# NEW PRODUCTS

CATALOG

For the Life Sciences



INNOVATIVE PRACTICAL SOLUTIONS FOR DATA ACQUISITION AND ANALYSIS

SYSTEMS FOR WINDOWS AND MAC

BIOPAC Systems, Inc. Registered to ISO 9001: 2008 NEW WIRELESS & WEARABLE SOLUTIONS!

## Powerful & Efficient Tools for Life Science Research

#### New Lab Solutions from BIOPAC

BIOPAC is recognized around the world as a premier choice for life science hardware and software. Our data acquisition & analysis systems support nearly every physiological recording scenario and are used in thousands of labs worldwide — and cited in thousands of publications!



- AcqKnowledge 4 Powerful data acquisition and automated analysis software. Perform stimulation, triggering, video sync, and complex analysis using simple pull-down menus and dialogs... recent updates include seizure detection, streamlined experiment setup, and licensed actigraphy and baroreflex sensitivity analysis
- *Wireless Solutions* new Mobita 32 CH wearable wireless biopotential system, Stellar small animal telemetry data integration, GPS location tracker, Epoch dual-channel EEG for small animals, B-Alert EEG and Cognitive Metrics, and BioHarness and TEAM systems for multi-parameter monitoring of multiple subjects
- **fNIR Systems** wired and wireless functional near infrared spectroscopy for real-time monitoring of tissue oxygenation in the prefrontal cortex of human subjects
- Noninvasive Blood Pressure Systems human or animal, standard and MRI
- *MRI Physiological Signal Processing* MRI Smart Amplifiers minimize artifact and Dual-Channel gating systems ensure reliable triggering for quality images
- Pulse Oximeters Human 18-321 bpm, Veterinary 18-450 or 90-900 bpm (MRI)
- Vibromyography breakthrough technology for muscle monitoring
- *Eye Tracking* turnkey systems for eye movement data, including HeadLock<sup>™</sup> precision positioner with camera speed options: 90 Hz, 220 Hz, or 400 Hz
- *Micro Pressure System* single-channel, hand-held fiber optic system for physiological pressure monitoring (BP, ICP, etc.) plus MRI option
- **Camera Systems** Multi-subject monitoring, synchronize with physiological data, choose from four, eight, or high-frame rate (100 fps) systems

See the full line of BIOPAC amplifiers, transducers, and accessories at WWW.BIOPAC.COM

## AGQKinowledge 4 Software WARE

#### Power & Flexibility — No Programming Required

Acq*Knowledge*<sup>®</sup> software is included with each MP150/36R, Mobita, B-Alert, and BioHarness system. It is highly interactive, user-friendly, and has intuitive controls that let users instantly view, measure, analyze, and transform data. Perform complex data acquisition, triggering, and automated analysis using simple drop down menus and dialogs — no need to learn a programming language or new protocol to get powerful, report-ready results!

- Record and analyze physiological, behavioral, and subjective response data in ambulatory, MRI, Lab, Real-World and Virtual environments.
- Use automated analysis routines to save hours (or days!) of processing time and standardize analysis procedures.
- Analysis routines automatically score and mark the data file and results can be output in multiple file formats including Acq*Knowledge* graph, Excel<sup>®</sup>, MATLAB<sup>®</sup>, Noldus, SMI, text, and more!

AcqKnowledge is compatible with many hardware platforms including:

MP150 — 16 channel system supports 20+ amplifiers / stimulator
MP36R — four-channel system with built-in universal amplifiers
Mobita — 32 channels of wireless biopotentials, live or logged
B-Alert — 9 channel wireless EEG system
BioHarness — Multi-parameter subject telemetry and logging
Stellar Telemetry Systems — schedule, record, and analyze Stellar small animal data

Use Linked Acquisitions to record from multiple hardware units at the same time — record from MP150 + B-Alert, multiple MP150s, etc.

#### AcqKnowledge Software Enhancements

*Rich Display Features* — multiple customizable display modes and grid system, journal with spreadsheet functionality for note taking, textual event markers, and measurement tools. Helpful mouse-over tool tips guide application use.

*Easy Setup* — One dialog box guides users through complete first experiment setup (Hardware, scaling, calibration, calculations, stimulation, and more!). Save settings as a template or default recording for future use.

**Video and Sound Interface** — Use our complete Camera Systems for frame-by-frame synchronization and control features. Place the cursor in Acq*Knowledge* data to advance the movie frame or select a movie frame to advance/locate data (Windows only).

User Interface Enhancements — Streamlined UI, Custom toolbars, Timers, MP150 Help Button, Transformation history/cancel/progress options, Event tools & label drawing enhancements, Customization options for chart track dividers/Transform toolbar/Analysis toolbar, Tooltip improvements, Toolbar retention, and more!





