Compact and Upgradable
- MEC Diffusion Capacity device is a low cost measurement station for precise and reproducible testing which can be easily and economically upgraded with many modular options. (Possibility to upgrade with options like Bodybox, slow and forced Spirometry, Respiratory Mechanic, ergospirometry etc).

Fast and easy to use
- Fast and reproducible results require uncompromising accuracy. The all-in-one concept helps you to save valuable time as the spirometry and flow-volume, Rint, measurement are integrated in the program.
- In compliance with the demands of leading pulmonologists, the entire data is obtained from a single breathing manoeuvre, which means the results are assessed on the basis of a continuous measurement faster to make and better accepted by the patient.
- Flow and Volume measurement with a very lightweight precise bi-directional Flow Sensor works according to the principle of Variable Orifice which offer many advantages.
- Gas is delivered to patient with a low resistive demand valve system with small dead space 130 mL.
- Gases are measured by a very fast response CO and CH4 infrared analyzer with fully automatic calibration system (no change of tubes or chemicals is necessary).
- Fast and reliable acquisition system oriented to future technology with: Serial port, I²C and USB connection and communication protocol
- Mobile trolley with isolated power supply, computer, printer and large screen TFT monitor.

Connected to the world
- Powerful and flexible measurement program compatible with Windows® based software and analysis with powerful PDI database management software open to central Hospital networking, automatic calibration programs and flexible report generator. Everything can simply be configured according to your desire.
- You or your staff can easily perform modifications at any time.
- Reports available in Word, HTML, PDF format.

Important measurement features
- The Apnea Time is often a real handicap for COPD-Patients therefore we offer Short breath-hold time option, interruptible down to 6 seconds
- Recording respiratory pressure during a breath holding manoeuvre makes Single Breath Diffusion test unique (Monitoring of alveolar pressure).
- The Concentration-slopes give important information about the validity of the test and about the uneven gas distribution into the respiratory airways
- Even with Alveolar Volumes down to 0.8 Liters, Diffusion Capacity Measurement is possible, thus the MEC-Diffusion is well suited for restrictive and Pediatrics
- “Fast-Space balancing method” is used for effective FRC, RV, TLC determination by gas dilution techniques

Cost effectiveness
- No working costs, no need for any disposable products or accessories.
- Cheap Preventive Maintenance Contract proposed for 1 year and special conditions for 5 years. Equipments need only one technical revision per year.
- No gas consumed for calibration or flushing. Automatic calibration of Reference and Diffusion-Gases happens during inspiration of the gases. A 10-liter bottle (150 bar) stands for ca. 350 tests.

Consumables:
- Only test gas, mouthpieces and disinfections cause expenses.
Measurements and Options

MEC Diffuson capacity measurement station is specially designed to determine:

- Diffusion capacity single breath. DLCO/TLC0, Alveolar volume
- Functional Residual Capacity FRC with gas dilution and static lung volumes.
- Pulmonary gas distribution during expiration

A variety of other recording programs are available so that, if desired, you can upgrade at any time and cover the entire range of lung function testing you require.

Options:
1. In combination with the optional MEC Bodybox Module, you will have a complete lung function laboratory at your disposal which also allows you to determine very easily:
   - Static and dynamic lung volumes Spirometry / Flow-Volume,
   - Bodyplethysmographic Intrathoracic Gas Volume ITGV
   - Bodyplethysmographic Airway Resistance AWR
   - With full report generator

2. In combination with the optional MEC Airway Mechanics module allows you to determine very easily:
   - Reversibility of obstruction after broncho-dilatation
   - Specific and non-specific Broncho Provocation with full reporting
   - Airway Mechanics, (Resistances and Compliances)
   - Airway resistance with flow interruption, Rocc, Rint,
   - Po1, Pimax, Pemax,
   - respiratory drive and hypercapnic stimulus Po1 and CO2 rebreathing
   - With full report generator

3. In combination with the MEC Exercise testing module allows you to determine very easily rest and stress spirometry together with 12 lead ECG parameters:
   - VO2; VCO2; VE; R; EEqO2; EEqCO2; O2/Pulse etc
   - Tabulation presentations and graphical presentations (Wassermann) etc
   - With full report generator

Variable Orifice Membrane Flow Sensor

The MEC bi-directional pneumotachograph VOM only weighs 32 grams, has a small dead space volume and is absolutely insensitive to moisture.

