

spirometer

above

the standards



MES Sp. z o.o.  
Founded 1993



100% of knowledge,  
passion and experience  
since 1993

LUNGTEST LAB

# LUNGTEST LAB



Lungtest LAB is a stationary advanced modular Pulmonary Function Testing laboratory system from MES designed for whole range of pulmonological tests and is able to perform computer analysis of measurements, operated by any PC with software implemented in any version of Microsoft Windows system. This concept allows practically unlimited implementation of new elements into the PFT system. The Lungtest LAB can be assembled to any requirements and instantly upgraded without having to send it to the manufacturer. Lungtest LAB fully complies with all ATS/ERS standards and is the perfect tool for accurate and reliable data in any hospital department or physician's office.

Measurement system of Lungtest LAB has been designed and constructed on the basis of the MES DV40 pneumotachograph with new developed digital converter. Lungtest LAB is a compact device with a modern design, easily installed on any trolley or a desk. Lungtest LAB owes the perfect functionality to many years of experience of top class engineers-enthusiasts.

## MES DV40 pneumotachograph head with digital converter of air flow

Flow measurement is performed with use of the unique MES DV40 pneumotachograph head patented by MES. Low resistance for flow, small dead space and low weight ensure patient conditions similar to the natural. No moving parts in the headpiece and a complete lack of sensitivity to humidity provide high accuracy and noise immunity. Sterilization of the entire headpiece gives a complete safety to tested subject. We introduced our new invention in the construction of the device which enables to eliminate air hoses,

transmitting a differential pressure signal from our MES DV40 pneumotachograph to a sensor situated in the housing of the device. We developed and patented a flow measuring system with a digital converter of air flow. Its essence is to place pressure sensors with digital converter directly on the MES DV40 pneumotachograph head and transmitting the measured flow signal digital by means of a cable. We can say that we have the digital pneumotachograph now which will be a key element in all of our new devices. This solution also prevents a signal distortion during the transmission over long air hoses and increases the ease of movement of the subject's head.

## Patient's data

Lungtest LAB system allows entering the following patient's data: name, surname, date of birth, weight, height, sex, identification number, the data listed above plus address, place of work, insurer, type of illness, attending doctor, diagnosis, history number, hospital ward, a name of the person carrying out the test.

## Standard tests

Slow spirometry:  
VC, IC, ERV, TV, IRV, MV, BF

## Flow/volume loop:

FEV0.5, FEV0.75, FEV1, FEV2, FEV3, FEV6, FVC<sub>ex</sub>, PEF, MEF75, MEF50, MEF25, MEF@FRC, FEF75/85, FEF25/75, FEF0.2-1.2, VPEF, TPEF, FET, TPEF%FET, MEF50%FVC<sub>ex</sub>, FEV1%FVC<sub>ex</sub>, FEV1%VC, FEV1/PEF, VC<sub>max</sub>, FEV1%VC<sub>max</sub>, FEV1%FEV3, FEV1%FEV6, BEV, BEV%FVC<sub>ex</sub>, TC25/50, MTT, AEX, FVC<sub>in</sub>, FIV1, PIF, MIF50, FIT, TPIF, VPIF, TPIF%FIT, FEV1%FVC<sub>in</sub>, MEF50/MIF50, PEF/PIF, FEV1/FIV1, FET%FIT, TTOT

## Maximal Voluntary Ventilation:

MVV, BF, BR

## Pre/ Post bronchodilatation

When a test is repeated after intake of the medicine, results of the second test are related to the results of the test preceding the medicine intake. Each initial test is marked as PRE and the test following the medicine intake is marked as POST to facilitate interpretation of the recorded results. The software allows automatic evaluation of a diastolic test consistent with ERS.

## Predicted values

Usually the due values are calculated according to ERS but the Lungtest LAB software contains currently 31 authors including GLI, NHANES III, Kuster, Hankinson, Falaschetti

## Data base

Patient data are stored in Microsoft SQL database, providing the flexibility to access, manipulate and report data in multiple ways, as well as transmitting the results to standard statistic programs and net using HL7 protocol.

## Trend reports

Trend reports allow printing and graphing data from previous patient visits so that progress can be monitored.

