Operator's Manual

Originalbetriebsanleitung

TestChest® V3

Manufacturer:

Organis GmbH

Schulstrasse 76
CH-7302 Landquart
Telephone: +41 81 300 65 80
Email: TestChest®@organis-gmbh.ch

Table of contents

1. User information 3
   1.1. Purpose of document and applicability 3
   1.2. Safety information 5
2. General safety instructions 6
   2.1. Introduction and intended use 6
   2.1.1. Important information/restrictions 7
   2.1.2. Technical specifications 9
   2.2. Reasonably foreseeable misuse 10
   2.3. Responsibility of the operator 11
   2.4. Staff responsibilities 11
   2.5. Staff qualifications 11
   2.6. Safety and protective devices 11
3. Description of TestChest® 12
   3.1. Structure of TestChest® 14
   3.2. Assemblies and components 15
   3.2.1. Active element 15
   3.2.2. Calboard 16
   3.3. Accessories 17
4. Transport / Storage 18
5. Installation and startup of theTestChest® 19
6. Operation (normal operation) 23
   6.1 Device power-on and power-off 23
   6.2. Basic Control software 23
   6.2.1. Main menu 23
   6.2.2 Changing lung parameters 25
   6.2.3 Configure the Patient and Breath Library 30
   6.3. Operation with CO2 32
   6.4. Operation with oxygen 32
   6.5. Operation with oximeter simulator 33
   6.6 Calibration 34
7. Contact addresses 35

1. User information

1.1. Purpose of document and applicability

These operating instructions describe the functioning, proper installation, operation, maintenance, and repair of TestChest®. They contain important information for the safe and efficient use of TestChest®.

The appendices to these operating instructions are part of this document.

1.2. Difference to earlier versions

TestChest V3 features the same functionality as earlier versions. There are no new risks or safety concerns and the same maintenance and repair procedures apply.

However, the following features were added:

Feature	**V2**	**V3**
Measurement Stream	50 per second	100 per second
Lung collapse time constant	same as Lung recruitment time constant	can be adjusted independent off Lung recruitment time constant
SpO2 in apnea	SpO2 remains unchanged	SpO2 is reduced by 0.1 precent points per second down to 70% saturation, and increased at the same rate if apnea is resolved. Apnea is defined as volume change smaller than 50ml per 30 seconds.
Total compliance when lung is recruited	constant, always corresponds to entered value	is increased when lungs are recruited and decreased when lungs are collapsing (see formulas below)
Service diagnostics	accessible via USB port	accessible via USB port, enhanded according to description given in the Service Manual
Pressure sensors	Ranges: -30..75mbar (Palv); +/- 250mbar (Paw)	Ranges: +/- 160mbar

You enter the following parameters via the user software (Parameter definitions see Chapter 6.2):
Total Compliance, Crs(entered)
FRC at ZEEP , FRCmin
FRC predicted (FRpred), (depends on size of simulatetd patient)

The above parameters are used to calculate the expected compliance at fully recruited lungs Crs(expected):

Crs(expected) = Crs(entered)/FRCmin*FRCpred

Finally, the actual total compliance is calculated as follows:

Crs(actual)= Crs(expected)/FRCpred*(FRCmin+RecruitedVolume)

where RecruitedVolume is the actually recruited lung volume, gained by increasing the inspiratory pressure above the entered threshold (Minimal recruitment pressure) for a sufficient amount of time. «Sufficient amount of time» is defined by the «Time constant recruitment» . The maximal value of Crs(actual) is Crs(expected).

IMPORTANT: Crs remains unchanged if the «Minimal recruitment pressure» is set high enough so that it is never reached.

1.2. Safety information

DANGER	
	Indicates an imminent danger. If the information is not followed, death or serious bodily injury (disability) will result.

WARNING	
	Indicates a potentially dangerous situation. If the information is not followed, death or serious bodily injury (disability) may result.

CAUTION	
	Indicates a potentially dangerous situation. If the information is not followed, property damage or minor to moderate bodily injury may result.

Note useful tips or tips to prevent possible property damage:

NOTE	
	Indicates general notes, helpful user tips, and work recommendations, but which have no effect on personnel safety and health. Emphasizes tips, recommendations, and information for efficient and trouble-free operation.

Note major property damage (alternative):

CAUTION	
	Indicates a potential dangerous situation. If the information is not followed, property damage will result. Points out a potentially dangerous situation that can lead to property damage when not avoided.

2. General safety instructions

2.1. Introduction and intended use

TestChest® was developed to simulate the human heart and respiratory system for teaching and training purposes. It can be used either as a stand-alone skill training station or integrated into a full-scale patient simulator.

TestChest®® is further intended to check the functions of ventilators, CPAP devices, and other respiratory support devices in laboratory facilities. In particular, TestChest® permits the testing of closed-loop controlled ventilators for exhaled CO_2 and SpO_2. Tests described in ASTM 1100, EN 794-1, and IEC/ISO 60601-1-10 can also be performed with TestChest®.

This new lung model supports the agile development process, the relevant regulatory design and manufacturing testing; functional testing for hospitals and bioengineering, and functional testing of respiratory support devices. In addition, TestChest® can be used to verify specifications of lung function equipment, including measurements of tidal volume, lung elasticity, V'CO_2, and P0.1.

Unlike existing devices, TestChest® can test not only respiratory mechanics and spontaneous breathing functions, but it also features the following:

1. Remote-controlled respiratory mechanics (resistance, elasticity, spontaneous breathing activity, leakage)
2. Programmable FRC and non-linear (sigmoidal) elasticity curves.
3. Different types of spontaneous breath with operator-adjustable respiratory rate and ventilation performance.
4. Hemodynamic interaction models allow the testing of closed-loop controlled ventilators with the provision of SpO_2 and pulse pressure variation (POPv) as appropriate in response to the ventilator setting.
5. Compatibility with wet gases.
6. Calibration based on national standards, due to the detachable Calboard module, which includes all the sensor components.

TestChest®® is designed for the following uses:

7. Interaction with commercially available ventilators.
8. TestChest®® is a table model and must be operated in a horizontal position. e.g., on a table, operating table, examination table, or the like.

The front board corresponds to the end of the upper respiratory tract, with a connection to the airway, a manually adjustable leakage valve, a CO2 connection, an Ethernet jack for connection to a PC, a USB port for service purposes, and a jack for connection of the artificial finger, that is, the pulse oximeter simulator.
The power cord connector and main switch are mounted on the rear panel.

WARNING	
	Warning, TestChest® may not be used: - In humid and wet areas. - At temperatures below 5°C or above 50°C - In the vicinity of flammable materials - In the vicinity of explosive materials - In heavily polluted or dusty environements - In harsh environments (for example, salty environments) - With humidification

2.1.1. Important information/restrictions

The design of TestChest® is state of the art, and it is based on recognized safety rules. The following general residual risks should be considered when using the device. Other residual risks are described in the following chapters.

WARNING

Make sure that the fan opening is not covered.
Make sure that the fan can not be blocked.

Blocking or covering the fan may result in a dangerous concentration of oxygen within TestChest®, which can result in a fire hazard.

WARNING

Warning: TestChest® can be contaminated by previously connected fans.

WARNING

Warning: Never operate TestChest® without the housing completely closed and secured.
Danger from electric shock or moving parts.

WARNING

Warning: If CO_2 is used with TestChest®, make sure a proper exhaust is guaranteed. Never use CO_2 as a drive gas.

CAUTION

Caution: At startup, TestChest® performs an initialization maneuver before it is ready for operation, resulting in a strong movement of the bellows. High pressures during this maneuver may damage any devices connected to TestChest®. Before starting up TestChest®, check that all devices are disconnected from TestChest® and that nothing is connected to the airway connector.

