

Extreme Modularity for the most innovative diagnostic equipment for Pulmonary Function Testing

- ▶ Spirometry
- ▶ Lung Volumes
- ▶ Lung Diffusing Capacity
- ▶ Respiratory Mechanics (P0.1, MIP-MEP)
- ▶ Airway Resistance (Rocc/Rint)
- ▶ Forced Oscillation Technique
- ▶ Integrated Dosimeter
- ▶ Cardio Pulmonary Exercise Testing & Nutritional Assessment



Application fields

Quark PFT is the ideal equipment for applications in Pulmonary Departments, Sport Science, Cardiology and any field where the study of the Cardio-respiratory system is necessary.

Unsurpassed accuracy

Quark PFT uses COSMED's innovative technology to ensure great accuracy exceeding ATS and ERS criteria. Automated calibration, warnings and messages are prompted to avoid errors and simplify testing procedures.

Rapid Response CO-CH₄ Analyzers

The new "diamond-like carbon" infrared technology allows for performing accurate and reliable DL_{CO} tests. The fast response CO-CH₄ multisensor allows real time analysis and accurate measurement event on Patients with reduced Vital Capacity

Paramagnetic O₂ Sensor

Quark PFT is provided with the most accurate and fast-response Paramagnetic O₂ sensor. This technology does not require periodical maintenance and prevents user from unexpected down-time due to sudden failures.

Choose Your Ideal Flowmeter

Quark PFT is the only PFT lab offering 3 different flowmeter configurations:

The bi-directional digital **Turbine** flowmeter ensures utmost accuracy within a wide flow range (up to 20 l/sec) requiring virtually no maintenance. The perfect choice for accurate flow/volume measurements during exercise in any application (patients to elite athletes)

The **multi-use Pneumotach X9** provides high accuracy at very low flow rates and extremely low thermal capacity (so avoiding condensation during expiration). Easily maintainable, it guarantees high reliability through many tests. Perfect for clinical applications during lung function.

The new **disposable Pneumotach Flowsafe** prevents patients from the risk of cross contamination and provides superior accuracy at very low flow rates. It can be used even during Lung Volumes and DL_{CO} tests. The ideal choice for continue/heavy testing load spirometry.

New Breathing Valve

The newly-designed breathing valve (patent) offers incomparable ease-of-disinfection and reliability over the time. An extra number of valves helps user simplifying the operating procedures.

Ultimate Software

The operating software designed for Windows XP and compatible with VISTA and Windows 7 (32 bits), provides easy operations through the intuitively designed Windows™ software. User-friendly interface, intuitive commands and icons are the perfect tools for fast and reliable data collection in any hospital department or doctor office:

- ▶ Complete management of patient archive, diagnosis database and clinical reports
- ▶ Fully custom design and user defined plots, parameters and printout reports
- ▶ Integrated patient database between all PFT modules and products
- ▶ Instant test data export in different file formats (Excel, ASCII files)
- ▶ User-defined parameter and predicted equations
- ▶ Database of diagnosis
- ▶ Automatic generation of PDF files according to consistent user-defined file names
- ▶ Printout batch of multiple tests
- ▶ Compatible with any LAN running under MS Windows.



The new breathing valve can be easily disinfected and exchanged between tests.



Single use Pneumotach "Flowsafe" provides extreme accuracy at very low flows.



Multi-use Pneumotach "X9" guarantees high reliability through many tests.



Breeze through the innovative software of Quark PFT.

True Modularity !!

Quark PFT has been designed to meet the needs of the modern physician who invests before spending. The system incorporates “plug and play” circuitry for instant upgrades. Save your money and choose your best product configuration at the most competitive price in the market. Quark PFT available modules are:

Spirometry Module (standard)

The basic PFT module includes all features and hardware for spirometry testing (FVC, SVC, MMV and bronchial-challenge tests).

Lung Volumes Module

Adds Functional Residual Capacity testing via Nitrogen Washout and Closing Volume (single breath with 100% O₂).

Body Plethysmography Module

Body Plethysmography is considered the Gold Standard for measuring lung volume (TGV, TLC, FRC) and resistance (RAW, GAW). The COSMED plethysmographic cabin guarantees accuracy and fast test execution. Ultimate pressure sensor transducers (resolution). Ensure maximum sensitivity with severe patient's response.

DL_{co} Module

Brings Lung Diffusing Capacity testing (single-breath, intrabreath, membrane diffusion and 3eq DL_{co}). The single breath dilution technique can also be used for measuring lung volumes, becoming an affordable and clinically accepted alternative to body plethysmography and nitrogen washout.

