



MES Sp. z o.o.
Founded 1993



The unmatched ergospirometer

VO2max Finder



100% of knowledge, passion
and experience since 1993

The Unmatched VO2max^{Finder} ergospirometer



VO2max^{Finder} ergospirometer

VO2max^{Finder} ergospirometer is the new stationary, modular, medical device constructed by MES made in the highest technology and designed for comprehensive exercise tests of respiratory and circulatory systems performed in the laboratory. VO2max^{Finder} is dedicated to CPET labs.

Measurement system of VO2max^{Finder} ergospirometer has been designed and constructed on the basis of the MES DV40 pneumotachograph with new developed digital converter and very fast gas analyzers allowing the measurement of breath-by-breath analysis and visualization of each phase of the respiratory. VO2max^{Finder} ergospirometer is a compact device with a modern design, easily installed on any trolley or a desk. VO2max^{Finder} ergospirometer exceeds the accuracy standards of both the American Thoracic Society and the European Respiratory Society. VO2max^{Finder} ergospirometer owes the perfect functionality to many years of experience of top class engineers-enthusiasts.

MES DV40 pneumotachograph head with digital converter of air flow



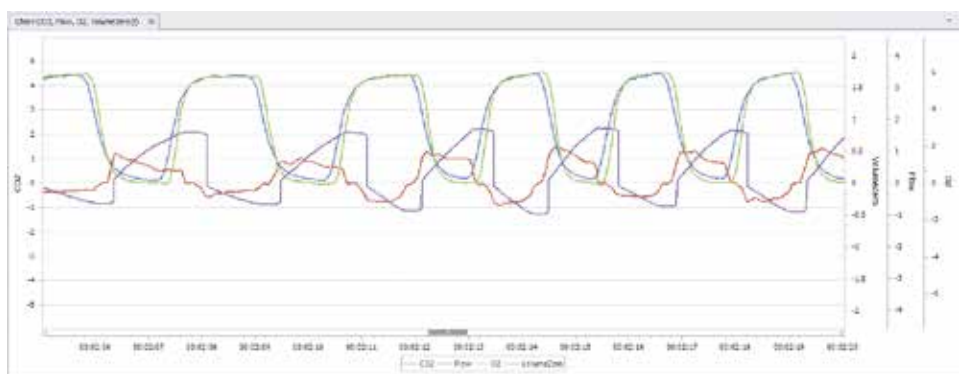
Ventilation measurement is performed with use of the unique MES DV40 pneumotachograph head patented by MES. Low resistance for flow, small dead space and low weight ensure patient conditions similar to the natural. No moving parts in the headpiece and a complete lack of sensitivity to humidity

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 cables and increases the ease of movement of the subject's head. The measuring of CO₂ and O₂ concentration of exhaled air is based on two sensors with a quick response time less than 100 ms and the life time over 5 years.

Superior technology with the unique headpiece guarantee accuracy and reliability

The technologically advanced design of the VO2maxFinder ergospirometer allows for application in cardiology, pulmonology, exercise physiology, sports medicine, cardiac rehabilitation, occupational medicine, intensive care, nutrition assessment and environmental medicine.

Unique headpiece constructed by MES used to measure ventilation, provides full comfort research through low flow resistance and insensitivity to moisture which allows you to perform tests even in tropical conditions. Loads can be set on a cycle-ergometer, a treadmill, or other devices. VO2maxFinder can be optionally extended with 12-lead ECG with full analysis of values, preview in real time and storage. VO2maxFinder allows for continuous recording applying breath-by-breath method to each exhalatory phase in time function of the following signals: respiratory volume, flow rate, O₂ and CO₂ concentration in exhaled air and 12-lead ECG signal. The system always stores the full record of the test and each exhalation may be restored. Presentation of the test record and printout of measured changes and calculated values are defined by an operator. The placement of connections, plugs and the power switch on the front panel of the device provides easy access and control of the ergospirometer to the operating personnel.



