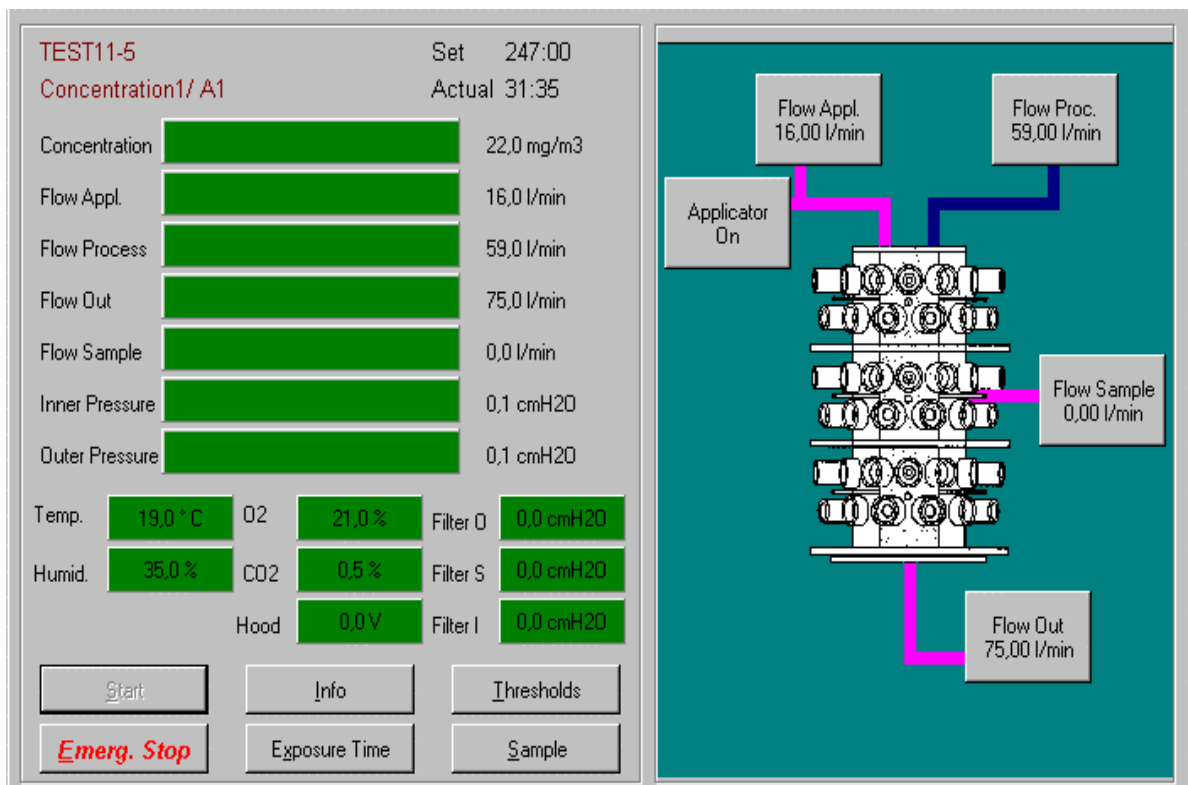


TSE ExpoSys



Planning, Control and Analysis of Inhalation experiments

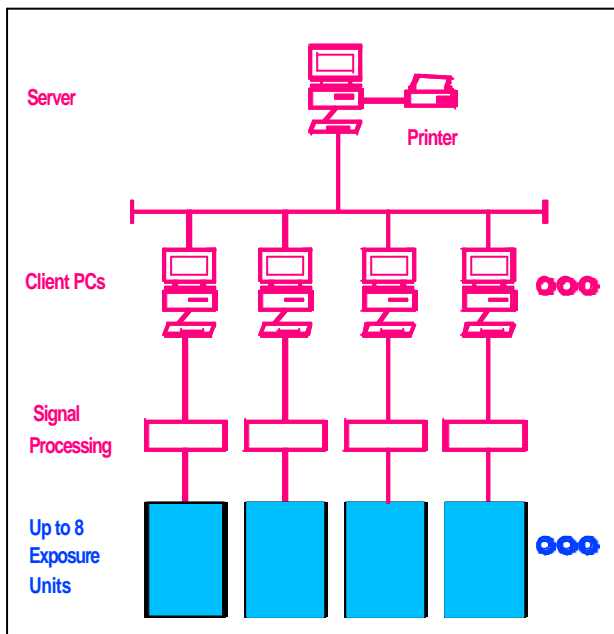
◆ TSE ExpoSys

Introduction

The recently-developed sophisticated ExpoSys software provides all the features necessary to perform inhalation studies in conformity with GLP requirements.

