# FACULTY **OF ENGINEERING MANAGEMENT**

Information on the selected test equipment at the
Faculty of Engineering Management, Poznan University of Technology
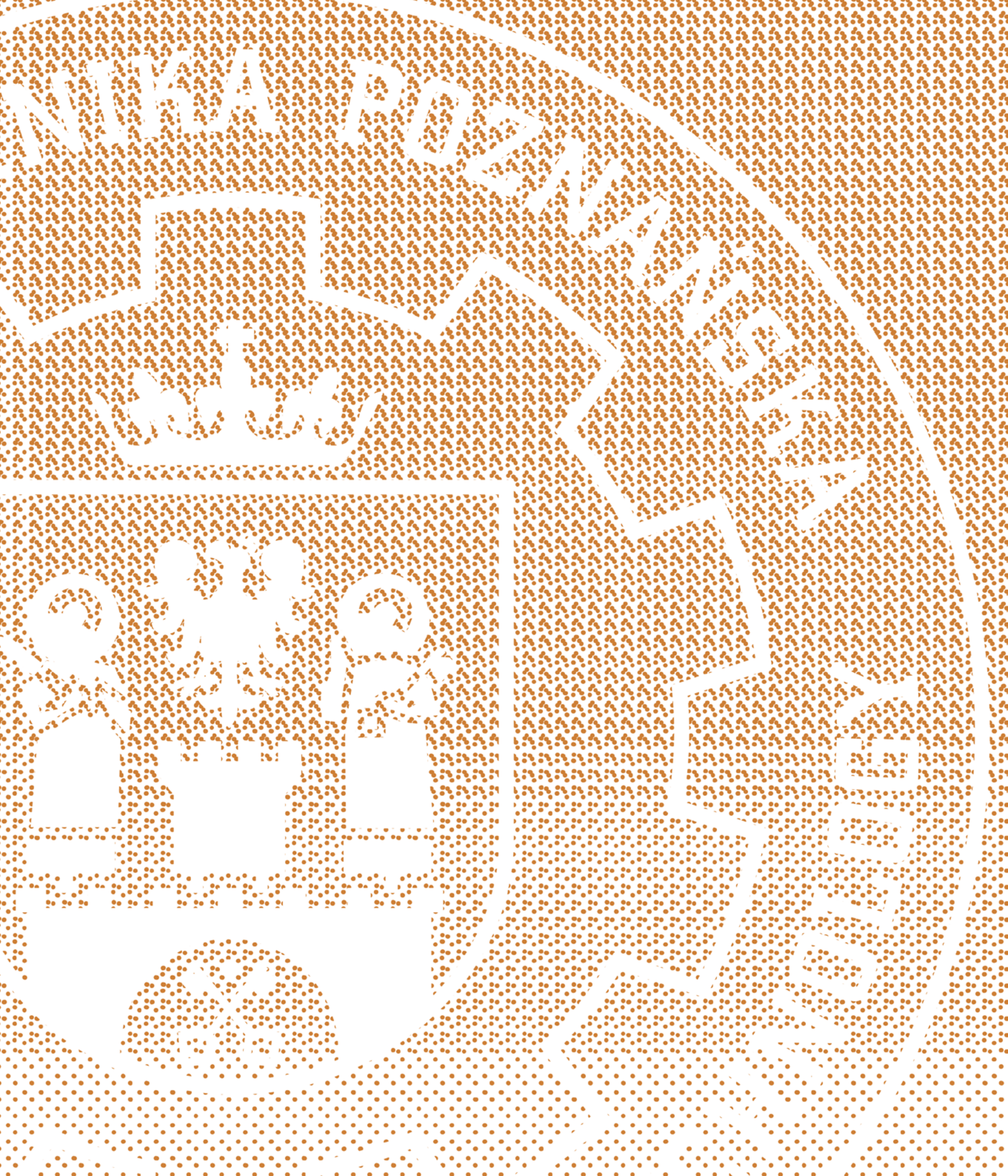
Faculty of Engineering Management has several teaching and research laboratories, including Ergonomics and Occupational Risk laboratory as well as Simulation and Optimization Centre In Logistics And Production Process (SOCILAPP).

Many companies, also with a high degree of production process automation, are facing problems of matching their work stations to psycho-physical abilities of their workers. Research teams at Faculty of Engineering Management have rich experience in the field of diagnosis, analysis and assessment of production processes with the use of the latest equipment. Fundamental know-how of the faculty is production organization and management with the help of information systems such as Microsoft Dynamics AX and FlexSim.