Dosimeter Module

The integrated dosimeter for automatic bronchial challenge tests delivers aerosols solution according to either predefined or user protocols.

- ▶ Multi-step protocol with a single drug concentration
- ▶ Pressure control during drug delivery to ensure maximal accuracy
- ▶ Inspired air filtration for both user and environment safety
- ▶ Requires compressed air gas

Respiratory Mechanics Module

Upgrade your PFT right on the field with all features you need for Respiratory Mechanics including PO.1, MIP-MEP and optionally Airway Resistance by occlusion technique (Rocc/Rint). This feature is standard with either Qbox standalone or module.

Quark i2m Forced Oscillations

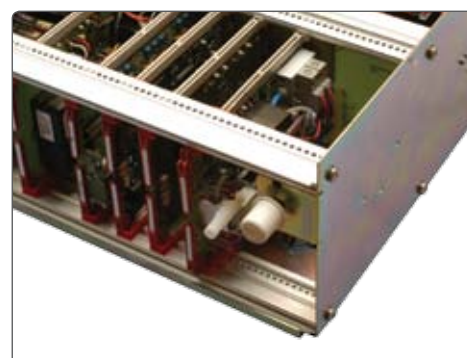
Add Forced Oscillations to your PFT lab by integrating Quark i2m unit. Featuring new Input Impedance measurements by Pseudo-Random-Noise signal, a non-invasive method for recording and monitoring the lung mechanics of the total respiratory system.

CPET Module

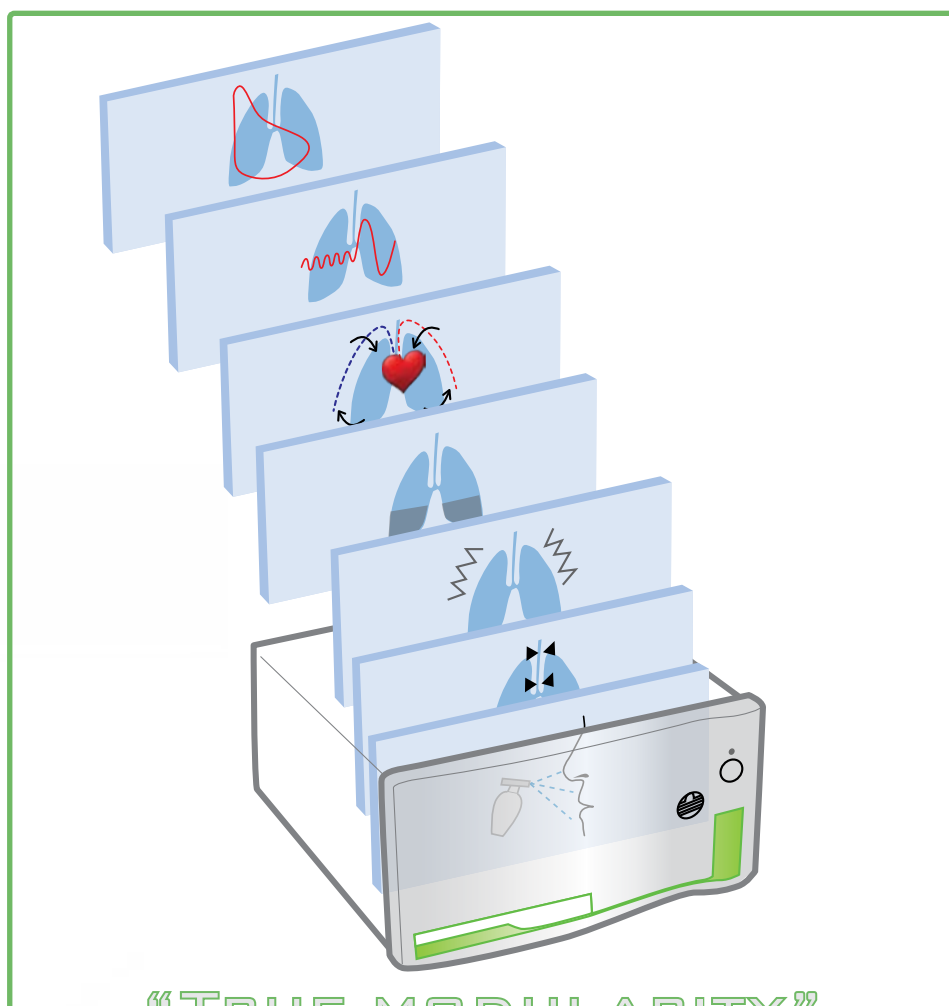
Expand your Pulmonary Function Testing with a fully integrated Cardio Pulmonary Exercise Testing using “breath by breath” Pulmonary Gas Exchange (VO₂, VCO₂, etc.).



