Indirect Calorimetry

The new standard for Resting Energy Expenditure measurement in research and clinical practice

"Calories, you can’t manage what you don’t measure."

Quark RMR

COSMED
The Metabolic Company
Quark RMR was demonstrated to be unbiased, precise, reproducible, and accurate device for measuring energy expenditure.

- Measurement of Resting Energy Expenditure (REE) & substrates
- Latest technology in gas analyzers
- Quick and user-friendly calibration procedures
- Suitable for patients above 15kg of weight
- Ideal for bed-side applications
- Independent validated on spontaneously breathing subjects and on mechanically breathing patients

The Quark RMR is a compact bed-side indirect calorimetry solution designed to allow accurate and instantaneous estimation of Resting Energy Expenditure (REE) and respiratory ratio (R), in a non-invasive way, through the measurement of oxygen consumption (VO$_2$), carbon dioxide production (VCO$_2$), together with other ventilatory parameters, and metabolism substrate utilization (%FAT, %PRO, %CHO). Quark RMR allows thus improved nutrition support and accurate planning of nutritional therapies.

Quark RMR is a modern device suitable both for research and clinical applications. By measuring REE and providing the correct energy balance in critically ill patients, hospital may improve patient outcome, and decrease the length of hospitalization which will have a significant and immediate impact on hospital bottom line. Scientific evidence highlights that negative energy balances are correlated with increasing number of complications, particularly infections.

Quark RMR accuracy and reliability have been validated against Gold Standard methods either with spontaneously breathing subjects and with mechanically assisted patients.

**Design**

- Latest technology in gas analyzers: paramagnetic, stable and durable for the O$_2$; rapid infrared for the CO$_2$. Both analyzers are reliable and do not need maintenance for long periods.
- Flowmeters (disposable pneumotach and multi-use turbine) guarantee great accuracy on the different measurement modes (canopy, mask and through mechanical ventilation).
- Quick and user-friendly calibration procedures guarantee accurate measurements either of flow/volume (using the 3-liter calibration syringe) and gas concentration.
- Ideal for bed-side applications Quark RMR compact dimensions and the optional medical graded cart configuration, make it the ideal choice for bed-side applications.
- Powered by OMNIA software innovative user interface, touch screen ready, easy-to-use and self-explanatory.

**REE on spontaneously breathing subjects**

**REE by dilution with Canopy Hood**

The Quark RMR is supplied with a dilution helmet for the measurement of the expiratory flow of patients with spontaneous breathing. This method does not require a mouthpiece or face mask and is more comfortable for obese patients. Gas is sampled at the expiratory port through a sampling line, while the ventilation is measured by a turbine. The ventilation output of the helmet is easily regulated in order to maintain the CO$_2$ expired fraction (FeCO$_2$) within a prefixed range of values.

- Bidirectional digital turbine flowmeter (reusable).
- “Bubble” canopy hood (18,7 L) with removable blanket.
- Integrated canopy blower pump inside the main unit (selectable flow rate).
- Internal emergency battery with acoustic alarms.

**REE breath by breath by Face Mask**

In addition to canopy, Quark RMR allows “breath-by-breath” gas exchange analysis by using multi-use silicone face masks (available in 5 sizes: 3 adult, 2 pediatric), or, alternatively, with mouthpiece and AB filter.
The optional ICU module for Quark RMR allows the integration with the ventilator for the measurement of REE in patients undergoing mechanically assisted ventilation in intensive care units. The module is extremely versatile allowing two different set-ups according to specific testing requirements.

**In-line Measurement within Patient’s Circuit**
- Disposable low-flow range PNT flowmeter (Flow-REE) inserted at the patient’s circuit
- “Breath by breath” gas sampling through a line connected proximally to the Y-piece of the ventilator tubing
- Inspiratory and expiratory phases directly measured by the flowmeter
- All parts are single patient, no need for cleaning and disinfecting
- FiO₂ ≤ 70%
- Independent from type of ventilator in use

**External Flow Measurement by Ventilator’s outlet**
- Patient minute ventilation measured by a turbine flowmeter connected to the expiratory port of the ventilator
- “Breath by breath” gas sampling through a line connected proximally to the Y-piece of the ventilator tubing
- Software allows users to detect the “Bias Flow” and identifies the inspiratory and expiratory phases with the use of an algorithm based on flow and expiratory CO₂ analysis
- Easy and less invasive set-up
- Lower costs with less consumables
- Compatible with most ventilators in the market

**Data Management & Software**
Quark RMR comes with the OMNIA Metabolic Module, the new software designed by COSMED. Compatible with the entire COSMED product range, OMNIA allows the user to operate complex equipment easily and with quick learning paths.
- Easy-to-use touch-screen (native) graphic user interface with intuitive workflow and hierarchy.
- Manage/display data and plots via dashboards (default and user defined).
- Select and define charts, data and widgets.
- Powerful chart creation (up to 4 Y axis and one X axe) with full control on settings.
- Change blower settings directly from dedicated widget.
- Select time interval to display averaged parameters (REE, RQ, variability, etc.) both in real time and in post analysis.
- Designed to work with both standard PC and tablets.
- SQL Database allowing virtually unlimited records and data safety.
- Full Network Database Management (optional). OMNIA allows installations in complex Server/Client environments.
- Multi-users access rights management (Principal Investigator, Physician, Technician, Administrator…) with event logging.
- Compatibility with Philips Intellibridge
- Compatible with Win 7, 8, 8.1, 10 (32/64). Mac OS compatibility when installed in Virtual PC OS (Parallel, VMware).

