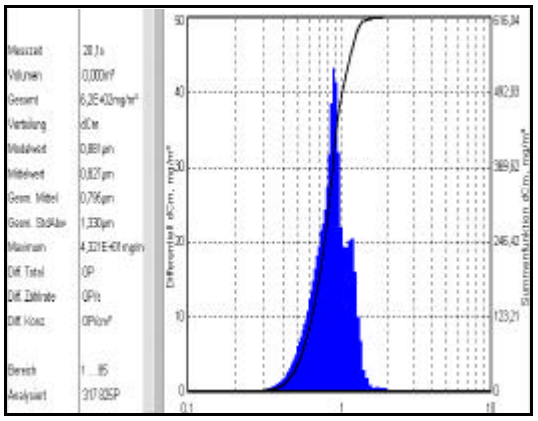
Online Particle Analysis

SpectroPan optical aerosol analyzer

SpectroPan was designed for the sophisticated real-time analysis of the particle size distribution during inhalation studies.



HeNe laser technology provides the highest accuracy and sensitivity in up to 64 (!) classification channels. Owing to monitoring by forward scattering the dependency on the particle material is negligible. The software instantly presents a graph and allows the calculation of, e.g., MMAD, number, mass or volume distribution.



Abscissa: particle size in µm; left ordinate: dCm (differential) in mg/m^3; right ordinate: dCm (cumulative) in mg/m^3

OptoPan virtual impactor

This optical instrument is a low cost component for the real-time analysis of aerosols.

The inhalable, thoracic and respirable fractions are continuously monitored by the detection of scattered infrared light. Three photometers are therefore installed at different locations in the monitoring unit. Extrathoracic and tracheobronchial fractions are calculated by the software provided.

Downstream Cleanliness

TSE offers a wide range of filter systems for downstream cleanliness to ensure the highest level of safety and to prevent contamination of exhaust air and downstream components. Membranes with different pore sizes are provided. Pore sizes: 0.1 up to 5 µm.

All filters come either as capsules (disposable) or as cartridges which have to be replaced. Several connection designs are provided.

Option: a differential pressure sensor can be installed to show the loading status.

Exposure Units

Whole Body Exposure Unit

Beside the advantage of simulating real exposure conditions, the whole body exposure system allows the investigation of effects on a wide range of species (e.g. rats, rabbits, pigs, dogs, etc.) for long exposure times.

The Whole-Body Exposure Unit may be operated in any of several modes: **dynamic, recirculation or static.**

A large number of animals can be exposed simultaneously as is required by most inhalation studies. The 2.3 m^3 chamber, for example, can accommodate approx. 70 to 90 rats simultaneously or a correspondingly smaller number of chickens, rabbits or guinea-pigs, or three beagles.

To improve the substance distribution we have designed the exposure unit as a cyclone (square cross section with pyramidal end shape). Together with the tangential substance feed and the specific flow and pressure conditions inside the chamber, the result is a virtually **homogeneous test substance distribution**.

We offer whole body exposure units in many sizes and several types of cage carrier racks are available for the highest degree of flexibility.

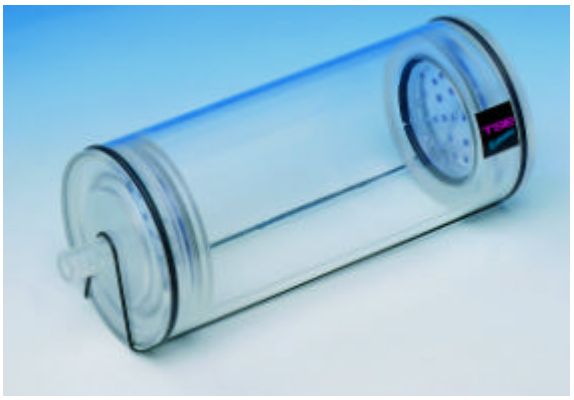
If required, customized specifications can be implemented.

