Cardiopulmonary Exercise Testing

The answer is in a single breath
Diagnosis with Foresight
Cardiopulmonary exercise testing from CORTEX

«Man is as healthy as his veins» – that is only part of the truth. Impairments of any part of the cardiopulmonary system often affect performance and require precise differential diagnosis.

This is where cardiopulmonary exercise testing as a noninvasive test procedure assumes an important role. Meaningful parameters for cardiac and respiratory function and metabolism can be determined simply and rapidly in a single test. In many patients dyspnea impaired performance and other early-stage diseases only occur on physical exertion and in this case exercise tests demonstrate clear diagnostic benefits over examinations performed at rest.

In your expert hands cardiopulmonary exercise testing with ECG recording is an excellent instrument for diagnosis, treatment monitoring and prevention. With the all-round expertise of a world market leader, CORTEX is your partner.
Looking for a simple procedure for assessing cardiovascular and respiratory function? Want to offer your patients meaningful individualized health services and extend your diagnostic spectrum? Performance assessment under realistic conditions is particularly important for your work?

Adopt the gold standard for cardiopulmonary exercise testing, risk assessment and performance testing:

**Cardiopulmonary exercise testing**

The diagnostic benefit of cardiopulmonary exercise testing in medicine is now recognized worldwide. Cutting-edge technology makes it possible to construct small, mobile and portable systems that are highly efficient and reliable.

This makes cardiopulmonary exercise testing the gold standard in performance testing:

- Determine important cardiopulmonary parameters in just one noninvasive test.
- Distinguish immediately between cardiovascular and pulmonary function deficits and institute the correct treatment.
- Diagnose in detail functional deficits that are only detectable on exercise.
- Use a procedure that provides feedback on performance and exercise tolerance in real-life situations.
- Receive medical results and conclusions that are relevant to your patient’s everyday life.
Cardiopulmonary Exercise Testing Pays its Way
Economic, multifunctional and flexible

We have given cardiopulmonary exercise testing a new status: first, CORTEX systems are small, light and robust; secondly, our software concept provides very flexible and customizable features. Ease of maintenance and well-designed accessories make not only acquisition, but also operation of our systems particularly efficient. Selected applications include:

- Differential diagnosis of cardiopulmonary conditions in cardiology, pulmonology and occupational and sports medicine
- Cardiac risk assessment, treatment evaluation and rehabilitation monitoring in heart patients
- Performance testing for training management in leisure and elite athletes
- Assessment of physical constitution and surgical risk in transplantation medicine and prosthetic surgery

By means of practice-oriented software modules, our systems can be adapted to fulfill almost any differential diagnosis or performance testing requirement: you choose the specific module that meets your application spectrum.

Convince your patients with your specialist skills. Exact diagnosis and an innovative, evaluated procedure – our cardiopulmonary exercise testing systems are a stepping stone to success.
Just a few years ago cardiopulmonary exercise testing was the domain of university diagnostics – large, stationary systems prevented simple and practice-oriented use. The CORTEX-mobile systems have changed all that. We are now the world market leader in mobile cardiopulmonary exercise testing and set new global quality standards. With modern know-how and as a result of an intensive exchange of experience with our customers, we are continuing to enhance our systems successfully. However, despite or perhaps even because of the increasing complexity, our self-imposed obligation is to ensure that cardiopulmonary exercise testing is simple and cost-effective.

For indoors or outdoors, portable or mobile – at CORTEX you will find the right solution for your needs. Our product lines:

**METALYZER®**
Practical, portable cardiopulmonary exercise testing systems for practices and hospitals for complete medical functional analysis of the heart, lungs and metabolism at rest and during exercise. By virtue of the ECG connection and a variety of hardware and software options, these systems can be used for a particularly wide range of applications.