Research using the equipment presented in the catalogue enables to identify the risks not only resulting from work environment but also related to worker's behaviour and capability. Detailed diagnosis and measuring the risk factors enable effective planning of modernization works and, consequently, the protection of health and life of employees.

In order to reduce the cost of modernization works, we use advanced computer applications to virtually model production processes and assist in their design and manufacture. Outside the specified specializations the Faculty of Engineering Management conducts research on logistics systems, process analysis and optimization, a multi-faceted diagnosis and assessment of enterprise status, strategic studies (including foresight type), creating industrial clusters, labour standardization, competence profiles and building intellectual capital.

Let's solve problems with ergonomics, logistics and management of production processes together!

Magdalena Wyrwicka, PhD DSc Eng. Associate Professor
Dean of Faculty of Engineering Management

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# Simulation and Optimization Center In Logistics And Production Processes – SOCILAPP

- The organizational unit of the Faculty of Engineering Management at Poznan University of Technology set up by decision of the Council of the Faculty of Engineering Management in 2011. The originator, organizer and director of the Center is Paweł Pawlewski, DSc. Eng.

- The aim of the Center is support the transformation process of student projects into business projects, and the promotion and application of new technological solutions (so-called: high-tech) in simulation and optimization of logistics processes.

- On October 22, 2012 a laboratory was opened dedicated to simulation and optimization of logistics processes. This is the first laboratory formally certified by FlexSim Software Products Inc. USA in Poland and Europe.
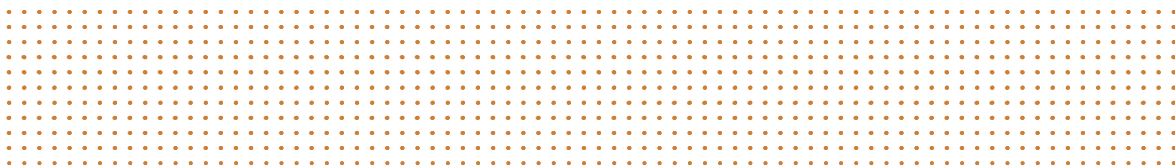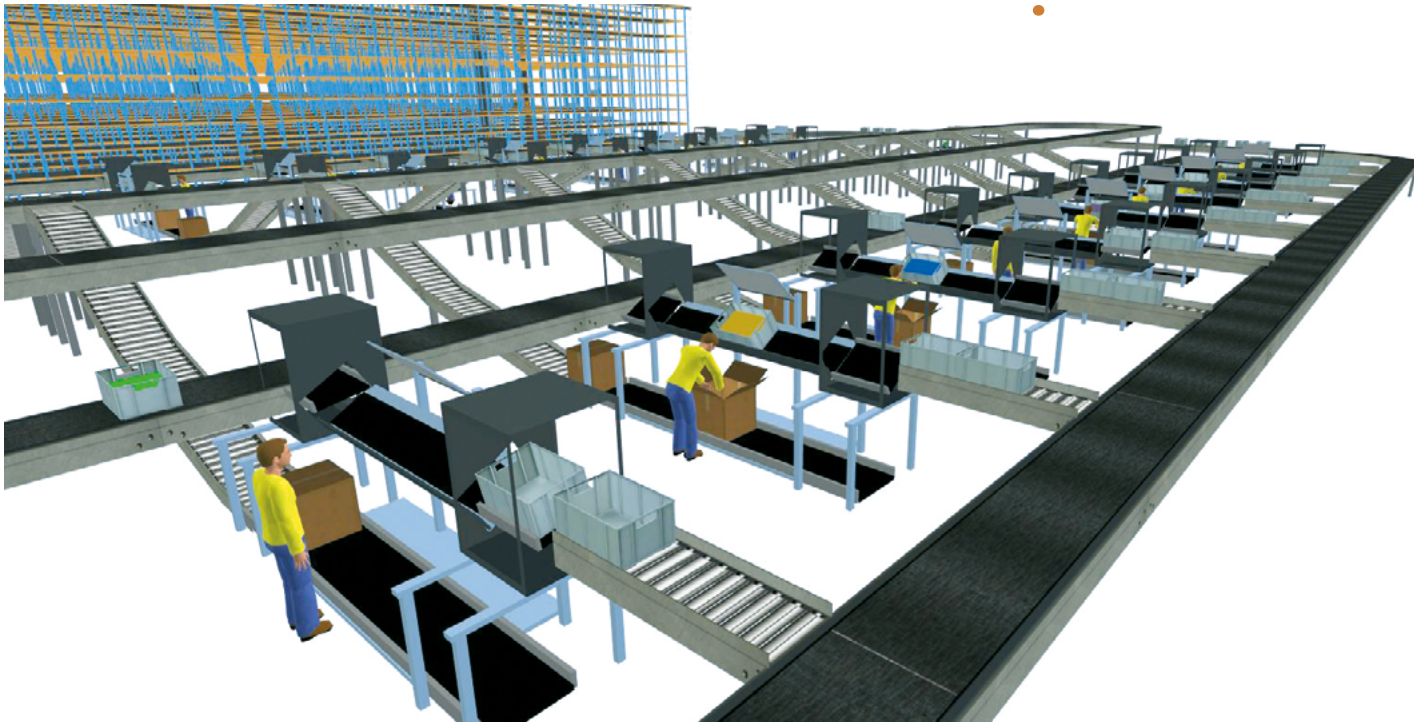
- The Center offers realization of business, research and education projects in the field of simulation and parametric optimization of logistic and production processes. Moreover, the Center offers the 5 gradual training courses, which are authorized by FlexSim Software Products Inc.

