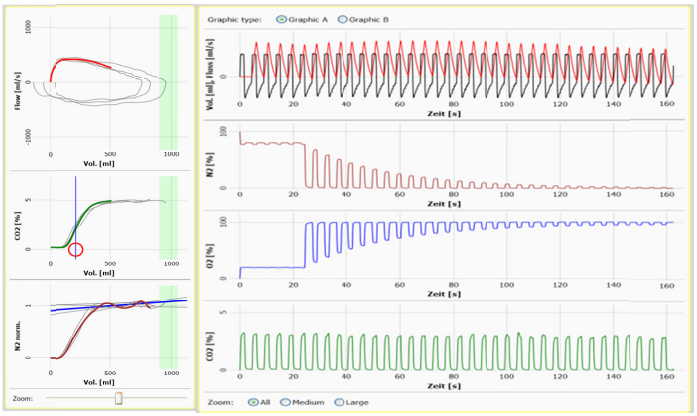
SPIROWARE® 3.x

Detection in an early stage . . . Small Airway Disease – Ventilation Inhomogeneity – Metabolics



Your advantage:

- **Asthma, CF and COPD monitoring**
- **Static lung volumes, LCI, Scond, Sacin, SNIII, alveolar N_2 slope analysis**
- **Multiple breath test from infants to adults**
- **Single breath N_2-washout**
- **Online quality control**
- **Customized reporting**

The most promising lung function technique to monitor the involvement of small airways is the multiple breath washout technique (MBW). It reflects the ventilation inhomogeneity of the lung. It has been shown that MBW is extremely sensitive to detect early structural changes. The new SPIROWARE® 3.x is a flexible software tool for easy performing, analyzing and reporting MBW and single breath (SBW) washout tests. This powerful package is the graphical interface between "ONLINE" quality controlled measurement and transparent documentation of the evaluated data. The future oriented concept fullfils highest requirements of reliability, functionality and easy operation.

Small airway disease/Ventilation inhomogeneity (LCI, Moment Ratios, Slope III Analysis)

Peripheral airway involvement is an established component of respiratory diseases such as asthma, cystic fibrosis (CF) and chronic obstructive pulmonary disease (COPD). The combination of ultrasonic flow meter and new gas-sensors offers now an easy to use clinical setup. Such test has been used for years by research centers only. The application ranges from infants to adults. It offers a new perspective in terms of detecting and following up of "small airway diseases".

Breathing Pattern (TBFVL) / Metabolic Exchange Rate (RQ) /Quality criteria

No re-breathing as well as low breathing resistance are technical essential requirements for a MBW washout test. Monitoring the breathing level and recording the "Breathing on a true FRC" through out the test are additional needs for reliable data recording, not only in small infants. Each application range (infants to adults) has an optimized dead space reduction to consider the ERS/ATS guidelines. Controlling the breathing pattern as well as the RQ is one of the major "online" quality control criteria for the MBW washout test.

Static volumes (FRC), trapped gas volume (V_{TG})

FRC reflects the volume of the lung in direct communication with the airway opening (mouth). The amount of "trapped gas" (V_{TG}) present in non-communicating lung volume compartments can now be reliable detected. Easy and efficient operation is guaranteed by the integrated user guidance. Cooperation of the patient is needed for this type of test.

FRC-Bypass Setup

HIS interface

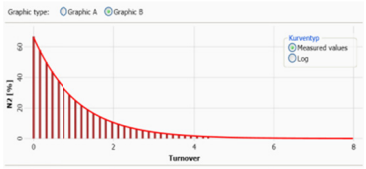
The optional HL 7- interface enables the communication from hospital information system (HIS) and the EXHALYZER D / CLD 88sp with SPIROWARE® 3.x. Patient information and all numerical and graphical results may be transferred to a host computer for centralized data collection and storage.

Specifications SPIROWARE® 3.x

Required Instrument: EXHALYZER D with FRC-Bypass Set up

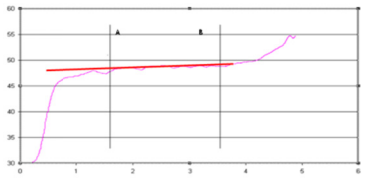
Flow range:	± 0.5 l/s (DSR small, 1.9 ml) ± 1.5 l/s (DSR medium, 7.2 ml) ± 8 l/s (DSR large, 20 ml)
Volume resolution:	0.6 / 1 ml
Principle:	N_2 washout, SF_6 or Helium for infants
Cont. flow:	adjust. up to 1250 ml/s
Sampling frequency:	200 Hz

Multiple Breath Nitrogen Washout



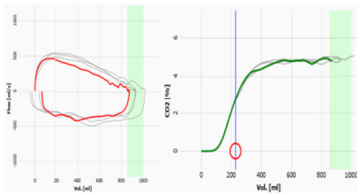
Application:	Infants, children and adults
Range selection:	Automatic
Valve control:	Automatic - flow controlled
Insp. gas:	100% O_2, (inert gas washout optional)
Parameters:	FRC, LCI, $MR_{1/2}$, $V_{dFowler}$, S_{NIII}, S_{acin}, S_{cond}, RQ, $etCO_2$, TBVFL-Indices, compartment analysis
Online Graphics:	versus Time, Breath No. or Turnover (selectable)

Single Breath Nitrogen Washout



Application:	Children and adults (cooperative)
Valve control:	Automatic – flow controlled
Incentive screen:	Flow and Volume (insp. / exp.)
Insp. gas:	100% O_2, (inert gas washout optional)
Phase detection:	Automatic or user selectable cursors
Parameters:	Normalized alveolar N_2 Slope analysis (S_{NIII}) Closing Volume

Tidal Breathing Analysis (TBFVL) and RQ



Application:	Infants, children and adults
Range selection:	automatic
Insp. Gas:	medical air, (others on request)
Parameters:	$V_{dFowler}$, TBVFL-Indices, RQ, $etCO_2$
Algorithms:	ATS /ERS guidelines (IGW standardization)

Database and Reporting

Database:	Microsoft SQL Compact or Express
Application:	Single computer or server-installation
Reporting:	Standard or custom specific reports Rich Text Format (RTF)
HIS – Integration:	HL 7 and GDT (optional)

System Requirements

Pentium i5 Processor or better, Microsoft Windows 7 Prof or higher, NET Framework 4.0 or higher, RS232 Interface, 16MByte RAM, 10GB free space on hard disk, XGA-Graphics or better, USB 2.0 or higher

Ref.: - Gustafsson PM. et al; Novel methodology to perform sulfur hexafluoride (SF6) based multiple breath washin and washout in infants using current commercially available equipment. J Appl Physiol (August 4, 2016). doi: 10.1152
- Robinson Paul D. et al; Inert Gas Washout : Theoretical Background and Clinical Utility in Respiratory Disease. Karger AG, Basel (June 12, 2009).
- Robinson Paul D. et al; Consensus statement for inert gas washout measurement using multiple- and single breath tests. Eur Respir J 2013; 41: 507-522.
- Robinson Paul D., Goldman MD, Gustafsson PM. Inert gas washout: theoretical background and clinical utility in respiratory disease. Respiration 2009;78(3):339-55.

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