



---

# PRODUCTS VETERINARY





## NeoRec amplifier for veterinary

NeoRec amplifier is intended to record various biosignal (EEG/ECG/EMG) and 3D acceleration events to files of different formats (EDF+ 16 bit, BDF+ 24 bit, GDF 32 bit) or transmit it on-line via stream LSL (Lab Streaming Layer) for analyze by third-party software as MATLAB / EEGLAB, OpenViBE etc.

Based on NeoRec amplifier has been developed next systems

- EEG cap for animals
- Standard ECG for horses and camels
- Heart screening for horses and camels
- Telemetric ECG for lab animals

## Advantages:

- 16 DC channels for biomedical and research applications;
- 24 bit resolution and wide dynamic range;
- BLE wireless for PC and mobile application;
- lightweight and small EEG amplifier;
- a wide range of accessories (different types of electrodes, adapters, etc.).

## Specification

Channels	16 DC monopolar according to GND
Dynamic range	$\pm 150$ mV, $\pm 300$ mV
Data resolution	24 bit
Output sampling rate (OSR)	125 Hz, 250 Hz, 500 Hz (8 channels), 1000 Hz (4 channels)
Passband (-3 dB)	0.– 430 Hz @OSR 1000 Hz
Input impedance at DC	more 1 GOhm
Self-noise	2.5 uV p-p @ 0.1.30 Hz
Electrode impedance measuring	1..140 kOhm $\pm 10\%$
Events from internal smart accelerometer	activity (4 steps of sensitivity), change orientation, free fall
Events from button	press
Check of battery status	smart by charge/discharge counting
Work from full internal battery	more 12 hours
Charging of internal battery	2.5 hour from +5V USB adapter
Firmware update	Wireless by special mobile application
Wireless data interface	BLE 4.2
Wireless certification	CE, FCC USA, Canada, Japan, Korea, Taiwan
Size	68 x 38 x 17 mm
Weight	35 g