Neither moisture of the breath nor water droplets can influence the measurement. After cleaning, it is immediately ready for use.

The form of the lamella and the housing were mathematicially optimized and guarantee a linear characteristic over the entire measuring range.

The «Variable Orifice Membrane Flow Sensor» was specially developed for spirometry and artificial ventilation to overcome the handicaps of conventional sensors unsensitive to low flow and sensitive to moisture

Advantages:
- Great durability,
- High accuracy and reproducibility of the measurements
- Easy to clean
- Very low resistance
- No heating, no errors due to humidity and sputum.
- No errors at low flow ranges

Hygiene:
- The system may be dismounted easily without any tools.
- Fast and Easy to clean

Special advantages

Analyzers:
Operate on the Principle of Infrared-Absorption. (NDIR)
They are especially fast, selective and require no service
There is no need of absorbers for CO2 and H2O (No consumables!)

Reference gas Methane:
Using Methane (CH4) as Reference gas offers decisive advantages in comparison to the formerly used Helium:
- Selective and fast NDIR- Analyzers
- Testgas consists to 99.5% of synthetic air, thus the measurement is done under physiological conditions.

Lung-Automate:
The System needs no sample-bags. During a deep inspiration, the Testgas is supplied automatically and directly from the bottle. Only the inspired amount of gas is consumed. A bottle of 10-liters- therefore may well last for about 350 measurements. No test gas is wasted.

Quality Control:
The graphic display gives a safe quality check. Leaks of nose, mouthpiece or the system are immediately visible.
The Gas-Curves can be edited: CH4-Slopes, and CO-extrapolation can be adapted.
With bad patient's cooperation this can be a very useful feature.
MEC Diffusion capacity measurement station is a Diagnosis System for measurement of Spirometry, Lung Mechanics and Lung Volumes

One of the cue elements of a comprehensive lung function analysis is the exact determination of the Oxygen-diffusion properties of the lungs. For technical and medical reasons, it is more easy and feasible to measure the CO-diffusion instead of the O₂-diffusion.

The CO-Diffusion capacity test is using the Single-Breath-Method:

- After normal breathing, the patient must exhale totally.
- While inspiring totally, a test gas is provided automatically, filling the lungs.
- For a breath hold-time (Apnea, ca. 6 to 10 sec), the airways are occluded by a shutter.

After breath hold-time the patient exhales deeply and continues breathing;

The test gas contains 99.5% air plus 2 additive gases:
- 0.30 % CH₄ (Methane), which is not soluble in the body. (Reference Gas)
- 0.30% CO (Carbon-Monoxide), absorbable in the body. (Reference Gas)

After elimination of Dead-Space Volume, the expired concentrations of CH₄ and CO are displayed in function of the volume

- CH₄ was only diluted by the residual lung volume, thus Residual Volume RV can be calculated
- CO is also diluted by RV, but additionally is submitted to dilution via CO-transport into the blood, which depends largely on diffusion properties of the lungs.

The decisive advantage of the Fast-Space-Method is the measure of the gas concentration gradients into the lungs from which we can calculate the TLC by inert gas (CH₄) dilution.

The right graph represents the amount of CH₄, which is recoverable during expiration. (Amount = Concentration x Volume) Under the reasonable assumption that the CH₄-Gradient will continue linearly into the Residual Volume, we get the „Fast-Space-TLC“ by extrapolating the CH₄ Slope until Expired area (area under the light blue line) is equal to Inspired (area under the green line). With this method we offer you a simultaneous calculations using the „Fast-Space“ and the „Classical“ Methods, combining enhanced progress and compatibility with the traditional results and the classical normal values.

With Classical gas sampling method the device takes only a small gas sample after washout volume and does not consider further pulmonary gas concentrations during the rest of the expiration phase. This method is contraindicated for patients with uneven distribution.

While the Fast-Space Balancing method analyse expiratory gas versus volume is using less sample gas than traditional method and giving full information about pulmonary gas distribution in the lungs airways.