Designed for single and multi-system applications, ExpoSys manages high throughput screenings as well as critical applications via automated scheduling and comprehensive experiment control. Control features for all aerosol types and handy organization of large numbers of animals are provided. In addition, well-designed input windows, perfect monitoring of running experiments and highest safety features contribute to a software system which is sure to meet your requirements.

ExpoSys simultaneously controls exposure units by a computer network consisting of one server PC and up to eight client PCs.



TSE Multi-Exposure System

The ExpoSys **Server** module is responsible for planning, general monitoring and application analysis. The ExpoSys **Client** module is responsible for the calibration in all channels, experimental set-up, detailed monitoring, correct hardware shut-down and data-transfer to the Server.

General Features

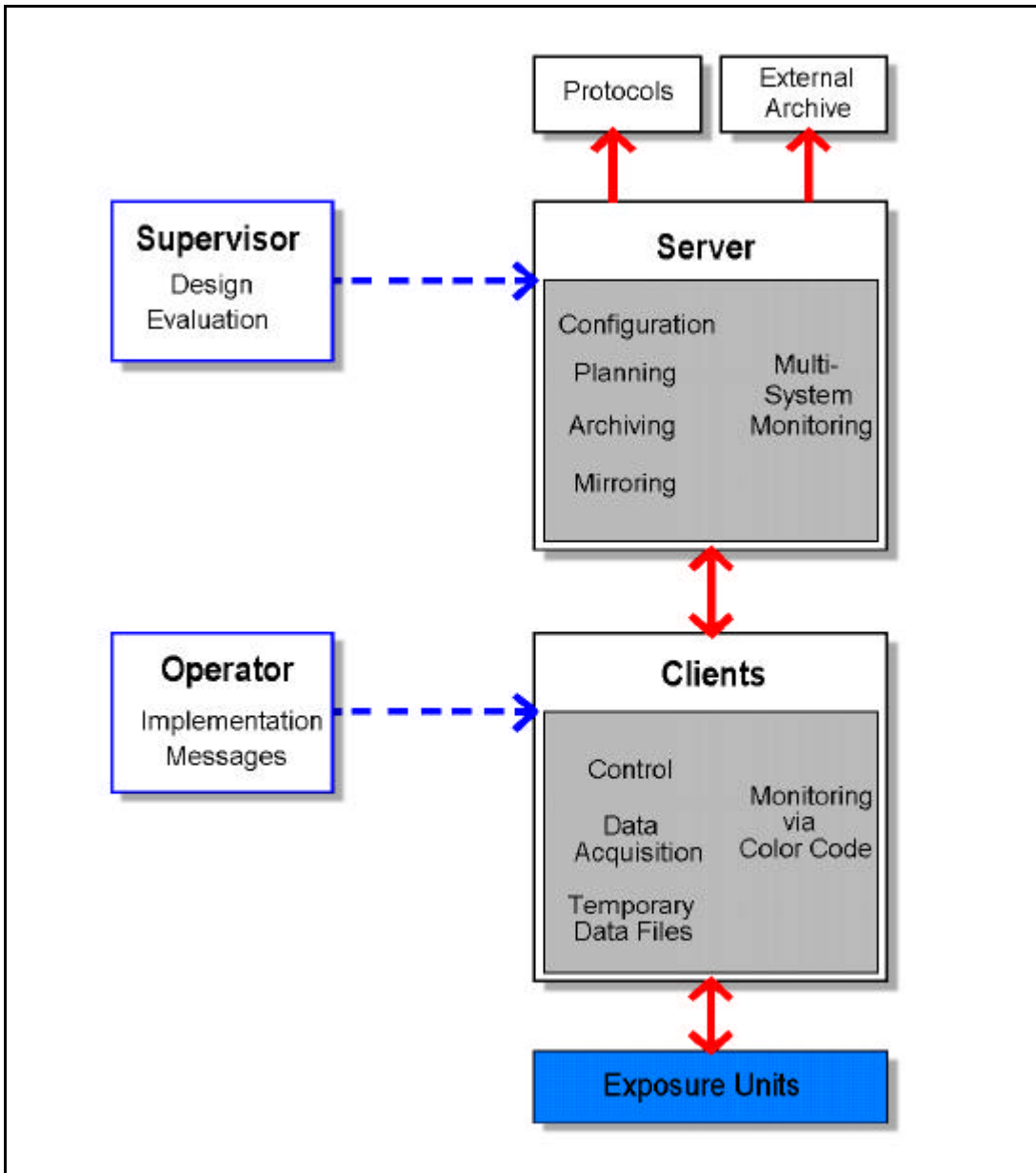
- In conformity with GLP requirements
- Organization and control of up to 8 exposure units
- Control of nose only - (up to 120 animals per unit) or whole body exposure units
- Client-Server design
- Highest safety provided by different authority levels

The Experiment

- Comprehensive planning of the experiment
- Automated scheduling and process control
- General monitoring at the server
- Detailed monitoring at the client
- Graphical analysis during and after the experiment
- Study, alert and data protocol

Hardware Components

To complete the system TSE provides all hardware components necessary for a sophisticated inhalation system (different exposure units and peripheral components, see brochure "TSE Inhalation Systems" and page 9).