- The Center has 3D simulation software - FlexSim GP and the optimizer OptQuest (from Opttek Systems, Inc.).

- The Center cooperates with companies in the Wielkopolska region: VW Poznan, Solaris Bus & Coach, Man, Pratt & Whitney Kalisz, Philips Piła, PKP Cargo, Bridgestone, Beiersdorf, Poznań Airport, Komputronik, Raben, Kompania Piwowarska and others.

# ErgoIntelligence™
# Manual Materials
# Handling (MMH)

**APPLICATION:**

- modeling of body position at work and analyses of risks associated with the existence of musculoskeletal system disorders
- aid in the design of work zones, taking into account force and torque acting on musculoskeletal system segments and repetitive movements

**TECHNICAL SPECIFICATIONS:**

- EI-MMH-N
- EI-MMH-NPRO
- EI-MMH-SCM
- EI-MMH-SCMPRO
- EI-MMH-EE

**KEYWORDS**

- musculoskeletal load assessment

# ErgoIntelligence™
# Upper Extremity Assessment (UEA)

APPLICATION:

· The methods used in the application are specified in e.g., international, European, and Polish standards as tools for carrying out manual handling risk assessments (PN-EN 1005-2+A1:2010 Safety of machinery - Human physical performance - Part 2: Manual handling of machinery and component parts of machinery; PN-EN 1005-5:2007 Safety of machinery - Human physical performance - Part 5: Risk assessment for repetitive handling at high frequency; ISO 11228-3:2007 Ergonomics - Manual handling - Part 3: Handling of low loads at high frequency).



TECHNICAL SPECIFICATIONS:

· RULA
· REBA
· Strain Index
· Occupational Repetitive Actions Index (OCRA)
· Cumulative Trauma Disorders Risk Index

KEYWORDS

· musculoskeletal load assessment

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**Chair of Ergonomics and Quality Management**

# Wirometer

## W-03

Includes:

- control panel
  with buttons and display
- exposition panel
  with rotating discs
- control joystick
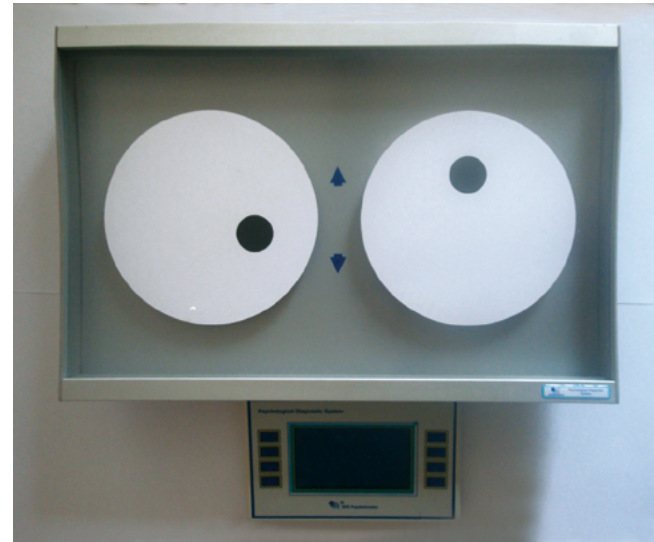


## APPLICATION:

- analysis of psychomotor abilities
- measurement of perception
  of differences in the rotational
  speed of rotating discs
- psychological assessment
  of drivers

## TECHNICAL SPECIFICATIONS:

- size of disc rotations: 200 – 400 – 600 rpm
- increase in disc rotational speed: 90 rpm
- increasing or decreasing rotation
- power: 12V, 2A