- By displaying the slope of the exhaled inert gas curve versus volume, which indicates levels of gas distribution abnormalities during complete expiratory phase.
- Because we use only a very small sample volume, the CO test can be performed with patient with very small vital capacity (down to 800cc) which is not possible with classical methods.
- Based on the principle that inhaled inert gas X Inspired volume must equal exhaled inert gas x exhaled volume we can by extrapolation measure rapidly and accurately the pulmonary residual volume and total lung capacity by gas inert gas dilution.
- These new important technical feature makes interpretation of the CO diffusion more reliable. Because for Fast-Space-Method the complete expiratory gas is taken into consideration. An exact balance of in- and expired amounts of gas can only be correctly calculated by the areas (V'i*Ci = Ve*C)e comparison.

This is especially important with patients suffering from severe uneven distribution.

Literature on Fast-Space-Methods:
## M.E.C. Diffusion capacity measurement station

<table>
<thead>
<tr>
<th>CO DIFFUSION</th>
<th>Single breath DLCO (TLCO)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Flow measurement</strong></td>
<td>Principle: VOM Variable orifice membrane</td>
</tr>
<tr>
<td><strong>Range</strong></td>
<td>±0.02 – ±20 l/s</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>0.05 – 15 l/s ±2%</td>
</tr>
<tr>
<td><strong>Resistance</strong></td>
<td>&lt; 0.01 kPa/l at 10 l/s</td>
</tr>
<tr>
<td><strong>Resolution</strong></td>
<td>&lt; 5 ml</td>
</tr>
<tr>
<td><strong>Back pressure</strong></td>
<td>&lt; 0.93 kPa at 14 l/s</td>
</tr>
<tr>
<td><strong>Volume determination</strong></td>
<td>Digital integration</td>
</tr>
<tr>
<td><strong>Range</strong></td>
<td>0 – ±20 l/s</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>5 ml</td>
</tr>
<tr>
<td><strong>Mouth pressure</strong></td>
<td>Solid state pressure transducer</td>
</tr>
<tr>
<td><strong>Range</strong></td>
<td>± 20 kPa</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>Accuracy: 0.2%, full scale (Resolution: 16 bit)</td>
</tr>
<tr>
<td><strong>CO analyzer / CH4 analyzer:</strong></td>
<td>Measuring range: 0 – 3000 ppm</td>
</tr>
<tr>
<td>Principle / type: ND Infrared absorption, selective/rapid response analyzer</td>
<td>Accuracy: &lt; 1%</td>
</tr>
<tr>
<td></td>
<td>Linearity: &lt; 1%</td>
</tr>
<tr>
<td></td>
<td>Resolution: 16 bit</td>
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<tr>
<td></td>
<td>Rise time: 110-90 &lt;100m</td>
</tr>
<tr>
<td><strong>Testing gas composition</strong></td>
<td>0.3% CO; 0.3% CH4; balance synthetic air</td>
</tr>
<tr>
<td><strong>Testing gas feeding</strong></td>
<td>Exclusively via high flow medical approved</td>
</tr>
<tr>
<td></td>
<td>pressure regulator</td>
</tr>
<tr>
<td><strong>CO diffusion block with demand valve and Shutter,</strong></td>
<td>Dimensions [mm]: 180 x 50 x 80 / 420g</td>
</tr>
<tr>
<td></td>
<td>Dead space volume: 30 ml</td>
</tr>
<tr>
<td></td>
<td>Resistance: 0.075 kPa/l at 14 l/s</td>
</tr>
<tr>
<td><strong>DLCO Calibration</strong></td>
<td>With every box calibration</td>
</tr>
<tr>
<td><strong>Volume and Flow</strong></td>
<td>during every inspiratory manoeuvre</td>
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<tr>
<td><strong>CO/CH4</strong> r</td>
<td></td>
</tr>
<tr>
<td><strong>Certification/Safety standards:</strong></td>
<td></td>
</tr>
<tr>
<td>93/42/EEC</td>
<td>Medical Device Directive</td>
</tr>
<tr>
<td>EN60601-1</td>
<td>General Requirements for Safety</td>
</tr>
<tr>
<td>EN60601-1-1</td>
<td>Safety Requirements for Medical Electrical</td>
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<td>Systems</td>
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<td>EN60601-1-2</td>
<td>Electromagnetic compatibility</td>
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<td><strong>CE approval</strong></td>
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<tr>
<td>DGM-163</td>
<td>Final inspection and test of cardiopulmonary</td>
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<tr>
<td></td>
<td>function test equipment in class I</td>
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<tr>
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<td>(93/42/EEC Annex VI Section 3.2 - Product</td>
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<td>quality assurance)</td>
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