Options, Info and Service

- Highest flexibility is provided. ExpoSys is adapted to your individual requirements during the system design, if necessary. All your parameters are taken into account.
- A software interface in ExpoSys allows communication with higher networks for a comfortable exchange of planning data and experimental results. Predefined character numbers for each input guarantee compatibility with planning data and result evaluation performed by a second supervisor.
- Our service team provides support during design, installation and upgrading. Simply ask for a detailed quotation, if you look for a new system or a modification/upgrading of your existing set-up.
- The low cost DACO control software provides manual functions and manages up to 4 exposure units. Please ask for details.

Studies

ExpoSys handles different studies in parallel which are characterized by their status: **planned, active, fixed and completed.**

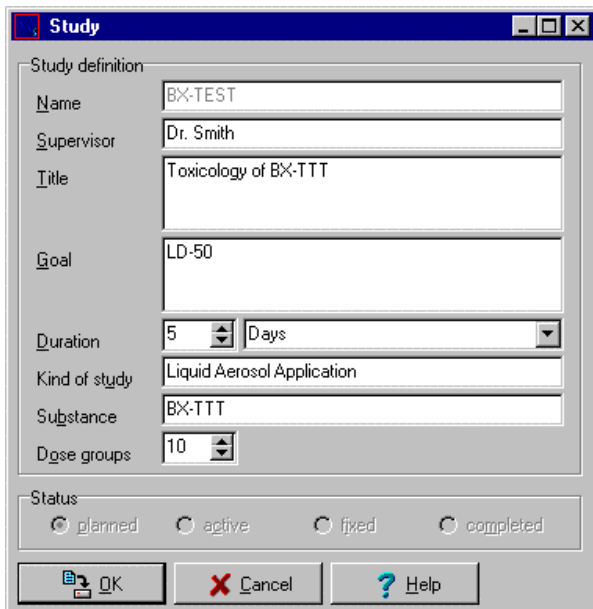
A newly created or just imported study is handled as a planned study. As soon as the first application has been performed the study is active.

The number of applications planned usually defines the duration of a study, because in general applications are performed once a day. In addition to this basic design ExpoSys allows multiple applications (SplitDose) or changes caused by problems.

When all applications are performed the study switches to fixed. If problems occur this status change can be revised.

A completed study cannot be altered any more.

Basic descriptive parameters are entered in the window shown below. They form an integral part of the protocols generated by ExpoSys (see "Analysis"). During exposure periods this window provides an overview regarding basic study features and study statuses.



Descriptive parameters for application groups are entered in the „Application Design“ window (see "Manual Planning").

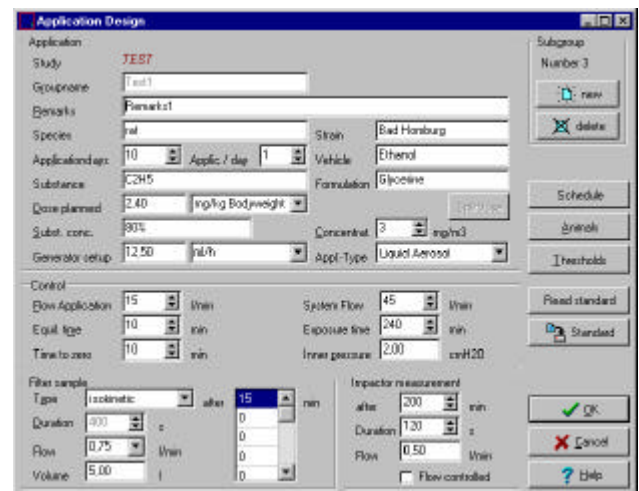
Manual Planning

After a new study has been defined all planning/experimental parameters for animal groups have to be entered.

As an alternative to manual planning, a complete study design can be imported from higher networks.

Group-specific Planning Parameters

The main planning window of Exposys allows inputs for each animal group. In general an animal group is characterized by an individual substance concentration. This means that the number of animal groups and concentrations to be tested is usually identical.



All generator types and their specific parameters are plannable. A typical planning window for liquid aerosol generation is shown above.

Group-specific descriptive parameters, control parameters and samplings are specified. For your convenience planning data can be stored as a standard (see standard buttons at the right) and recalled at any time to generate other groups instantly.

Several internal controls help to enter appropriate values. A warning Expert (see "The Expert") appears, for instance, if overlapping sampling times are planned.