## KEYWORDS

- psychomotor
  skills assessment

# Dufour Cross-Shaped Apparatus K-03

## TECHNICAL SPECIFICATIONS:

- adjustable examination time from 10 to 300 seconds
- pulse frequency in the range of 10 to 120 pulses per minute
- 9 setting combinations for visual stimuli emitters
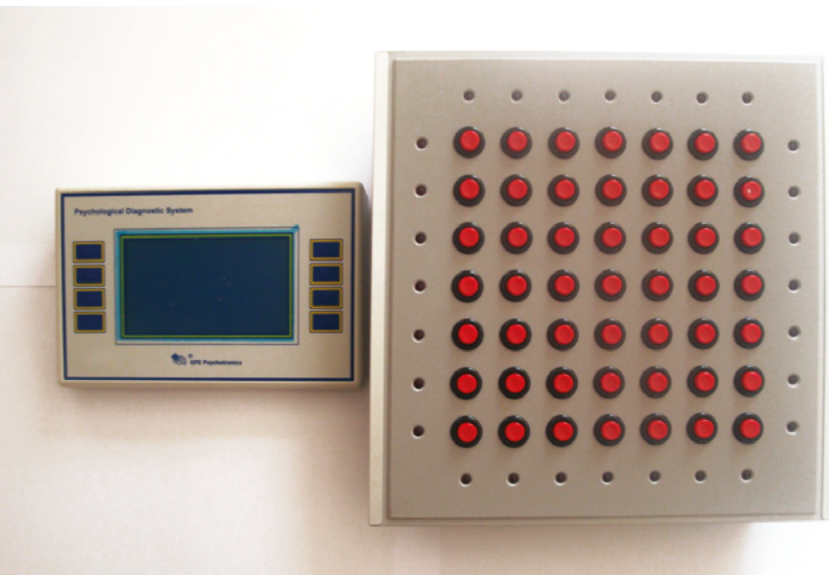- power: 12V; 0.5A

Includes:

- control panel with buttons and display
- research keyboard



## APPLICATION:

- analysis of psychomotor abilities
- measurement of reaction time to visual stimuli
- central nervous system function tests
- employee psychological assessment

## KEYWORDS

- psychomotor skills assessment

# Electronic Goniometer, Electromyograph, Electronic Dynamometer, and Accelerometer Set



Includes:

- DataLog recorder W4X8
- computer software for result analysis
- Angle Display Unit (ADU301)
- 2 x dual-axis goniometer (SG65)
- 2 x dual-axis goniometer (SG110)
- 2 x dual-axis goniometer (SG110/A)
- 2 x dual-axis goniometer (SG150)
- 1 x torsiometer (Q150)
- 8 x wire (J1000)
- 1 x event marker (IS3)
- 8 x EMG preamplifier (SX230)
- 1 x EMG antistatic strap (R200)
- tape measure sets for goniometer and EMG
- ACL300 Accelerometer
- G100 Dynamometer
- G100 Dynamometer cable

**APPLICATION:**

- musculoskeletal load assessment
- analysis of body position at work and repetitive movements
- vibration exposure assessment
- analysis and assessment of ergonomic risk (performance of occupational risk assessments with the use of the EAWS, KIM, REBA, RULA, JSI, OCRA, CTDI RI methods, among others, especially for assembly work with high repeatability)
- performing observation-based research of the work process or device-based measurement of worker position with the use of Biometrics Ltd. electronic goniometers and torsiometers
- risk analysis supported by specialized computer software

**KEYWORDS**

- musculoskeletal load assessment
- vibration exposure assessment

# POLAR S810i
# Heart Rate
# Monitor

## TECHNICAL SPECIFICATIONS:

- heart rate recorder enables wireless data transfer to a computer
- sensor mounted on the chest using a nylon polyester tape, powered by a lithium-ion battery with a life of 25,000 hours
- operating temperature range: -10 to +50°C
- recorder mounted on the wrist (polyurethane band)
- water-resistant up to 50 m
- heart rate range: 30 to 240 bpm

## APPLICATION:

- measurement of energy expenditure based on heart rate variability analysis
- analysis regarding the need to ensure employer-provided employee meals (according to legal requirements)
- support in the selection of cold protective clothing at a specified level of metabolic heat production

