A new approach to human performance assessment through VO$_2$ max and resting metabolism

"Assess, Measure, Improve my Performance"
The Fitmate PRO is a desktop metabolic monitor designed to break the mould of traditional Cardio Pulmonary Exercise Testing and proposes a new approach for the measurement of oxygen consumption during exercise testing or at rest. Fitmate PRO measures VO\textsubscript{2}max, either directly or through a sub-maximal protocol, and provides additional features like the calculation of the Anaerobic Threshold (AT) and the definition of heart rate training zones.

Fitmate PRO is a compact desktop device with internal rechargeable battery, a large LCD screen and in-built printer that allow testing without a computer or mains power lead. Fitmate PRO processes test results and stores all information inside its internal memory, ready for upload to PC software (included).

Fitmate PRO has been validated for measuring VO\textsubscript{2}max and for predicting maximal oxygen consumption with a sub-maximal protocol.

**Cardio Respiratory Fitness (VO\textsubscript{2} max)**

The Fitmate technology allows to execute the VO\textsubscript{2}max and sub-max test with most of cyclergometers and treadmills available in the market (h/p/cosmos, Ergoline, Trackmaster, Technogym, Monark etc.).

- VO\textsubscript{2} ventilation, heart rate and related parameters with a 15 seconds sampling rate
- Pre-defined VO\textsubscript{2}max and Sub-max exercise protocols and user defined protocols
- Pre-defined or custom exercise protocols (Bruce, cycle, ramp etc.)
- Automatic and adjustable Anaerobic Threshold detection
- Automatic RQ compensation during resting and graded exercise
- Automatic (protocol) or manual ergometer control
- Heart Rate measurement with wireless belt (included) or TTL from ECG (optional)
- Calculation of Training Zones based on relationship between VO\textsubscript{2} and HR (both sub-max and VO\textsubscript{2}max testing)
- Warnings and quality control messages (mask leaks, breathing pattern etc.) are displayed during test.

**Training Zones based on the relationship between VO\textsubscript{2} and HR**

![Training Intensity Graph]

<table>
<thead>
<tr>
<th>Training Intensity</th>
<th>% VO\textsubscript{2}max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anaerobic Capacity</td>
<td>101-105</td>
</tr>
<tr>
<td>VO\textsubscript{2}max</td>
<td>96-100</td>
</tr>
<tr>
<td>Race Pace</td>
<td>91-95</td>
</tr>
<tr>
<td>Threshold</td>
<td>81-90</td>
</tr>
<tr>
<td>Endurance</td>
<td>56-80</td>
</tr>
<tr>
<td>Recovery Fat burning</td>
<td>35-55</td>
</tr>
</tbody>
</table>


Comfortable silicone masks (5 sizes, both adult and pediatric) are available for exercise testing and for resting measurements.
Fitness Assessment
- Muscular fitness, resistance & flexibility
- Body Composition
- Standard Measurements (WHR, blood pressure etc.)
- Comprehensive Exercise Prescription report based on ACSM guidelines with a database of exercises and pictures for educational purposes
- Cardiovascular Risk Analysis (PC software only)

Nutritional Assessment
- Fitmate measures accurate oxygen consumption at rest (REE, RMR), comparable with conventional metabolic carts. Tests can be executed either with multi-use silicone face masks, with mouthpiece and antibacterial filter or, optionally, with an integrated canopy hood;
- Individual weight management programs based on Energy Balance equation;
- Weekly Dietary plan and software (w/ USDA Database);
- Complete Lifestyle and Physical activity assessment up to 60 days (optional).

Dear James,

Based upon norms for your age and sex, we have identified cardiovascular risk factors based upon a thorough review of your health risk appraisal and fitness assessment.

Your exercise prescription has been prepared based on your progress and update the exercise prescription. We recommend that you consult with your exercise specialist in 4 to 6 weeks to review and confirm your progress and update your exercise prescription. We will focus on gradual increases in training to minimize risks of injury, teach proper technique and create an environment where you are able to commit to a lifestyle of training.