Standard chamber sizes (m^3)		
0.5	1.3	2.3
3.3	4.32	5.30

Minimized Whole Body Exposure Unit

The minimized Whole Body Exposure System was designed for low-cost inhalation studies.

This system design is particularly useful for small numbers of animals and for animals which need careful handling, e.g. when pregnant. Another advantage is the longer exposure time.



The size of the exposure tube can be specified according to your requirements. If required an insertable mesh floor can be included.

Nose-Only Exposure Unit

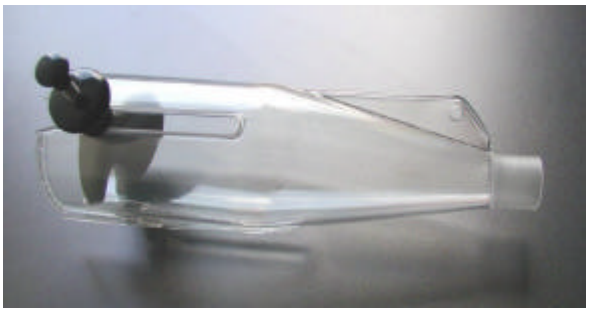
The main advantages of nose-only exposure are the extraordinarily uniform exposure conditions, an effective administration design (most effective design for conscious animals), a minimal use of substance and the shortest equilibration times owing to the flow-past design.

The **modular** construction of our exposure unit allows the exposure of up to **120 animals** (20 per module) in one system in short or long-term inhalation toxicity studies. Different chamber sizes are provided.

- The **flow-past design** minimizes the re-breathing of exhaled air.
- Owing to the low total air flow (minimal amount of air flow per animal), tests can be conducted with an extraordinarily **small test compound consumption**.
- Our new **isokinetic sampling unit** allows most sophisticated samplings to be carried out directly at the exposure ports. An integrated high-precision pump enables sample flows from 0.10 up to 1.00 l/min.

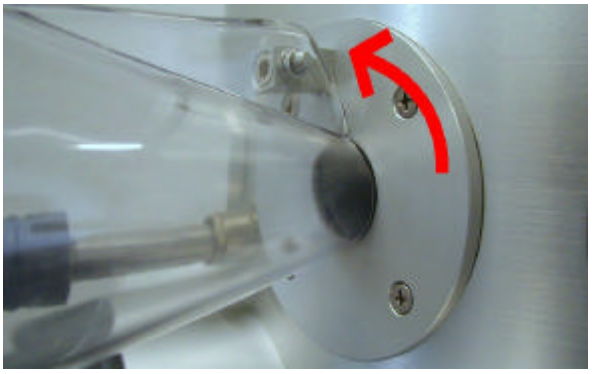
Basic System Components

- 2-chamber nose-only exposure segment with 20 exposure ports in 2 tiers for up to 20 animals. A maximum of 6 segments can be combined (i.e. for up to 120 animals).
- Polycarbonate exposure tubes and restrainers for small, medium or large rodents (mice included).
- Feces collector.



Polycarbonate exposure tube with restrainer

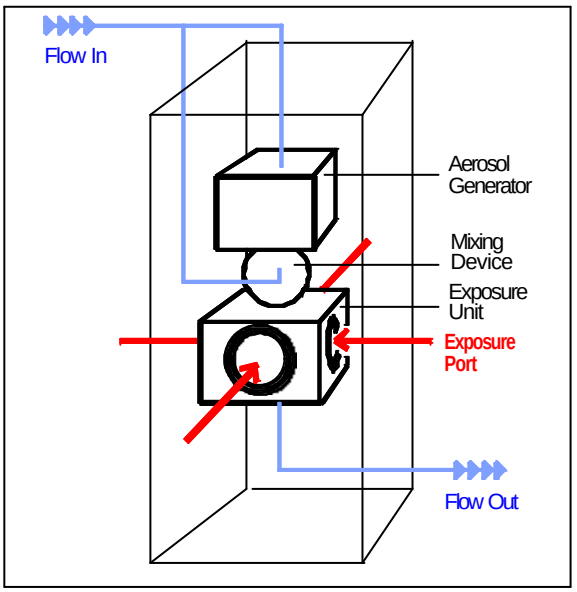
Our innovative exposure port design allows the easiest handling (simply insert and turn the tube using one hand!) and eliminates peripheral fixing devices for exposure tubes.