## KEYWORDS

- energy expenditure measurement

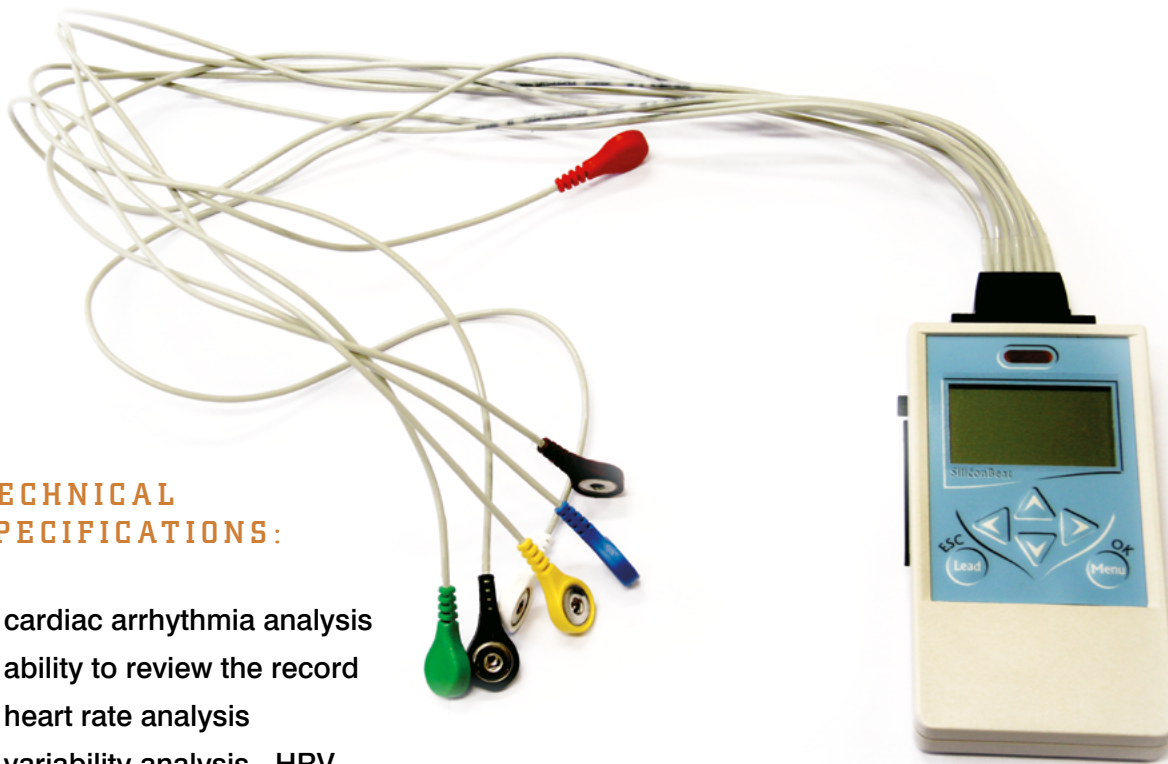# Holter monitoring for the measurement of energy expenditure

**APPLICATION:**

- measurement of energy expenditure based on heart rate variability analysis

**TECHNICAL SPECIFICATIONS:**

- cardiac arrhythmia analysis
- ability to review the record
- heart rate analysis
- variability analysis - HRV
- reports, archiving

**KEYWORDS**

- physical fitness assessment

# ELF
# Magnetic Field Meter 4090



## APPLICATION:

- magnetic field measurements
- risk assessment of worker exposure to magnetic fields in the working environment according to Journal of Laws No. 217/2002, item 1833 (as amended)

## TECHNICAL SPECIFICATIONS:

- dynamic range: 0,1 mG to 1999 mG, RMS
- range I: 199.9 mG – resolution 0.1 mG, at high sensitivity
- range II: 1999 mG – resolution 1 mG, at low sensitivity
- accuracy: 1% ± 1 digit
- directivity: ± 1 for all measured angles (isotropic)
- operating temperature: -10 to +50°C; relative humidity: 90% at +40°C
- transport and storage temperature: -20 to +85°C; relative humidity: 95% over +65°C

## KEYWORDS

- work environment study

# VLF/ELF
# Electromagnetic Field Meter



## APPLICATION:

- electric field (EF90 meter) and magnetic field (MR100SE) measurements
- risk assessment of worker exposure to EM fields in the working environment according to Journal of Laws No. 217/2002, item 1833 (as amended)

## KEYWORDS

- work environment study

## TECHNICAL SPECIFICATIONS FOR EF90 METER:

- frequency range of measured fields:
  - ELF: from 30 to 2000 Hz (-3dB)
  - VLF: from 2 to 500 kHz (-3dB)
- limiting error ± % of reading + Least Significant Digits (LSD); defined from 5% to 100% of the range:
  - ELF Low: 3% + 3 LSD; 1.0 – 10.0 V/m: 5% + 3 LSD
  - ELF High: 3% + 4 LSD
  - VLF Low: 3% + 3 LSD; 1.0 – 10.0 V/m: 5% + 3 LSD
  - VLF High: 3% + 4 LSD
- ambient temperature: from 0 to +40°C during operation and -20 to +50°C for storage and transport
- relative humidity: ≤70% to 50°C or ≤80% to 35°C
- resistance to magnetic field: at most a 2.5% error in a magnetic field of 0.1 mT (50 Hz)