## Printouts

Lungtest LAB allows printing of the results and comparisons of results in color or black and white in formats designed by the User.

## Full PFT laboratory customised system can be created

Lungtest LAB offers modules for full PFT laboratory giving high-quality measure-

ments and excellent repeatability. A modular design architecture allows to configure Lungtest LAB selecting only the required test features. This solution gives the opportunity to scale at any time to a more complex configuration. Patented main parts of flow measurements and other hardware components allow accurate measurements and fast test procedures.

## Diffusion Single Breath

DLCO module allows to measure the diffusing capacity of carbon monoxide (CO) in the lungs with different test options: single-breath and intrabreath diffusion. The measurement is made possible through the continuous analysis of CO fractions and helium tracer with extremely fast analyzers.

## Intra Breath Method

DLCO is measured at increments of the exhaled volume and does not require a breath hold. This measurement is easier for sick patients.

## Measured parameters:

VCmax, VI SB, VA SB, RV SB, FRC SB, TLC SB, RV SB%TLC SB, FRC SB %TLC SB, TLCO SB (DLCO SB), TLCO SB K (DLCO SB K), (TLCO SB /VA (DLCO SB/VA), KCO, FI CO, FA CO, FI He, FA He, tBH, tsc, TIn, TV, ERV, IRV, IC, Hb, Grade quality

## ISPA-inhalation system for provocation in allergology

Inhalation System for Provocation in Allergology is designed for provocation tests with inhalation of a provoking agent. The unit consists of an operating module and software controlling operation of the unit. The unit allows for accurate determination of a dose inhaled by a patient. Double system stabilizing and controlling the pressure ensures stable nebulization capacity and unchangeability of distribution of generated particles. The unit may operate in the mode of continuous and impulse nebulization controlled by patient's breath. ISPA system allows for automatic control of changing the selected spirometric values, and FEV1 drop allows for calculation of PD20 and PC20.

## Advantages of ISPA:

- the system allows for very precise measurement of the dose absorbed by the patient
- the accurately finished-up, precise measurement method for assessing the breathing stage allows to use the ISPA system during relaxed breathing
- the provocative inhalation examination may be carried out both „Five breaths” and „2 minutes respiration”

■ standard of the provocative inhalation examination with current control of the dose of the provocative agent and analysis of diminishing of the FEV1 and calculation of the values of PD20 and/or PC20 according to the linear and/or logarithmic formula

■ GRS (breathing conductivity), in case of purchasing a measuring option for breathing resistance with occlusion method (RRS)

■ SGAW (specific breathing conductivity of the respiratory system) by Users of the bodyplethysmograph.

## Additional Lungtest LAB modules for constructing of PFT systems

■ ISPA (inhalation system for provocation in allergology)

■ RRS (Respiratory Resistance)

■ Compliance

■ Compliance HB

■ DRT (Diaphragm Relaxation Time)

■ NEP (Negative Expiratory Pressure)

■ CAPS (Cold Air Provocation System)

■ Ambient Condition Electronic Module

■ Breath Patern

■ PIPE (Pressure Inspiration Pressure Expiration)

■ Breath Patern E

■ Breath regulation

■ Rhinomanometry

## RRS-respiratory resistance (occlusion method)

Low patient collaboration required so it is ideal for testing children. Respiratory resistance is measured with occlusion method. Air flow is interrupted with a MES patented shutter which closes at the beginning of inspiration (or expiration) and opens in 100, 150, 200, or 250 ms, as required. Pressure is measured at the level of the oral cavity and air flow is measured behind the closing valve. Low patient collaboration required so it is ideal for testing children.

## Unique patented shutter

While producing the equipment, the MES company places special emphasis on the patient's protection against infections. The pneumotachographic head that we have patented offers the possibility of using sterile measurement elements for each patient during the basic spirometric examination. The new construction of shutter for the RRS, P0.1 and bodyplethysmography examinations is a development based on the idea of easy sterilization of elements used during the examinations in the area of respiratory mechanisms. The idea behind the construction of new shutter is the elimination of potential threats of infection

during the examination performance. The MES shutter is driven by a rotary solenoid built-in into the ergonomic plastic casing. An element closing the air flow is replaceable and design for sterilization. The whole item consists of one drive and many replaceable shutters.