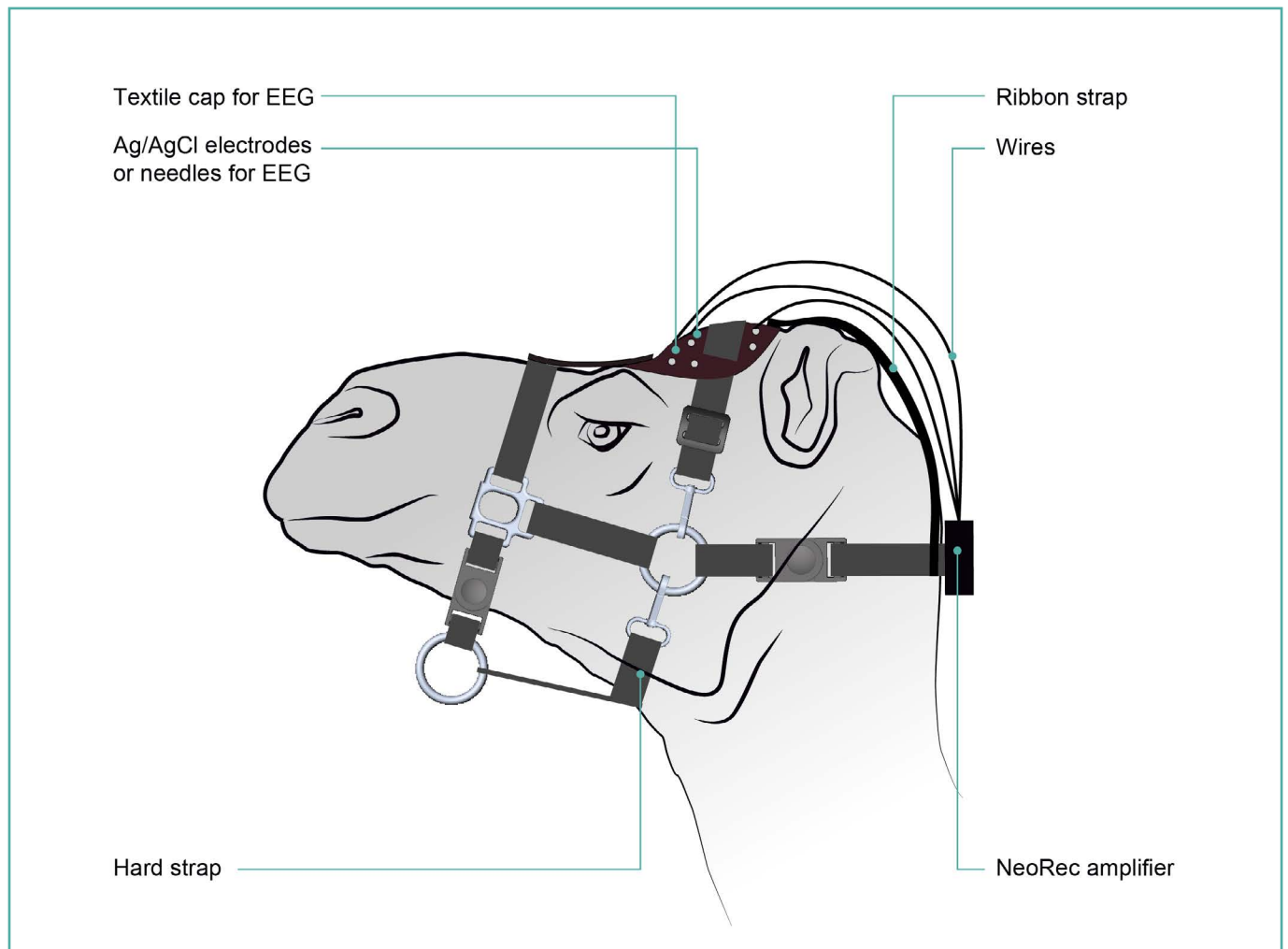


## EEG cap for animals

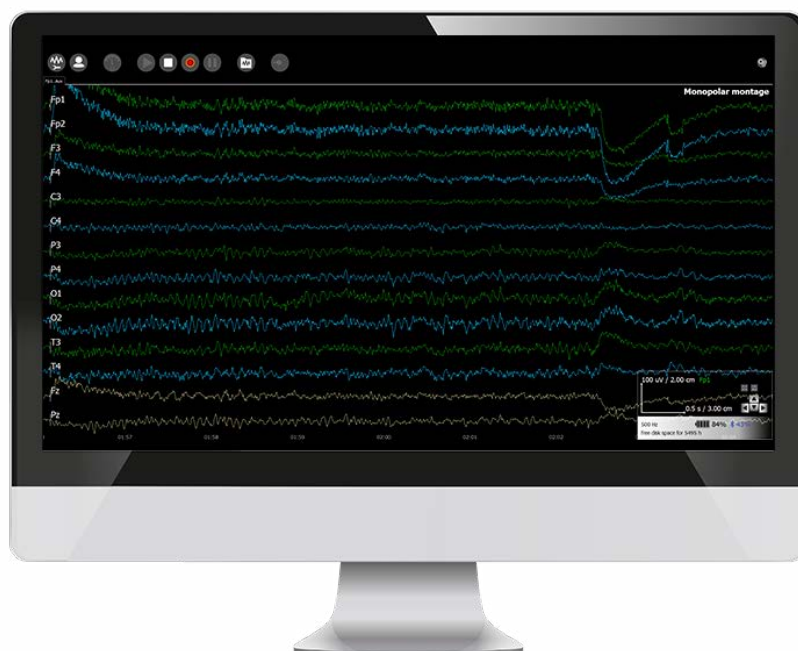
EEG is an ideal diagnostic tool for assessing brain wave activity, to study brain diseases, brain damage, sleep, the impact of anesthesia, epilepsy, to name a few. But, as you can imagine, it is difficult to gather reliable recordings. To do so, often the animal needs to be shaved and fixated (sedated). This is not practical for many reasons, especially for clinical studies using large animals.

Small wireless amplifier NeoRec can be placed on animal head and transfer EEG to PC online. Was designed special head caps for horses or camels. For EEG acquisition are used Ag/AgCl electrodes with gel or needles.

## Scheme of EEG belt for electrodes and device fixation on camel



PC software NeoRec records EEG in files and data streams for further analysis and processing by third-party software. Additionally, NeoRec can add event marks, produce filtration and scaling, do averaging and calculate Evoked Potentials online.



## NeoRec supported next file formats and data flows:

EDF+	European Data Format (EDF) is a simple 16-bits format for exchange and storage of multichannel biological and physical signals. An extension of EDF, named EDF+, was developed in 2002 and is largely compatible to EDF.
BDF+	BDF+ is the extension of BDF and 24-bits version of EDF+. BDF is the 24-bits version of EDF used by Biosemi, hence the name Biosemi Data Format.
GDF	General Data Format for biomedical signals (GDF) is 24/32-bits universal format for various biomedical signals.
EEG	Extended format for Brain Vision applications.
SM	Proprietary «internal» format of the producer allowing to provide data storage requirements under conditions of a large input data stream.
LSL	Data flow for Lab Streaming Layer project provides time-synchronized data transmission over TCP for real-time systems. It provides synchronized data recording with a large number of data sources, such as EEG, video, audio, motion sensors, etc.