## TECHNICAL SPECIFICATIONS FOR MR100SE METER:

- frequency range of measured fields:
  - ELF: from 5 to 2000 Hz (-3dB) and from 10 to 2000 Hz (-3dB), switchable; from 20 to 1 kHz (± 0.1dB)
  - VLF: from 2 to 400 kHz (-3dB), from 5 to 200 kH (± 0.5dB)
- imiting error ± % of reading + Least Significant Digits (LSD); defined from 5% to 100% of the range:
  - ELF Low: 1% + 3 LSD; 0.10 – 1.0 $\mu$T: 5% + 2 LSD
  - ELF High: 1% + 3 LSD
  - VLF Low: 1% + 3 LSD; 1.0 – 10.0 nT: 5% + 3 LSD
  - VLF High: 1% + 4 LSD
- ambient temperature: from 0 to +40°C during operation and -20 to +50°C for storage and transport
- relative humidity: ≤70% to 50°C or ≤80% to 35°C
- resistance to magnetic field: at most a 1% error in a magnetic field up to 10 kV/m (50 Hz)

INCLUDES:

- Class I Sound Level Meter and Analyzer, 32MB (SVAN945A)
- 1/1 and 1/3 octave filters for the SVAN945A meter
- Class I acoustic calibrator (NC 74)
- windscreen for 1/2" microphone (SA 22)

# Noise exposure monitoring set

APPLICATION:

- risk assessment of worker exposure to noise in the working environment according to Journal of Laws No. 217/2002, item 1833 (as amended)
- analysis of sound parameters for design purposes
- analysis of sources of sound
- noise mapping
- selection of hearing protection according to exposure

KEYWORDS

- work environment study

# Vibration exposure monitoring set



## INCLUDES:

- whole-body vibration meter, triaxial, in a rubber cushion (SV39 gene)
- miniature, triaxial, for local vibration with a cable (3023M2)
- triaxial mounting set for vibration transducers (SA 25)
- miniature, single-axis, for key vibration with a cable (3225F1)

## APPLICATION:

- risk assessment of worker exposure to local and whole-body vibration in the working environment according to Journal of Laws No. 217/2002, item 1833 (as amended)
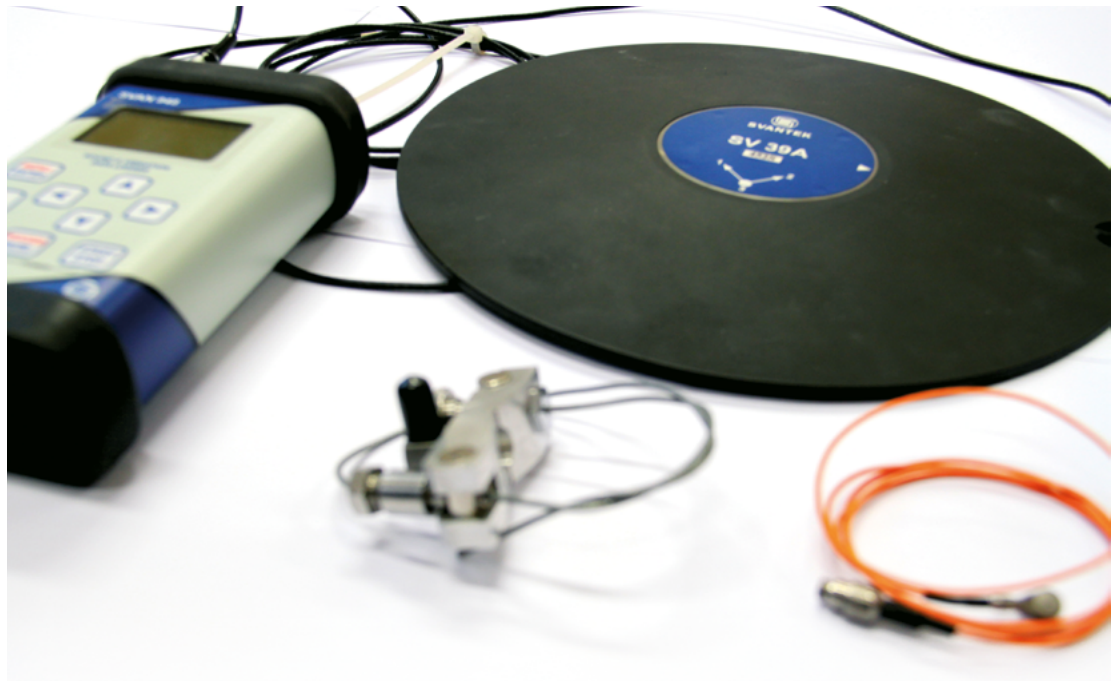
## SŁOWA KLUCZOWE