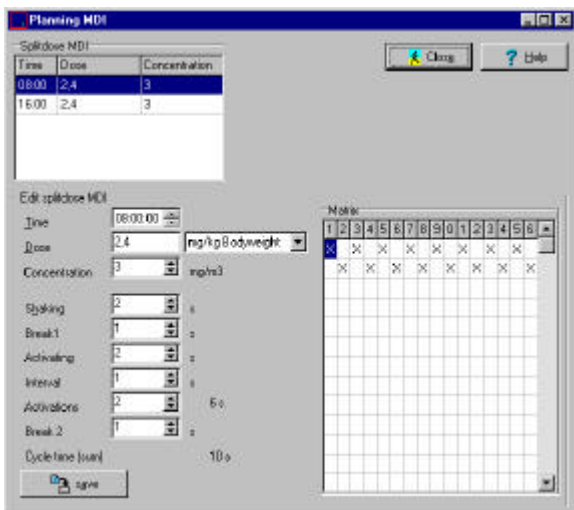
Separate windows are provided for the **MDI planning, schedule, animal groups and threshold values.** The „Planning MDI“ window is opened by choosing MDI as the application type. The others are activated by pressing the buttons on the right in the „Application Design“ window.

MDI-Application

An MDI-application requires further inputs, e.g. durations of shakings, intervals, etc. ExpoSys controls all 16 (!) MDI-positions of the hardware unit independently.

The window below shows the MDI activation matrix with the positions to be activated during the first cycle shown in the first line.

16 of these cycles are plannable and are represented by 16 lines which can be filled in. After running all predefined cycles (the first loop is finished) the system continues with line 1 to start a second loop and so on.



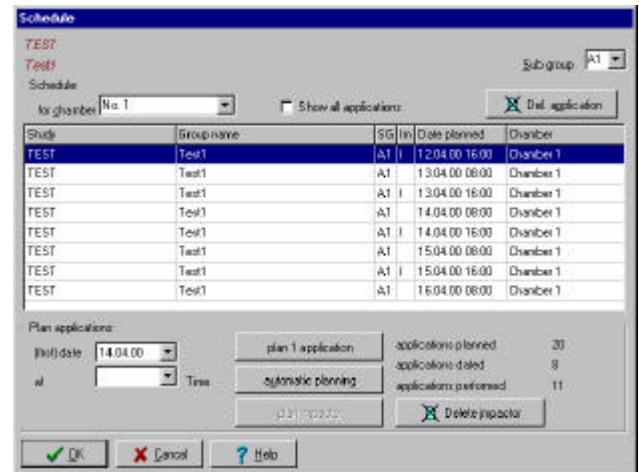
Schedule

All applications planned for one animal group can be scheduled instantly based on the inputs for application days and applications/day (by pressing the „automatic planning“ button in the following window).

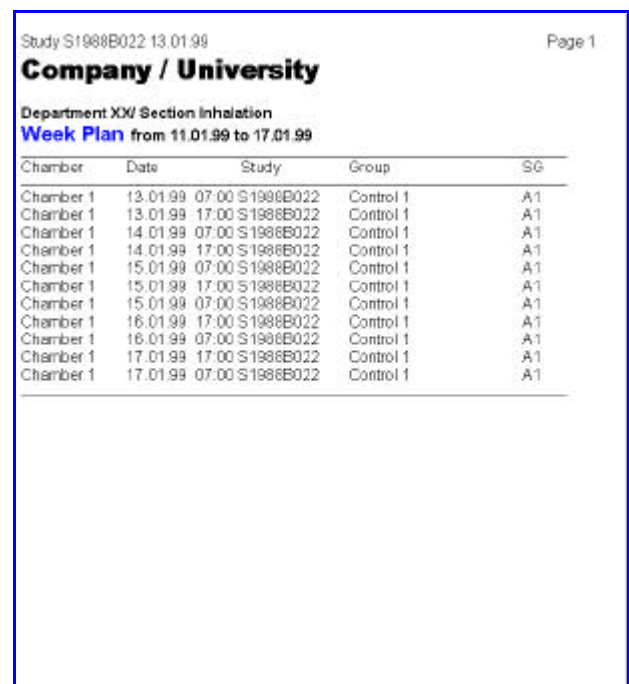
Scheduled applications appear in the white field of the window. „I“ indicates an impactor sampling. Applications already performed disappear automatically from the window.

In addition, if a specific design has to be implemented individually; this means that each application is given a date which is not necessarily the day following the previous application.

The actual numbers of applications planned, dated and performed are shown at the right-hand side in the „New applications“ frame.



A day plan or week plan can be shown or printed out for each exposure chamber at any time.