## For viewing or processing the recorded data the following third-party programs and software packages are recommended:

EDFbrowser	Free multi-platform universal program with open source designed for viewing and processing of physiological data such as EEG, EMG, ECG, bioimpedance, etc. Supports the following formats: EDF(+), BDF(+).
Polyman	Free program to view/check EDF/EDF+ files. The program can show signals, counts, annotations and video data.
SigViewer	Free multifunctional application for viewing and analyzing EEG and other electrophysiological data. With the library libbiosig supports the following data formats: GDF, EDF, CNT, EEG and others.
EEGLAB	EEGLAB is a free, open-source package for Matlab designed to handle continuous and evoked EEG activity, MEG, and other physiological data, including independent component analysis, spectral analysis, artifact suppression, and some useful additions to data visualization.
ERPLAB	Free toolbox for Matlab, open source, designed for the analysis of evoked potentials (EP). The package is integrated with the EEGLAB package, expanding its capabilities to provide efficient tools for EAP processing, visualization and analysis.
OpenViBE	Free open-source platform designed for the development, testing and use of neurocomputer interfaces. Can be used to record, filter, process, classify and visualize brain signals in real time or offline from a file.
BioSig	Open-source library designed for biological signal processing. Main areas of application: neuroinformatics, neurocomputer interface, neurophysiology, psychology, cardiology and sleep research.
MATLAB Viewer	MATLAB Viewer is a MATLAB function (vis_stream) that is included with the full LSL distribution. It allows you to view the signal content of any stream on your lab network in real time.
Lab Recorder	The Lab Recorder is the default recording program that comes with LSL. It allows to record all streams on the lab network (or a subset) into a single file, with time synchronization between streams.

