Product Overview

Sophisticated Life Science Research Instrumentation

TSE Animal Respirator "Compact"

For small laboratory animals

www.TSE-Systems.com

– Specifications subject to change without notice –

TSE Animal Respirator “Compact”

System description

The **TSE Animal Respirator “Compact“** is a modern and versatile system for the respiration of small laboratory animals (mouse up to young rat).

The instrument has already been calibrated by the manufacturer. All the sensors used are maintenance-free.

The respirator is supplied complete with a **TSE cannula set** (special tracheal cannula adapter and tubing connections) that can be connected to any commercially available tracheal cannula.

The respirator can also be controlled by a PC and will then work in a fully automatic mode. *Please contact us to receive detailed information.*

Operating principle

The instrument works according to the intermittent positive pressure ventilation principle.

A continuous air / O_2 stream, adjustable by means of a flow controller, is led via solenoid valves to the animal (inspiration phase) or to the overflow outlet (plateau or expiration phase).

In contrast to the Starling respiration principle, in this type of respiration system the ratio between the inspiration phase and the expiration phase is not fixed but is **freely selectable**.

The air which the animal exhales is not removed by suction but only led away to the atmosphere (**passive exhalation**). This air is available for further measurements.

The air outlet can also be connected directly to an immersion tube to achieve a positive end-expiratory pressure (PEEP). This is especially recommended when long-term ventilation is necessary.

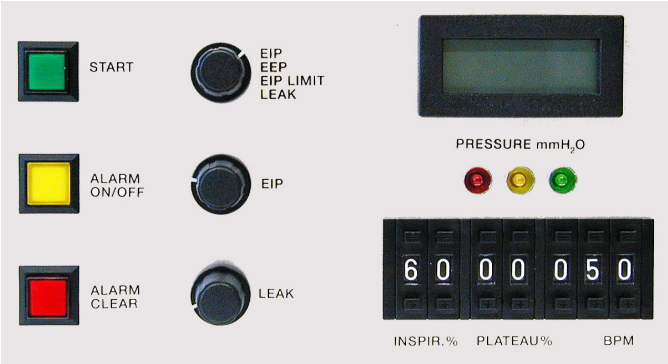
Respiration parameters	
Inspiration phase	1 ... 99%
Plateau phase	0 ... 99%
Respiration frequency	1 ... 360 per minute
Pressure	
Measuring range	0...300 mmH_2O
Max. overpressure	3571 mmH_2O
Dimensions (WxDxH)	approx. 250 x 265 x 145 mm
Weight	approx. 5 kg
Power supply	230 V / 115 V; 50 / 60 Hz

Adjustable respiration parameters

With the help of the operating elements on the instrument front panel all the necessary respiration parameters can be set by the operator.

Ventilation parameters

- **Breathing frequency:** 1…360 bpm (breaths per minute), digital setting.
- **Inspiration length** in % of a breathing cycle: 1…99%, digital setting.
- **Plateau length** in % of a breathing cycle: 0…99%, digital setting.



Pressure measurement

- **EIP (End-Inspiratory Pressure)**
  Pressure value immediately before the start of the plateau or expiration phase.

- **EEP (End-Expiratory Pressure)**
  Pressure value immediately before the start of the inspiration phase (i.e. before the inlet valve is opened).
- **EIP Limit**
  An EIP Limit can be defined to set a maximum for the tracheal pressure which is to be maintain during the whole inspiration phase by continuous readjustment.

  The tracheal limit is then checked continuously to see whether the limit has been exceeded.
- **LEAK Alarm**
  The system can be checked for tightness during operation by defining the leak alarm limiting pressure (e.g. for the occurrence of leaks).

Animal specific configuration

Because of its flexibility the system can be configured according to the customer’s requirements for the respiration of small laboratory animals.

Adaptation is carried out by equipping the instrument with a suitable flow controller which can be selected by the user.

Retrofitting with another flow controller is possible.

Configuration:

Animal	Total Flow (ml/min)	Volume (ml) administered to the animal per minute at 50% Inspiration
Mouse up to young rat	30 - 230	15 - 115

Flow adaptation is carried out by a control knob with a built-in needle valve. The air flow is read off above this knob from the middle of the float in the metering tube.