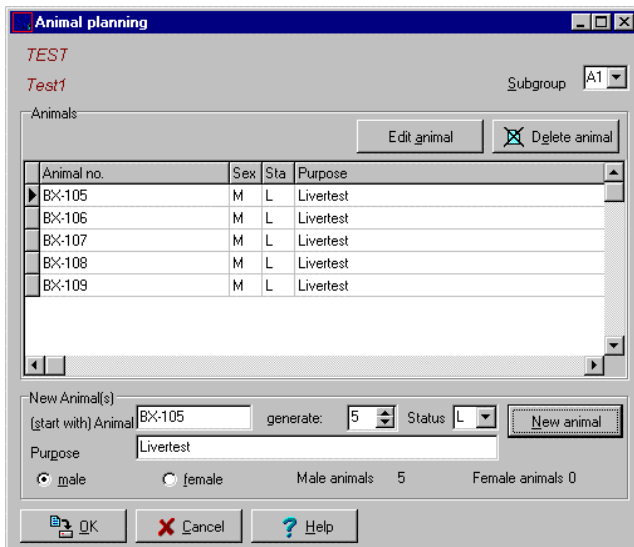


Animal Planning

The “Animal Planning” window provides a perfect overview during planning and exposure periods even if high animal numbers are under investigation.

ExpoSys features the animal identification number, sex, status and purpose of all animals.

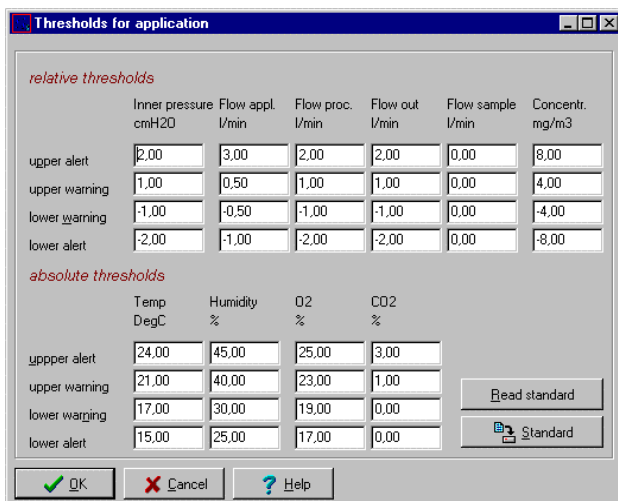
Several animals can be generated simultaneously (value in the field „generate“ > 1). ExpoSys automatically adds an ascending numeric suffix to a stem entered in the „(start with) Animal“ field.



To keep the system updated the animal status can be changed at any time. Animal statuses are „alive“, „dead“ or „removed“.

Thresholds for Application

In the right column the application monitor of the Client is shown. The „Thresholds for application“ window allows all inputs necessary for the status display of the hardware channels via a color code (channel ok: green, warning: yellow, alert: red).



The Experiment at the Client

Preparation of the Application

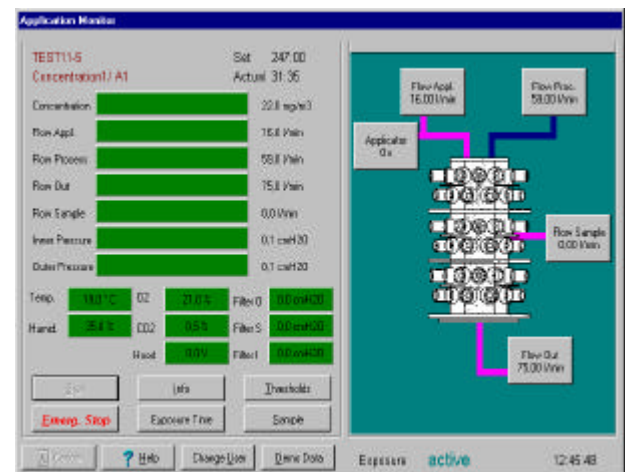
During the preparation of the experiment (set-up) the operator is guided step by step by the software, e.g. the installation of hardware components necessary to perform the application

has to be confirmed in a setup window. All animal identification numbers of the group under investigation are shown in an additional window which has to be confirmed as well.

The design described ensures the highest safety of the experiments, namely the implementation of all planning features as well as protection of the staff from dangers arising from the use of toxic substances.

The Running Application

During an application the following window allows the monitoring of all 15 channels provided (e.g. flow at different locations, temperature, O_2 , CO_2 , etc.). Customized parameters are taken into account.



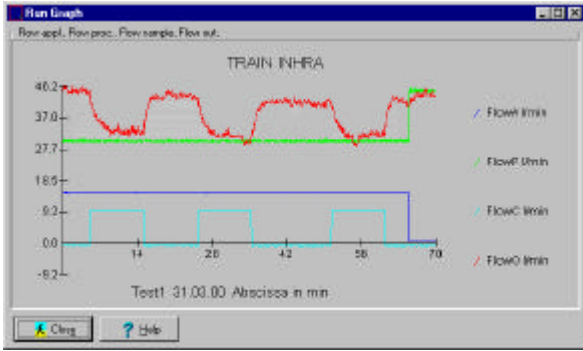
Each channel is represented either by a status bar or a status button. Both are refreshed every 10 seconds and show critical values or alarms via a yellow or red color respectively (green = ok).