Standard software range

■ Exercise test of respiratory system

- **measured values:** t, VE, TV(VT), BF(RR), HR, FeO₂, PEO₂, FetO₂, FeCO₂, PETO₂, PETCO₂, PECO₂, FetCO₂, VO₂, VCO₂, RQ(RER), VE/VO₂(EQO₂), VE/VCO₂(EQCO₂), VO₂/kg, MET, VO₂/kg/HR, VD/VT, VC/VT, WATT(WORK), TI, TE, TTOT, TI/TE, TI/TTOT, TV/TE, PEF, PIF, BR, VET_SUM, O₂ kinetics (T0,5VO₂peak, τ63%ΔVO₂), O₂ oxygen deficit and debt parameters, cardiac output parameters: C(a - v)O₂, CO, SV, HI, SVI, CI are estimated noninvasively from oxygen uptake during exercise (by Wassermann Algorithm), indirect calorimetry.



■ Wireless heart rate recording system

The possibility of development options

The basic range of ergospirometer configuration can be extended with additional measurement modules:

■ Full range of spirometry test meeting all ERS/ATS standards, with quality and correctness control

Slow spirometry:

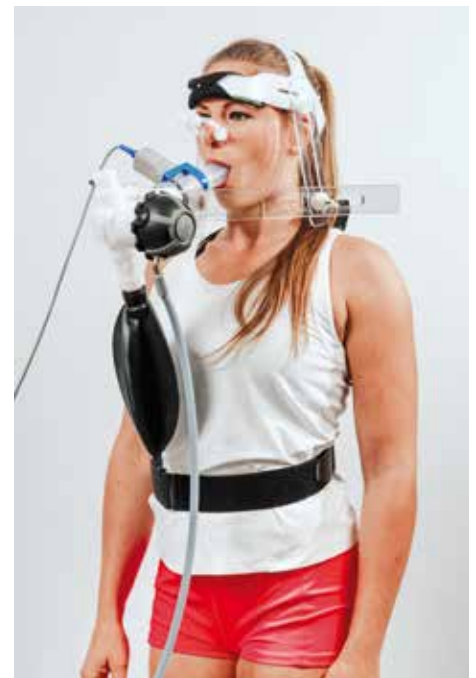
VC, IC, ERV, TV, IRV, MV, BF

Flow/volume loop:

FEV0.5, FEV0.75, FEV1, FEV2, FEV3, FEV6, FVCex, PEF, MEF75, MEF50, MEF25, MEF@FRC, FEF75/85, FEF25/75, FEF 0.2-1.2, VPEF, TPEF, FET, TPEF%FET, MEF50%FVCex, FEV1%FVCex, FEV1%VC, FEV1/PEF, VCmax, FEV1%VCmax, FEV1%FEV3, FEV1%FEV6, BEV, BEV%FVCex, TC25/50, MTT, AEX, FVCin, FIV1, PIF, MIF50, FIT, TPIF, VPIF, TPIF%FIT, FEV1%FVCin, MEF50/MIF50, PEF/PIF, FEV1/FIV1, FET%FIT, TTOT

Maximal Voluntary Ventilation:

MVV, BF, BR



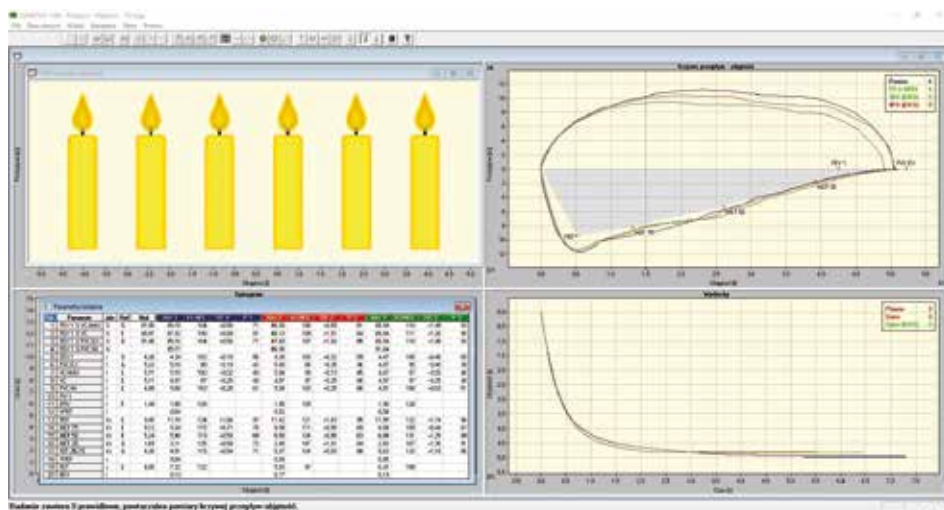
■ Non-invasive determination of cardiac output (Indirect Fick Method)