Fixing the exposure tube

Dog Exposure Unit

Our dog exposure unit features mask or head-only exposure depending on the specific requirements. The standard model provides 4 exposure ports per unit. All components are mounted on a rack with 4 wheels.



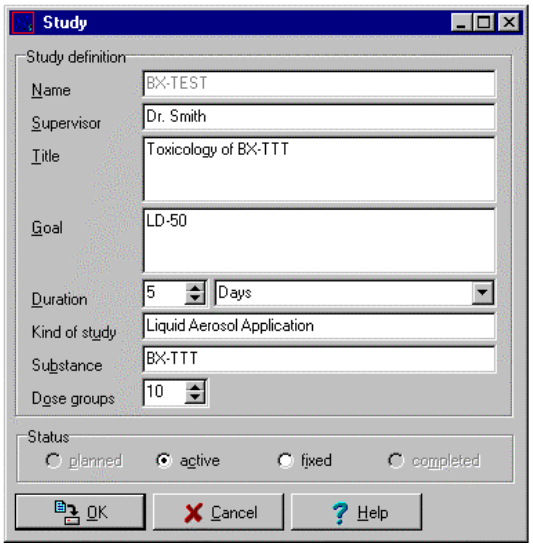
ExpoSys Control Software

Basic Features

Our newest development, the professional ExpoSys software, provides all the features necessary to run single or multi-exposure inhalation systems in conformity with **GLP-requirements.**

For safety reasons ExpoSys features **three authority levels** (service, supervisor and operator) each providing access to selected functions.

The software handles different studies in parallel which are characterized by their status**: planned, active, fixed and completed**. In parallel with the first application performed in your laboratory the study switches automatically from "planned" to "active".

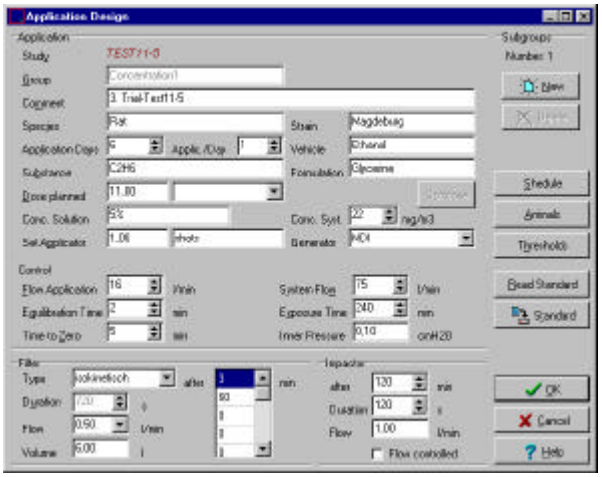


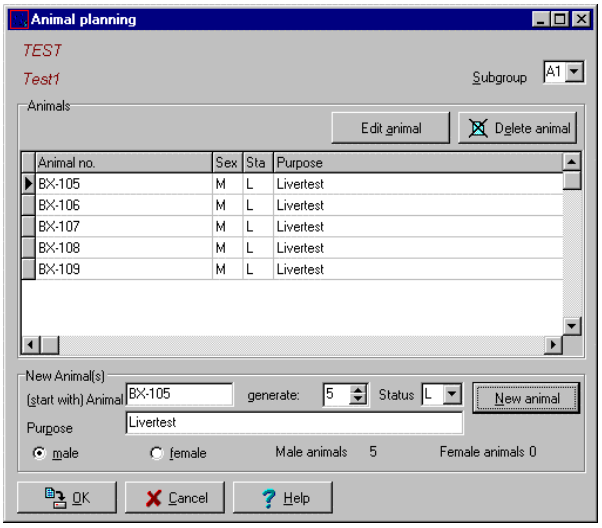
Usually the number of applications defines the duration of a study (one application per day). In addition ExpoSys allows **split-dose exposure** (several applications), changes due to problems or very individual schedules as well.