NOTE

Perform regular leak and functional tests on TestChest®. The test intervals are specified in the Service and Maintenace Manual, Chapter

2.1.2. Technical specifications

Dimension		Unit
Length	685	mm
Width	292	mm
Height	202	mm
Weight	16	kg

Electrical and pneumatic supplies		Unit
Voltage	110/230	VAC
Frequency	50/60	Hz
Wattage	520	W
CO_2 supply	Max. 4	bar

Parameter	Range	Unit
Total compliance	8 to 60	ml/mbar BTPS
Measured FRC	300 to 4000	ml
Spontaneous breathing activity (P0.1)	0 (passive patient) to 15	mbar/100 ms
Spontaneous breathing frequency	0 (apnea) to 100	/min
Upper and lower inflection points	0 (no inflection point) to 100	mbar
Chest wall compliance	3 to 200	ml/mbar
Predicted FRC (according to physiological model)	100 to 4000	ml
Alveolar pressure	+/- 160	mbar
Airway pressure	+/- 160	mbar
Bellows, measured temperature	0 to 50	°C
Measured barometric pressure	800 to 1100	mbar
End-expiratory lung volume	Approximately 500 to 4000	ml
Breath volume	1 to 2500	ml BTPS

Options	Range	Unit
CO_2 production	0 (no CO_2 production) to 500	ml/min STPD
SpO_2 simulation	80 to 100	%
Pulse rate	20 to 300	bpm
Plethysmograph. variation of the SpO_2	-30 to 100	%
Leakage	3 leak sizes, manually	Arbitrary
Cardiac output	500 to10000	ml/min
Dead space	approximately 175, 190, 205	ml
FAO_2	0 to 100	vol %
Raw	Rp5, Rp20, Rp50, Rp200	hPa/-(L/s)

Interfaces			
Airway connector: 22M-15F, compliant with EN/ISO 5356-1			
Ethernet connection: J45 jack			
Pulse oximeter simulator (artificial finger): DB9 receptacle			
Service connection: USB connector			
Analog output: DB9 header			

The Declaration of Conformity is located in the appendix to these instructions.

2.2. Reasonably foreseeable misuse

Use of the device other than that specified under "intended use" constitutes improper use and is prohibited. Any other use requires consultation with the manufacturer.

Modifications/changes:
Unauthorized modifications and changes to TestChest® void any warranty by the manufacturer.

Spare and consumable parts and supplies:
The use of spare and consumable parts from third parties can be hazardous. Use parts from the original manufacturer-only.

2.3. Responsibility of the operator

The operator shall permit the use of the device only by people who:
1. Are familiar with basic rules of workplace safety and accident prevention
2. Are trained to work on the device
3. Have read and understood these operating instructions.

2.4. Staff responsibilities

All persons who work on the device must:
1. Observe the basic rules of workplace safety and accident prevention,
2. Have read, understood, and observe the safety notices in the safety chapter of this manual.

2.5. Staff qualifications

Persons Activity	Specially trained operators	Persons with specialized training (mechanical /electrical engineering)
Transport	X	X
Installation	X	X
Troubleshooting and fault elimination	--	X
Operation	X	X
Service	--	X

Legend: X Permitted -- Not permitted

2.6. Safety and protective devices

TestChest® may be operated only with an appropriate, completely closed housing. Otherwise, further operation is prohibited.

3. Description of TestChest®

The Test Chest includes two bellows (which are driven by a linear motor); sensors for alveolar pressure, airway pressure, and environmental pressure; a temperature sensor; and a real-time clock.

Optionally available are:

Intrapulmonary oxygen sensor, mass flow controllers for proportioning CO2, an "artificial finger" for simulation of the pulse oximetry signal; and programmable dead space volume, leakage, and variable airway resistance (during operation).

Front view:

Rear view:

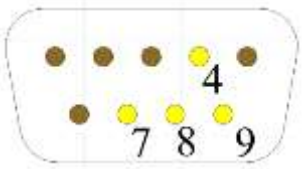
1	Airway connector, connection to the ventilator
2	Manually adjustable valve for leakage
3	CO_2 connector, tube Ø 4 mm
4	Leakage outlet
5	DB9 connector for analog output
6	J45 connector for Ethernet
7	USB-B connector for service
8	DB9 connector for pulse oximeter simulator
9	ON/OFF switch
10	Fuse (10 A)
11	Low power device panel connector C14

DB9 connector for analog output

Ppl	pPleural Druck	-50	-	100	mbar
Palv	alveolar pressure	-20	-	100	mbar
Pmusc	muscular activity	-50	-	50	mbar
VL	tidal volume	0	-	5	Liter

Pin configuration for analouges output DSUB9/m is as follwing:

- Pin 4: Ppl
- Pin 7: Palv
- Pin 8: Pmusc
- Pin 9: VL

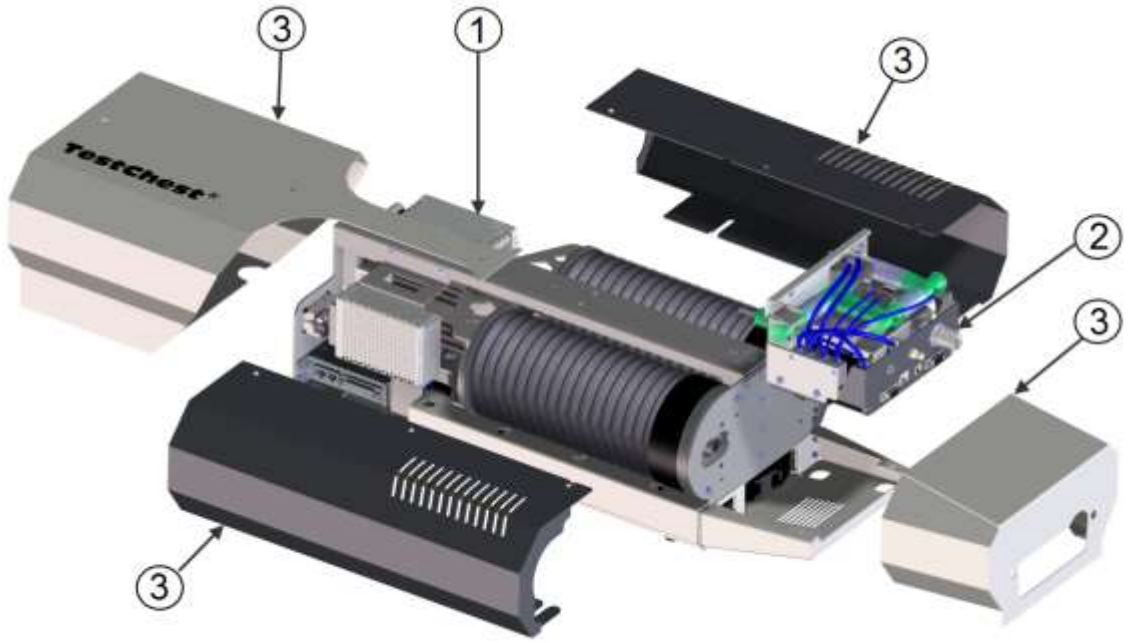


The residual pins are GND
Voltage range DAC: 0 - 3.3V

3.1. Structure of TestChest®

TestChest® consists of three modules:

1	**Active element** This includes the base frame with the structural elements for the drive: the drive for the horizontal movement of the bellows as well as the entire electrical supply.
2	**Calboard** The Calboard includes connector sockets, actuators, sensors, and electronics
3	**Housing** The housing consists of four parts and protects the operator from electrical and mechanical hazards