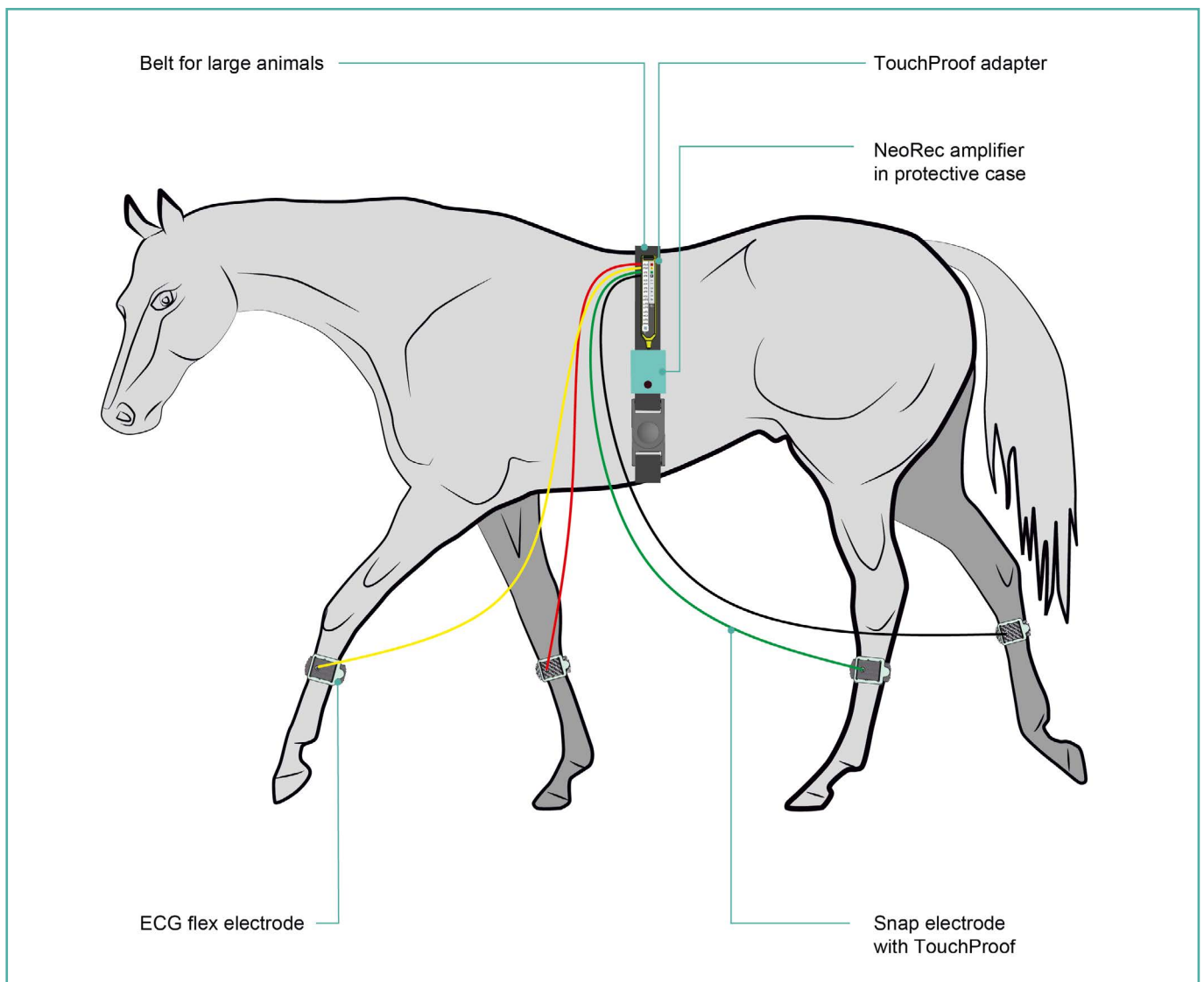


## Standard ECG for horses and camels

ECG is standard most popular method of heart diagnostic. Using ECG examination may be detected left ventricular hypertrophy (LVH) or heart rhythm abnormal etc.

For 6/12 leas ECG acquisition is used small wireless amplifier NeoRec and special torso belt with 4 or 10 Ag/AgCl electrodes, which have designed special for exact type of animal. Wireless amplifier was placed on belt and transfers ECG to PC online.

## Scheme of ECG belt for electrodes and device fixation on horse (6 ECG leads, 4 electrodes at limbs)



## ECG Ag/AgCl flex electrodes for the limbs





## Specification

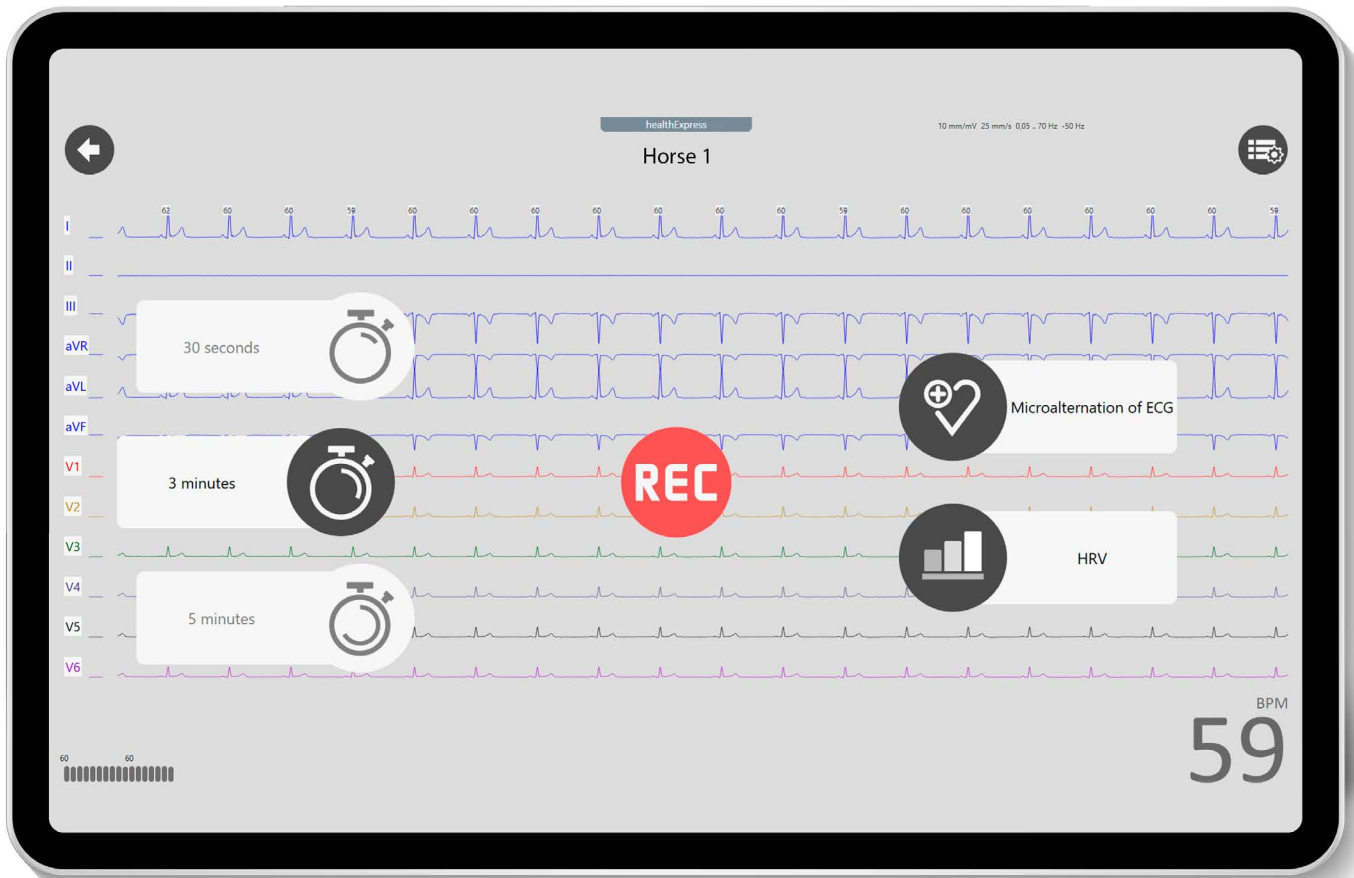
Duration of ECG recording	10 sec. (default), 30 sec., 60 sec.
ECG leads	I, II, III, aVR, aVL, aVF, C1, C2, C3, C4, C5, C6 (by default); 6 standard: I, II, III, aVR, aVL, aVF
Checking the quality of connection of electrodes	during preparation and continuously during ECG registration
Artificial pacemaker pulses display	on the ECG graph
Voltage range	0.02 – 10 mV
Common-mode signal attenuation coefficient	not less than 100 000 (100 dB)