Status bars continuously scroll from the right to the left and thus show an overview over 30 minutes! The study and animal group are shown in red at the top of the window.

Control parameters during the experiment are flow application, flow process (dilution air), flow out, sample flow and pressure. Actual flow values and active system components are shown in the right half of the window.

Graphics, Samplings, Inputs and Manipulations during the Application

At any moment a graphical analysis for a chosen signal can be shown (after mouse-click on a status bar in the „Application Monitor“). Flows are shown as one graph (next figure).



Sampling is initiated by the system according to the application design previously entered. For this reason a window presenting all sample parameters appears at the time planned. After checking the hardware (e.g. control of impactor installation or correct connections) the operator starts sampling by pressing the start button.

User-defined text markers can be set at any time. Spontaneous sampling, changing of threshold values for alarms and altering of the experiment duration are possible.

In order to alter the last two parameters mentioned above the user needs "supervisor-access". In routine work the operator, who has limited access, works at the Client. For a change the supervisor has to enter the correct password in a window which appears after pressing the „change user“ button. The system then switches to the "supervisor-level".

Hardware and Animal Shut-Down

The experiment duration is controlled by the system which means that after the exposure time has elapsed the aerosol generator stops automatically.

As soon as the aerosol concentration is zero the hardware shut-down starts and the operator is guided in a way similar to the preparation procedure but in the opposite direction.

Monitoring at the Server

The Exposys Server module enables comprehensive „Remote-Monitoring“ of all the systems activated. In the default setting (radio button „Alert“ is active) alarm messages of all systems activated are presented. Chamber number, alarm type and time of appearance/disappearance are shown in a table. The short messages instantly appear in the Application monitor of the Server after the problem occurs at the exposure unit.

Monitoring design „All“ (shown below) is characterized by the presentation of all channel status changes and event markers of all systems monitored. Other monitoring designs are chosen via the radio buttons „Warning“ and „Info“.

The system performance allows monitoring of up to eight exposure units via the computer network.

Active applications			
Chamber	Status	Group	SS
Chamber 1	TEST	Testgroup	AT
Chamber 2	519775	GIX-S12	At

Messages			
Chamber	Time	Alert/Warning/Info	
Chamber 1	11.04.00 14:45:42	Start of the application	
Chamber 1	11.04.00 15:13:55	Sampling start	
Chamber 1	11.04.00 15:19:44	Sampling stop	
Chamber 1	11.04.00 15:30:36	Alert - row out - start	
Chamber 1	11.04.00 15:30:54	Alert - row out - stop	
Chamber 1	11.04.00 15:37:34	Warning - concentration - start	
Chamber 2	11.04.00 15:21:33	Start of the application	
Chamber 2	11.04.00 15:26:13	Sampling start	
Chamber 2	11.04.00 15:42:13	Sampling stop	

Analysis

Application Analysis

An analysis of applications which have already been carried out can be performed at any time even during running applications. A time filter helps to find the application of interest.

Two different protocols are provided after an application: A protocol for all experimental data, "Run Table", and a protocol for alarms and events, "Application Protocol"

Study S198B022 13.01.99 Page 1

Company / University

Run Table
Server Version 1.2 / Client Version 1.2

Study S198B022
Group Application 1/A1
Substance C2H6 10,00 mg/kg Bodyweight
Application Start 21.12.98 11:04:27
Supervisor Dr. Müller
Data C:\Programme\TSE\EXPOSYS\ARCHIV\1000001.DAT
Operator Selig Signature (13.01.99)

Thresholds

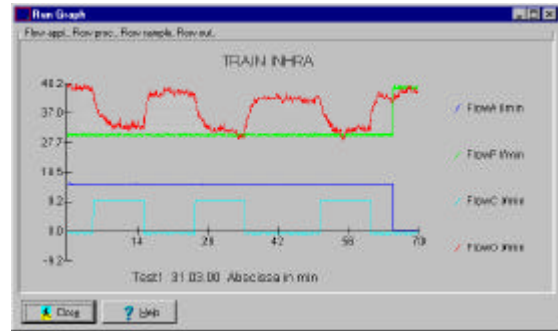
Presl	PresO	FlowA	FlowP	FlowC	FlowO	Temp	Humi	Conc	O2	CO2
cmH2O	cmH2O	l/min	l/min	l/min	l/min	DegC	%	mg/m3	%	%
2,00	2,00	-1,00	2,00	1,00	1,00	24,00	61,00	8,00	25,00	3,00
-2,00	-2,00	-1,00	0,00	-2,00	-1,00	15,00	25,00	-8,00	17,00	0,00