Medical graded cart allows easy move of Quark PFT and accessories anywhere in your lab.



The modular design of Quark PFT minimizes technical assistance by means of boards replacement.

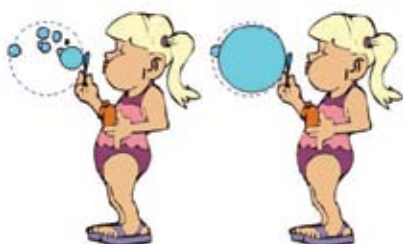


“TRUE MODULARITY”

Labs interested in Nutritional Assessment and Resting Energy Expenditure Measurements of confined-to-bed patients or for weight loss programs, may benefit the complete integrated Nutritional Module for indirect calorimetry. The module includes necessary hardware for both ventilated canopy and/or face mask assessment.

COSMED has done everything to protect customer's investment by keeping the running costs as low as possible. The design architecture has been made to eliminate the procedure of ordinary maintenance and to easily and rapidly solve any technical problem by replacing a board.

- ▶ Forced Vital Capacity
- ▶ Slow Vital Capacity (In-Ex)
- ▶ Forced Vital Capacity post BD
- ▶ Quality Control messages according to the latest ATS/ERS recommendation
- ▶ Best Test selection and reproducibility criteria according to the ATS/ERS standards
- ▶ Automatic test interpretation according to the latest ATS/ERS criteria
- ▶ Simplified management of bronchial challenge test with user defined protocols
- ▶ Auto-calculation of key interpretive indices (ERS '93) for bronchial dilator and metacholine tests
- ▶ Calculation of PD10, PD15 and PD20
- ▶ Lung age
- ▶ Fall FEV1 plot
- ▶ Trend analysis on multiple parameters



- ▶ Software encouragement tool for paediatric or non-cooperative patients
- ▶ 11 free selectable sets of predicted and unlimited number of user defined sets
- ▶ New NHANES III predicted equations included
- ▶ FEV6, FEV6/FVC
- ▶ Printouts complying ATS/ERS standard
- ▶ Automatic BTPS correction
- ▶ New GDT format for data export



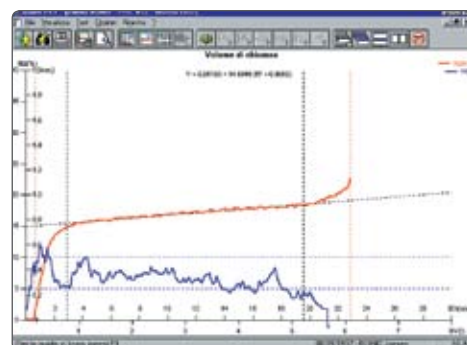
PFT use a unique breathing valve to perform different testing manoeuvres.

- ▶ FRC, RV, TLC
- ▶ Real time N2 Wash-Out plot together with several indicators for the control of the respiratory pattern
- ▶ Quality control messages during test maneuver (Wash-out pattern)
- ▶ User defined Multi axis graphs during and after test execution
- ▶ Visual leak detection by real-time FetN2 plot.
- ▶ Possibility to perform SVC separately.