#### Upgrade your data collection and analysis experience with the latest version of AcqKnowledge

#### **Flexible Recording Options**

*Linked Acquisitions:* Record from multiple hardware devices at the same time. At the end of recording, data can be merged into a single, comprehensive data file. Record from MP150 and B-Alert, two MP150s, MP150 and BioHarness, etc.

**Consolidated Hardware Support:** Acq*Knowledge*<sup>®</sup> now has integrated support for multiple hardware platforms including Mobita and Stellar. Choose your device and begin recording!

#### **New Automated Analysis Tools**

#### Focus Areas: Get only the results you need — target your analysis!

Select different experimental conditions, before/after stimulus delivery, etc. and then run specialized analysis routines (find cycle, EDA, BP, etc.) on only the marked focus areas.



#### Seizure Detection:

Locate, mark, and score seizure data from small animals. User configurable seizure parameters and output options.

#### Baroreflex Sensitivity Analysis:

Licensed feature provides two methods (slope and sequence) to analyze BRS from ECG and Blood Pressure data.

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#### Actigraphy Analysis:

Licensed feature provides analysis of long-term sleep and activity data recorded from wireless accelerometers.

#### Pressure-Volume Loop Analysis:

Record and Analyze PV Loop Data. Licensed Feature includes

QuickStart Template, Baseline Analysis, and full interactive PV Loop Analysis. Easily include or exclude loops from analysis and the display updates per-loop and multiple loop statistics.

#### Intuitive, Customizable User Interface

*Timers:* set alarms, elapsed timers, or use a stopwatch to control experiment timing from within Acq*Knowledge* 

**Channel Specific Grids:** Create customized grids for each channel of the graph. Save commonly used grid settings as templates (e.g., clinical ECG grid).

Tabbed Graph Display: Easily click or tab through multiple open files.

**Custom Presets**: Rate, Measurement, and Expression Functions. Save commonly used settings as templates to streamline and simplify the analysis process.

*Linked Selections:* Selections made in one data view will also be highlighted in other data views. Select and view data in multiple formats or zoom levels.

**Textual Value Toolbar:** Overlay real-time numerical values on a waveform (e.g., Heart Rate, Blood Pressure) or view as a toolbar.

#### **Enhanced Import/Export Features**

**Noldus Observer XT:** Import Observer XT data into Acq*Knowledge* or export BIOPAC physiology data to Noldus software via dialog guided menu options. **SMI BeGaze:** Merge & Sync BIOPAC data and SMI BeGaze eye tracking data.

## ANA Analysis Automation & Scoring Tools

AcqKnowledge software is included with BIOPAC Research Systems and provides comprehensive tools to simplify & standardize advanced analysis.

#### ECG

Detect and Classify Heartbeats; Locate ECG Complex Boundaries; Heart Rate Variability; Chaos Analysis— Detrended Fluctuation Analysis; Optimal Embedding Dimension; Optimal Time Delay; Plot Attractor; Correlation Coefficient; ECG Interval Extraction

#### EEG

Compute Approx. Entropy; Delta Power Analysis; Derive Alpha-RMS; Derive EEG Frequency Bands; EEG Frequency Analysis; Remove EOG Artifacts; Seizure Detection

#### EGG

Gastric Wave Analysis; Gastric Wave Coupling

#### EMG

Derive Avg. Rectified EMG, Derive Integrated EMG; Derive RMS EMG; EMG Frequency & Power Analysis; Locate Muscle Activation



#### EDA

Derive Phasic EDA from Tonic; Eventrelated EDA Analysis; Locate SCRs

#### Impedance Cardiography

Adaptive template matching; C point location; Body Surface Area; Ideal Body Weight; ICG Analysis; VEPT; PEP Preejection Period; dZ/dt from Raw Z; dZ/dt Classify B, C, X, Y, and O Points; dZ/dt Remove Motion Artifacts; Estimated CO from BP



#### Respiration

Compliance & Resistance; Penh Analysis; Pulmonary Airflow

#### Hemodynamics

Classify ABP, LVP, and MAP; Arterial BP; Left Ventricular BP; Monophasic Action Potential; Respiratory Sinus Arrhythmia; Baroreflex Sensitivity

#### Neurophysiology

Amplitude Histograms; Classify Spikes; Avg. Action Potentials; Dwell Time Histograms; Generate Spike Trains; Locate Spike Episodes; Find Overlapping Spike Episodes; Set Episode Width & Offset

#### MRI

Artifact Frequency Removal; Artifact Projection Removal; Median Filter Artifact Removal; Signal Blanking; Slew Rate Limiter