**METAMAX®**
Mobile wireless „indoor“ and „outdoor“ cardiopulmonary/metabolic exercise testing system for sport and training sciences and for occupational medicine under real exercise conditions. The mains-independent operation and wireless transmission ensure a particularly wide radius of operation, while numerous hardware extensions and coordinated software options provide a high degree of flexibility.
Precise Determination of Individual Exercise Tolerance
METALYZER® – cardiopulmonary exercise testing redefined

Cardiopulmonary exercise testing for diagnosis, therapy and prevention – that is the focal point of our research and development. The METALYZER® systems in conjunction with our MetaSoft® software are the key to our innovative success. Whether as a metabolic exercise testing system for performance testing or as a complete cardiopulmonary exercise testing system – CORTEX measurement technologies and the powerful CORTEX software solutions will convince you:

- Incomparable measurement precision as a result of cutting-edge sensor technology and simple, rapid calibration
- Respiratory gas analysis using breath-by-breath or mixing chamber methodology
- Measurement and monitoring of heart function via a heart rate chest strap or 12-channel ECG*
- Small, light, portable: 24 x 17 x 9 cm weighing only 1.3 kg, in a robust carrying case
- Individual and reusable masks available in different sizes
- Additional diagnostic measurement systems of important parameters and peripheral components*
- Interfacing and control of almost all current available bicycle ergometers and treadmills
- Interfacing to hospital and practice IT systems*
- Numerous software options*

Options and add-ons
- METALYZER 3B (Breath-by-Breath-System): Part No. 220-01-008
- METALYZER II (Mixing Chamber System): Part No. 210-01-995

*Options and add-ons
The METAMAX® is a mobile, mains independent indoor and outdoor cardiopulmonary exercise testing system for sports and exercise science as well as for occupational medicine. Complete performance testing directly under actual performed activity. Thanks to the bidirectional wireless transmission and battery operation you can obtain previously unachievable freedom for your application. This means: put on, connect up and measure. A variety of hardware expansions and complementary software options increase flexibility. The «International Forum Design» awarded the METAMAX® with the famous iF Product Design Award.

- Maximum measurement precision as a result of cutting-edge sensor technology and rapid calibration
- Extremely compact design, well designed body attachment and light weight (570 g including battery)
- Mains-independent operation up to 15 hours
- Wireless range up to 1,0 km
- Respiratory gas analysis using breath-by-breath or mixing chamber methodology
- Patented bidirectional telemetric data transmission and audio output for efficient patient management
- Measuring the heart rate with a chest strap and recording the heart function with a 3-channel or 12-channel ECG*
- Cutting-edge GPS technology to determine speed and altitude*
- Integration of blood pressure devices and pulse oximetry systems*

METAMAX 3B (Breath-by-Breath-System): Part No. 130-01-992
METAMAX 3X (Mixing Chamber System): Part No. 140-01-993

*Options and add-ons

The answer is in a single breath
Cardiopulmonary Exercise Testing in Practice

Multifunctionality – the key advantage of CORTEX

For the cardiologist

The situation: A 58-year-old man is referred to you with dyspnea of unknown origin. You must decide whether he is suffering cardiac-induced dyspnea or whether this is a case of respiratory insufficiency.

The solution: Knowing the value of cardiopulmonary exercise testing, you immediately decide on this testing method. You use your CORTEX METALYZER® 3B for the test, combined with the 12-channel ECG, blood pressure module, pulse oximeter and PC. This system incl. all accessories are integrated on the compact CORTEX-mobile system cart and can therefore be used anywhere in your practice. Patient data can be transmitted directly from your practice IT system to the computer via the network. Using this testing method you can detect significantly reduced values in maximum oxygen uptake, heart rate reserve and oxygen pulse even at a low exercise load of 90 Watts.

Your success: A single test gives you the treatment-relevant differential diagnosis of cardiac-induced dyspnea. You do a risk assessment using the CORTEX STATERA® software and make treatment outcomes measurable. Your referring colleague has long appreciated your precise, clearly structured cardiopulmonary exercise testing documentation.
For the pulmonologist

The situation: As a pulmonologist you are examining a 52-year-old teacher at a vocational school. He has been referred to you by his GP with unremarkable findings. The patient is a heavy smoker and complains of rapid tiredness, irritability and impaired concentration at work. Previous medical examinations failed to produce a definitive diagnosis.