- work environment study
- local and whole-body ibration exposure assessment

# Luxmeter
# L-100

## APPLICATION:

- measurement of the parameters of light intensity in the workplace
- measurement of light intensity for the purposes of evaluation and correction of viewing conditions



## TECHNICAL SPECIFICATIONS:

- accuracy class: A (CIE)
- total error: ≤2.5% ± 1LSB (for illuminant A)
- spectral adaptation: $f1 \leq 2\%$ (CIE)
- cosine adaptation: $f2 \leq 1.5\%$ (CIE)
- measurement ranges: 0.001 – 300000 lx
- detector: silicon photodiode spectrally adapted to V( ) (CIE 1931 Standard Observer)
- display: LCD graphic display (128 × 64)
- power: 9V battery (6LR61)
- dimensions: 152×83×33 mm
- operating temperature range: 0 to +40°C
- maximum relative humidity: 80%

## KEYWORDS

- work environment study

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# Radiophotometer



**APPLICATION:**

- measurement of the parameters of luminance (L) and illuminance (E) in the working environment
- measurement of luminance and illuminance for the purposes of evaluation and correction of viewing conditions

| Measurement ranges: | |
| --- | --- |
| E [lx] | L [cd/m²] |
| Angular measurement field | 1° |
| 0,001 – 30 | 0,1 – 12 k |
| 0,1 – 3000 | 10 – 1,2 M |
| 10 - 300000 | 1 k – 120 M |

**TECHNICAL SPECIFICATIONS:**

- adapter for luminance measurement PL1.RF-100 - angular measurement field of 1°
- accuracy class: A (CIE)
- total error: ≤2.5% ± 1LSB (for illuminant A)
- spectral adaptation: $f1'$ ≤2% (CIE)
- cosine adaptation: $f2$ ≤1.5% (CIE)
- detector: silicon photodiode spectrally adapted to V( ) (CIE)
- display: LCD graphic display (128 × 64)
- power: 9V battery (6LR61)
- dimensions: 152×83×33 mm
- operating temperature range: 0 to +40°C
- maximum relative humidity: 80%

**KEYWORDS**

- work environment study

# Integrated microclimate analyzer MM-01

## MEASURED PARAMETERS:

- $t_a$ - air temperature: -40 to +100°C; maximum measurement error: from ±0.2 to ±0.5°C
- $t_h$ - ventilated wet bulb temperature: 0 to +60°C, maximum measurement error: ±0.2°C
- $t_g$ - globe temperature: -40 to +120°C, maximum measurement error: from ± 0.3 to ± 0.5°C
- $T_w$ - natural wet bulb temperature: +5 to +50°C, maximum measurement error: ±0.3°C
- $V$ air velocity: 0 to +10 m/s, maximum measurement error: ±0.05 to +5%
- $t_d$ - dewpoint: 0 to +50°C, maximum measurement error: ± 0.3
- $t_r$ - mean radiant temperature MRT: -40 to +50°C, maximum measurement error: ± 0.5 ÷ ± 1°C
- $t_o$ - operative temperature: -30 to +50°C, maximum measurement error: ± 0.5°C
- RH - relative humidity: from 5 to 100%, maximum measurement error: ± 3%
- Pa - vapor pressure: from 0.5 to 10 kPa, maximum measurement error: ± 0.1 kPa

## INDICATORS CALCULATED BY THE MM-01 ANALYZER:

- WBGT - wet bulb globe temperature: 0 to +120°C
- PMV - predicted mean vote index: from -3 to +3
- PPD - predicted percentage of dissatisfied index: 5 to 100%
- SWP - predicted sweat rate: 0 to 400 W/m²
- DLE - duration limited exposure time: 2 to 480 minutes
- WCI - wind chill index: 0 to 2000 Kcal/m²h
- IREQ - required clothing insulation index: 0 to 6 clo



## APPLICATION:

- measurement of parameters and indicators of microclimate in the working environment according to Journal of Laws No. 217/2002, item 1833 (as amended)
- clothing selection for operating in a cold microclimate
- expertise in the organization of working time in a cold environment

## KEYWORDS

- work environment study

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# MRK Reaction Time Meter

Includes:

- control panel with buttons
  and display
- exposition panel with audio
  and visual indicators
- table with manual
  and foot switches