Nonlinearity frequency response of the amplifier	from -10% to + 5% (in the frequency range from 0.5 Hz to 150 Hz), from -30% to + 5% (in the frequency range from 0.05 Hz to 0.5 Hz)
Signal sampling frequency	2000 Hz
High-pass filter of holding isoline	0.05 Hz (default), 0.1 Hz, 0.5 Hz
LPF suppression of muscle tremor(myographic)	35 Hz, 70 Hz, 150 Hz (default)
Powerline interference filter	off (default), 50 Hz, 60 Hz
ECG signal line thickness	normal (default), thick
Speed	12.5 mm/sec, 25 mm/sec (default), 50 mm/sec
Amplification	5 mm/mV, 10 mm/mV (default), 20 mm/mV
Start of ECG recording	by pressing a button without delay (default), by pressing the button with a delay of 5 seconds, automatically when all electrodes are connected with a 5 sec delay.
On screen manual measuring of times and amplitudes	yes
Range of heart rate values	30-250 min <sup>-1</sup>
Heart rate measurement error	±2 min <sup>-1</sup>
Automatic ECG registration	in accordance with the requirements for measuring amplitudes and intervals (IEC 60601-2-25:2011)
Report format	PDF 1.4 (ISO 32000-2:2017 Portable Document Format)
Ability to define baseline ECG exam for comparison	available, with the display of the ECG of the basic examination in the report