The flow controller has its input on the rear panel of the instrument.

Respiration modes

In principle the respirator allows 2 different respiration modes:

1. Constant flow respiration
2. Constant pressure respiration

Constant flow respiration

The respiration gas is administered during the *whole* inspiration phase at the constant and low flow rate selected on the **flow controller**.

An upper respiration pressure limit set by the operator is monitored; the so-called **EIP Limit** (max. 300 mm H_2O). If this limit is set so (high) that this pressure is *not* reached during the inspiration phase then the *respiration volume*, which is obtained from the set flow rate and the laid down time parameters, is actually achieved.

On the other hand, if the **EIP Limit** is **exceeded** (e.g. because the bronchial resistance changes) then the inspiration valve will be closed immediately *independent of the elapsed time*. In this way the animal is effectively protected against the pressure in the lungs increasing too much. By actively controlling the pressure if the pressure is falling during the remaining inspiration phase time the achieved pressure remains constant.

Constant pressure respiration

In this respiration mode the respiration pressure rises *rapidly* at the start of the inspiration phase as a result of the very high flow rate to a value selected by the operator (**EIP Limit**) and is maintained at this level by active control during the whole of the total length of the inspiration phase (not, however, during the plateau phase).

Constant pressure respiration avoids pressure peaks which could damage the lungs.

Respiration gas

Normally **atmospheric air** is used as the air source and is supplied by the built-in pump. Alternatively air or oxygen can be supplied externally from a compressed gas line or compressed gas cylinder.

The connection of a **vaporizer** to the respirator is also possible.

Oxygen and compressed air mixtures mixed with inhaltion narcotics can be administered if the respirator is included in the **TSE Respiration and Inhalation Anesthetics System**.

Aerosols can be added via an ultrasonic **nebulizer** which will be connected in front of the animal.

Built-in pressure sensor

During respiration the pressure (tracheal pressure) in the expiration lead (i.e. in the animal's trachea) is measured continuously via a **pressure sensor** in a by-pass circuit. End-inspiration pressure (**EIP**) and end-expiration pressure (**EEP**) are shown on a display. A chart recorder can be connected to show the pressure waveform.

Alarm monitoring

The whole system is monitored continuously for tightness with a minimum pressure selected by the operator (**leak alarm)**. In this way pressure loss caused by faulty tubing connections, etc., can easily be recognized.

Display of the alarm condition, i.e. the undercutting of the defined limit is carried out during the respiration in 2 different ways:

- **Optical Alarm**
  When the leak limit is undercut the key is illuminated red. The lamp goes out automatically when the alarm condition has ended.
- **Acoustic Alarm**
  The undercutting of the leak limit can also be indicated by an acoustic signal.

MRI Application

The Animal Respirator can also be used just outside the high magnetic field environments (e.g. MRI). It was successfully tested with up to 10 m long tubings.

Options

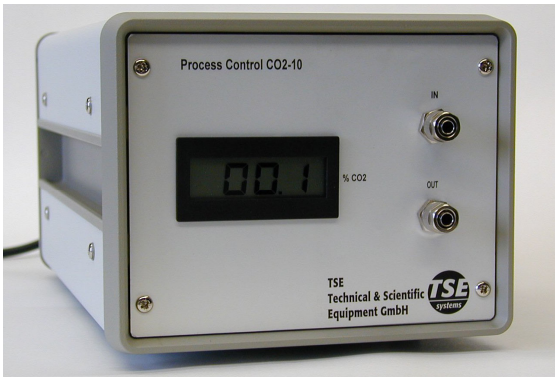
A variety of **optional components** is available for the TSE Animal Respirator

O_2/CO_2 modules (optional)

The TSE **O_2** and **CO_2 measuring modules** allow an accurate determination of the O_2 or CO_2 concentration in the expiration air during respiration. The measuring ranges are:

- **O_2** **0 - 25% V/V**
- **CO_2** **0 - 10% V/V**

The signals are shown on a display and can additionally be output on a chart recorder or a PC.