Measured values of cardiac output in CO₂ Rebreathing test:

FetCO₂, FeCO₂, VCO₂, RQ, HR, PaCO₂, PaO₂, FvCO₂, PvCO₂, CaO₂, C(v-a)CO₂, C(a-v)O₂, CvCO₂, CaCO₂, Qa, SV, HI, SVI, CI, VE, VA, VA/Qa, SpO₂, Vd_f/VE, Hb, pH, Btemp, WATT



■ measurement of energy expenditure with evaluation of substrates oxidation



■ pulse-oximetry module with SpO₂ analysis

■ SBP/DBP noninvasive measurement module

■ Single Breath Diffusion module (DLCO)

■ inhalation system for allergological provocations

■ cold air bronchial provocation

■ Eucapnic Voluntary Hyperpnoea Provocation

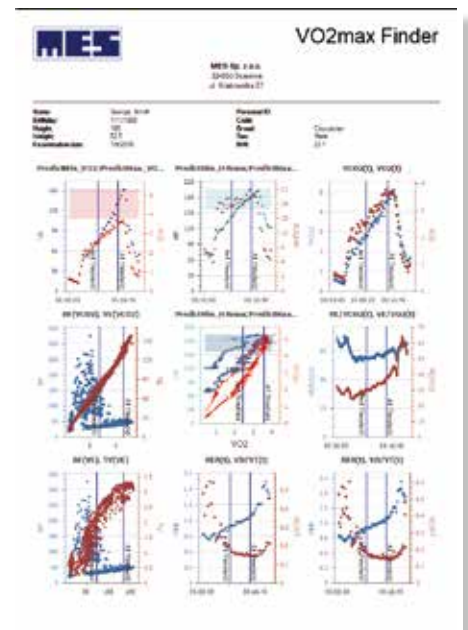
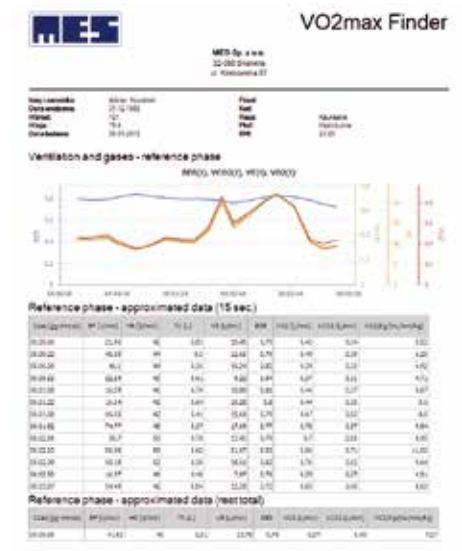
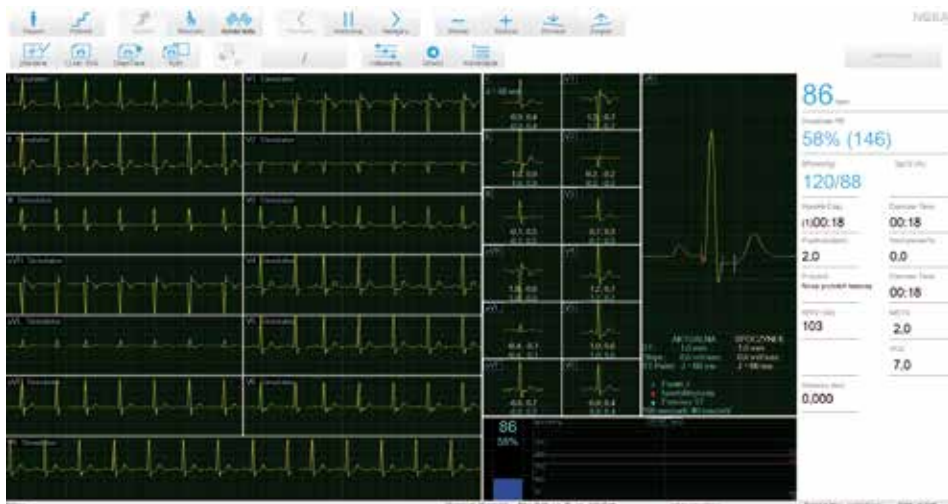
■ stress test system based on 12-lead ECG