#### Stimulus Response

Digital Input to Stim Events; Stim-Response Analysis

#### **Specialized Automation**

Ensemble Average; Epoch Analysis; Principal Component Denoising; Remove Trend; Spectral Subtraction; Waterfall Plot; Wavelet Denoising; Actigraphy (Sleep & Activity)



Watch New Feature and Analysis Tutorials online! WWW.BIOPAC.COM



## Customize and Automate MATE

#### AcqKnowledge — Standard Analysis Tools

Cycle/Rate Detector Digital Filters FFT & PSD Histogram Expression Evaluator

#### AR Time-Freq Analysis Principal Component Analysis Independent Component Analysis Plotting options - 3D, overlap, X/Y Autoregressive Modeling

Nonlinear Modeling Template Analysis Wavelet Analysis (DWT) Fourier Linear Combiners



Do it your way... BIOPAC Developer tools give you greater access to your data and developer tools for customization.

### **BIOPAC Basic Scripting**

Consolidate many tasks into one automated routine that eliminates the potential for human error with a BIOPAC Basic Script. Significantly reduce analysis time and improve consistency by standardizing procedures. Use BIOPAC Basic Scripting to customize the display and simplify the user interface.



*Customize* – Acquisition setup and analysis, include user prompts to guide tasks *Automate* – Create fully automated analysis routines & combine complex tasks *Expedite* – Reduce analysis time and publish faster *Quality* – Improve results with greater consistency

Acq*Knowledge* is very intuitive and has a wide range of tools for filtering, transforming, measuring and analyzing the data, but performing the same task on multiple files can become time consuming. Use a script to eliminate repetitive and monotonous tasks that lead to errors and shortcuts that compromise results. Scripts are easily created within Acq*Knowledge* and do not require programming experience, but a familiarity with scripting will certainly help. Support packs available.

#### **Remote Monitor**

Simplified view of subject data on another computer, tablet, or mobile device. Convenient "bedside monitor" displays trend data and current data to track the welfare of subjects



and offers alarms to warn when signals fall out of range. Remote Monitor is a Licensed Feature and works on the same IP based network as the MP150.

#### Real-Time Network Data Transfer (NDT)

The new NDT license integrates network data transfer functionality with the existing Acq*Knowledge* environment for applications that require real-time subject feedback. NDT allows 3rd-party applications to tap into the data stream generated by the MP unit and Acq*Knowledge* during acquisitions and provides basic controls to query and control the Acq*Knowledge* application state. Networking facilities allow for integration into a distributed application environment.

#### **API for Hardware & Software**

*Windows only* — Developer tools to control BIOPAC MP150 and MP36R acquisition units and File Format library to identify and parse information in BIOPAC's ACQ binary file format.

# **BioNomadix from BIOPAC**

Powerful Dual-Channel Wireless Physiology Monitoring

- All the benefits of wireless with the signal quality & integrity of a wired system
- Comfortable for subjects, empowering for researchers
- Full-bandwidth, high-quality data
  - Electrocardiogram Electroencephalogram Electrogastrogram Electromyogram Electrooculogram Electrodermal Activity Impedance Cardiography Heel-Toe Strike

Respiration Temperature Pulse Accelerometry Gyroscope Goniometry Dynamometry

Dual-channel BioNomadix<sup>®</sup> amplifiers include a wireless transmitter and receiver for either two of the same signal or a combination of signals.

Acq*Knowledge* software adds the power of sophisticated automation and scoring routines for each signal type, plus customization options.

BioNomadix are optimized for specific signal types. You don't have to adjust settings on the hardware or software for high-quality data suitable for advanced analysis, such as heart rate variability.

BioNomadix is the perfect tool for applications that demand greater degrees of subject freedom and complex experimental design. The unhindered setup significantly improves the quality of the data, and makes it much easier for subjects to respond naturally.

Use BioNomadix with single or multiple MP150 systems or with third-party data acquisition hardware via the isolated power supply module (IPS100C).











VIDEO DEMO ONLINE! BIOPAC.COM

## Request your complete BioNomadix catalog!



## <sup>™</sup> Wireless EEG <sup>□</sup>

## B-ALERT X10

#### Wireless acquisition of 9 channels of high fidelity EEG plus ECG AcqKnowledge adds powerful analysis tools, including automated scoring and reporting options



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- Comfortable and nonintrusive—set up in less than 5 minutes!
- Patented real-time artifact decontamination
- Automated EEG analysis routines for filtering & displaying EEG frequency bands, removing EOG artifacts, and performing a complete frequency analysis
- Multiple options for data synchronization with up to six simultaneous subjects
- Real-time cognitive state metrics add-on available for engagement, confusion/distraction, drowsiness, workload, and stress
- Neurocognitive assessment of susceptibility to effects of sleep deprivation & apnea

#### **Cognitive State Metrics**

For real-time monitoring of subject fatigue, stress, confusion, engagement and workload, add the B-Alert Cognitive State software with proprietary metrics to classify data from B-Alert Wireless EEG systems. The GUI intuitively represents both the raw and processed data for greater clarity and understanding.