The solution: You suspect occupational causes as well as excessive smoking and after taking a detailed history you perform a cardiopulmonary exercise test. For this you use your CORTEX METALYZER® 3B system with the MetaSoft® software, 12-channel ECG and blood pressure module. What you value about this combination is the simplicity and reliability of use and the variety of different analysis options. The CORTEX Interpretation Assistant helps you analyze the results. You diagnose exercise-induced asthma, which manifests as impaired ventilation, an increased heart rate reserve and a reduced respiratory reserve. The patient is also exhibiting the impaired lung function typical of smokers.

Your success: As a result of the outstanding facilities offered by the METALYZER® for a complex diagnosis, you spare the patient additional, stressful examinations. You can institute promising treatments straight away. The positive effects of the recommended smoking cessation can be demonstrated objectively in subsequent cardiopulmonary exercise tests. Cardiopulmonary exercise testing extends your range of services and your circle of patients.
For the occupational physician

The situation: As an occupational physician you assess the fitness for deployment of professional groups exposed to particularly demanding or risky situations. The breathing apparatus crew and the municipal fire brigade regularly come to you for their statutory medical check-ups. In these professional groups the assessment of physical performance is vital if they are to be assigned to the appropriate category of crew or to remain a member of the breathing apparatus crew.

The solution: You use your portable METAMAX® 3B system from CORTEX with blood pressure module and notebook PC for the examination. Cardiopulmonary exercise testing and analysis are performed directly under real conditions in the breathing apparatus test chamber. Because it is an easy to use noninvasive procedure, you can also examine larger groups of patients within a minimal period of time. In your practice you combine METAMAX® 3B with the 12-channel ECG, the CORTEX-mobile system cart and your treadmill. As a result you do not require a further cardiopulmonary exercise testing system.

Your success: With our MetaSoft® software you receive all the data relevant to your assessment in real time. The examination is documented accurately, reliably and in detail by the system.
This is how it works:
- Prepare system
- Enter or call up patient data
- Prepare and connect patient
- Perform measurement
- Evaluate and interpret results
- Print out and discuss results

For the sports physician

The situation: As a sports physician you often treat athletes from clubs in your home town. The wide variety of sports and the very different performance levels mean that you require a procedure for performance testing that meets all the requirements of mass and elite sport. Simple-to-perform measurements and practical implementation of your individual training recommendations are important for your work.

The solution: You know about the multifunctional and sport-specific options of cardiopulmonary exercise testing and use your CORTEX complete system with METAMAX® 3B, MetaSoft® software, 12-channel ECG, blood pressure module and system cart. You use METAMAX® 3B both in your practice and also directly during sporting activity. The CORTEX Training Assistant and CORTEX Training Planner software modules assist you in individual counseling. In mass-sport testing you use the CORTEX Energy Metabolism module to determine the workload-dependent substrate utilization rate. For obese individuals you can use the results to establish appropriate dietary recommendations.

Your success: With the results of your performance testing you motivate athletes at all performance levels, particularly in endurance sports. Their targets can be translated into specific, individualized activities and the sporting achievements of your patients become objectively measurable. From performance enhancement through correction of training errors to explanation of health risks, you cover a broad spectrum of sports medicine through your individualized support.
MetaSoft® Software

The core of our systems

The basis of all CORTEX systems is the MetaSoft® software. It perfectly meets the requirements of practice-oriented, powerful cardiopulmonary exercise testing – quickly learnable, intuitive to operate.

Individual user profiles ease the work flow. Modular software expansions increase the flexibility of the system. The workload profiles can be optimally adapted to any patient.

The software MetaSoft® reliably controls all peripheral devices or systems, in example blood pressure measuring devices, ergometers and further workload devices. Parallel to the basic values, the software determines further parameters such as oxygen uptake, oxygen uptake kinetics as well as ventilatory thresholds.

The tracings of the 12-channel ECG are continuously displayed and can be saved as desired.

Clearly laid out graphical user interfaces assist you while evaluating the results. Innovative cardiopulmonary exercise testing software must be simple.
Patients with an unknown cardiovascular risk can be jeopardized when subject to a maximum exercise load. For this patient group we have developed STATERA® – our expert system for risk assessment and treatment evaluation in patients with heart disease. Even with low exercise loads and short exercise times you will obtain clinically relevant feedback with STATERA®.