Powerful evaluation software with report generator

The software developed and manufactured by MES gives you virtually unlimited programming possibilities of measurement, its visualization, to define their own parameters and new predicted values. The user has a full set of standard reports and algorithms research. The software also gives you the ability to archive and complete courses of study results of multiple studies

Report types:

- summary report provides data for a simple and easy interpretation
- ready-to-print pre-defined reports
- 9-chart Wasserman report with a single page report containing the 9 graphs and additional test results for an easy clinical interpretation



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

- | | | |
|--|--|--|
| <ul style="list-style-type: none"> ■ cable transmission of the measured flow signal ■ headpiece cable connected with main unit ■ pre-test calibration is not required | <ul style="list-style-type: none"> ■ high accuracy and resolution ■ parameters do not change in the course of a test ■ no moving elements ■ sterile for each patient ■ easily sterilizable as a whole | <ul style="list-style-type: none"> ■ lightweight ■ small dead space ■ low flow resistance ■ no heating system ■ insensitive to moisture ■ life period - 10.000 tests |
|--|--|--|



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® Ergospirometer VO₂max^{Finder}

Stability and reliability VO₂max^{Finder} ergospirometer



Features and advantages of ergospirometer:

- breath-by-breath testing method
- lightweight, low-resistant MES DV40 pneumotach headpiece without movable elements
- 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
- long life advanced high-tech gas sensors
- automatic two points calibration of gas analyzers
- automatic ambient conditions measuring system
- displays real-time data and graphs in either pre-defined or user formats
- real time visualization of O₂, CO₂, flow, volume waveforms
- exercise flow-volume loops
- automatic or manual determination of the aerobic, anaerobic and RCP thresholds
- standard and custom exercise protocols designing
- presentation of measured values against standard values
- add user defined parameters and predicted equations with custom based formulas
- VO₂max determination
- O₂ kinetics feature automatically provides O₂ debt, O₂ deficit and time constant values
- indirect cardiac output by Wassermann Algorithm
- alternative method of heart rate with wireless system and/or with 12-lead ECG
- edition of the test report
- ready-to-print pre-defined standard and customer reports
- 9-chart Wasserman report with a single page report containing the 9 graphs
- summary report provides data for a simple and easy interpretation
- advanced data elaboration with evaluation compatible with Wassermann Algorithm
- test data exporting to standard statistic programs
- software compatible with Microsoft Windows
- automatic treadmills and/or bicycle ergometers control
- wide selection of treadmills and bikes for both clinical and performance applications
- numerous upgrading options: full range of spirometry, 12-lead ECG Stress Test, pulse-oximetry, module for measurement of energy expenditure with evaluation of oxidation of energy substrates, minute heart stroke with non-invasive method, diffusion (DLCO), cold air and methacholine challenge tests
- very stable and highly mobile trolley available
- low maintenance costs and easy servicing
- providing free of charge upgrades during and after warranty period

Technical specifications of the VO₂max^{Finder} ergospirometer:

Flow rate and volume measurement:

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

Oxygen analyzer:

- measurement range	laser 0 - 25 % (0 - 100 %)
- response time	t ₉₀ < 100 ms
- accuracy	± 0,01 %
- resolution	0,01 %

Carbon dioxide analyzer:

- measurement range	NDIR infrared absorption 0 - 10 % (0 - 15 %)
- response time	t ₉₀ < 100 ms
- accuracy	± 0,01 %
- resolution	0,01 %

General data:

- weight	2,9 kg
- dimensions (L x W x H)	300 x 300 x 100 mm
- power supply	230 V ±10 %, 50/60 Hz
- power intake	40 VA

Ambient conditions:

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

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 MES DV40 pneumotachograph headpiece
- Patent 230143 Developed and patented by MES
- digital flow converter, placed directly on the MES DV40 pneumotachograph headpiece



Certificates: CE 1011, ISO 13485:2016

Standard packaging includes:

measurement module with a coupler for MES DV40 pneumotachograph headpiece and built-in: sensor and digital converter of air flow, connection cable and the air tube for gas analyzers, USB cable, pneumotachographs (10 pcs), large, medium and small face masks with caps and couplers, 3-liter calibration syringe, POLAR receiver and transmitter belt, software for VO₂maxFinder ergospirometer (works with Windows 7/8/10), manual CD.

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



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