Easy-to-read B-Alert dashboard facilitates analysis and is fully customizable:

- Gauges display B-Alert's highly validated second-by-second metrics
- Heat maps display EEG power spectral densities (PSD) for the traditional Hz bands

Real-time GUI displays B-Alert Cognitive State gauges with timeline, as well as EEG heat maps and spectograms

> GAUGES Engagement, Workload, Drowsiness, Heart Rate

HEAT MAPS Spatial & Temporal EEG PSD Beta, Alpha, Theta, Sigma





Request a live demo at info@biopac.com

#### Isolated Linear Stimulator — STMISOLA

*Modes:* Constant Voltage or Constant Current (unipolar or bipolar) Output arbitrary waves: pulse (single or train), square, sine, triangle,

exponentially decaying, modulated envelopes, and fully user-specified types. Connect to any analog output signal drive (±10 V input), including an MPI50 system.



#### Haptic (Tactile) Stimulation Transducer — TSD190

Electromagnetically actuated plunger mechanically stimulates a 1.5 mm diameter area of skin surface. Connects to the STM100C stimulation module and AcqKnowledge controls plunger force and rate. Prime 2

#### **Stimulus Presentation Packages**

#### Stimulus Presentation Systems

Stand-alone systems measure subject responses to visual or auditory stimuli. Systems include Stimulus Presentation software (E-Prime 2.0 Professional or Standard, or SuperLab 5) and an Isolated Digital Interface (STP100C) with cables to work with a BIOPAC MP System.

#### Programmable Electrical Stimulation System for E-Prime

Interface the Constant Current or Constant Voltage Isolated Linear Stimulator (STMISOLA) with E-Prime to control the stimulus frequency and stimulus intensity for real-time stimulus delivery changes based on a subject's responses.

#### StimTracker USB Universal Marker Interface for SuperLab

Send digital triggers from SuperLab to BIOPAC recording device. Stand-alone STK100 or complete System with SuperLab & STP100C Isolated Interface STK100W/M

#### Max/MSP/Jitter Interface — MAXACQ-M

Permits data collection into Max/MSP/Jitter from BIOPAC MP150WS or MP36RWS Research System via Network Data Transfer (AcqKnowledge licensed feature).

#### Camera Systems

Record time-synchronized video data with physiological signals from an MP Research System for Windows. Camera systems record single or multiple subjects and AcqKnowledge media tools synchronize video with physiological data. Advance cursor in physiological data to jump video and advance video to move cursor in data file. High frame rate camera is driven by AcqKnowledge and MP Hardware for optimum synchronization.

*Multi-camera systems:* Four camera CAMSYS4 Eight camera CAMSYS8 High frame rate system: Up to 100 fps CAM-HFR-A



#### **Eye Tracking Systems**

Binocular or monocular eve tracking for applications involving fixed or moveable head with scene camera option. Analog outputs included. Interface to a BIOPAC data acquisition system (cables included) or 3rd-party A/D converter.

Fixed HeadLock<sup>™</sup> (90/220/400 Hz options) **EYEFIXBINOCLAMP** Frame Mounted Scene Camera Moveable Head for HMD1B Moveable Head for HMD2 Moveable Head for 3rd-party HMD

or MONOCLAMP EYEFRAMESCENEBI or MO EYETRAKHMD1B-B90 or **M90** EYETRAKHMD2BINO or MONO EYETRAKHMD3RDBI or MO









## N rNIR Lab-ready Optical Brain Imaging

## **ASSESS COGNITIVE ACTIVITY** Complete fNIR Systems for



fNIR optical imaging eliminates many of the drawbacks of fMRI

#### Cognitive Function Assessment

- Safe & Noninvasive
- Comfortable sensors—adult 16-channel or pediatric 2-channel
- Record simultaneous EEG
- Affordable
- · Fast & Efficient Setup
- · Real-time display
- · Portable—use in lab or field studies
- Avoids claustrophobia issues
- No special MR considerations
- · Synchronize with other data or video

fNIR technology measures hemodynamic response and neural activity of human subjects and empowers researchers by providing greater flexibility for study design, including working within complex lab environments and operating in non-traditional lab locations for field studies.

Subjects wear an fNIR sensor on the forehead that detects oxygen levels and provides real-time values for oxy-hemoglobin and deoxygenated hemoglobin. It provides a continuous and real-time display of the oxygen changes as the subject performs different tasks. Subjects can sit in front of a computer and take a test or perform mobile tasks.