STATERA® uses a submaximal metabolic exercise test to determine selected risk-predictive exercise parameters for left ventricular function and sympathetic activity. Laboratory values such as BMP and CRP and other relevant information can be included here. Based on scientific studies, the STATERA® risk parameters are proven predictors of cardiovascular risk. Meaningful trend and comparison graphs allow you to monitor the changes obtained with a given therapy.

Our software fulfills your most important requirement in testing cardiac risk patients: the acquisition of clinically relevant data without exposing the patient to unnecessary risks. CORTEX takes your responsibility seriously: with STATERA®.
Lightning-Fast Results
Help from the CORTEX Interpretation Assistant

The path from measurement to report can be very simple, even if a large number of different individual values and curves need to be interpreted. The CORTEX Interpretation Assistant guides you rapidly, securely and simply to a meaningful individual report.

Clearly structured, interactive decision trees based on K. Wasserman’s interpretation flow-chart approach help you to evaluate the parameters measured. A definite diagnosis is obtained in the blink of an eye. Physiologic reasoning underlies each step in the decision. The suggested decision paths and diagnosis texts can be customized at any time. You can choose between a short or long report form, with or without a complete decision path and with supplementary physiologic explanations.

Your patients appreciate a short waiting time between testing and discussion of the diagnosis. With the innovative software tools from CORTEX you gain more time in differential diagnosis and performance testing.

CORTEX Interpretation Assistant: Part No. 720-09-031
Cardiac Output Module Reveals Heart Disease

A number of heart diseases cause changes in heart rate and in left and right ventricular stroke volume. These changes become particularly marked on exercise. Our cardiopulmonary exercise testing systems allow the continuous, noninvasive recording of cardiac output based on the maximum and real-time oxygen uptake (K. Wasserman’s method). Therefore, even during cardiopulmonary exercise testing you are obtaining indicators of cardiac changes.

Our CORTEX Cardiac Output software option supplements MetaSoft® with the continuous determination and display of cardiac output and offers a safe and permanent indicator of heart function for both healthy subjects and cardiac patients.

Conventional Spirometry

All our solutions for cardiopulmonary exercise testing naturally offer the option of conventional spirometry. You therefore receive our CORTEX Spirometry software option, which operates within the MetaSoft® functional environment and offers you a number of other measurement, calculation and comparison options in addition to VC, FVC and MVV tests.

With minimal additional effort you can offer your patients a lung function test at any time under laboratory conditions with CORTEX Spirometry.
Isn’t Weight Control Easy?

With the CORTEX Energy Metabolism module it is!

Optimized fat metabolism through individually adapted training is crucial for successful weight reduction. Focused and stress-free weight loss is only possible if you know your energy balance at rest and during exercise. The CORTEX Energy Metabolism software for MetaSoft® helps you to optimize your patients’ weight control individually.

With each CORTEX cardiopulmonary exercise testing system you can measure energy metabolism and substrate consumption at rest and during exercise. The methodological basis of this procedure is indirect calorimetry. A number of parameters, such as gross efficiency and percentage substrate consumption, supplement your analysis. This allows you to determine the maximum fat burning range individually. The results can be compared with normal values and presented in terms of body measurements. Using the CORTEX Energy Metabolism module, you can create clearly written reports as a basis for individual diet or training recommendations. And, in conjunction with our portable METAMAX® 3B system, you can determine energy metabolism directly during training or in a work environment.

As a physician you are required now more than ever to provide competent advice. Our software options make this task easier for you.
Efficient Training

The CORTEX Training Assistant points the way

The CORTEX Training Assistant software option for MetaSoft® offers you reliable support in determining optimal training and documented progress. In more than 20 years of cooperation with colleges, universities and Olympic training centers, we have built up an extensive database. Using this database, the software module evaluates the individual performance and determines the training zones on the basis of a well-established methodology. Key indicators of cardiopulmonary exercise testing such as Watt/kg, $V'\text{O}_2\max$, $V'\text{O}_2$/kg, HR, $V'\text{O}_2$/HR, AT and body mass index (BMI) are included. Five individualized, scientifically based heart rate training zones are determined automatically for different exercise phases. Training progress can be easily monitored and documented; to be achieved goals can be seen.