During setup the user is guided step by step by the software, a design which provides the highest degree of safety for the process.

Alternative: The low cost DACO control software provides several manual functions and manages up to 4 exposure units.

Planning Windows



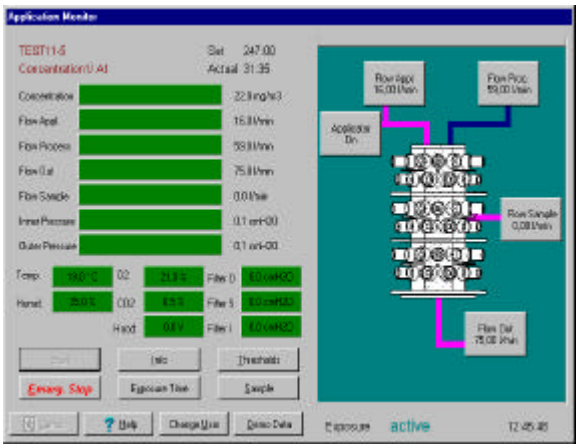


In addition to the windows shown above, separate windows are provided for the planning of schedule and threshold values for alerts. Alternatively all **planning data can be imported** from external sources (e.g. higher networks).

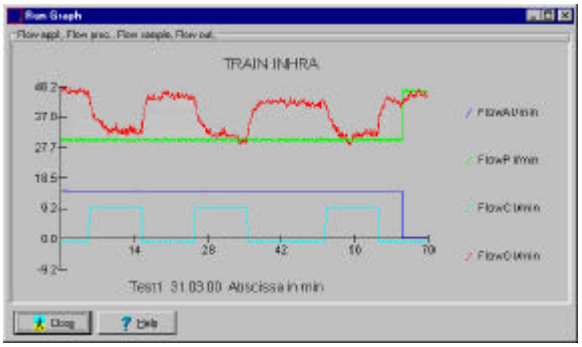
During the planning **internal error detectors** are active and a “warning expert” window automatically appears after errors (e.g. if the sampling time exceeds the application time).

Monitoring and Manipulations by the Client

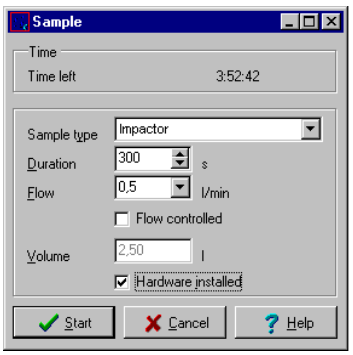
The channels are represented by either a status bar or a status button. Both are refreshed every 10 seconds and show critical values or alarms via a color code (**green=ok**, **yellow=warning**, **red=alert**). Status bars scroll from the right to the left and can thus show an overview of the last 30 minutes!



Up to 15 parameters are monitored, usually concentration, flow at different positions, pressure and a user-defined selection of environmental parameters. At any moment a graphical analysis for a chosen signal can be shown (after mouse-click on a status bar or a status button).



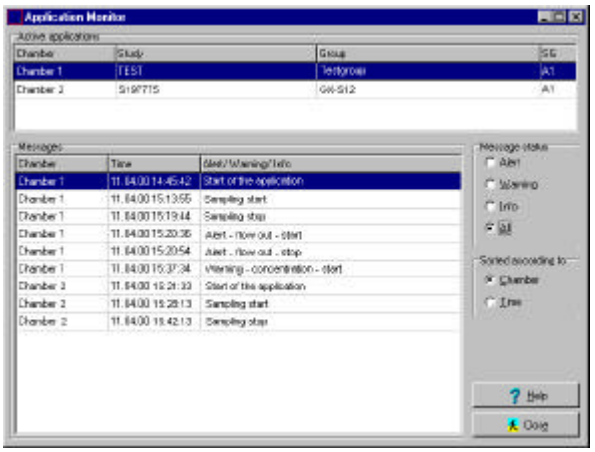
Complex manipulations during the experiment are provided (spontaneous samplings, changing of threshold values for alerts, changing of the experiment duration, input of event markers, etc. – see buttons at the bottom of the "Application Monitor" window). All these manipulations are stored automatically for the application protocol provided.