#### fNIR imaging systems measure oxygen level changes in the prefrontal cortex of human subjects.

Each fNIR system provides real-time monitoring of tissue oxygenation in the brain as subjects take tests, perform tasks, or receive stimulation and allows researchers to quantitatively assess brain functions—such as attention, memory, planning, and problem solving—while individuals perform cognitive tasks.

#### DATA COMPUTER **fNIR IMAGING SYSTEMS** real-time monitoring of tissue oxygenation fNIR Systems also include isolation transformer in fNIR100A/200A/300A/400 and fNIRSoft Standard Edition in fNIR100A/200A/300A/100W and Pro Edition in fNIR400 STIMULI fNIR100A fNIR200A fNIR300A COMPUTER Starter System Data Collection System Data & Stimulation System FNIR PORTABLE ENID DATA IMAGER CADDY IMAGER 16 CHANNEL COMPUTER SENSOR 16 CHANNEL **16 CHANNEL** FNIR ROLLING SENSOR SENSOR MAGER STAND

## **IN REAL-LIFE SITUATIONS** *functional brain imaging*

Interface the fNIR hardware with a BIOPAC MP System to simultaneously record physiological data and synchronize to a variety of stimulus presentation systems including virtual reality, eye trackers, video, and observational data.

The fNIR device provides relative change in hemoglobin levels, calculated using a modified Beer-Lambert law. The powerful fNIR spectroscopy imaging tool measures NIR light absorbance in blood of hemoglobin with and without oxygen and provides information about ongoing brain activity similar to functional MRI studies—without the expense or hassle!

For a detailed subject assessment, combine fNIR data with other physiological signals such as ECG, EEG, respiration, cardiac output, blood pressure, electrodermal activity and stimulus response markers.

Synchronize with a BIOPAC Research System and AcqKnowledge. The fNIR imager has a BNC trigger output that sends TTL pulses at the beginning and end of baseline, and at the beginning and end of a recording session.

Use the MP150 System with a wide array of amplifiers and transducers, including wireless BioNomadix. AcqKnowledge provides automated analysis tools for ERP, ensemble averaging, and more!

#### fNIRSoft STAND-ALONE SOFTWARE

Use fNIRSoft (fS) to record, process, analyze and visualize functional near infrared (fNIR) spectroscopy signals. Easy to use GUI and wizard style tools for...

Temporal Visualization Time Series Analysis Topography Data Management Scripting Engine Signal Analysis



#### Demos and detailed specs online!



#### Synchronize with other systems for a complete assessment!

- BIOPAC Research Systems for physiology monitoring
- B-Alert X10 Wireless EEG
- Subject Monitoring frame-by-frame video
- Stimulus Presentation— E-Prime, SuperLab, etc
- Eye Tracking
- Observational Behavioral Data



## Noninvasive Automated BP

#### Noninvasive Blood Pressure Monitoring System Real-time, continuous, noninvasive blood pressure



- Accurate noninvasive blood pressure values
- Comfortable for subjects to wear
- Set up & calibrate in less than three minutes
- Suitable for small children (~4-5 years) to large adults

The *NIBP100D* provides a continuous, beat-to-beat, blood pressure signal—uses a double finger cuff that is comfortable for the subject and easy to place. The cuffs (included with system) come in three sizes. Outputs a continuous BP waveform and displays values for systolic, diastolic, mean blood pressure, and heart rate. Use with Acq*Knowledge* for automated BP analysis. Request an NIBP brochure!



#### **Noninvasive Blood Pressure for MRI**

Wireless and noninvasive physiological monitoring system

• Track blood pressure using Pulse-Decomposition Analysis (PDA) technology.

• The system provides relative, real-time, beat-to-beat pressure measurement values during magnetic resonance imaging.

The **NIBP-MRI** operates passively at a low constant coupling pressure of 40 mmHg. After being provided a calibrated blood pressure reading, the device tracks blood pressure by analyzing the timing and amplitudes of the primary left ventricular ejection pulse as well as the arterial pulse reflections. Record at the thumb, middle finger, wrist, or upper arm. If recording from upper arm, add **NIBP-MRI-SPLINT** to hold arm in optimal position. The system runs on a computer using Windows OS and sends analog signals back to a BIOPAC MP Device or third-party A/D converter.

#### **Small Animal Tail Noninvasive Blood Pressure Measurement**



**NIBP250** Touchscreen LCD controls & displays data for local analysis and storage of systolic, diastolic, and mean BP values. Use as a stand-alone system or interface to BIOPAC or third-party A/D hardware.

NIBP200 Interface to BIOPAC or third-party A/D hardware and computer.