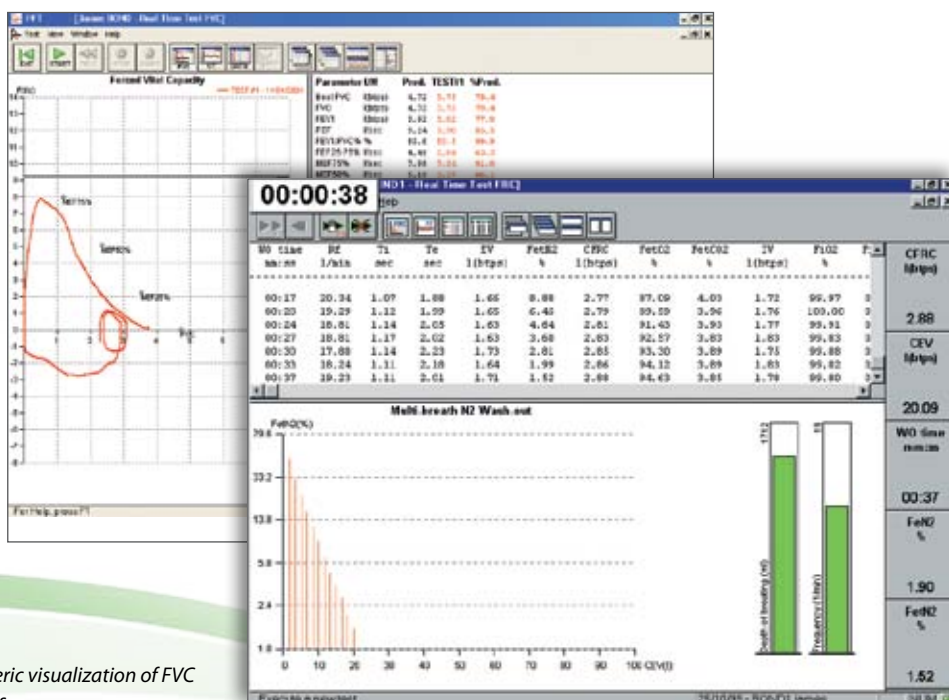


Integrated dosimeter for automatic bronchial challenge tests

- ▶ Large cabin volume (873 litres)
(Constant-Volume technique)
- ▶ Lung Volumes (TGV, TLC, FRC etc.)
- ▶ Absolute and Specific Airways Resistance (RAW, SRAW)
- ▶ Conductance of Airways GAW/SGAW)



Real time display of the Closing Volume test.



Real time graphic and numeric visualization of FVC and Nitrogen Wash Out tests.

Lung Distribution

- ▶ Closing Volume with pure O₂ Single Breath technique
- ▶ Automatic/manual detection of the 4 phases composing the washout curve
- ▶ Automatic/manual detection of the Dead Space according to the Fowler method
- ▶ Automatic calculation and display of the linear fitting on the alveolar plateau
- ▶ Data elaboration tools for Lung Distribution Analysis
- ▶ Calculation of LCI (Lung Clearance Index) and AMDN (Alveolar based Mean Dilution Number).

Lung Diffusing Capacity

- ▶ DL_{CO} Single-Breath with Apnea
- ▶ Visual inspection of CO and CH₄ traces
- ▶ DL_{CO} intrabreath, without breath hold
- ▶ Dm, Vc, DL_{CO} 3 equations and DL_{CO} steady state
- ▶ Continuous measurement and display of CO and CH₄%
- ▶ Ability to change the rejection and sampling volume for accurate measurement of patients with reduced vital capacity
- ▶ Possibility to split the membrane diffusion capacity and capillary volume

- ▶ Breath hold time settings according to different standards (Jones, Ogilvie and ESP)
- ▶ DL_{CO} compensation for hemoglobin, carboxy hemoglobin and environmental pressure
- ▶ Graphical leak detection during breath hold time
- ▶ View and change dead space detection by the Fowler method.

DL_{CO} by 3 Equation Method

The method of calculating DL_{CO} developed by Graham, Cotton and coll. based on separate equations that analytically account for the differences of CO uptake during the three phases of the test (inhalation, breath holding, exhalation). This makes the measurement of the single breath DL_{CO} independent from the maneuver and increases the accuracy of the test.

Respiratory Mechanics

- ▶ Measurement of respiratory muscle strength (MIP/MEP)
- ▶ Respiratory drive (P0.1).

Airway Resistance

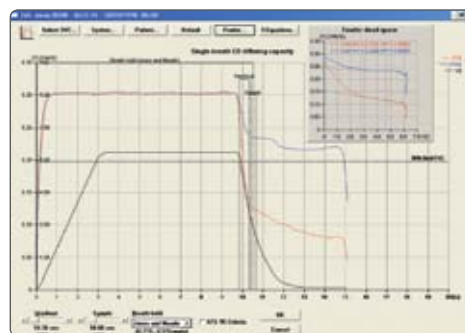
- ▶ Rint, Rocc, RoccEX, RoccIN, Gav etc.
- ▶ Dedicated low-flows Pneumotach
- ▶ Respiratory resistance with interrupter technique.