Sampling is initiated by the system showing the sample parameters as a first step. The real start of a sampling is performed by the user by pressing the "Start" button.

Monitoring at the Server

The server enables all the activated systems to be monitored. Alert type and time of appearance are shown in a table. Alternatively, to give more details, all status changes and event markers of all the exposure units can be displayed. Up to eight units can be managed by the computer network.



Analysis

Three different protocols are provided. The protocol format is in conformity with GLP requirements regarding header, pagination and dating. In addition all data files can be exported to spreadsheet programs such as **LOTUS** or **EXCEL** for further evaluation.

The **"Run Table**" protocol shows all measuring values. The time window for which average values are calculated is defined by the user. Parameters shown in the protocol are also user-defined. The real raw data are not changed. The **"Application Protocol"** contains all alerts for the channels and in addition all events (samplings, manipulations and text markers) for the application performed. At any time a **"Study Protocol"** can be printed out, this shows a schedule of all applications planned and performed. In addition all animals and their actual status information (alive/dead/removed and date of change) are taken into account.

Please Note: Detailed brochures are provided for ExpoSys and all other components. Simply ask for further information.

♦ Ordering Information

Cat.No.	Description
700100-KNES-X*	Head/Nose-Only Exposure Unit according to Dr. PAULUHN [Publication in the Journal of Applied Toxicology, Vol. 14 (1), 55-62 (1994)] 2-Chamber Principle, for up to X* mice, rats or guinea-pigs, including 3 sample ports. Made from aluminium with special galvanic treatment (for toxicological studies). Expandable for up to 120 animals.
700100-KNES-TE	Rotating carrier system to hold the Head/Nose-Only Exposure Unit; all animal exposure tubes can be inserted/taken out from the front side.
700110-AH	Outlet Valve for TSE Head/Nose-Only Exposure Units; (balltype) made of stainless steel.
700110-GG	Baseframe for Head/Nose-Only Exposure Units Series 700100-KNES-X installed under outer and inner cylinders.
700110-GS-KS	Rubber Stopper for closing the exposure ports if less animals are used.
700110-GS-PS	Rubber Stopper for closing the sampling ports not in use.
700110-K-M	H/NOE-Animal Tube "Mouse" made of Plexi/PVC/Polycarbonate - inner diameter at your choice - with restraining device - adjustable
700110-K-ME	H/NOE Animal Tube "Guinea Pig" made of Plexi/PVC/Polycarbonate - inner diameter at your choice - with restraining device - adjustable
700110-K-R-EG	H/NOE Animal Tube "Rat extra large" (for rats > 350 g) made of Plexi/PVC/Polycarbonate - inner diameter: approx. 80 mm - with restraining device - adjustable
700110-K-R-EK	H/NOE-Animal Tube "Rat extra small" (for rats < 100 g) made of Plexi/PVC/Polycarbonate - inner diameter: approx. 42 mm - with restraining device - adjustable
700110-K-R-G	H/NOE Animal Tube "Rat large" (for 250-350 g rats) made of Plexi/PVC/Polycarbonate - inner diameter: approx. 72 mm - with restraining device – adjustable
700110-K-R-K	H/NOE Animal Tube "Rat small" (for 100-160 g rats) made of Plexi/PVC/Polycarbonate - inner-diameter: approx. 52 mm -with restraining device –adjustable
700110-K-R-M	H/NOE Animal Tube "Rat medium" (for 160-250 g rats) made of Plexi/PVC/Polycarbonate - inner diameter: approx. 62 mm - with restraining device – adjustable
700110-PROB-ST	Sample Port for Head/Nose-Only Exposure Unit.
700200-WB-05	Whole Body Exposure Unit with frame and mounting scaffold. For static and dynamic tests. Measurements: 800 x 800 x 800 mm (Volume: 0.51 m^3).
700200-WB-1	Whole Body Exposure Unit with frame and mounting scaffold. For static and dynamic tests. Measurements: 1.000 x 1.000 x 1.300 mm (Volume: 1.30 m^3).
700200-WB-2	Whole Body Exposure Unit with frame and mounting scaffold. For static and dynamic tests. Measurements: 1.250 x 1.200 x 1.500 mm (Volume: 2.25 m^3).
700200-WB-3	Whole Body Exposure Unit with frame and mounting scaffold. For static and dynamic tests. Measurements: 1.400 x 1.400 x 1.650 mm (Volume: 3.23 m^3).
700200-WB-4	Whole Body Exposure Unit with frame and mounting scaffold. For static and dynamic tests. Measurements: 1.550 x 1.550 x 1.800 mm (Volume: 4.32 m^3).
700200-WB-5	Whole Body Exposure Unit with frame and mounting scaffold. For static and dynamic tests. Measurements: 1.650 x 1.650 x 1.950 mm (Volume: 5.31 m^3).