Your exercise prescription as described to you at the time of the assessment is comprised of three stages:

• Initial conditioning stage, 6-8 weeks.
• Improved conditioning stage, 4-8 months.
• A maintenance conditioning stage, lifetime.

In each of these phases, the components of the program (duration and intensity of cardiovascular training, strength training and flexibility development) will gradually change based upon your individual progress. In this initial stage the goal is to create a strong foundation from which your exercise prescription will be developed. We will focus on gradual fuel, it is important that you adhere to the following exercise guidelines:

In order to control/reduce risk factors, achieve a cardiovascular benefit, and burn stored fat as a primary fuel, it is important that you adhere to the following exercise guidelines:

- Fuel efficiency: While exercising at a sub-maximal heart rate, the body switches to a more efficient fuel source. This is why exercises that simulate the intensity of everyday activities are highly recommended.
- Energy expenditure: To achieve a cardiovascular benefit, you need to burn enough calories to make a difference in your health. This is why you should aim for at least 30 minutes of moderate intensity exercise each day.
- Duration: The longer you exercise, the more calories you burn. Therefore, it is important to aim for at least 30 minutes of moderate intensity exercise each day.

- Warm-up: A warm-up helps to prepare your body for exercise by increasing blood flow to your muscles and raising your heart rate.
- High-intensity training: High-intensity training can help to improve cardiovascular health and increase stamina.
- Flexibility training: Flexibility training helps to improve range of motion and prevent injury.

- Heart rate training: Heart rate training is a way to measure the intensity of your exercise.
- Metabolic cart: A metabolic cart measures the amount of oxygen you use during exercise.
- Gas exchange data: Gas exchange data provides information about how your body is using oxygen during exercise.

- Anaerobic threshold: Anaerobic threshold is the point at which your body switches from aerobic to anaerobic metabolism.
- VO2 max: VO2 max is a measure of how much oxygen your body can use during exercise.

- Exercise prescription: Exercise prescription is a plan that includes the type, intensity, duration, and frequency of physical activity.
- Subject data & test Information
- Gas Exchange Data (VO2, VE, HR etc.) at peak, average, or each 15 secs interval
- Individual HR Training Zones based on calculated Anaerobic Threshold
- Easy to replace, the O2 cell comes in a sealed bag, lifespan is 12-18 months and it is indicated by the device.

Thermal printout sample (original size 110mm wide): Sub-Maximal Exercise Test

Real-time screenshot of VO2 max and RMR tests as shown on Fitmate PRO LCD display

Software provides complete information of current open session or previously closed sessions, offering the ability to review serial test data.

Software printout sample (available in A4 or Letter size): ACSM Exercise Rx

Subject data & test Information

The Graph shows VO2 / Kg, Heart Rate

Gas Exchange Data (VO2, VE, HR etc.) at peak, average, or each 15 secs interval

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## Technical Specifications

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>REF</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fitmate PRO</strong></td>
<td>Desktop metabolic monitor</td>
<td>C09066-02-99</td>
</tr>
<tr>
<td><strong>Standard packaging</strong></td>
<td>Unit, Carrying Case, PC Software, Battery Charger, USB Cable, Oxygen Sensor, Roll of thermal paper, Measuring Tape, RMR Flowmeter ID18, VO2 Flowmeter ID28, Reusable V2 mask (Medium size), HR probe and belt, Head cap for V2 mask</td>
<td></td>
</tr>
<tr>
<td><strong>Standard Tests</strong></td>
<td>Cardio Pulmonary Exercise Test (CPET)</td>
<td>VO2,max, Sub-max VO2, Thresholds (AT, RCP), Heart Rate with HR belt</td>
</tr>
<tr>
<td><strong>Nutritional Assessment</strong></td>
<td>Resting Energy Expenditure (REE, RMR), Indirect Calorimetry (w/ Face Mask or w/ mouthpieces-antibacterial filter), Weight Management Program (Energy Balance), Diet Planner, Standardized Measurements (WHR, BP, RHR, etc), Body composition by Skinfold</td>
<td></td>
</tr>
<tr>
<td><strong>Fitness Assessment</strong></td>
<td>Muscular Endurance/Strength/Flexibility, Standardized Measurements (WHR, BP, RHR, etc), Body composition by Skinfold</td>
<td></td>
</tr>
<tr>
<td><strong>Exercise Prescription</strong></td>
<td>ACSM Exercise Prescription, VO2/HR Training Zones (based on AT)</td>
<td></td>
</tr>
</tbody>
</table>