Time	Presl	PresO	FlowA	FlowP	FlowC	FlowO	Temp	Humi	Conc	O2	CO2
11:07:47	0,02	0,03	15,00	30,00	0,00	45,00	30,0	30,0	4,50	18,0	0,01
11:11:09	0,02	0,03	15,00	30,00	0,00	45,00	30,0	30,0	4,52	18,0	0,00
11:14:27	0,02	0,04	15,00	30,00	0,00	45,00	30,0	30,0	4,51	18,1	0,00
11:17:47	0,02	0,05	15,00	30,00	0,00	45,00	30,1	30,0	4,50	18,1	0,01
11:21:07	0,02	0,05	15,00	30,00	0,00	45,00	30,1	30,0	4,50	18,0	0,00
11:24:27	0,02	0,04	15,00	30,00	0,00	45,00	30,2	30,0	4,53	18,0	0,00

...

Presl Inner pressure
PresO Outer pressure
FlowA Flow Appl.
FlowP Flow Process
FlowC Flow Sample
FlowO Flow Out
Temp Temperature
Humi Humidity
Conc Concentration
O2 O2
CO2 CO2

The time window for which average values are calculated is defined by the user. Channels shown in the Run Table are chosen by the user as well. For further evaluation all **data files can be exported** to spreadsheet programs such as EXCEL or LOTUS. In addition a **graphical analysis** of each channel can be shown and printed out.



Study protocol

A study protocol can be printed out at any time; this shows an overview for all planned and performed applications. In addition, all animals are shown taking their status (alive, dead or removed) and the date of status change into account.

Study S198B022 13.01.99 Page 1

Company / University

Application Protocol
Server Version 1.2 / Client Version 1.2

Study S198B022
Group Application 1/A1
Substance C2H6 10,00 mg/kg Bodyweight
Application Start 21.12.98 11:04:27
Supervisor Dr. Müller
Data C:\Programme\TSE\EXPOSYS\ARCHIV\1000001.DAT
Operator Selig Signature (13.01.99)

Thresholds

Presl	PresO	FlowA	FlowP	FlowC	FlowO	Temp	Humi	Conc	O2	CO2
cmH2O	cmH2O	l/min	l/min	l/min	l/min	DegC	%	mg/m3	%	%
2,00	2,00	1,00	2,00	1,00	1,00	24,00	61,00	8,00	25,00	3,00
-2,00	-2,00	-1,00	0,00	-2,00	-1,00	15,00	25,00	-8,00	17,00	0,00

Date	Message	Min	Max
21.12.98 11:04:27	Start of the application		
21.12.98 11:50:35	Sampling start		
21.12.98 12:30:37	Threshold test		
21.12.98 12:41:35	Sampling stop		
21.12.98 12:44:08	Change of exposure duration: + 1 h		
21.12.98 15:59:27	Stop of the application		

Presl Inner pressure
PresO Outer pressure
FlowA Flow Appl.
FlowP Flow Process
FlowC Flow Sample
FlowO Flow Out
Temp Temperature
Humi Humidity
Conc Concentration
O2 O2
CO2 CO2

Study S198B022 13.01.99 Page 1

Company / University

Study Protocol
Server Version 1.2 / Client Version 1.2

Study	S198B02
Supervisor	Dr. Müller
Title	Test3
Goal	Concentration Test + Formulation
Study type	Pretest
Substance	Water
Actual Status	active

Group	GG-Concentration XX
Remarks	First Test
Species	Rat
Strain	Magdeburg
Appl.-Days	10
Appl./Day	3:07:00/ 12:00/ 17:00
Substance	Water
Vehicle	Ethanol
Formulation	Glycerine
Dose	12 mg/kg
Appl.-Type	Liquid Aerosol
Generator setup	1,00 l/min
Flow appl.	15 l/min
Flow system	45 l/min
Inner pressure	10,00 cm H2O
System concentration	200,00 mg/m3 /200,00 /300,00 /400,00
Times	Equil. 5/ Exposure 600/ Time to zero 5 min
Sampling	isokinetic after 5/15/25 min
Sampling duration	6 min
Sampling Flow	0,75 l/min
Sampling Volume	4,50 l
Impactor after	35 min
Impactor duration	5 min
Impactor flow	3,00 l/min

Subgroup A1

Date pl.	Appl. date	Dose	Concentration	Impactor
22.12.98	22.12.98	20,00 mg/kg Bodyweight	200,00 mg/m3	
23.12.98	24.12.98	20,00 mg/kg Bodyweight	300,00 mg/m3	
13.01.99	13.01.99	20,00 mg/kg Bodyweight	200,00 mg/m3	