# Heart screening for horses and camels

Sports or extremely hard work can provoke irreversible changes in the heart of animals. Automated monitoring of the state of the heart and measuring the level of stress will optimize the training process or load for your horse or camel. Such monitoring is also useful for rehabilitation after illness or overload.

healthExpress - a 'simple to use' system for a highly effective heart health screening solution.



For carrying out of examination, small wireless amplifier NeoRec record ECG at 6 standard leads (I, II, III, aVR, aVL, aVF) from the limbs of horses or camel. An operator can choose the recording period: 30 seconds (suit for microalternations analyzing only), 3 or 5 minutes (for both methods). Data is analyzed by special PC software healthExpress, after three types of reports are generated automatically:



#### SIMPLE REPORT

This report displays aggregated examination data in easy-to-understand visual format



#### GENERAL REPORT

This report displays basic quantitative data, graphics, and conclusions.



#### EXPERT REPORT

This report contains all quantitative and graphical data. It can be used for control the dynamics of changes the Myocardium Index by compare 30 second segments, full Heart Rate Variability analysis (R-R Interval).

healthExpress software realize two methods: Dispersive mapping for measuring ECG microalternations and Heart Rate Variability analysis for determination of heart functional state.

## Method 1: Dispersive mapping for measuring ECG microalterations

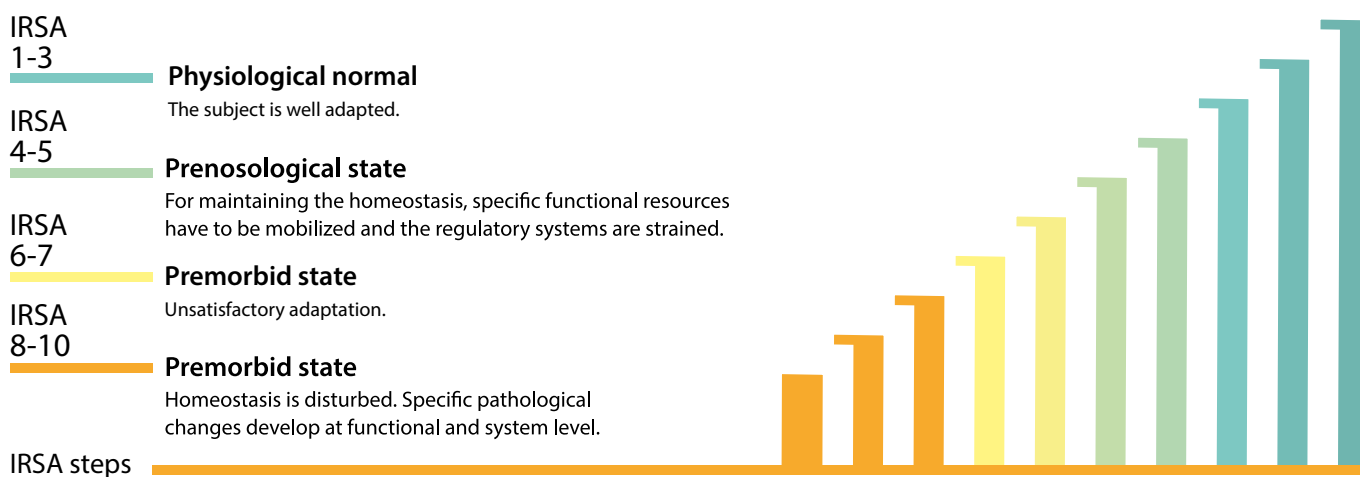
This method selects 30 seconds segments from a 3 or 5 minutes ECG record and analyzes the low-amplitude oscillations in ECG-signals automatically - microalterations analysis. This is a fundamental difference from a standard ECG contour analysis. The analysis is shown in the Myocardium index and another 9 indices, which detail the changes in heart zones. Microalterations are sensitive indicators of the mechanisms of regulation of heart. The system reacts to small metabolic changes.



## Method 2: Heart Rate Variability analysis for determination of heart functional state

Heart rate variability (HRV) analysis is a standard science-based prenosological tool that measures change in the time intervals between adjacent heartbeats and is directly related to the body's interdependent regulatory systems. An optimal level of HRV within reflects healthy function, an inherent self-regulatory capacity, adaptability and resilience.

To measure HRV requires a 3 or 5-minute ECG recording. The time and frequency parameters are recorded and the functional state is expressed as an Activity Index of Regulatory Systems (IRSA).





## Telemetric ECG for lab animals

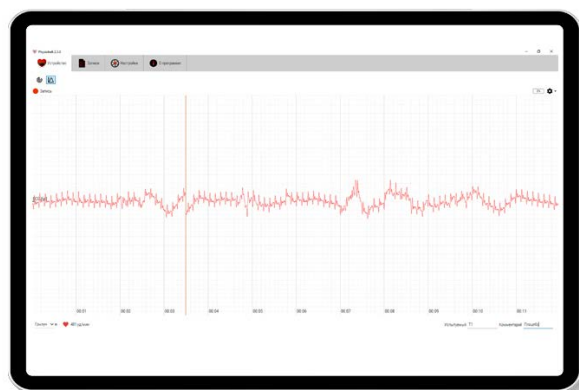
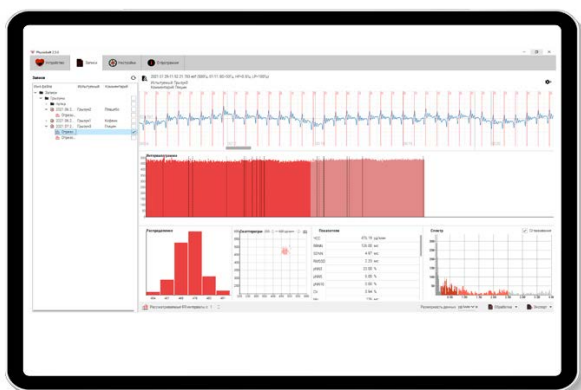
The system is designed for long-term recording and radio transmission of an ECG signal with a polling rate of 1000 Hz and is used as part of a computer system that provides wireless data reception and processing in the study of ECG of medium and large animals, such as mice, rats, guinea pigs, rabbits, cats, dogs.

## The main characteristics and advantages of the system:

- ECG registration from 1 bipolar channel with a frequency of 1 Hz;
- Operating time at least 10 hours from a fully charged battery;
- More than 100 days in standby mode;
- Transmission distance up to 50 meters;
- Weight no more than 35 g.

## Areas of use:

- Pharmaceutical Testing;
- Teaching students in human and animal physiology courses;
- Long-term monitoring of physiological parameters;
- Veterinary.