700200-WB-MI	Minimized Whole Body Exposure Unit (Tube Design) - for rodents e.g. in the state of pregnancy, customized size, insertable mesh floor on request.
700210-AH-G	Outlet valve for Whole Body Exposure Units, complete with olive
700210-IS	Installation set consisting of tubing, piping, gaskets, adapters, wiring
700210-ROHR	Tube System made of stainless steel, for -air inlet -air outlet
700210-WB-IG/05	Inner Rack for 700200-WB-05 made of stainless steel, with skids, capable to take animal test cages.Please specify cage sizes.
700210-WB-IG/1	Inner Rack for 700200-WB-1 made of stainless steel, with skids, capable to take animal test cages.Please specify cage sizes.
700210-WB-IG/2	Inner Rack for 700200-WB-2 made of stainless steel, with skids, capable to take animal test cages.Please specify cage sizes.
700210-WB-IG/3	Inner Rack for 700200-WB-3 made of stainless steel, with skids, capable to take animal test cages.Please specify cage sizes.
700210-WB-IG/4	Inner Rack for 700200-WB-4 made of stainless steel, with skids, capable to take animal test cages.Please specify cage sizes.
700210-WB-IG/5	Inner Rack for 700200-WB-5 made of stainless steel, with skids, capable to take animal test cages.Please specify cage sizes.
700300-DS	Pressure tubing, basic equipment
700300-FI	Filter Combination, activated carbon and micron filter, efficiency: 99,998 %
700300-FI-EF	Exchange-Filterelements (set of 2) for component no. 700300-Fl
700300-LLS	Drying and humidizing system
700300-RF	Dispensible Filter Unit (capsule design) for the protection of flow measuring/control units
700300-RF-G	Filter Housing for filter elements (700300-RF-K)
700300-RF-K	Filter Elements for housing 700300-RF-G - reusable - for the protection of flow measurement/control units
700300-SH	Signal horn
700300-VS	Vacuum tubing, basic equipment
700400-PRO-C-D/Y**	Online Control/Monitoring Unit (PC, Monitor, Interface, Software "DACO", Data Processing Unit). For Y** Nose Only Exposure Units (up to 120 animals each) or Y** Whole Body Exposure Units, expandable.
700400-PRO-C-E/Z***	Online Control/Monitoring System ExpoSys. For Z*** Nose Only Exposure Units (up to 120 animals) or Z*** Whole Body Exposure Units, expandable. Complete and consisting of: Softwarepackage ExpoSys for WINDOWS Z-place Special interface ExpoSys Z-place Control-Unit ExpoSys Z-place Z=1: 1 PC & Monitor Z>1: Z x Client PC & Monitor + 1 Host PC & Monitor
700400-PRO-S	Software "PSD" for particle analysis (calculation of standard parameters, graphic evaluation)
700500-GM-CO2	Carbon Dioxide Measuring Unit (CO_2). Technical data: measuring 2 beam Infrared, range 0 -10 Vol. %, accuracy better than +/- 2 %, temp.-range 0-45 degree C, humidity 0-100 %.
700500-GM-NO-1000	NO Measuring Unit. Range: 0-1000 ppm
700500-GM-NO2-1000	NO_2 Measuring Unit. Range: 0-1000 ppm
700500-GM-O2	Oxygen Measuring Unit (O_2). Technical data: measuring Zicone cell, range 0-95 Vol. %, accuracy better than +/- 1 %, temp.-range -10 to +55 degree C, humidity 10 -95 %, life approx. 20.000 workinghours, calibration calibrated; neither reference gas nor recalibration is needed.