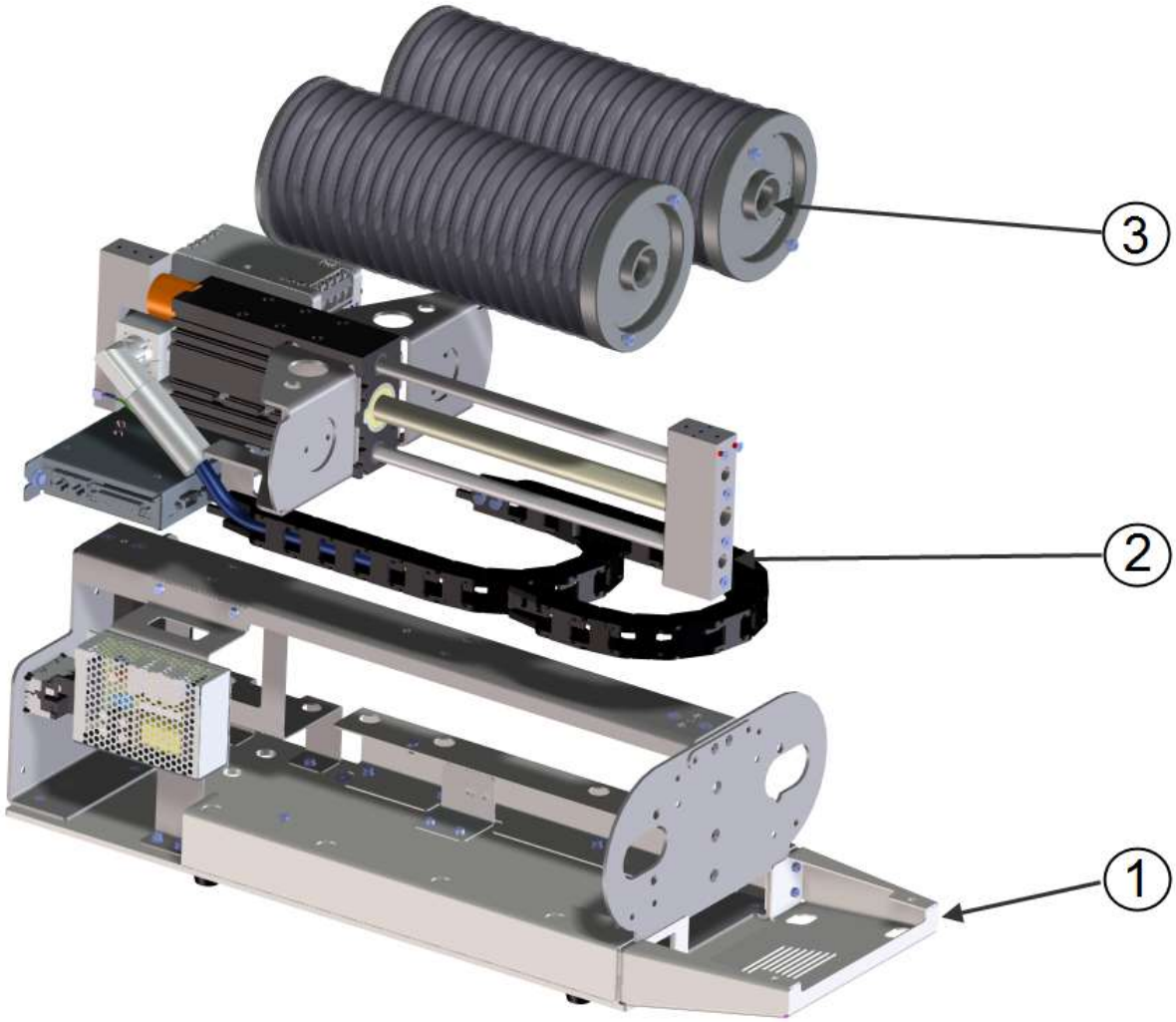


3.2. Assemblies and components

3.2.1. Active element

The active element consists of the following components

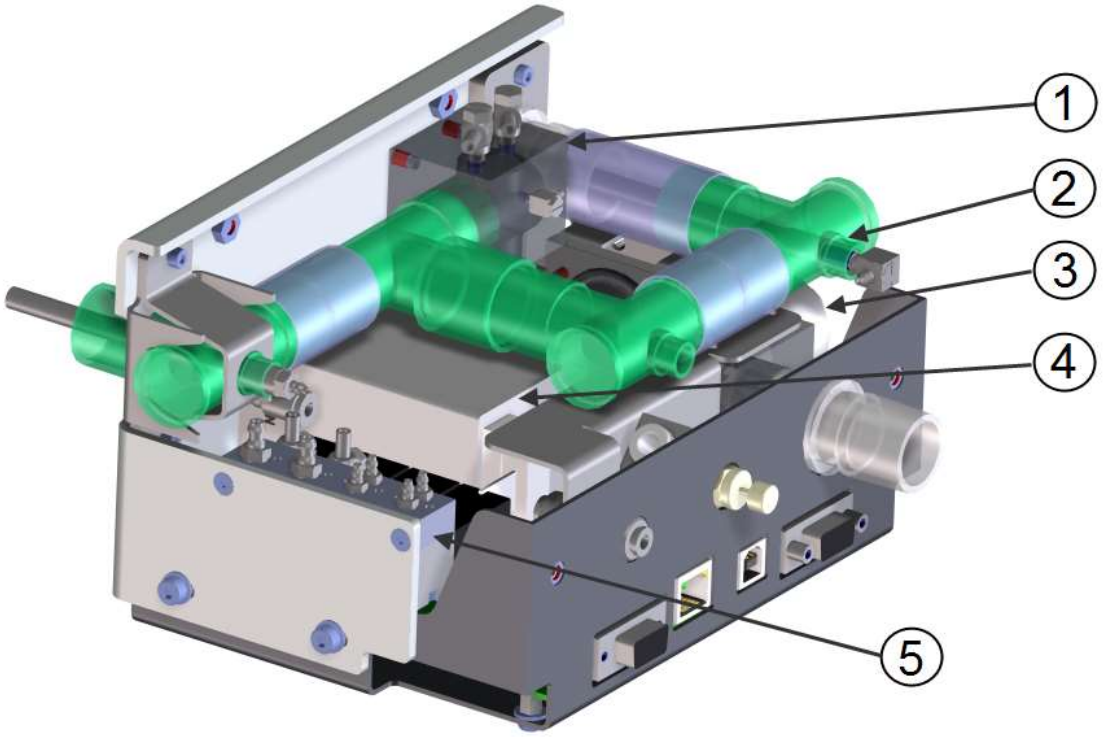
1	**Base frame** The base frame provides the structural basis for the mechanism and the housing.
2	**Drive** The drive is carried out by a linear motor, which is guided by two parallel rods.
3	**Bellows** The two bellows hold up to 4.5 l volume, mirroring the lung volume.



3.2.2. Calboard

The Calboard consists of the following components:

1	**Flow restrictor** The flow restrictor or airway resistance may be adjusted during operation to these fixed sizes: Rp5, RP20, RP50, and RP200.
2	**Dead space** Dead space can be adjusted via control valves to three levels.
3	**Oxygen sensor** The oxygen sensor measures the oxygen content of the respiratory gas that is reduced by the insufflated CO_2. (This is how oxygen consumption is simulated.)
4	**Mass flow Controller** The mass flow controller controls the intake of CO_2.
5	**Leakage** Leakage is controlled through valves, and the level is also manually settable.