## Advantages of the new shutter construction:

- sterile closing element for each patient
- easy sterilization of the whole closing element
- small dead space of the closing element
- small flow resistance of the closing element
- low price of the replaceable closing elements
- drive of the closing element placed in ergonomic casing
- fast and easy replacement of the closing element
- universal construction to be used in the RRS, P0.1 and bodyplethysmography examinations
- closing element is not susceptible to dampness
- low price of the replaceable closing elements
- drive of the closing element placed in ergonomic casing
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- universal construction to be used in the RRS, P0.1 and bodyplethysmography examinations
- closing element is not susceptible to dampness

## Compliance-static and dynamic

Lung compliance is calculated at the basis of simultaneous recording of changes in volume and intrapulmonary pressure. Volume changes are recorded with a pneumotach headpiece and intrapulmonary pressure is defined indirectly by measurement of oesophagus pressure. Oesophagus pressure is measured with a flexible catheter ended with a balloon.

## Compliance HB

Compliance module for neonatals utilized the Hering-Breuer reflex in the neonatal period.

## DRT (Diaphragm Relaxation Time)

DRT is a test for evaluation of respiratory muscle fatigue. Analysis of inspiration pressure changes measured with a resistor allows determination of a lot of parameters which describe dynamics of diaphragm relaxation. The test is very useful for evaluation of diaphragm muscle training level.

## Breath Pattern and Breath Pattern with P0.1

Modern diagnostic systems provide objective measurements of breath mechanics and do not require co-operation on the side of the patient.

### Breath Pattern E

Modern diagnostic system for infants and small children below 3 years old provide objective measurements of breath mechanics which does not require co-operation on the side of the patient.

### NEP (Negative Expiratory Pressure)

The technique uses negative applied pressure during tranquil to detect expiratory airways Flow Limitation (FL) as described in 1994 by J.Milic Emili et al. Application of negative pressure should increase the expiratory driving pressure so increasing the flow if a patient is not flow limited. This effect is observed by overlaying the flow-volume curve with NEP applied with the previous tidal expiration without negative pressure. This measurement has been used to measure FL in numerous conditions know to affect the respiratory system, but is particularly useful in categorizing the degree of FL in patients with severe COPD for whom spirometry test is either too difficult or can give misleading results. The NEP technique is effort independent and does not require the patient to perform the FVC maneuver.

### Used patents:

- Patent 173767 Developed and patented by MES the pneumotachograph MES DV40 headpiece for flow measurement
- Patent 195041 Developed and patented by MES the fast coupler, for quick and easy replacement of the pneumotachograph MES DV40 headpiece
- Patent 213374 Developed and patented by MES shutter for blocking airflow path close to mouth
- Patent 230143 Developed and patented by MES digital flow converter, placed directly on the pneumotachograph MES DV40 headpiece

## CAPS (Cold Air Provocation System)

CAPS is a cost effective substitute for drug induced bronchospasm. A patient needs to be monitored for only one-half hour following the conclusion of the exposure to cold air. CAPS is an excellent source of portable cold air for bronchial provocation and Exercise Induced Asthma studies throughout the year.

### PIPE (Maximal Static Inspiratory and Expiratory Pressure)

Measurement of the maximum static inspiratory pressure that a subject can generate at the mouth (P<sub>I</sub>max) or the maximum static expiratory pressure (P<sub>E</sub>max) is a simple way to gauge inspiratory and expiratory muscle strength. Recorded values of P<sub>I</sub>max and P<sub>E</sub>max can be compared with published normal values

### Advanced Breath Regulation Module

Modern diagnostic systems provide objective measurements of breath mechanics controlling respiratory responses to chemical stimulation in patients. System can be easily configured for use with breath pattern, hypercapnia, isocapnic hyperventilation and hypoksia protocols.

## Rhinomanometry

Rhinomanometry module for examinations of flow and pressure in patient nasal ways measures nasal flow and pressure producing that flow, using anterior or posterior methods with either the Broms or Standard technique as approved by the International Standardisation Committee. Innovative technical solutions used by MES in rhinomanometry module affords possibilities to real-time visualization and recording flow and pressure waveforms additionally besides pressure-flow loops and provide rhinosprometry in a forced nasal flow and maximally ventilation per minute.