	O_2 module	**CO_2 module**
Measuring principle	Zirconia cell	2-beam infrared
Operating range	0 to 25% V/V	0 to 10% V/V
Accuracy	better than ± 0.5% FS (full scale)	better than ± 2% FS (full scale)
Stability	better than ± 0.5% FS	better than ± 2% FS
Temp.-range	-10 to +50 °C	-10 to +45 °C
Humidity	up to 98%	up to 98%
Calibration	calibrated, no recalibration is needed	calibrated, no recalibration is needed
	lifetime: > 30 000 operation hours	

Isoflurane, halothane vaporizer (optional)

If necessary, an isoflurane or halothane vaporizer can be connected to the inputs provided for it on the rear panel of the respirator. The vaporizers are designed for “out of circuit” use in continuous flow techniques.

The concentration of the anesthetic within the range of clinical applications is independent of temperature variations, alterations in the flow or duration of operation.

The anesthetic concentration can be set easily and rapidly via an easy-to-read dial control; a safety device protects against accidental alteration.

A well-laid-out filling level indicator provided with a sight glass allows the amount of anesthetic present to be checked rapidly.

- **Adjustable concentration range** 0.5% - 5.0% (halothane, isoflurane) (with a scale setting of 0.5%)
- **Filling volume** approx. 125 ml

Gas mixing station (optional)

The gas mixing station offers the possibility of using oxygen and compressed air with the addition of nitrous oxide as the respiration gas.

The required mixing ratio can be set via mechanical flowmeters and varied as required. These are flowmeters with a fine-adjustment valve, that work according to the floating body principle.

The flowmeters are enclosed in a stable rack that also allows a vaporizer to be attached.

- **Flowmeter for oxygen**
- **Flowmeter for compressed air**
- **Flowmeter for nitrous oxide**

According to the system configuration various flowmeter dimensions are available. Please refer to the ordering information.

The respirator, in combination with the gas mixing station and a vaporizer, can be extended to form a system for inhalation anesthesia.

Partial list of users

- Albert-Ludwigs-Universität Freiburg, Freiburg, Germany
- Autonomous University of Barcelona - UAB, Barcelona, Spain
- Biomedizinische NMR GmbH am MPI für biophys. Chem., Göttingen, Germany
- Charité - Universitätsmedizin Berlin, Berlin, Germany
- Deutsches Primatenzentrum GmbH - DPZ, Göttingen, Germany
- Johann Wolfgang Goethe-Universität, Frankfurt am Main, Germany
- Technische Universiteit Eindhoven, MB Eindhoven, The Netherlands
- Universiteit Maastricht, MD Maastricht, The Netherlands
- University of Sheffield, Sheffield, Great Britain
- Universitätsklinikum Schleswig-Holstein - Lübeck, Lübeck, Germany
- Uppsala University, Uppsala, Sweden

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Ordering Information

Cat-No.	Description

994600-AR-C	**Animal Respirator "Compact"**
	Processor controlled respiration system for for small lab animals
	> MOUSE up to SMALLL RAT <
	Types of respiration:
	• constant flow
	• constant flow with EIP-limit
	• constant pressure
	
	Technical data:
	• breathing frequency 1 - 360 bpm (breaths per minute) – adjustable in steps of 1 bpm.
	• total flow 10 - 230 ml/min
	• inspiration/expiration phase in 1% steps per respiration cycle (1-99%)
	• plateau phase adjustable in 1% steps per respiration cycle (0-99%)
	• respiration pressure (end-inspiratory (EIP)) and leak-alarm adjustable infinitely (mmH_2O), both adjustable in 1% steps
	• continuous system supervision for leaks
	• connection for oxygen measuring unit (O_2)
	• connection for carbon dioxide measuring unit (CO_2)
	• PC interface
	
	Complete system with
	• 1 Flowmeter for Mouse / young Rat
	• 1 Tracheal Cannula Set of your choice (please specify):
	  • Tracheal Cannula Set (Tracheal Cannula Adapter & Tubing Set) for Mouse
	  • Tracheal Cannula Set (Tracheal Cannula Adapter & Tubing Set) for young Rat