Both systems provide two analog outputs: pressure and pulse. Systems incorporate a built-in pump that automatically inflates the blood pressure cuff to occlude the vessel in the tail of a rat or similar small animal. Once the pump reaches the inflation point it deflates the cuff, providing a linear drop in pressure. A single control runs both the inflation and deflation cycles, making the system very user-friendly. Systems include one cuff sensor, one restrainer, and interface cables. Optional heater and MRI-compatible sensors.



## Oxygen Saturation □ N

#### SpO<sub>2</sub> Measurement

- Measure beat-by-beat, blood oxygen saturation (SpO<sub>2</sub>) level in a noninvasive fashion
- Output SpO<sub>2</sub>, Pulse Wave, Pulse Rate, and Module status simultaneously

OXY amplifier modules have built-in calibration for a simplified setup procedure that permits easy scaling of all these signals when used with an MP System. Modules operate in accordance to the principles outlined by the Beer-Lambert law. The SpO<sub>2</sub> transducers incorporate light-emitting diodes (LEDs) which face photodiodes through a translucent part of the subject's body.



Human 18-300 BPMVeterinary 18-450 BPMAmplifiersOXY100E SpO2 ModuleOXY200 SpO2 ModuleTransducersTSD124A Finger ClipTSD270A ReflectanceTSD124B Ear ClipTSD270B WrapTSD124C Flex WrapExtensionOXY100E-200 EXT Optional 3 meter module cable

#### SpO<sub>2</sub> Measurements for MRI Applications



#### Human 18-321 BPM OXY-MRI

Stand-alone system for adult human pulse oximetry in the MRI; can also be used with a BIOPAC MP150 Research System via existing HLT100C (cables included). Includes SpO<sub>2</sub> amplifier and fiber-optic oximetry sensor for the finger. Order additional finger sensors as **OXY-MRI-SENSOR** 

#### Veterinary 90-900 BPM OXY300-MRI

Quick, Easy, Accurate Way to Monitor Subject Health



Complete system for noninvasive small animal SpO2 measurements in an MRI

- Works on neonatal mice, rats, or other small animals  $\leq 500$  grams
- MRI sensor works in closed, small and large bore MRI machines
- Analog output cables included to interface BIOPAC MP150 System

The **OXY300-MRI** system provides immediate access to Vital Signs for pre-, intra- and post-operative measurements: Arterial Oxygen Saturation—comprehensive health indicator, indicates lung efficiency, not just airflow; Heart Rate; Pulse Distention—indicates signal quality; and Alarms for each vital sign.

### WWW.BIOPAC.COM



BioHarness<sup>™</sup> with AcgKnowledge<sup>®</sup>

Eliminate complex setup, maximize subject comfort & data quality Smart Fabric sensor technology | Lightweight transmitter | Wireless



State-of-the-art lightweight portable biological data logger and telemetry system. Easily attach the BioHarness<sup>™</sup> strap to subjects and start collecting data in virtually any environment—from the lab to the sports field. Great for single or multiple subject applications.

BioHarness maintains performance under extreme activity and offers fast, accurate collection and analysis of high-quality, in-depth data. Live data viewing features include a variety of selectable waveforms and trend data including ECG, heart rate, R-R values, respiration, respiration rate and depth, skin temperature, accelerometer (X, Y & Z), Activity level, and Posture (attitude of device in degrees from vertical).

#### **TEAM Systems**

TEAM Systems provide simultaneous real-time physiological monitoring for multiple subjects across a wide area. Each subject wears a BioHarness system that telemeters back to a TEAM central recording station.

- Simultaneous monitoring of up to 50 subjects
- Logging or Radio (RF) transmission
- · Works under extreme activity
- Fabric-based, dry contacts-no skin breakdown
- Comfortable over long periods, washable
- Unobtrusive, light and small-no wires
- Multi-subject, color-coded tab display
- Detect ventilatory (anaerobic) threshold
- Fitness and fatigue using well known methods
  - Heart Rate reduction at end of activity
  - Anaerobic threshold detection
- Biomechanical markers give context (at rest vs. active)
- Individually configurable thresholds and bio alarm algorithms for prioritization

VIDEO DEMOS ONLINE! BIOPAC.COM





## ETelemetry & Logging

#### Mobita 32-Channel Wearable Biopotential System

Record up to 32 channels of high-fidelity wireless ECG, EEG, EGG, EMG, EOG, etc., plus 3D accelerometer and trigger channel. Mobita physiological signal amplifier systems include the hardware unit with choice of ConfiCap and are fully integrated with Acq*Knowledge* software. Telemeter data back to a computer running Acq*Knowledge* for real-time display and analysis of the signals, or record it locally for later download. Easily switch between live or logging modes to suit your research protocol, and swap headers to quickly change electrode configuration or signal type.