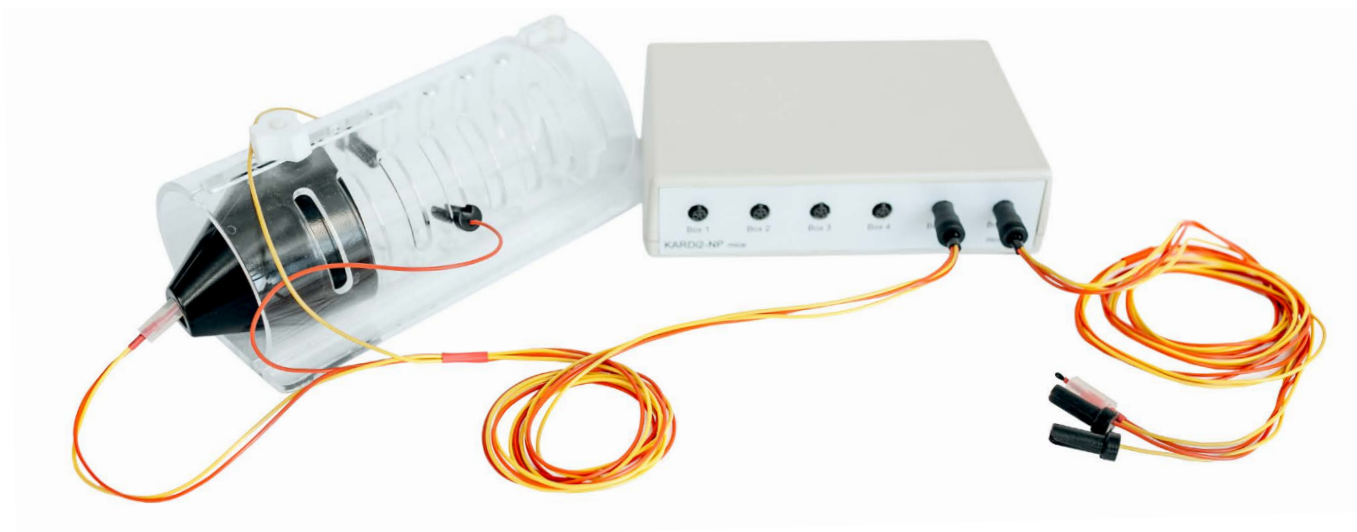
## System's software allows:

- log data and save it in EDF/BDF format;
- real-time heart rate calculation;
- display and export cardiointervalogram, scatterogram, spectrum, tabular statistical values;
- display and export summary statistics for multiple selected experiments;
- upload EDF/BDF files to view and analyze ECG in terms of calculating R-R intervals;
- select individual segments of the intervalogram on the record;
- save analysis results in text, table (Excel) and graphic formats.



## Cardiorespiratory system for lab animals

System is designed to assess the state of the cardiorespiratory system of small and medium-sized animals (mice, rats, rabbits) in laboratory or field conditions through registration and subsequent processing of ECG and respiration signals. Simultaneous registration of signals from 6 small animals.



## Specification

ADC digital signal processing	2 MHz sigma-delta modulation synchronously on all channels, filtering and decimation up to the output frequency of 250, 500, 1000, 2000, 4000 or 8000 Hz (20 bits). Band 0-150 Hz for 500 Hz output.
ECG channels input stages	6 monopolar, calculated leads (I -aVF,V1,V2), Sky, EASI DC DC amplifiers; impedance > 70 MΩ; constant monitoring of «electrode separation»; defibrillator protection
Dynamic range	set by software ±820, 410, 200, 100, 80, 40, 20, 10 mV
Noise level	less than 15 μV pk-pk / 3 μV rms (0.5...75 Hz)
Sensor channels	6 differential sensors, galvanic isolation from ECG channels (4000 V AC test), NeoSENS compatible
Input stages	DC amplifiers; impedance 5 MΩ;
Dynamic range	set by software ±2.9; 1.5; 0.75; 0.35; 0.3; 0.15; 0.075 V
Noise level	80 μV pk-pk / 33 μV rms (0.5...75 Hz)
Sensor power supply	+3.3 V, 15 mA electronically limited
External synchronization	2 digital TTL outputs and 2 digital TTL inputs
PC connection	USB V1.1, full speed mode
Supply	from USB: 5 V, 350 mA max.
Dimensions, weight	155x110x40 mm, 300 gr.
Safety	class 2a, IEC60601-1: II / BF (CF for ECG channels)
Programmer support	XP/Vista driver, application programmer library, test software

