Energy-Lab Technologies

Innovative Heart and Stress Screening Technologies

vicardio
cardioscan
viport
Company – Who is ELT?

• Innovative medical Technologies company with headquarters in Hamburg (Germany)

• Providing leading Technologies in ECG-visualization and Stress measurement systems in Europe and worldwide

• Funded by the government of the city of Hamburg; supported by the oldest private bank of the world
Company philosophy

Energy-Lab Technologies is working towards one shared vision:

The aim is preventing tens of thousands of sudden, unnecessary deaths caused by heart- and stress infarcts, sepsis and falling asleep at the steering wheel and therefore becoming the market leader in the field of intelligible heart- and stress-screening.

This means:
• Providing physicians and patients with innovative hardware and software tools to lead healthier and better lives.
• Developing intelligent life science technologies for diagnosis and prevention of cardiovascular diseases.
Technology/Patents/Studies

Heart screening & 3-D-Heart-Portrait

Stress level measurement with HRV

Patents: Europe: EP 1047987 B1; USA: PCT 6,694,178 B1

Studies
## Patents and Brands

### Patente

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CERTIFICATE
for the
Quality Assurance System

As a notified body of the European Union (Reg. No. 0124) DEKRA Intertek Certification GmbH hereby approves the Quality Assurance System applied for design, manufacture and final inspection by the company

Energy-Lab Technologies GmbH
Burchardstr. 21 • D-20095 Hamburg

Approval is based on the result of the certification audit with report number 51039-Z1-00 and is performed in accordance with the stipulations of

Annex II, Section 3 of the Directive 93/42/EEC

of the Council dated June 14, 1993 governing medical devices. The certification is applicable to the devices specified in the Annex. The devices in question are subjected to testing and examination in accordance with Annex II, Section 3 of the Directive 93/42/EEC. The listed devices may be affixed with the CE marking indicated below.

Date of the first certification: 08.12.2005
This certificate is valid until: 07.12.2010

Date of the last recertification: 51039-15-00
Certificate-registration No.: 51039-Z1-00

DEKRA Intertek Certification GmbH
Stuttgart, 08.12.2005

DEKRA Intertek Certification GmbH · Handwerkstraße 15 · D-70565 Stuttgart · www.dekra-intertek.com
Product Lines

cardioscan

vicardio

viport
Competitive Advantage Fitness

- Heart Rate Monitors, e.g. Polar
- Cardio Tests
- BPM
- Cardioscan technology
Benchmark Medical

<table>
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<tr>
<th>Hardware</th>
<th>GE Corina &amp; Cardiosoft</th>
<th>Schiller Cardiovit AT-10</th>
<th>Schiller Vermessung Cardioday</th>
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Benchmark Consumer

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Energy-Lab Technologies GmbH
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Heart Screening - The “Traffic Light“ Principle

The ECP transforms the curve of an ECG into a three-dimensional heartportrait. The „Traffic Light“ principle immediately shows the health level of the tested person.

Green and blue colours stand for a healthy heart with low stress level. Yellow and orange-like colours already call for caution (deviation from the norm ECG curve)

Red and dark purple colours immediately call for alert. Further check up's are highly recommended!
## ECG Assessment

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<th>5.0 to 4.6</th>
<th>Good condition</th>
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<tr>
<td>Electrocardiographical results are within the usual range of physiological variations.</td>
<td>4.5 to 3.1</td>
<td>Physiological deviations</td>
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<tr>
<td>Possibly serious deviations in your heart condition have been detected. Pay attention to changes in your heart portrait. Do seek a doctor’s advice on these results.</td>
<td>3.0 to 1.1</td>
<td>Beyond physiol. deviations</td>
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<tr>
<td>Potentially very serious characteristics discovered. Make sure that you have not made any mistakes during the examination (incorrect method or incorrectly attached electrodes). Repeat the examination instantly. Should the results remain unchanged, you are strongly advised to consult your doctor without delay.</td>
<td>1.0 to 0.0</td>
<td>Pathological deviations</td>
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CSI: Cardio Stress Index

- Normal
- Slightly increased
- Increased
- Highly increased – further examination is recommended
Validation Study at the University of Münster
Prof. Dr. med. K. Völker / Dr. P. Rudack

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</table>
VIPORT - Technology

- Multichannel-ECG
- Cardio-Stress-Monitor for observation of Cardio Stress Index (CSI)
- Storage: Up to 20 complete data sets
- Data Transmission via USB
Calculation of Electro Cardio Portrait (ECP) and Cardio Stress Index (CSI)
Electro Cardio Portrait

The heart portrait translates the electrocardiograph into a three-dimensional colourful figure.
Heart Portraits

No deviation

Deviation requires further analysis by a doctor

Heart function and ECG
The Stress level

Analysis of heart rate variability

"If the heart beat gets as steady as the pecking of the woodpecker or as the raindrops on the roof, the patient is going to die within four days."