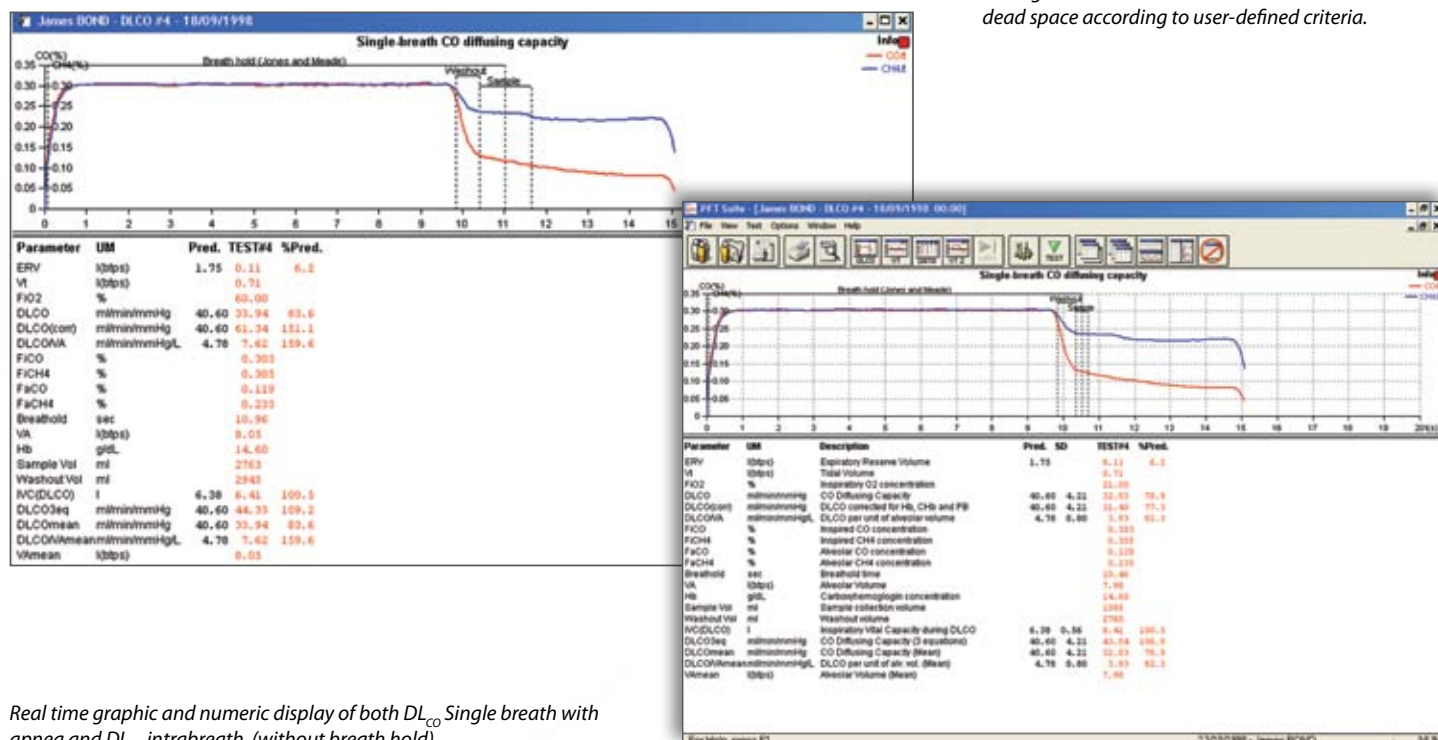
TGV and RAW tests inside the Body Box



The Roccc kit for airway resistance is highly indicated for pediatric applications.



Editing tool for the selection of alveolar volumes and dead space according to user-defined criteria.



Real time graphic and numeric display of both DL_{CO} Single breath with apnea and DL_{CO} intrabreath (without breath hold).

Forced Oscillations

Quark PFT can be fully integrated with **Quark i2m** the forced oscillation system for measuring total respiratory system impedance

- ▶ Pseudo random noise signal
- ▶ Tidal Breathing analysis
- ▶ Fast and easy testing procedure (8 seconds tidal breathing only)
- ▶ No patient collaboration required ideal for pediatric applications
- ▶ Frequency range from 4 to 48Hz
- ▶ Adjustable arm for maximum comfort during testing
- ▶ Great accuracy and reproducibility.