## TECHNICAL SPECIFICATIONS:

- simple reaction time test
- complex or choice reaction time test
- signal display time: 500 ms



## APPLICATION:

- analysis of psychomotor
  abilities
- measurement of simple
  and complex reaction times
  to visual
  and auditory stimuli
- psychological
  assessment of drivers

## KEYWORDS

- psychomotor skills
  assessment

# Stereoscopic depth perception test device

Includes:
- control panel
  with buttons and display
- exposition element
  with moving rods
- control panel for
  the examinee
  with manual switch

**APPLICATION**
- analysis of psychomotor abilities
- assessment of spatial perception
  (stereoscopic vision)
  and visual acuity
- psychological assessment
  of drivers

**TECHNICAL SPECIFICATIONS:**
- multiple automatic
  measurements of near
  and far vision
- measurement of the deviation
  of the measuring rods from
  the middle
- display of averaged
  and partial results

**KEYWORDS**
- psychomotor skills
  assessment

# Win-Pod
# Foot Analysis
# Platform



## A P P L I C A T I O N :

- static, dynamic, and postural analysis of foot pressure distributions
- analysis of the impact of work processes on perpetuating poor posture
- biomechanical analysis of an employee's musculoskeletal system during the work process

## K E Y W O R D S

- psychomotor skills assessment

## T E C H N I C A L   S P E C I F I C A T I O N S :

- dimensions (length x width x height.): 530 x 600 x 45 mm
- thickness: 4 mm
- sensing area: 400 x 400 mm
- weight: 6.8 kg
- sensor size: 8 x 8 mm
- sensor thickness: 0.15 mm
- number of sensors: 2 304 (48 x 48)
- operating temperature: -40 to +84°C
- sensor durability: >1000000 startups
- maximum pressure: 100 N/cm2
- PC connection: USB
- sampling rate: 200 images/second

# Thermographic Camera

## TECHNICAL SPECIFICATIONS:

- high quality wide-angle lens 32° with F1 optics
- image refresh rate: 9 Hz
- detector resolution 160x120 interpolated to 320x240 pixels on display
- thermal sensitivity NETD: <0.1°C (at +30°C)
- manual focus
- minimum focus distance: 10 cm
- geometric resolution: 3.5 mrad
- detector type: FPA 160x120 pixels, a-Si
- spectral range: 8 to 14 $\mu$m
- temperature range: -20 to +100°C / 0 to +350°C (switchable)
- accuracy: ± 2°C, ± 2% of measured value
- minimum diameter measurement point: 3x3 pixels: 10 mm at 1 m (standard lens)
- operating temperature range: -15 to +40°C
- storage temperature range: -30 to +60°C
- air humidity: 20% to 80% not condensing
- protection class of housing: IP54

## APPLICATION:

- thermal measurements
- analysis of worker hypothermia or overheating during work according to PN-EN ISO 9886
- analysis of working conditions in areas with a hot or cold microclimate
- analysis of thermal radiation in work areas and assessment of the level of discomfort

## KEYWORDS

- surface temperature distribution measurement

# Defibtech
# AED Trainer

Includes:

- main trainer unit with battery
- training pads
- remote control



## TECHNICAL SPECIFICATIONS:

- 6 training scenarios:
  - VF (Ventricular Fibrillation) that converts to a non-shockable rhythm after the 1st shock
  - non-shockable rhythm throughout
  - damaged pads simulation
  - VF that converts on the 2nd shock to a non-shockable rhythm
  - non-converting persistent VF
  - pads not applied to the patient
- volume control
- pause function

## KEYWORDS

- AED training

## APPLICATION:

- conducting training in BLS-AED according to the guidelines of the European Resuscitation Council
- the device should be used in conjunction with a dummy (available at the Laboratory of Ergonomics and Occupational Exposure)

# Contact

Luxmeter L-100

Radiophotometers

Integrated microclimate analyzer MM-01

MRK Reaction Time Meter

Stereoscopic depth perception test device
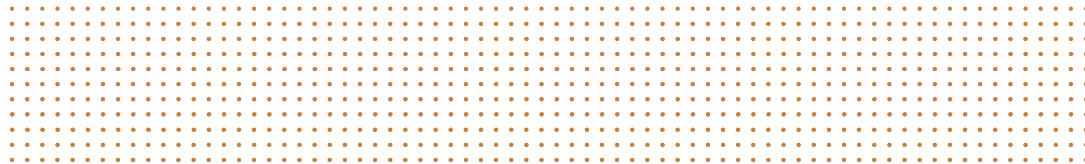
Win-Pod Foot Analysis Platform

Thermographic Camera

Defibtech AED Trainer

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# NOTES