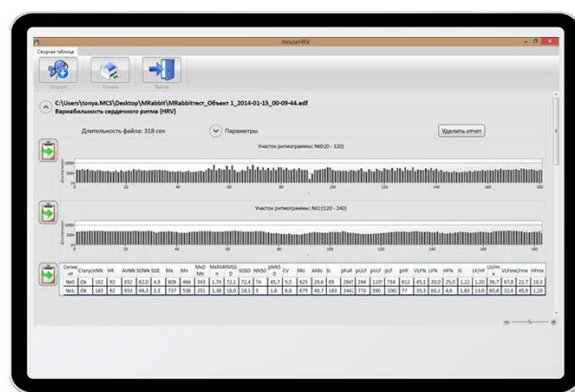
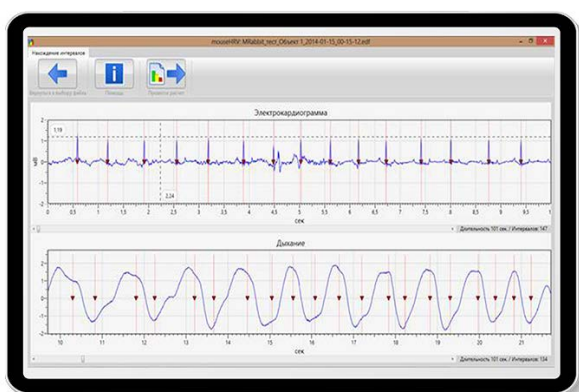


## Special software MMice for small-size animals or MRabbit for middle-size animals

Special software for recording electrophysiological signals MMice and MRabbit (for small-size animals and for middle-size animals accordingly) is intended for recording and saving electrophysiological signals during scientific research.

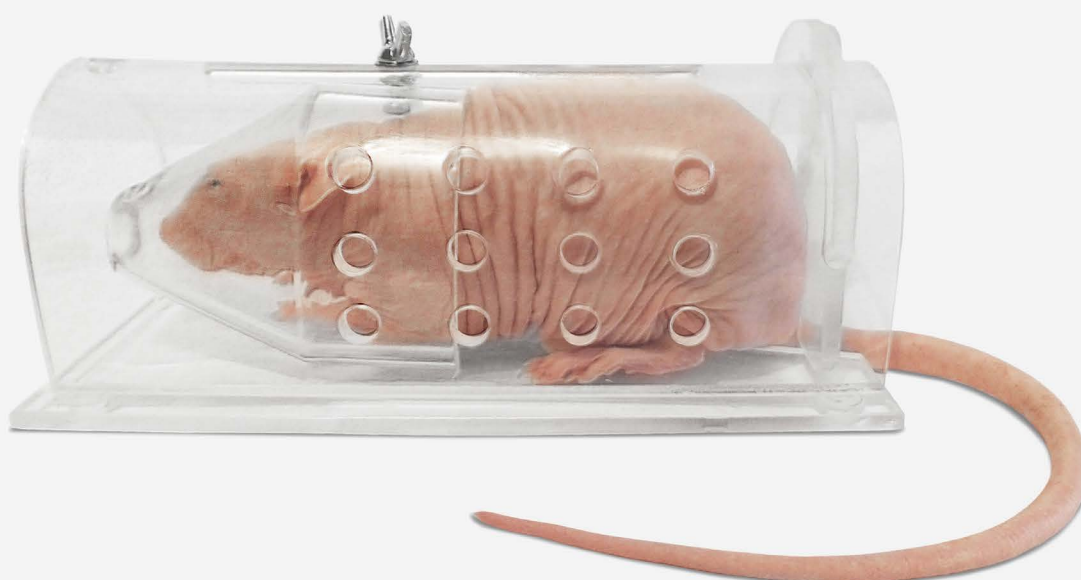
When working with biomedical signals, the software provides the following features:

- planning an experiment and saving its settings in profiles;
- creation of new profiles;
- setting the number of channels, type, filtering, speed and amplitude;
- registration and recording of signals in EDF+ (European Data Format) and GDF (General Data Format for Biomedical Signals) formats.



Small animal restraints with adjustable internal size and holes for ventilation, connection of sensors or injection of drugs. Six sizes of restraints for small animals from 30 up to 500 grams.

**XS:** length - 105 mm, diameter - 30 mm. For mice weighing 30 to 70 grams. **S:** length - 130 mm, diameter - 55 mm. For mice and rats weighing 30 to 70 grams. **M:** length - 150 mm, diameter - 55 mm. For rats weighing 100 to 200 grams. **L:** length - 165 mm, diameter - 55 mm. For rats weighing 180 to 320 grams. **XL:** length - 210 mm, diameter - 55 mm. For rats weighing 300 to 500 grams.





# NeoRec Veterinary

---

Medical Computer Systems Ltd.

Passage 4922, 4-2, Zelenograd, Moscow, 124460, Russia

Phone: +7 495 913 31 94

E-mail: [mks@mks.ru](mailto:mks@mks.ru)

Internet: [www.mks.ru](http://www.mks.ru)

Internet shop: [www.mcscap.com](http://www.mcscap.com)