700500-LD-020	Electronic Airflow Dosing and Control Unit, Range 0,5 to 20 NLM
700500-LD-100	Electronic Airflow Dosing and Control Unit, Range 0,5 to 100 NLM.
700500-LD-200	Electronic Airflow Dosing and Control Unit, Range 1 to 250 NLM.
700500-LDM-020	Electronic Airflow Measuring Unit, 0.5 to 20 NLP
700500-LDM-100	Electronic Airflow Measurement Unit, Range 0,5 to 100 NLM.
700500-LDM-200	Electronic Airflow Measurement Unit, Range 1 to 250 NLM.
700500-T-L	Temperature and Humidity Measuring Device, 0-50 °C, 0-99 %.
700500-T-L-107	Temperature and Humidity Measuring Device, 0-100 °C, 5-95 %. New Type.
700600-DM-A	Pressure Measuring Unit (absolute) for TSE Exposure Units.
700600-DM-D	Pressure Measuring Unit (differential) for TSE Exposure Units
700600-DR-N	Pressure Regulator including Manometer, 0,5 / 8,5 bar
700600-PHM	pH-meter
700600-SM-00100	Flow meter with fine adjustment valve; for manual air-flow regulation, max. 100 NL/h
700600-SM-01200	Flow meter with fine adjustment valve; for manual air-flow regulation, max. 1200 NL/h
700600-SM-02000	Flow meter with fine adjustment vlave, for manual air-flow-regulation, max. 2000 NL/h
700600-SM-05000	Flow meter with fine adjustment valve; for manual air-flow regulation, max. 5000 NL/h
700600-SM-10000	Flow meter with fine adjustment valve; for manual air-flow regulation, max. 10000 NL/h
700600-SM-15000	Flow meter with fine adjustment valve; for manual air-flow regulation, max. 15000 NL/h
700600-V-XXX	Precise Adjusting Valve
700700-ACU	Air Conditioning Unit for compressed air
700700-AP-1	Exhaust Pump for Process Air
700700-AP-2	Exhaust System with Filter Unit for outlet air suction and pre-decontamination
700700-DE	Dosing unit for simultanuous use of 2 syringes (range: 10 µl/min to 140 ml/min)
700700-DG-015	Air pressure-generator for the generation of process-air. Efficiency: 8 bar, 15 l/min. Nearly noiseless: 35 dB (A) 1 m.
700700-DG-125	Air pressure-generator for the generation of process-air. Efficiency: 8 bar, 125 l/min. Nearly noiseless: 35 dB (A) 1 m.
700700-DG-250	Air pressure-generator for the generation of process-air. Efficiency: 8 bar, 250 l/min. Nearly noiseless: 35 dB (A) 1 m.
700700-DH-MS	Nozzle Holder, made of MS surface treated. Complete with 3 screws and 2 o-rings.
700700-DH-PVC	Nozzle Holder, made of PVC - complete with 3 srews and 2 o-rings.
700700-GV	Reverse Flow Mixing Device
700700-LV	Laminar Flow Preseparator - Cyclon to separate large particles - with adapation for the nozzle holder.
700700-MDI-01F	MDI Activating System for software-controlled use (adaption to custom MDIs is included in the price)
700700-MDI-16F	MDI Activating System for software-controlled use of up to 16 MDIs (individual control).
700700-OG	Ozone Generator for Laboratories (Micro Ozone Generator)
700700-OG-K	Ozone Catalyzer for downstream cleanliness
700700-RP	Rotationpump for Whole Body Exposure Units run under static mode
700700-SD	Special Nozzle with fastlock connector for application air and substance-inlet, standard flow: 15 l/min.
700700-SG-01	Dust generator (up to 250 mg/m3) for accurate dosage of dust