3.3. Accessories

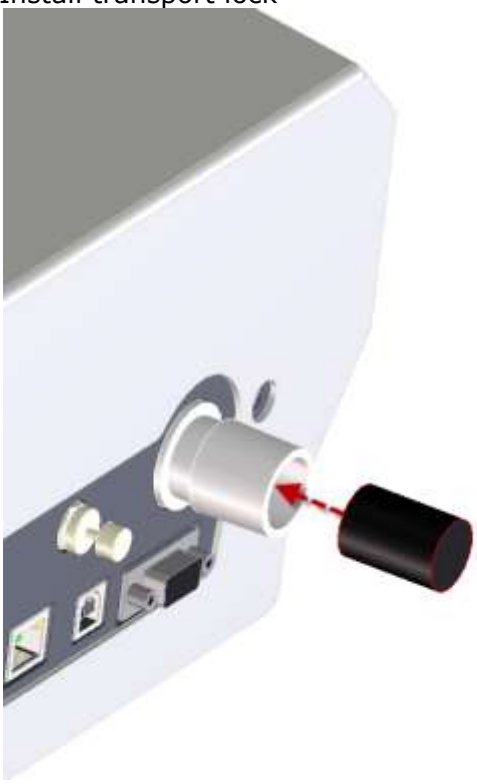
	**OxSim** OxSim is a pulse oximeter simulator. This processes the parameters set on the PC for heart rate, oxygen saturation, and perfusion index, and it and generates the applicable signals.
	**OxSim cable** The data cable between TestChest® und OxSim, including the electrical supply for the OxSim
	**Basic Control operating software** Communication software, to control TestChest® based on the operator-adjustable parameters and to display parameters measured by TestChest®.

4. Transport / Storage

For transport purposes, it is essential that TestChest® flow restrictor be set to RP200. In addition, the Basic Control software must be shut down/terminated and then TestChest® powered off. This prevents the linear motor from becoming misaligned.

As an additional security measure during transport, a transport lock can be installed in the airway opening to prevent undesired movement of the linear motor.

Install transport lock



Transport lock

CAUTION	
⚠	Caution: If TestChest® is not turned off in the correct order (that is, first turn off the Basic Control program, then power down TestChest®) and/or no transport lock is fitted to TestChest®, damage to TestChest® may result.

Adequate stable and padded packaging is necessary to protect TestChest® from damage during transport. Organisms GmbH offers an optional carrying case for TestChest®.

Storage:

Keep TestChest® in a dry place at room temperature between 5°C and 40°C.

5. Installation and startup of theTestChest®

Step 1

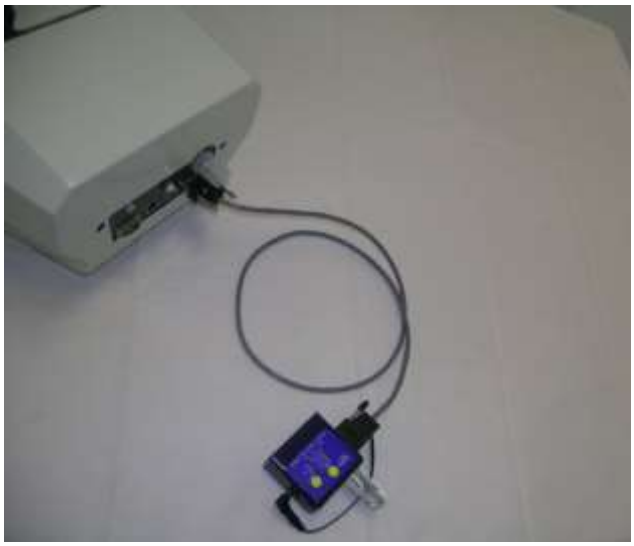
Place TestChest® in a horizontal position, e.g., on a table, operating table, patient examination table, or the like.

NOTE	
	TestChest® is a table model and must be operated in a horizontal position. Otherwise, measurement or simulation errors may result.

Step 2

Connect the power cord to TestChest®.

Step 3



Connect the OxSim to TestChest® with the supplied cable, as shown.

NOTE	
	TestChest® supplies electrical power to the OxSim. The OxSim is not required to run on batteries while connected to TestChest®. Turn the OxSim ON/OFF switch to the OFF position.

Step 4

Connect the laptop to TestChest® with a RJ45 patch cable (Ethernet).

NOTE	
	Requirements for the laptop: Microsoft Windows 7 operating system

Step 5

Install on your laptop and run the Basic Control software (TestChest®Projekt.exe) on the CD-ROM that was delivered with your TestChest®.

CAUTION	
	Caution: At startup TestChest® performs an initialization maneuver before it is ready for operation, resulting in a strong movement of the bellows. High pressures during this maneuver may damage any devices connected to TestChest®. Before starting up TestChest®, check that all devices are disconnected from TestChest® and that nothing is connected to the airway connector.

Step 6

Turn on TestChest® by pressing the power switch. After a short initialization phase, TestChest® is ready for operation.
The first time you use the ChestTest, a calibration of the TestChest® is absolutely necessary to achieve the desired operation accuracy. The calibration process is described in Chapter 6.6 Calibration or in the Service Maintenance Manual, Chapter 4.4, Calibration. The calibration of TestChest® takes about 5 minutes. After calibration, TestChest® is ready for use. To maintain the desired level of accuracy, calibrate TestChest® at the intervals given in the Service Maintenance Manual Chapter 4.4.

Step 7

Connect TestChest® with the respirator. The simulation can be started

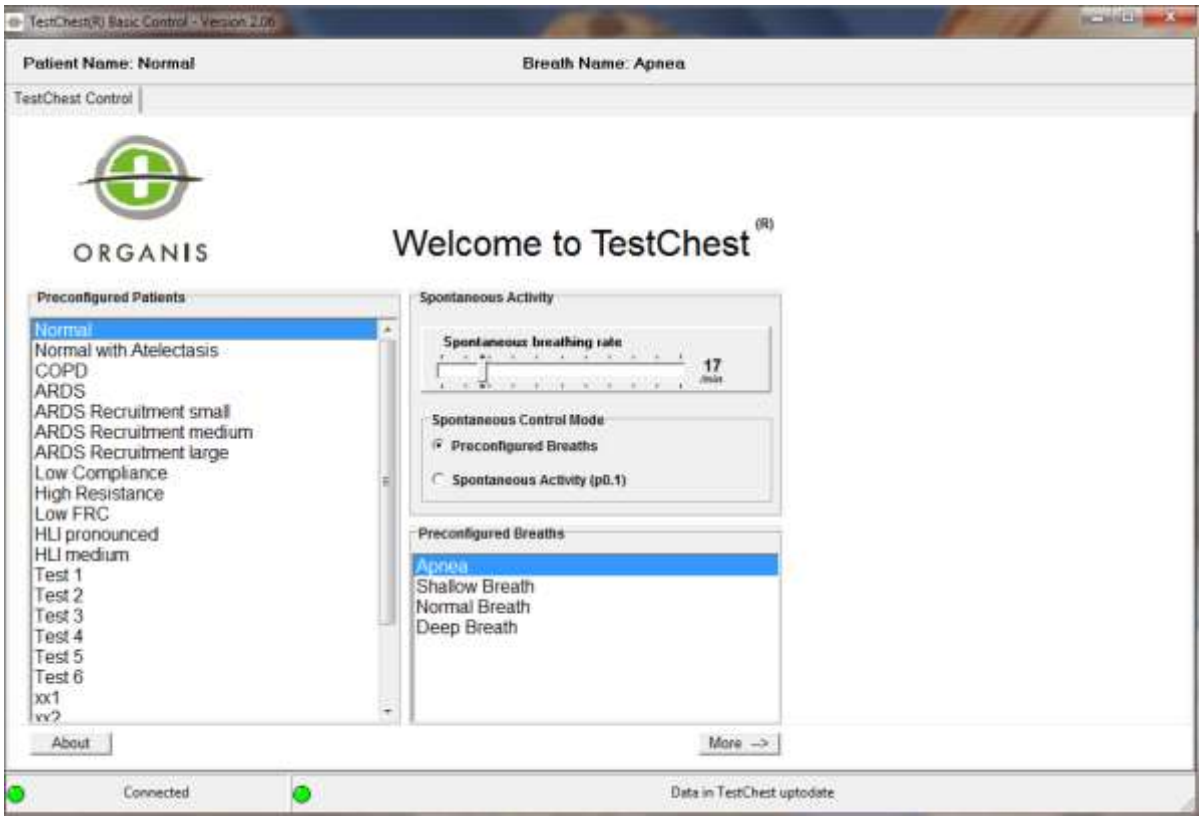
6. Operation (normal operation)