CORTEX Training Assistant: Part No. 720-09-008

Planned Success

Efficient training: the CORTEX Training Planner

Convert the results of the CORTEX Training Assistant simply and rapidly into a specific training plan. Simply set the parameters such as target, frequency and training equipment and generate a weekly and global training plan. With sport-specific, individual training zones it is easier for clients to organize their training themselves. And you improve their compliance with the training plan and make it easier for you to monitor the results.

CORTEX Training Planner: Part No. 720-09-007
Extend Your System and Your Performance

Workload devices
Cortex will offer you many current available workload devices from well-known manufacturers. We would be happy to provide you with further details.

Complete measurement set
This will provide you with everything. METALYZER® 3B cardiopulmonary exercise testing system including accessories, 12-channel PC-ECG with electrode suction system, bicycle ergometer, PC system with two monitors and printer, CORTEX-mobile system cart and MetaSoft® software.

CORTEX-mobile system cart
Remain mobile – CORTEX-mobile system cart can carry the METALYZER®, PC, printer, 2 monitors, ECG and ECG electrode suction system, and blood pressure device. Move your complete cardiopulmonary exercise testing system effortlessly to wherever you need it.

Ipod® and Xpod®
Simple and flexible pulse oximetry
**Ipod:** External digital system with finger clip sensor.
**Xpod:** Like Ipod, but with selectable application-specific sensors. With their compact size, Ipod and Xpod are particularly suitable for mobile use with METAMAX®.

Cardiopulmonary exercise testing and ECG
For cardiopulmonary exercise testing, most available ECG systems can be interfaced to the CORTEX systems. Moreover, CORTEX offers 12-channel ECG systems from well-known manufacturers.

Tango+
Automated, low-artifact blood pressure and HR measurement with upper arm cuff specifically for treadmill application. External system with a wide range of applications.

GPS module for METAMAX®
Even out in the field you can be kept informed about the moment-to-moment speed and altitude. Additional spatial data are recorded alongside the metabolic exercise test data and make it possible to specify the workload even without a bicycle ergometer.

PC, Notebook, second monitor and color printer
Our MetaSoft software works with Microsoft® Windows® XP and Windows® Vista™. On request we can supply you directly with the complete, customized hardware such as a PC or notebook with operating system, second monitor and color printer.
Metabolic Exercise Testing –
an Integral Service

Innovation and competence from CORTEX

WE OFFER:

- Extensive on-site product training
- On-site installation
- Software updates
- Attractive financing
- On-site and hotline service support
- A variety of seminars

All our products are CE certified and meet European standards for Quality and Safety*.

In your area – our sales and service partners are competent and authorized. For us, competence in cardiopulmonary exercise testing means constant technical innovation and close partnership – aspects you can rely on with CORTEX.

Innovative Solutions for Cardiopulmonary Exercise Testing

That’s what CORTEX stands for

With our two main product lines, METALYZER and METAMAX, we are pioneers in the field of medicine, sport and fitness. We achieve maximum performance in cardiopulmonary exercise testing with innovative hardware and software.

Our solutions for cardiopulmonary exercise testing are applied worldwide, ranging from basic research to routine cardiac diagnosis, from competitive sport to fitness centers. Physicians, therapists and coaches successfully use our systems in the fields of sports medicine, cardiology, pulmonology and occupational and rehabilitation medicine, as well as in exercise and sports science. CORTEX also stands for competence in extreme situations and high-level requirements, which has been demonstrated by our participation in the largest Everest medical expedition to date, the »Xtreme Everest« project (2007), and our involvement in many Olympic training centers.

Development, production and administration are located at our head office in Leipzig, Germany. From there we distribute our solutions for cardiopulmonary diagnostics to all continents via a worldwide network of local sales and service partners.

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