Exercise Testing

- ▶ Breath by breath or Mixing Chamber pulmonary gas exchange (VO_2 , VCO_2)
- ▶ Real time visualization of O_2 and CO_2 waveforms
- ▶ Automatic and manual detection of anaerobic threshold (modified V-slope)
- ▶ Advanced data elaboration (filtering, smoothing, spread-sheet features)
- ▶ O_2 Kinetics (O_2 deficit, O_2 debt and time constant)
- ▶ Estimation of Cardiac Output from measured $\text{VO}_{2\text{max}}$
- ▶ Extrapolation of $\text{VO}_{2\text{max}}$ during a sub-maximal test
- ▶ Custom fittings (linear and exponential)
- ▶ Exercise Flow-Volume loops
- ▶ Ergometer control by RS232 interface
- ▶ Instant test data export to Excel, TXT, ASCII and in XPO (COSMED proprietary) formats
- ▶ User defined parameters
- ▶ Customized graphical and numerical data presentation (display, report and printout)
- ▶ Test data and predicted values editing
- ▶ Compatible with any LAN running under MS Windows.

- ▶ Continuous display of all 12 leads
- ▶ True diagnostic quality waveforms
- ▶ Single or multiple leads view including zoom and freeze features
- ▶ Current and reference ST analysis profiled for 12 leads
- ▶ ST depression and slope trends displayed during test
- ▶ Averaged QRS complexes overlapped on a reference ECG complex.



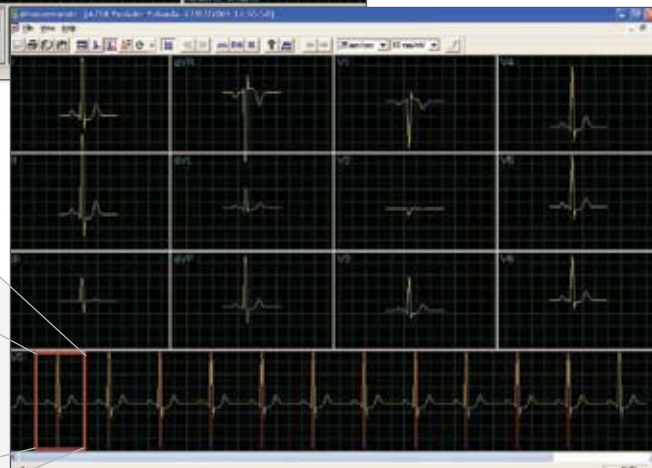
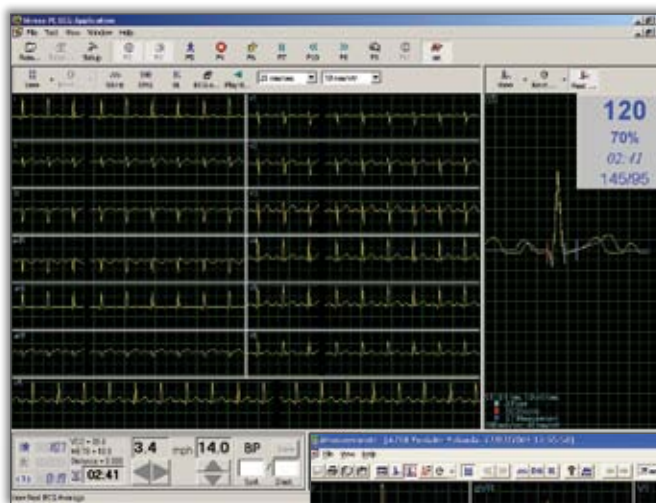
The CPET module add the possibility of performing pulmonary gas exchange analysis during exercise.

Nutritional Assessment

- ▶ Indirect calorimetry VO_2 , VCO_2 , RQ, REE and related parameters
- ▶ Available with Canopy or facial mask
- ▶ Individuation of energy substrate utilization (%FAT, %CHO, %PRO)
- ▶ Available with High FiO_2 kit for enriched O_2 mixture use
- ▶ Suitable for mechanically ventilated patients (ICU) (option)
- ▶ Long lasting measurements while sleeping
- ▶ Canopy blower flow rate directly measured with digital turbine flowmeter
- ▶ Automatic re-calibration procedure during test
- ▶ The ethanol kit for the respiratory quotient control.

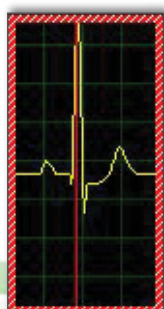


Measurement of resting energy expenditure with a Canopy.