6.1 Device power-on and power-off

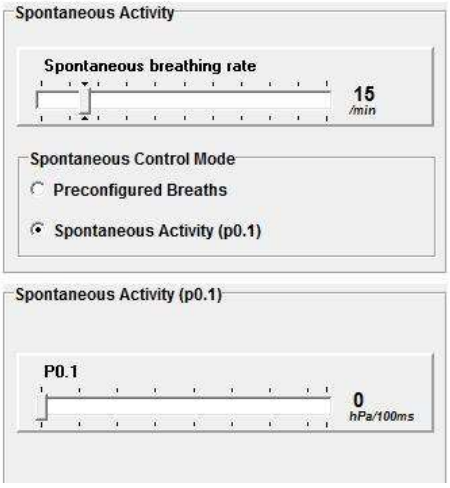
6.2. Basic Control software

6.2.1. Main menu

As soon as the Basic Control software starts, it automatically establishes communication with TestChest®. In addition, TestChest® must be turned on and connected according to the above steps. By default all TestChest® parameters are set to reflect the conditions of a healthy, fully relaxed patient without spontaneous breathing. These are the "Normal Stable" parameters. The communication status is indicated by two LED indicators. The left-hand LED has three states: green indicates normal communication with TestChest®. During calibration, this LED is purple. If communication errors occur, the display turns red. Then follow the instructions in the message field. When the right-hand LED remains green, it indicates that TestChest® has loaded all current parameters. If several parameters are changed, the LED is dark green and it blinks until all parameters have reached their predefined target values, after which the message box displays "Data Loading". When errors occur, this indicator turns red and error messages are displayed in the corresponding message field, with instructions for troubleshooting.



From the main menu, the user can, by simply clicking, select from six preset patients with predefined sets of parameters corresponding to the relevant disease state. The name of the selected patient is displayed in the title bar of the window. If required, advanced users can create their own sets of parameters (described in Chapter 6.2.3), which are then also available for selection from the main menu.
Additionally, a selection of predefined spontaneous breaths is available, which vary in strength of patient effort and duration. The user can select one by simply clicking on the desired selection.
Via the Button "Spontaneous Activity (P0.1)" the spontaneous activity can be a adjusted manually in frequency und force.

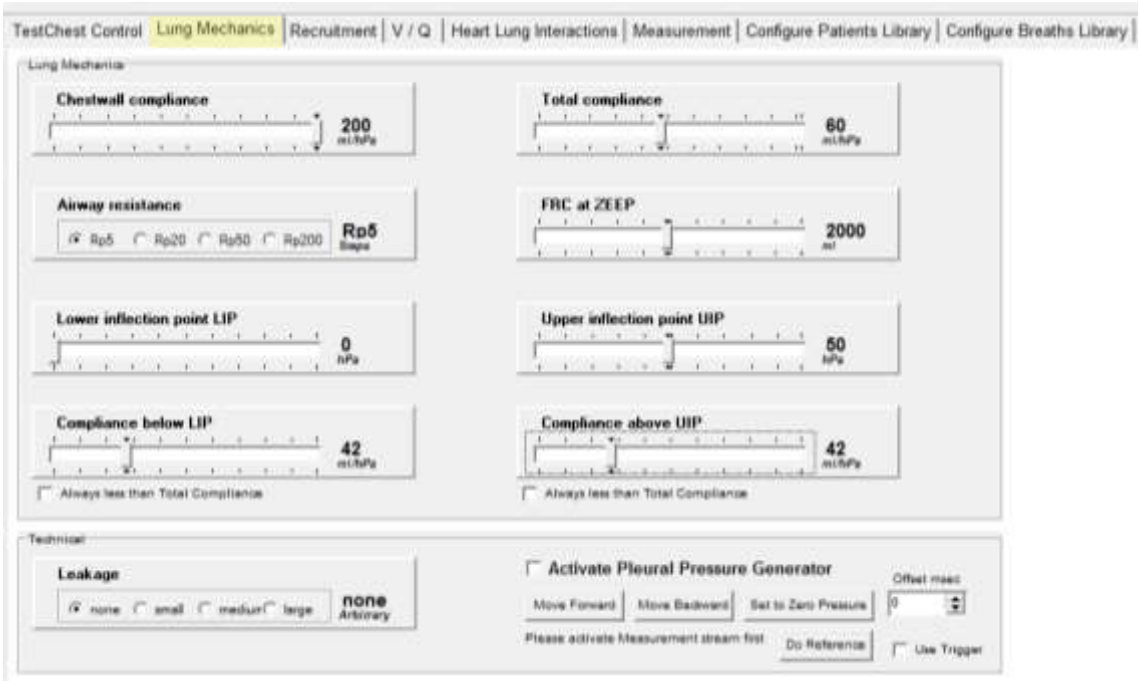


6.2.2 Changing lung parameters

Tabs labeled "Lung Mechanics", "Recruitment", "V/Q", and "Heart Lung Interaction" provide access to parameters, which can be separately adjusted using sliders or radio buttons. Individual measured parameters can be accessed for recording and graphical display through the "Measurement" tab.

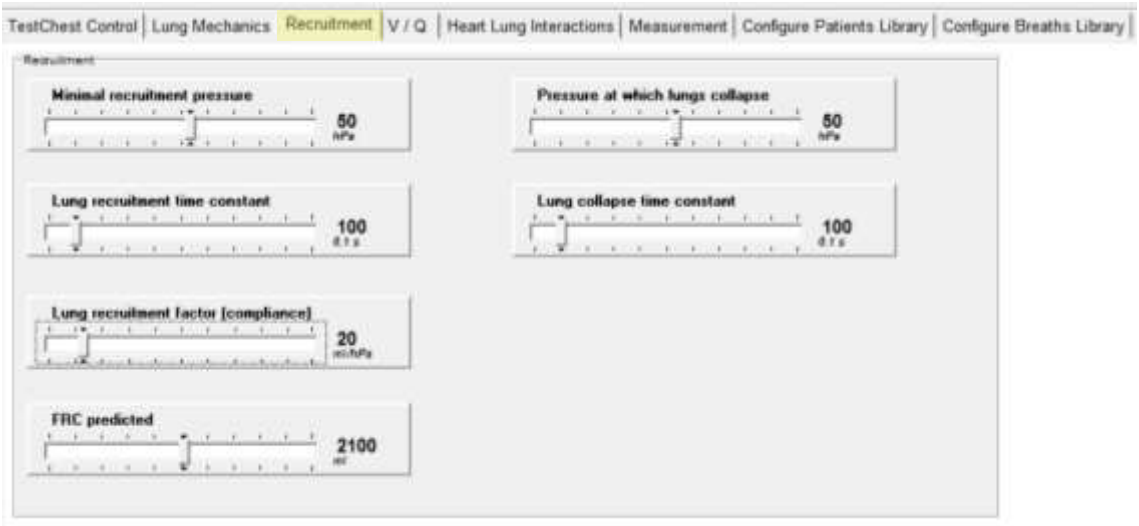
The "**Lung Mechanics**" tab provides for adjustment of the following parameters:

Parameter	**Explanation**
Chestwall Compliance	Distensibility of the chest wall. The compliance reflects the change in volume with a change of the applied filling pressure. The lower the compliance of the chest, the stiffer it is.
Total Compliance	Overall extensibility. In addition to the compliance of the chest, the elasticity of the lung is also taken into account.
Airway Resistance	The physiological state of the respiratory tract, particularly the respiratory muscles of the airways, is modified by varying airway diameters, which correspond to different airway resistances.
FRC at ZEEP	Functional residual capacity (the volume of air remaining in the lungs after normal expiration) without additional end-expiratory pressure (zero end expiratory pressure).
Lower Inflection point LIP	Lower inflection point in a pressure-volume graph
Upper inflection Point UIP	Upper inflection point in a pressure-volume graph
Compliance below LIP	System compliance during the opening of the alveoli, that is, below the lower inflection point
Compliance above UIP	Compliance of the system during the hyperinflation of the alveoli, that is, above the upper inflection point
Leakage	Leakage, that is, system leak



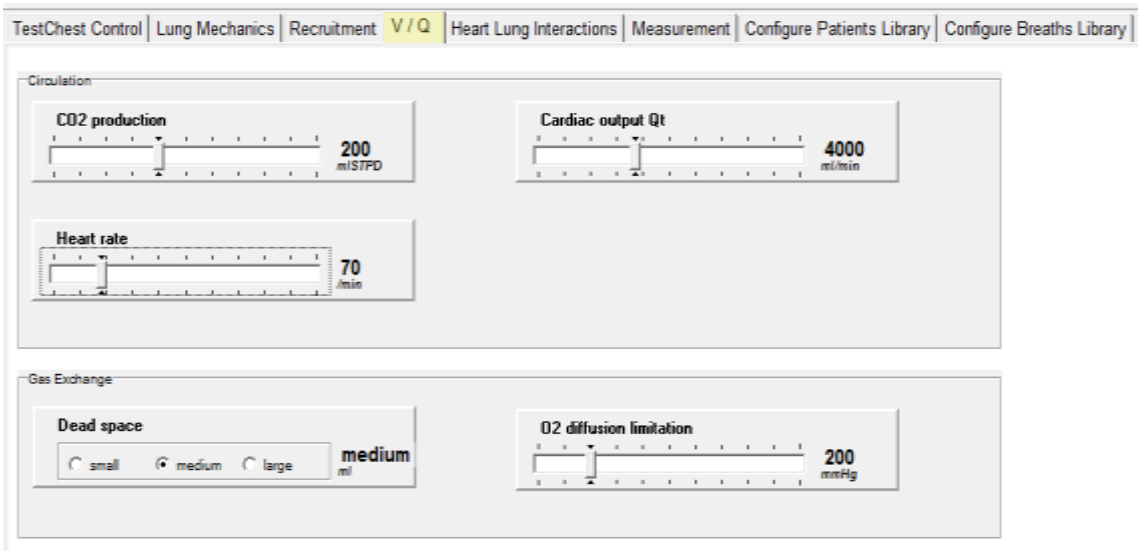
The "**Recruitment**" tab provides for adjustment of the following parameters:

Parameter	Explanation
Minimal recruitment pressure	Above this pressure, alveoli open, that is, recruitment of the alveoli takes place
Pressure at which lungs collapse	Below this pressure, alveoli collapse
Lung recruitment time constant	Reflects how long it takes for the alveoli to open (with a change in pressure above the opening/recruitment pressure).
Lung collapse time constant	Reflects how long it takes the alveoli to collapse (with a change in pressure below the lung collapse pressure).
Lung recruitment factor	Compliance during recruiting
FRC predicted	According to the predicted FRC of the physiological model, the difference betwen the actual FRC, that is, the FRC at ZEEP, strongly influences oxygenation.



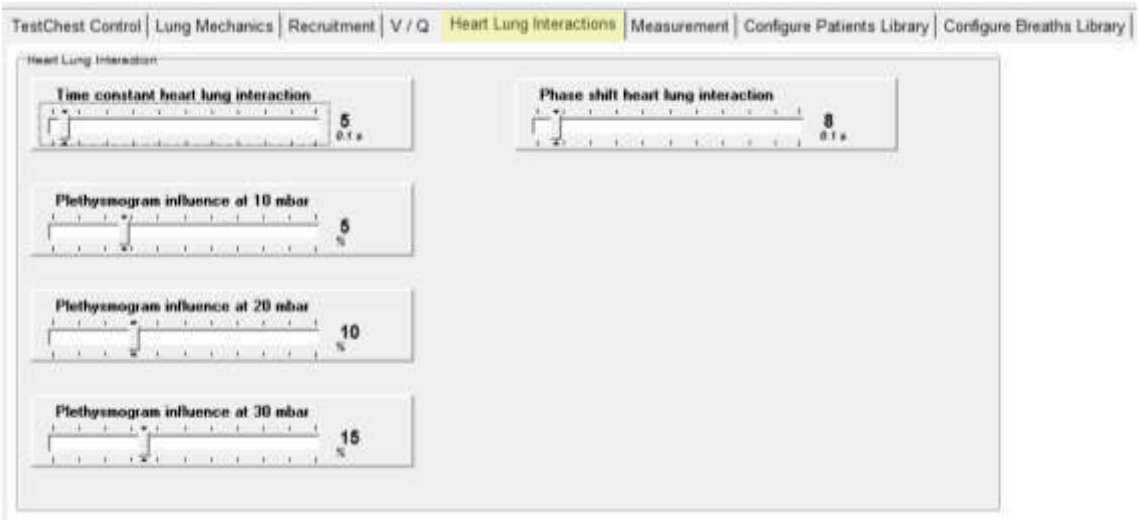
The "**V/Q**" tab provides for adjustment of the following parameters:

Parameter	Explanation
P0.1	Also known as mouth occlusion pressure, it reflects the strength of an inspiratory effort.
Spont. Respiratory Rate	Frequency of spontaneous breathing.
CO_2 Production	Rate of production of CO_2 by the metabolism of O_2 in the human lung (gas exchange).
Cardiac output	Cardiac output is calculated as the product of heart rate and stroke volume.
Heart Rate	Heart rate.
Dead Space	Dead space volume, that is, volume that is not involved in gas exchange in the human lung.
O_2 diffusion limit	This value, a quotient of alveolar oxygen partial pressure, directly influences the effective O_2 partial pressure, which in turn influences oxygen saturation.



The "**Heart Lung Interaction**" tab provides for the adjustment of the the following parameters:

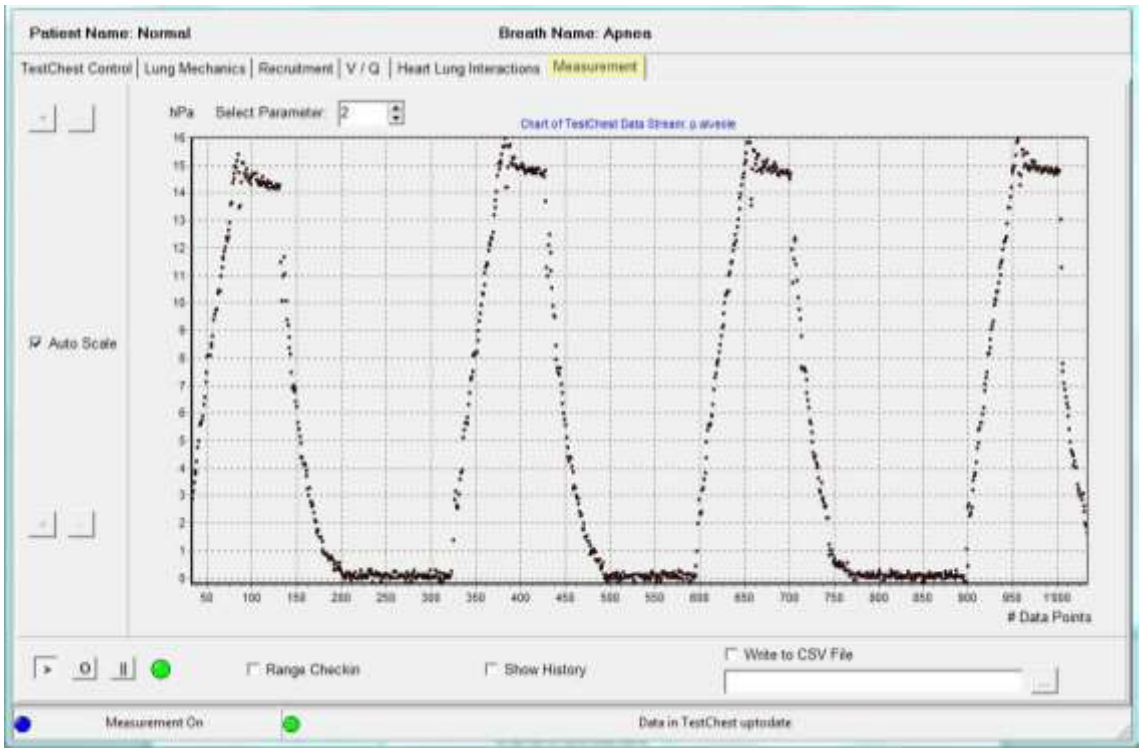
Parameter	Explanation
Time constant heart lung interaction	Reflects the time dependence and absorption, with which the heart responds to thoracic pressure, which is in turn influenced by respiration.
Phase shift heart lung interaction	The phase shift indicates the time delay of the interaction between cardiac and thoracic pressure relationships.
Plethysmogram Influence	Influence of heart-lung interaction in the plethysmogram (pulse pressure variation POPv) at various pressures of Pcardio. Pcardio is derived from the pleural pressure and the time constants
at 10	At Pcardio < 10 mbar
at 20	At Pcardio between 10 mbar .. 20 mbar
at 30	At Pcardio >30 mbar



The "**Measurement**" tab allows the user to determine which of the following parameters will be collected and graphically depicted:

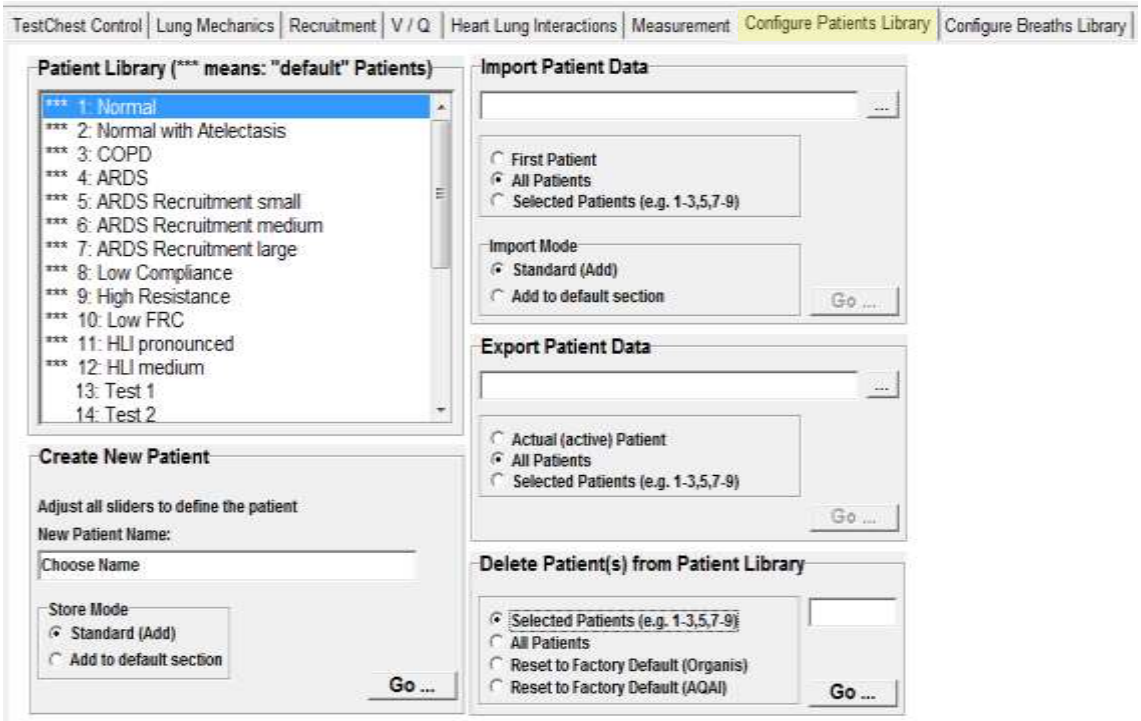
No.	Parameter	Explanation
0	Flow	Flow
1	Lung Tidal volume	Tidal volume of the lungs
2	p alveole	Alveolar pressure
3	Airway pressure	Airway pressure
4	Bellows position	Bellows position
5	Intrapleural pressure	Intrapleural pressure
6	Cardial pressure	Cardiac pressure
7	Fraction of O_2 inspir	Fraction of inspired O_2
8	Ambient pressure	Atmospheric pressure / ambient pressure
9	Temperature in °C	Temperature in °C
10	FRC actual	Current functional residual capacity
11	Shunt fraction	Shunt fraction
12	Partial pressure O_2 chamber	Partial pressure of O_2 in the chamber
13	Partial pressure O_2 effective	Effective O_2 partial pressure
14	Oxygen sat. pulm. capillaries	Oxygen saturation of pulmonary capillaries

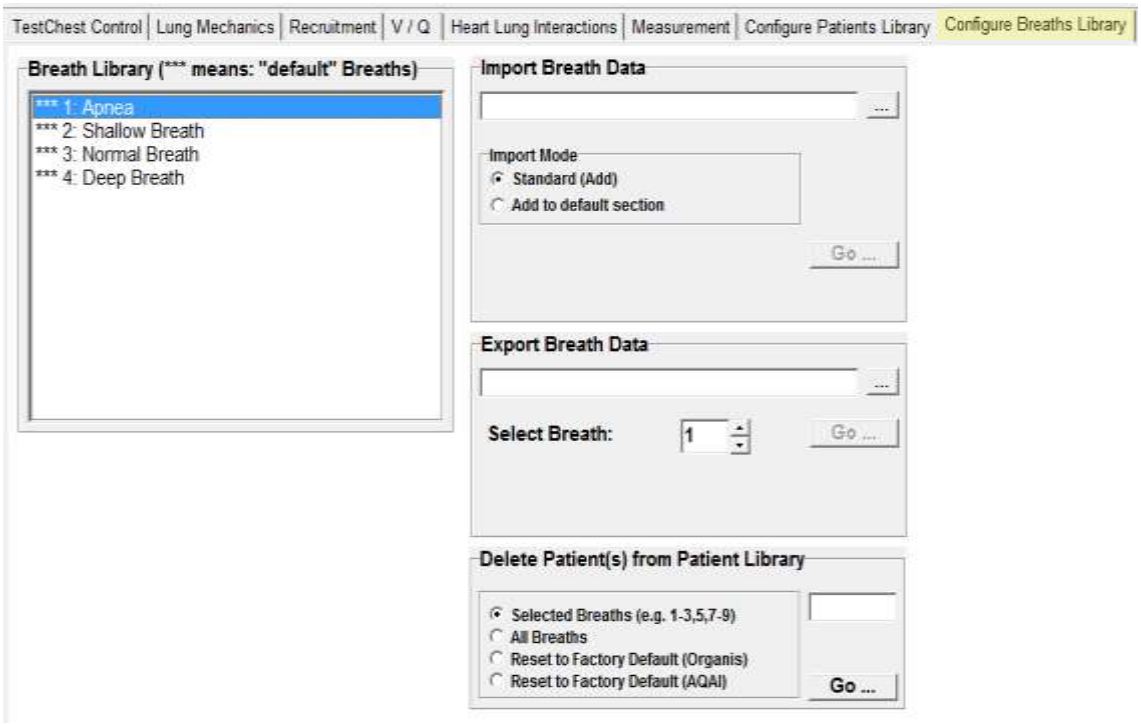
As an example, a pressure alveole measurement of the lungs is shown below. The individual measured parameters can be selected through "*Select Parameter*".