994600-O2	**Oxygen Measuring Unit (O_2), extension unit for Animal Respirator.** Technical data: • measuring principle: Zirconia cell • measuring range: 0 to 25% V/V • accuracy: better than ± 0.5% FS • stability: better than ± 0.5% FS • temperature range: -10 to +50 °C • relative humidity: up to 98% • lifetime: > 30 000 operation hours • calibrated, no recalibration is required
994600-CO2	**Carbon Dioxide Measuring Unit (CO_2), extension unit for Animal Respirator.** Technical data: • measuring principle: 2-beam infrared • measuring range: 0 to 10% V/V • accuracy: better than ± 2% FS • stability: better than ± 2% FS • temperature range: -10 to +45 °C • relative humidity: up to 98% • calibrated, no recalibration is required
994600-TC-2-M	**Tracheal Cannula Set for Mouse** for Animal Respirator. Consisting of: • Tracheal Cannula Adapter • Tubing Set
994600-TC-3-YR	**Tracheal Cannula Set for young Rat** for Animal Respirator. Consisting of: • Tracheal Cannula Adapter • Tubing Set
994650-NV-H	**Veterinary Vaporizer for Halothane**
994650-NV-I	**Veterinary Vaporizer for Isoflurane**

994650-GSM-3-S	**Gas mixing station for inhalation anesthesia,** for SMALL laboratory animal, artificial respiration with 3 gases. Suitable for connecting to Animal Respirator. Complete and consisting of:
	• rack with base plate, including attached:
	  • flowmeter for oxygen 100 - 2000 Nml/min
	  • flowmeter for air 100 - 2000 Nml/min
	  • flowmeter for nitrous oxide 100 - 2000 Nml/min
	  accuracy of all flowmeters 5% FS (full scale)
	• holder for vaporizer
	including all connectors.
	Flowmeters in other sizes or for other gases are also available. Please specify if required.

994650-GSM-3-L	**Gas mixing station for inhalation anesthesia,** for LARGE laboratory animal, artificial respiration with 3 gases. Suitable for connecting to Animal Respirator. Complete and consisting of:
	• rack with base plate, including attached:
	  • flowmeter for oxygen 1000 - 20000 Nml/min
	  • flowmeter for air 1000 - 20000 Nml/min
	  • flowmeter for nitrous oxide 750 - 15000 Nml/min
	  accuracy of all flowmeters 5% FS (full scale)
	• holder for vaporizer
	including all connectors.
	Flowmeters in other sizes or for other gases are also available. Please specify if required.

Other TSE Products

This overview illustrates additional inhalation products which are supplied by TSE Systems, detailed information concerning each of the items listed below can be found on our website, for any additional information please do not hesitate to contact us:

- **LabMaster**
  Multipurpose Screening System: Indirect Calorimetry, Home Cage Activity via Infrared Sensor Frames, Drinking & Feeding Behavior, Wheel Activity, Production of Urine & Feces, Rotameter, etc.

- **Behaviour**
  Conditioning, Activity & Exploration, Video Tracking, Mazes, Anxiety & Depression, Motor Function & Performance

- **Startle Response**

- **Analgesia**
  Hot Plate, Tail Flick, Randall Selitto, Power Meter (Incapacitance Tester)

- **Physiology**
  Blood Pressure Monitoring – invasive & non-invasive, Telemetry, Volume Meter, Bronchospasm Measuring

- **Inhalation**
  Head Nose Only and Whole Body Exposure Units, Aerosol Generation & Conditioning, Aerosol Analysis, Inhalation Software, etc.

- **Stereotaxic Instruments**

- **Isolated Organs**
  Organ Bath Systems, Langendorff and Working Heart Systems

- **Microtomes**
  Krumdieck Tissue Slicer

- **Pumps & Infusion**
  Syringe Pumps, Animal Infusion Systems

- **Surgery & Handling**
  Operating Tables, Homeothermic Blankets, Temperature and ECG Pads, etc.

Physiology

TSE Systems – your Partner!

As your partner TSE Systems offers you solutions that are fully integrated with state-of-the-art technology and powerful software, customized to your specific needs, dependably consistent and easier to use for meeting even the most challenging research work.

Our committed team is ready to assist you in formulating solutions for your research. Let us become part of your team. Do not hesitate to contact us.

Metabolism

Behavior

Motor Function

Inhalation

System Solutions for Life Science Research

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