**Options**
- **Exercise Testing Kit** With the optional CPET (Cardio Pulmonary Exercise Testing) module users can perform full exercise protocols to measure VO₂ and VCO₂ up to maximal effort.
- **Ethanol burning Kit** It consists of a lamp, parts and connectors to be wired to the Quark RMR. Burning ethanol generates a predictable ratio of VO₂ and VCO₂ and it can be used to verify the Quark RMR accuracy of Respiratory Quotient measurement.

Beside canopy hood, REE can also be measured on spontaneously breathing subjects using a multi-use silicone face mask (5 sizes available)

Disposable flowmeter (Flow-REE) inserted at patient’s circuit during testing in ICU settings

An alternative test method is to connect the turbine directly with a mouthpiece and an antibacterial filter
Validation articles

- More scientific studies on www.cosmed.com/bibliography

Technical Specifications

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<tr>
<th>Product</th>
<th>Description</th>
<th>REF</th>
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<tbody>
<tr>
<td>Quark RMR</td>
<td>Indirect Calorimetry Laboratory</td>
<td>C09074-01-99</td>
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<tr>
<td>Standard packaging</td>
<td>Quark RMR unit, canopy hood (with veil and backpack), turbine flowmeter w/ sampling line, calibration syringe (3 liters), HR monitor (receiver and transmitter), antibacterial filters (5 pcs), nose clips, OMNIA PC software, adapters, pipes, cables, probes and user manual</td>
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Standard Tests

- Indirect Calorimetry: Resting Energy Expenditure (REE, RMR), w/ canopy hood, face mask or mouthpieces-antibacterial filter, Respiratory Quotient (RQ), Substrates Analysis (%FAT, %PRO, %CHO)
- Flowmeter: Turbine Ø-18mm (Canopy/Mask), Flow-REE (ICU) - Optional

Flowmeter

- Type: Bidirectional Digital Turbine
- Disposable PNT (Lilly)
- Flow Range: 0-8 l/s, 0-1.7 l/s
- Ventilation Range: 0.04-50 l/min
- Accuracy: ± 2% or 20 ml/s (flow) ± 2% or 100 ml/min (ventil.)
- Resolution: 3 ml, 1 ml
- Resistance: <0.27 cmH₂O/l/s @ 1 l/s, <2.35 cmH₂O/l/s @ 1 l/s

Gas Analyzers

- O₂: Paramagnetic, Range: 0-100% (Standard 0-30% - ICU 0-70% - or user defined), Accuracy: ± 0.1 %
- CO₂: NDIR, Range: 0-10%, Accuracy: ± 0.02 %
- Response time: 120 ms, 100 ms

Hardware

- Dimensions & weight: Unit: 17 x 30 x 45 cm/8 Kg Canopy: 32 x 50 x 30 cm/0.6 Kg
- Interface ports: USB A-B, RS-232, HR-TTL, SpO₂
- Electrical requirements: 100-240V ± 10% 50/60 Hz
- Standard Tests: 12V; 1.2 Ah
- Environmental conditions: Temperature 0-50 °C (32 - 122 °F); Barometer 400-800 mmHg; Humidity 0-100%
- Software: OMNIA
- Available languages: Italian, English, Spanish, French, German, Portuguese, Greek, Dutch, Turkish, Russian, Chinese (Traditional & Simplified), Korean, Romanian, Polish, Czech, Norwegian, Hebrew
- PC Configuration: Gigabit Ethernet, 1 GB RAM, 5 GB free space (pluss tools)

Modules

- Description | REF  
- ICU kit for vent Patients | Allowing Quark RMR measurement of REE in patients undergoing mechanically assisted ventilation. C04436-01-11
- Cardio Pulmonary Exercise Test (CPET) | Kit to perform full exercise breath by breath protocols to measure VO₂ and VCO₂ up to maximal effort C03740-01-11

Accessories & Options

- Description | REF  
- Mixing Chamber | 7 liters Mixing Chamber (physical) C03261-02-11
- Gas Calibration Kit | Gas cylinder required for O₂/CO₂ calibration (16% O₂, 5% CO₂, N₂, bal) and a pressure regulator A-860-000-004 (Gas) A-870-150-005 (Regul.)
- Pulse Oximetry | Oximeter (Xpod) requires probe Oximeter ipod (w/ finger probe) C02600-01-05 C02390-01-05
- Ethanol Burning Kit | Kit consists of a glass ampoule for the verification of respiratory quotient C03440-01-11
- Medical Cart | Medical-graded with isolation transformer (according to MDD directive). Designed to hold the whole equipment during bedside applications. C03550-01-04 (230VAC) C03550-02-04 (120VAC)

Safety & Quality Standards

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