700700-SG-02	Dust generator 594203 for accurate dosage of dust. 30-400 mg/m3. 220 V, 50 Hz
700700-SG-04	Dust Generator for dispensing dust from compressed substance. acc. Dr. B.M. Wright.
700700-UV	Ultrasonic Aerosol Generator, 1-chamber system, 0-7.0 ml/min, average mass diameter about 2.8 micron
700700-VE	Evaporation unit for continuous evaporation of solvents; rotational evaporation principle
700800-CI-05	Cascade impactor for particle analysis of aerosols. Measuring Range: from 0.25µm to 5 µm, 2 l/min at 20°C
700800-CI-08	Cascade impactor for particle analysis of aerosols. Measuring Range: from 0.15 µm to 8µm, 5 l/min at 20°C
700800-CI-10	Cascade impactor for particle analysis of aerosols. Measuring Range: from 4 µm to 10 µm, 28.3 l/min at 20 °C
700800-FI-EL	Filter Housing (Set of 2) for 50 mm filters.
700800-FI-ELF	Filters for concentration analysis (diameter: 50 mm, material: cellulosenitrate, pore size: 8 µm) set of 100
700800-FI-ELF2	Filters for concentration analysis (diameter: 50 mm, material: teflon, pore size: 1 µm) set of 50
700800-KM-01	Concentration measuring unit for continuous measurement of aerosol concentration in the exposure system, 0.3-3000 mg/m³
700800-KM-02	OptoPan - 3 stage virtual cascade impactor for online aerosol fraction monitoring
700800-OG-KM	Ozone Concentration Measuring Unit
700800-PA-100	SpectroPan - real-time particle analyzer (HeNe laser technology) - Range: 0.2 to 20 µm - comprehensive software package included.
700800-PA-100-SP	Sparepart-Set for ParticleSizeAnalyser 700800-PA-100
700800-PP-005	Sample Suction Pump, 0.5 l/min
700800-PP-05	Sample Suction Pump, 5 l/min
700800-PP-10	Sample Suction Pump, 10 l/min
700800-PP-40	Sample Suction Pump, 40 l/min
700900-ABZ-B	Fume Hood System, Walk-In Type, outlines: 2200x1200x2600mm (WxDxH); inside measurements: 1800x940mm (WxD); manufactured according to DIN 12924 part1.
700900-KWK	Calibration and maintenance kit for sensors consisting of pressure calibration unit, flow indicator, thermometer+heating device, humidity testing kit, calibration mixture for 0_2, calibration mixture for CO_2.

Please specify when order

X* = Animal number per Head/Nose Only Exposure Unit
Choose 10, 20, 40, 60, 80, 100, or 120.

Y** = Number of Head/Nose Only – or Whole Body Exposure Units
Choose 1, 2, 3, or 4 (4 = maximum for the control monitoring system “DACO”).

Z*** = Number of Head/Nose Only - or Whole Body Exposure Units
Choose 1, 2, 3, 4, 5, 6, 7, or 8 (8 = maximum for the control monitoring system “ExpoSys”).

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