Mobita 32-Channel Wireless Systems

Wireless EEG System - **MOBITA-EEG-W** Wireless Biopotential System - **MOBITA-W** 



#### Snap-on configuration header for Mobita mobile physiology units

ConfiCap: 12 surface electrodes + 20 TP adapters - *MB-12+20-CAP* ConfiCap: EEG 10/20 + 13 TP adapters - *MB-20EEG-CAP-B* EEG 32-CH ConfiCap - *MB-32EEG-CAP-A* 

#### **Stellar Animal Telemetry Interface**

Control wireless data acquisition from multiple animals and harness the power of dozens of sophisticated automated analysis routines...

*Intuitive Animal Scheduler:* Easy-to-configure calendar display—Select a subset or complete range of animals for long term recordings of conscious, unrestrained small animals

*Customizable Display:* View Data in Multiple Display modes simultaneously; Signal Conditioning Tools include filtering and artifact removal

*AcqKnowledge:* Multi-Animal, Multi-Channel simultaneous automated data analysis. Stellar Analysis routine extracts mean values and standard deviations from data segments...Powerful automated routines for EEG, seizure detection, EMG, ECG, HRV, EOG, EGG, and dozens more...results are easily exported to Excel for further statistical analysis.

## AcqKnowledge for Stellar Telemetry

with up to six (6) implants - **ACK100W-STL** 

#### **Additional Implant Licenses**

Purchase Qty 1-9 - **ACK100-STL1-9** Purchase Qty 10-49 - **ACK100-STL10-49** Purchase Qty 50+ - **ACK100-STL50+** 



## WWW.BIOPAC.COM for video demos!



## PH Physiology in the MRI<sup>M R I</sup>

#### BIOPAC provides physiological data acquisition and analysis systems specifically for human and small animal MRI life science research applications.

BIOPAC offers data acquisition systems, MRI Smart Amplifiers, transducers, stimulus options, electrodes, and leads with advanced software tools for safe data collection, subject monitoring, and cleaner physiological signals in the MRI environment.

MP Systems and amplifiers are placed in the MRI Control Room, and specialized cable systems optimize data quality with isolated and RF filtered interfacing between the subject/MRI Chamber and the Control Room. Filter leakage currents and dielectric isolation satisfy IEC60601-1.

#### *MRI-Compatible Amplifiers & Transducers* Solutions for Human & Animal Studies

Biopotentials ECG, EEG, EGG, EMG, EOGAirflow Respiratory Gas Analysis  $CO_2$  ( $ETCO_2$ ) and  $O_2$ Blood Pressure Micro Pressure Measurement Electrodermal Activity (EDA) Force Gating Units (Trigger/Synch) Respiration Temperature Pulse Pulse Oximetry (SpO<sub>2</sub>) Stimulation Laser Doppler Flow Differential Pressure Subject Feedback *finger twitch, grip strength pressure-based signals* 



Request the MRI Catalog Today!

### **MRI Smart Amplifiers**

#### Record high-quality physiological data in the MRI

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|             | ,  | Start   |        |

Features

- Less sensitivity to electrode and transducer lead placement
- Improved gain selectability
- No missing spectra in physiological signal frequency band
- Minimized computer-based real-time or postprocessing signal processing
- Cleaner data available as real-time analog output

Advanced signal processing circuitry removes spurious MRI artifact from the source physiological data. Signal processors are able to distinguish between physiological signal and MRI artifact as manifested by gradient and RF power switching during MRI sequences, such as echo planar and spiral imaging. Record physiological signals at the normal (non-MRI) rate and eliminate the need for secondary computer-based processing steps to remove artifact. In every aspect, data recording is easier and final results are cleaner when using MRI Smart Amplifiers to record physiological data in the fMRI/MRI.

ECG100C-MRI EMG100C-MRI EEG100C-MRI EDA100C-MRI PPG100C-MRI

### Watch demo videos at BIOPAC.COM

### Improve MRI image quality with Dual Channel Gating Systems Cardiac/Respiratory Gating Units





*MRI Gating Units* **DTU200** Small Animal **DTU300** Human

The DTU system sends cardiac trigger pulses to the MRI when a respiration signal is in the quiet phase. Pre-processing filters and gain controls further refine the quality of the signal and ensure reliable triggering.

Dual-channel gating requires two analog input signals:

#### Cardiac Signal

Electrocardiogram Smart Amplifier (*ECG100C-MRI* + *MECMRI-BIOP*) or Micro Pressure System (*MPMS200* + *TSD283*) or Small Animal Pulse Oximetry System (*OXY300-MRI*)

*Cardiac Phase:* The signal (ECG, BP, or Pulse) passes through a user-selectable threshold in both directions and creates a square wave (0-5 V) cardiac trigger signal.