### Flowmeter

<table>
<thead>
<tr>
<th>Type</th>
<th>Flowmeter VO2max (Turbine Ø-28mm)</th>
<th>RMR/REE (Turbine Ø-18mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
<td>Bidirectional Digital Turbine</td>
<td>Bidirectional Digital Turbine</td>
</tr>
<tr>
<td><strong>Flow Range</strong></td>
<td>0-16 l/s</td>
<td>0-8 l/s</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>± 2% or 20 ml/s (flow) ± 2% or 200 ml/min (ventil.)</td>
<td>± 2% or 20 ml/s (flow) ± 2% or 100 ml/min (ventil.)</td>
</tr>
<tr>
<td><strong>Resistance</strong></td>
<td>&lt;0.6 cmH2O/l/s @ 14l/s</td>
<td>&lt;0.7 cmH2O/l/s @ 3l/s</td>
</tr>
<tr>
<td><strong>Ventilation range</strong></td>
<td>0-300 l/min</td>
<td>0-50 l/min</td>
</tr>
<tr>
<td><strong>Gas Analyzers</strong></td>
<td><strong>O2</strong></td>
<td><strong>CO2</strong></td>
</tr>
<tr>
<td><strong>Type</strong></td>
<td>GFC</td>
<td>GFC</td>
</tr>
<tr>
<td><strong>Range</strong></td>
<td>0-25%</td>
<td>0-50%</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>±2% (REE) ±0.02% (O2)</td>
<td>±2% (REE) ±0.02% (O2)</td>
</tr>
<tr>
<td><strong>Warm-up time</strong></td>
<td>10 seconds</td>
<td>10 seconds</td>
</tr>
</tbody>
</table>

### Hardware

- **Dimensions & Weight**: 24 x 20 x 8 cm / 1.5kg
- **Interface ports**: USB A-B, RS-232, HR-TTL, Flowmeter
- **Display**: Colour LCD 320 x 240 pixel
- **Printer**: High speed thermal printer 12 cm
- **Battery**: Rechargeable Li-ion batteries (autonomy 6h; charging time 2h10)
- **Electrical Requirements**: 100-240V ± 10% 50/60 Hz

### Firmware

- **Available languages**: Italian, English, Spanish, French, German, Portuguese, Greek, Dutch, Turkish, Chinese, Korean, Japanese, Finnish, Polish, Russian, Slovenian
- **Software**: Fitmate Suite
- **PC Configuration**: Pentium or faster, Windows XP, VISTA, 7, 8, 10 (32/64 bit), 128 Mb RAM or more, USB, CD-Rom reader, 80 Mb on HD space available.

### Accessories & Options

<table>
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<tr>
<th>Description</th>
<th>REF</th>
</tr>
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<tbody>
<tr>
<td>Kit including transparent canopy hood and blower for “gold standard” indirect calorimetry measurements at rest</td>
<td>C03950-01-11</td>
</tr>
<tr>
<td>Fits Fitmate unit, printer, masks, printouts, carrying case</td>
<td>C02950-01-11</td>
</tr>
<tr>
<td>3L syringe for accuracy check of flow volume measurements</td>
<td>C00600-01-11</td>
</tr>
<tr>
<td>Includes GFC sensor, sampling line and mounting key</td>
<td>C02748-01-11</td>
</tr>
</tbody>
</table>

### Safety & Quality Standards

- **MDD (93/42 EEC); FDA 510(k); EN 60601-1 (safety) / EN 60601-1-2 (EMC)**

### Validation articles

- Lee J et al. Validation Of The Cosmed Fitmate For Predicting Maximal Oxygen Consumption Medicine & Science in Sports & Exercise: May 2009 - Volume 41 - Issue 5 - p 269
- More scientific studies on [www.cosmed.com/bibliography](http://www.cosmed.com/bibliography)