Study S1988B022 13.01.99 Page 2

Animal No	Sex	Status	Purpose	Status change
001	M	L	Livertest	
002	M	L	Livertest	

Subgroup A2

Date pl.	Appl. date	Dose	Concentration	Impactor
20.01.99	20.01.99	20,00 mg/kg Bodyweight	200,00 mg/m ³	
21.01.99	21.01.99	20,00 mg/kg Bodyweight	300,00 mg/m ³	I
22.01.99	22.01.99	20,00 mg/kg Bodyweight	200,00 mg/m ³	I

Animal No	Sex	Status	Purpose	Status change
003	F	L	Substance deposition	
004	F	D	Substance deposition	22.01.99

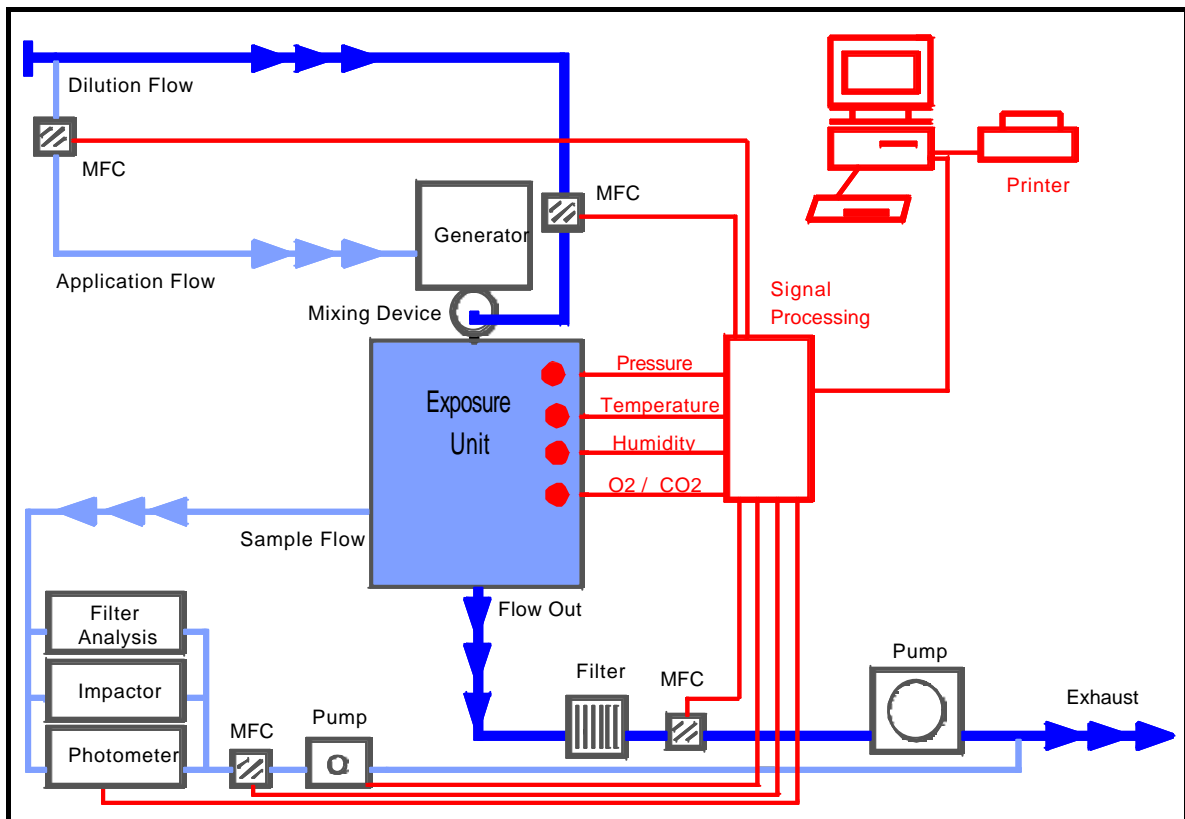
End of protocol

The Expert

To prevent trouble the ExpoSys Expert continuously looks for mistakes or helps to run the system. He appears in many situations and checks inputs via internal error detectors or recommends a certain procedure.



Hardware Components



In the sketch a typical hardware configuration is shown. Red lines show connections to control or monitoring components. Basically **Whole Body Exposure Systems** and **Nose Only Exposure Systems** are run in the same way by simply providing components which take the specific flow requirements into account.

Complete system solutions are offered. TSE provides a wide range of hardware components featuring state-of-the-art technology. An overview for all components available is presented in our brochure „**TSE Inhalation Systems**“. Please ask for a quotation. Our experts will help to find your individual hardware configuration.

◆ Ordering Information

Cat.No.	Description
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

Please specify when order

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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