6.2.3 Configure the Patient and Breath Library

Full access to the sliders to change lung parameters is password protected for security purposes, to prevent misuse. The experienced user may, in administrator mode, save changes to lung parameters so that they will be available to all users through the main menu. However, this requires a separate password, which can be entered through the main menu using the "*More →*" button. To avoid unnecessary password entry, the administrator can also enter the password directly at the highest security level. All related tabs are then released.
When saving the data in each case, the total configuration, that is, the states of all individual pulmonary parameters, is stored. This requires that all lung parameters be set to the desired state. Then the name of the desired configuration can be entered through "**Choose Name**", at New Patient Name: The button "***Go…****" at Create New Patient* permits the entire configuration to be stored to the patient name entered. It is not possible to override the predefined patients; different patient names must be assigned. User-supplied patient profiles can be overwritten. Further you can import and export patient data. Also you can delete any kind of patient data acc. to you selection.




TestChest Control
Lung Mechanics
Recruitment
V / Q
Heart Lung Interactions
Measurement
Configure Patients Library
Configure Breaths Library
Breath Library (*** means: "default" Breaths)
*** 1: Apnea
*** 2: Shallow Breath
*** 3: Normal Breath
*** 4: Deep Breath
Import Breath Data
Import Mode
Standard (Add)
Add to default section
Go ...
Export Breath Data
Select Breath:
1
Go ...
Delete Patient(s) from Patient Library
Selected Breaths (e.g. 1-3,5,7-9)
All Breaths
Reset to Factory Default (Organis)
Reset to Factory Default (AQAI)
Go ...

6.3. Operation with CO_2

DANGER	
	DANGER OF SUFFOCATION. Use only in well vented rooms. Use a monitoring device to check for excessive build-up of CO_2. Use only certified bottles and pressure reduction equipment.

For the gas supply of CO_2 it can be used either a transportable gas container or a wall socket of a central CO_2 supply. It has to be secured that the pressure is limited to max. 4 bar. If you use a gas bottle it is mandatory to mount a pressure reducing valve. In case of a wall socket the main system pressure has to be clarified and when indicated a pressure reducing valve has to be mounted and set to max. 4 bar. Connect the CO_2 supply and TestChest® with a fixed tube (nylon). The connection to TestChest® is suitable for a tube diameter of 4mm, which can be connected simply by plugging in the hose. To remove the hose, simultaneously press on the connector ring and simultaneously pull the hose.
You adjust the amount of CO_2 through the Basic Control software.
TestChest® procre CO_2 only if TestChest® is working, that mean a gas exchange occurs. If TestChest® is inactive, the valve of the massflow controller is closed and the CO_2 delivery is blocked.
For checking the CO_2 delivery, please use a respiratory and read the etCO_2.

6.4. Operation with oxygen

TestChest® is supplied with high oxygen content through the ventilator.
Chapter 2.1.1 explicitly describes the risks associated with elevated oxygen concentrations.

6.5. Operation with oximeter simulator

TestChest® sends the OxSim SpO_2 simulator the current anticipated values (heart rate, oxygen saturation, and perfusion) through the data cable. This generates the signals for the artificial finger. The ventilator's pulse oximetry finger clip is clipped on this artificial finger, and the generated values are transmitted to the ventilator.

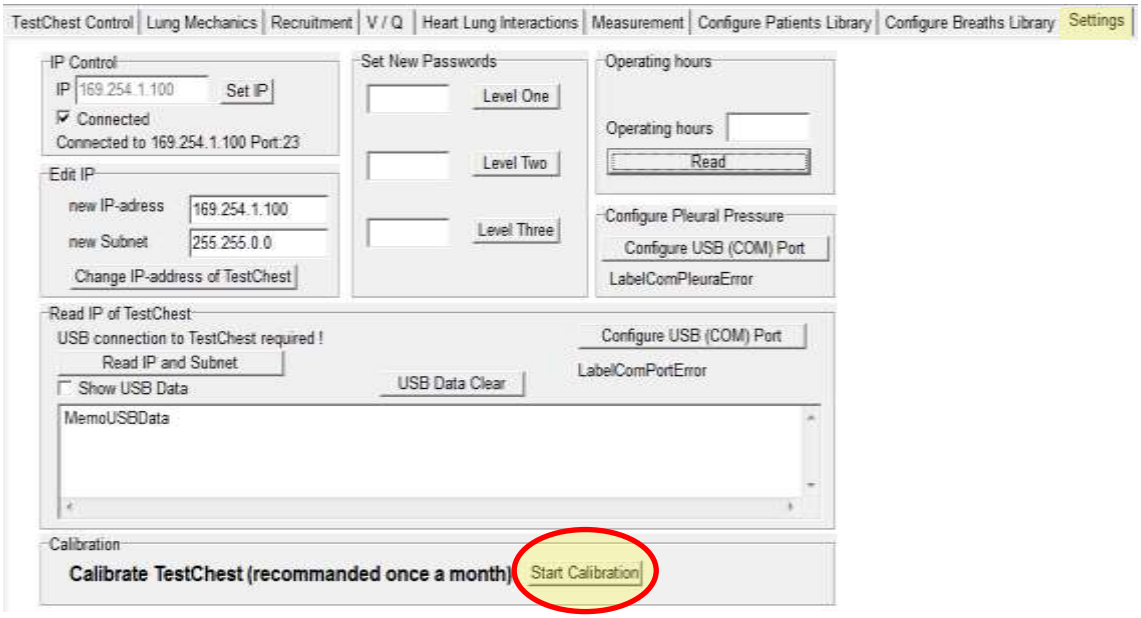
6.6 Calibration

TestChest® must be recalibrated after the following:

1. Installation of new bellows
2. Shipment
3. A prolonged period of non-use
4. Returning from factory calibration (Calboard)

Calibrate TestChest® as follows:

1. Disconnect all hoses from TestChest®, including the CO_2 supply hose and the airway tube.
2. From the Basic Control software, tab ***Settings*** press the "Start Calibration" button.



3. Calibration starts. It takes about 3 minutes.
4. TestChest® is now ready for use.

CAUTION	
	NOTE: Calibration starts, and takes about 3 minutes. Touching and moving TestChest® during this time can affect the accuracy of the calibration.

7. Contact addresses

Developer and manufacturer:

Organis GmbH
Schulstrasse 76
CH- 7302 Landquart

Tel.: +41 (0) 81 / 300 65 80
Fax: +41 (0) 81 / 300 65 81

info@organis-gmbh.ch
www.organis-gmbh.ch

Sales and service:

AQAI Simulationszentrum Mainz
Wernher-von-Braun-Strasse 9
D-55129 Mainz

Tel.: +49 6131 380 75 40
Fax: +49 6131 380 75 49

wh@aqai.de
www.aqai.de

Trinity Trading Co. Ltd.
Unit A, 13/F, Goodwill Industrial Building, No. 36-44 Pak Tin Par Street, Tsuen Wan, N.T.
Hong Kong
Tel: 852-2385 6044
Fax: 852-2770 1508

info@trinity-medical.com
www.trinity-medical.com

neosim AG
Susenbühlstrasse 12
CH-7000 Chur

Tel.: +41 (0) 81 / 252 2131
mobile: +41 (0) 79 / 254 0312

jxb@neosim.ch
www.neosim.ch

8. Declaration of conformity