#### **Respiration Signal**

Small animal respiration pad transducer (**TSD110-MRI + DA100C**) or Human respiration transducer (**TSD201 + RSP100C + MECMRI-TRANS**)

*Respiration Phase:* The respiratory signal passes through a threshold to create a square wave when the signal crosses the threshold in both directions. The quiet period is the interval between rising and falling edges or falling and rising edges.

#### **MRI Trigger Output**

The MRI trigger channel only outputs a cardiac trigger when the respiration trigger channel goes into the quiet period, which occurs when the subject is between breaths and still. Onboard Hold-Off, Blanking, and Monitoring improve trigger precision. The system will output a precise number of cardiac triggers between each respiratory period by adjusting the trigger count control (1-8). Buffered outputs for the cardiac and respiration conditioned signals are BNC outputs  $\pm 10$  V. The respective triggers are TTL 0-5 V. Seven BNC to 3.5 mm monitoring cables (CBL102) are included.

#### **Complete Gating System**

Complete system includes an MP150 data acquisition & analysis system, cardiac/respiratory dual channel gating unit, ECG amplifier, and appropriate cables, electrodes, and leads. *GATE-CARDRESP-E* 

## WWW.BIOPAC.COM



#### **Micro Pressure Measurement System**

Compact, Rugged Single-Channel Micro Pressure Measurement System with Standard or MRI Compatible Sensor

*Ideal for small animal physiological pressure monitoring applications including:* 

- Intra vascular blood pressure Intra ocular pressure
- Intra cranial pressure • Intra uterine pressure
- Urodynamic pressure

The MPMS200 is a single-channel, hand-held fiber optic micro pressure measurement system. The MPMS200 amplifier unit provides an analog output signal (±5 V range) and has a 250 Hz frequency range. System has automatic atmospheric pressure correction. The system includes a CBL101 cable to interface directly with the UIM100C for MP150 Research Systems or third-party hardware.

Fiber optic transducers for the MPMS200 have a 0.30 mm (1 F) sensor diameter.

**TSD280** 5 cm tip **TSD282** 15cm tip

**TSD281** 5 cm tip MRI **TSD283** 15 cm tip MRI

## **EEG Telemetry for Rats and Mice**



Long-term, wireless EEG recording from rats or mice in their home cages.

Collect two channels of long-term wireless EEG/neural signal data from rodents housed in industry standard home cages. Systems consist of a receiver tray that is placed under the animal's home cage, two implantable EEG sensors for mice or rats, and a Faraday cage. EEG sensors are small enough for mice as young as P6. Sensors weigh between 1.5 g and 2.8 g.



Dual-Channel Systems include tray, two 2-channel sensors, and cables:



EPOCH-RAT-SYS Two Channel Rat EEG System EPOCH-MSE-SYS Two Channel Mouse EEG System

Order additional EEG sensors as: **EPOCH-T2** Two channels, 2 month battery life **EPOCH-T6** Two channels, 6 month battery life

## See more animal solutions at WWW.BIOPAC.COM



## Vibromyography

#### **Breakthrough Muscle Measurement Technology!**

Use Vibromyography (VMG) to record vibration data received from precision accelerometers and proprietary software algorithms to capture muscle force data in real time.

#### VMG Benefits

- Ability to perform muscle balance assessments
- Convenient setup—no electrodes, no skin prep
- Improved reproducibility between muscles and individuals
- Measure absolute muscle effort up to 100% of maximum voluntary contraction

#### Vibromyography Systems

Complete systems for muscle monitoring using Vibromyography include an MP data acquisition and analysis system with VMG analysis filters and VMG transducers. Add transducers to extend up to 16 channels. *WSW for Windows, WS for Mac.* 

VMG System 2-Channel 4-Channel with MP150 System VMG102WSW or WS VMG104WSW or WS with MP36R System VMG36R2WSW or WS VMG36R4WSW or WS

#### Transducer & License Packs for existing MP System users

Add to compatible BIOPAC data acquisition system; HLT100C also required.

Vibromyography Transducer VMG Transducer & License Large Muscle TSD250 or Facial TSD251for MP150VMG150PACK-W or -Mfor MP36RVMG36RPACK-W or -M



#### Checks electrode/surface impedance levels so you can detect and correct any electrode contact issues **before** you start recording data. Portable battery operated device measures electrode impedance from < 5 K $\Omega$ to > 50 K $\Omega$ . Accepts standard Touchproof and BioNomadix leads.



# NEW SOLUTIONS



42 Aero Camino Goleta, CA 93117



- www.biopac.com