(Wang Shuhe 300 AC)
Heart Rate Variability (HRV)

RR-Intervals in ECG-Record

RR-Intervals as a tachogram
Heart Rate Variability

- **Long time analysis**
  - Analysis in **time domain and frequency domain**
  - 24 h Recordings (Holter-ECG)
  - mainly used for clinical purposes
  - time intensive

- **Short time analysis**
  - 2–15 min Recordings
  - Screenings i.e. in general medicine, sports medicine
  - quick and feasible
Heart Rate Variability
Analysis in time domain

Basis:
Interval between 2 RR-peaks
Heart Rate Variability
Analysis in time domain

Histogram: Categories of RR-Intervals.
- Calculation of the Histogram Baseline (scope) and the distribution of RR-Intervals.
Heart Rate Variability
Analysis in time domain

- Basis: Interval between 2 RR-peaks
- Calculation of average value and standard deviation (SDNN) within a certain time period.
- Calculation of Histogram scope, Histogram of proportional distribution
Heart Rate Variability
Analysis in time domain

measurement with artefacts (for example noise, muscle activity) or arrhythmia
Heart Rate Variability
Analysis in frequency domain

- Basis: Periodical processes of biological systems and their signals
- Signal split by spectral analysis
Heart Rate Variability
Analysis in frequency domain

LF – Range
(0,04 - 0,15 Hz)

- parasympathic und sympathetic Influence

LF

0,04-0,15

0,15-0,4 Hz

Blutdruck
Sympathikus
Parasympathikus

Atmung
Parasympathikus

Spektraldichte (ms² hz⁻¹)

Frequenz (Hz)

0 0,1 0,2 0,3 0,4 0,5
Heart Rate Variability
Analysis in frequency domain

HF – Range
(0,15 - 0,40 Hz)

- Parasympathetic Influence
Heart Rate Variability
Analysis in frequency domain

- **Ratio LF / HF**
  - Indicates autonomous balance
  - normal: 1.5 – 2.0
  - > 2.0: Indicator of an increasing sympathetic influence

- **LF – Range**
  - (0.04 - 0.15 Hz)

- **HF – Range**
  - (0.15 - 0.40 Hz)
The Stress level

Minor variations in heart rhythm

High Stress level

„Normal“ variations in heart rhythm

Low Stress level
What does Heart Stress mean?

Considerations about HRV related Science
Usage Areas of Heart Rate Variability

- **CARDIOLOGY**
  - CHD, Arrhythmia

- **NEUROLOGY**
  - Alzheimer's disease

- **ENDOCRINOLOGY**
  - Hyperthyroidism

- **PATHOPSYCHOLOGY**
  - Depression

- **DIABETES MEDICINE**
  - Cardiac Neuropathy

- **PRENATAL HEALTH CARE**
  - Sudden child death

- **GENERAL MEDICINE**
  - Physical and mental Stress

- **PHARMAKOLOGY**
  - Drugs, Medication Control
Stress causes for the heart

- Psychological stress
- Physical stress

Internal stressors:
- Inner tension
- Infection
- Former diseases
- …

External stressors:
- Heat / Cold
- Hypoxy
- Noise
- …

Augmentation
Possible causes for high stress load:

- Chronic mental stress
- Cold or flu infection
- Cardiovascular disease
- Type II diabetes
- Drugs and certain medication (e.g. Thyroxin)
- Over-exertion and excessive training
Usage areas of Heart Rate Variability: Intensive Care

- close correlation between reduced HRV and critical state of the patient

<table>
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<th>HRV ↑</th>
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<td>• Recovery of intensive</td>
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<td>• Early detection of</td>
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<td>sepsis</td>
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<tr>
<td>• Possible Complications</td>
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<tr>
<td>after Operation</td>
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</table>

HRV as a prognosis factor in intensive care

Winchell RJ et al. J Trauma 43 (1997) 927-933
Usage areas of Heart Rate Variability: CHD

• close inverse correlation between HRV and mortality in patients with CHD

• Suitable for risk estimation after myocardial infarct
  • Close correlation between reduced HRV and post infarct arrhythmia
  • Inverse correlation between HRV und mortality
  Kleiger RE et al. Am J Cardiol 59 (1987) 256-262

HRV as a prognosis factor in patients with CHD
Usage areas of Heart Rate Variability: Autonomous diabetic Neuropathy

- Reduced life expectancy with neuropathic patients
- Increased mortality rate: +29%
- Correlation between HRV and risk of CHD in diabetes patients


HRV as a Prognosis- and Diagnosisfactor in diabetic neuropathy
Usage areas of Heart Rate Variability: Depression

• reduced HRV with depressed patients

• Risk of heart diseases increased with depression

• Increase of HRV by improving the psychological condition through successful psychological healthcare  [Carney 2000]

HRV as a *risk- and therapy marker* in psychological therapy
Cardio Stress Index: Single parameters

- Histogram of RR-Intervals
- Tachogram
- Fast Fourié Transformation
- Poincaré-Plot
- Spectral Analysis
- pNN 50 and pNN 100
Mobile ECG
Overview: viport raw data

- CSI = Current cardiac stress load

- Duration of QRS in ms indicates the stimulus conduction through the ventricles

- Rhythmic or non rhythmic

- Heart rate

- RRSD = standard deviation as an absolute degree of HRV
Usage areas

- Coronary patients
- Psychosomatic patients
- Active people
- Corporate Healthcare
- Measurement of vegetative dysbalance
Benefits for patients

- Quick and easy to use
- Results are intuitively comprehensible
- Information about a global health indicator
- Documentation of progress
VIPORT - Screen
VIPORT - Technology

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- Cardio-Stress-Monitor for observation of Cardio Stress Index (CSI)
- Storage: Up to 20 complete data sets
- Data Transmission via USB
Check your heart!