### Ambient Condition Electronic Module

All spirometry volume values should be reported at BTPS. The calibration is done under ATP i.e. ambient conditions. This means current temperature, current barometric pressure and current humidity. A volume change occurs during expiration the measurement on the patient because of the changes in temperature and humidity. These changes are corrected to BTPS conditions and the conversion from ATP to BTPS occurs automatically. Ambient Condition Electronic Module is hung on a wall and connected with PC via USB, allows continuous acquisition of ambient condition parameters in laboratory.

**Certificates: CE 1011, ISO 13485:2016**

## Advantages of our pneumotachograph head with digital converter (patents: nr 173767 and 230143)

- |  |  |                              |
|--|--|------------------------------|
| ■ cable transmission of the measured flow signal | ■ high accuracy and resolution                     | ■ lightweight                |
| ■ headpiece cable connected with main unit       | ■ parameters do not change in the course of a test | ■ small dead space           |
| ■ pre-test calibration is not required           | ■ no moving elements                               | ■ low flow resistance        |
|  | ■ sterile for each patient                         | ■ no heating system          |
|  | ■ easily sterilizable as a whole                   | ■ insensitive to moisture    |
|  |  | ■ life period - 10.000 tests |



Manufacturer:

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®

# LUNGTESTLAB

## Stability and reliability Lungtest LAB



### Features and advantages of Lungtest LAB:

- lightweight, low-resistant MES DV40 pneumotach headpiece without movable elements
- easy replaceable measurement pneumotach headpiece - with no anti-bacterial filters
- immediately ready to use after replacing a headpiece
- measuring air flow system with digital converter placed inside a coupler of the MES DV40 pneumotachograph close to headpiece
- air tubes for flow measurement eliminated and digital signal is sent by cable to the main unit
- automatic ambient conditions measuring system
- automatic control of the test correctness according to ATS/ERS standards
- automatic assessment of the quality of the correctly performed examination in the A-F scale
- real-time visualization of graphs: flow-time, volume-time time waveforms and flow- volume loops
- possibility of measurement's interrupting in any time for control of reached results and starting measurement again
- automatic assessment of the diastolic test according to ERS with text commentary
- possibility to turn on the automatic diagnosis system
- computation of standard deviations and percentiles
- presentation of measured values against predicted values
- GLI and many others predicted values available
- edition of the test report
- summary report provides data for a simple and easy interpretation
- test data exporting to standard statistic programs
- motivational system for children
- database without any limitations with quick searching for patients and examinations
- open-architecture database with flexible software system
- user-friendly software compatible with Microsoft Windows
- numerous upgrading options
- possibility to control the spirometer calibration by the user with the use of a syringe
- low maintenance costs and easy servicing
- very stable and highly mobile trolley available
- providing free of charge upgrades during and after warranty period

# Technical specification of Lungtest LAB



## Flow rate and volume measurement:

- measuring headpiece	MES DV40 (or DV40e)
- dead space	38 ml (or 20 ml)
- flow range	$\pm 20$ l/s
- flow resolution	1 ml/s
- usable flow resolution	10 ml/s
- volume measurement range	0 - $\pm 10$ l (0 - 20 l)
- usable volume resolution	10 ml
- accuracy	< 2 %
- headpiece resistance	< 0,9 cmH <sub>2</sub> O/l/s (at 14 l/s flow rate)
- ventilation range	300 l/min

## CO analyzer:

- measurement range	NDIR infrared absorption 0 - 0,35 %
- response time	t <sub>90</sub> < 100 ms
- accuracy	$\pm 0,001$ %
- resolution	0,001 %

## He analyzer:

- measurement range	conductance 0 - 15 %
- response time	t <sub>90</sub> < 100 ms
- accuracy	$\pm 0,01$ %
- resolution	0,01 %

## General data:

- power supply	230 V $\pm 10$ %, 50/60 Hz
- power intake	90 VA
- dimensions (L x W x H)	300 x 300 x 100 mm
- weight	3,9 kg

## Ambient conditions:

- humidity	0 - 100 %
- temperature	0 - + 50 °C
- atmospheric pressure	500 - 1200 hPa

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