12-lead Stress Testing ECG

Only COSMED gives you the power to integrate a 12-lead ECG with the breath by breath metabolic data. Developed in conjunction with a world leader in ECG technology, the PC card based Quark T12x and C12x offer the following features:



Real time ECG display and scroll-back of all leads, QRS complexes and trends

Available flowmeters

Available flowmeters

Disposable pneumotach "Flowsafe"
Multi-use pneumotach "X9"
Digital Turbine (28 mm)
Digital turbine (18 mm)

Pulse Oximeter

An integrated monitor of oxygen saturation (SpO₂) at rest and during exercise available with finger, reflectance or ear sensors

Mixing Chamber

Special technology that allows gas exchange analysis of low and high ventilation ranges

12-lead stress test ECG

Available in both wireless and direct patient cable configurations

Ergometers

Wide selection of treadmills and bikes for any applications

Anti-Bacterial Filters

High filtration efficiency filter barrier to avoid cross contamination

Dosimeter

Integrated dosimeter for accurate bronchial challenge tests

Medical Cart

Medical graded Cart with isolation patient transformer required for medical environments

Arm support

An adjustable arm holding the breathing valve

Gas cylinder & regulator

Specific medical gas mixtures and pressure regulators for calibration and testing

PC & Peripherals

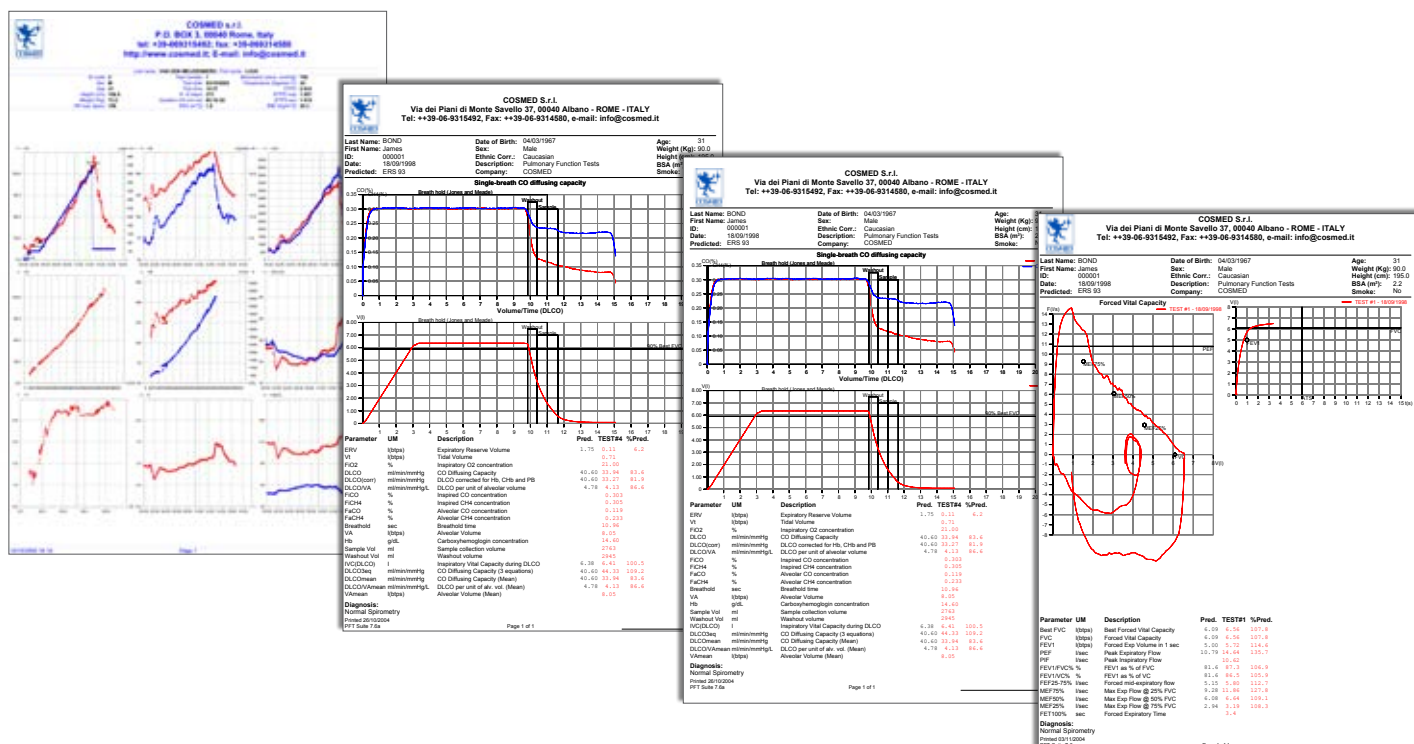
Proven PCs & peripherals fully compatible
w/ COSMED equipment, factory-installed
to avoid any possible compatibility issue



The SpO₂ module is available with different sensor probes: Finger, Ear and reflectance.



True diagnostic quality 12-lead stress test ECG available in both wireless and Patient-cable configurations.



Explicative colour printout reports in different formats deliver clear information to user including: graphical test display, numerical data compared to predicted values and automatic interpretation of test results.

Technical Specification

Tests	Spirometry	Lung Volumes	Body Box	Diffusing Capacity	Respiratory Mechanics	Metabolic
Forced/Slow Vital Capacity (SVC-FVC)	•					
Maximum Voluntary Ventilation (MVV)	•					
Bronchial Challenge Test	•					
Integrated Dosimeter	○					
Multi-Breath Nitrogen Wash-out		○				
Single-Breath 100 % O ₂ (Closing Volume)		○				
Lung Volumes by DLCO Single Breath dilution		○				
Thoracic Gas Volume (TGV)			○			
Airway Resistance (Roc/Rint)			○			
DLCO Single Breath (w/ Breath Hold & Intrabreath)				○		
DLCO 3eq (3 equations method)				○		
Membrane Diffusing Capacity				○		
MIP/MEP					○	
Respiratory Drive (P _O .1)					○	
Airway Resistance (Roc/Rint)					○	
Forced Oscillation Technique (FOT)					○	
Indirect Calorimetry w/ Mask						○
Indirect Calorimetry w/ Canopy Hood						○
Indirect Calorimetry w/ Ventilator						○
VO ₂ max, Anaerobic Threshold						○
Integrated Pulse Oximeter (SpO ₂)						○
Integrated 12-lead ECG (Gas/ECG)						○
HR Interface w/ external ECG (TTL)						○

Analyzers	O ₂	CO ₂	CO	CH ₄
Type	Paramagnetic	Infrared digital	Infrared	Infrared
Range	0-100 %	0-10%	0-0.35%	0-0.35%
Accuracy	± 0.1 %	± 0.1 %	± 0.003 %	± 0.003 %
Response time	120 ms	100 ms	200 ms	200 ms
Warm-up time	5 min	10 min	15 min	15 min

Flowmeter	Digital turbine (Ø 18mm)	Digital turbine (Ø 28 mm)	Flowsafe PNT	PNT X9
Type	Bi-directional	Bi-directional	Lilly Pneumotach	Lilly Pneumotach
Flow range	0-8 l/s	0-16 l/s	0-14 l/s	0-14 l/s
Ventilation range	0-50 l/min	0-300 l/min	-----	-----
Accuracy (flow)	±2% or 20 ml/s	±2% or 20 ml/s	±2% or 20 ml/s	±2% or 20 ml/s
Accuracy (ventil.)	±2% or 100 ml/min	±2% or 200 ml/min	-----	-----
Resistance	<0.7cmH ₂ O/l/s@3l/s	<0.8 cmH ₂ O/l/s@14l/s	<1cmH ₂ O/l/s @ 14 l/s	<1cmH ₂ O/l/s@14l/s

Hardware

Temperature	0-50°C (32 - 122 F°)
Barometer	400-800 mmHg
Humidity	0-100%
Dimensions (Main unit)	33 cm x 41 cm h 16 cm (12,9 x 16 in h 6.2 in)
Weight (Main unit)	11 kg (24,2 lb)

Available languages

Italian, English, German, Spanish, French, Portuguese.

Electrical requirements

Power supply	100-240V ± 10% 50/60 Hz
Power consumption	100 VA
Class	I type BF (EN60601-1)

PC configuration required

Pentium or faster, Windows XP, VISTA (32 bit), Windows 7 (32 bit), 128 Mb RAM or more, USB or RS 232, CD-Rom reader, 80 Mb on HD space available.

Safety & Quality Standards

Equipment complies with MDD (93/42 EEC) and FDA 510(k) cleared, EN 60601-1 (safety) and EN 60601-1-2 (EMC)
COSMED is an organisation whose quality management system is certified by CERMET according to UNI EN ISO 9001:2008 and UNI EN ISO 13484:2004

Distributed by:



COSMED srl Headquarters

Via dei Piani di Monte Savello 37
Albano Laziale - Rome
00041 ITALY
Phone +39 06 931-5492
Fax +39 06 931-4580

info@cosmed.com

USA Concord, CA - Chicago, IL

Phone +1 (925) 676-6002
Fax +1 (925) 676-6005
info@cosmedusa.com

CHINA Guangzhou

Phone +86 (20) 8332-4521
Fax +86 (20) 8332-0683
china@cosmed.com



cosmed.com