Vessel Diameter & Flow Recording System

Complete real-time, turnkey system for diameter recording

- **Up to 60 vessel diameter measurements/second (outer and luminal, wall thickness, area, media/lumen ratio)**
- **Real-time flow characterization (vascular resistance, shear stress, Reynolds number)**

IonOptix
USA T: 1-617 696-7335 F: 1-617 698-3553 E: info@ionoptix.com
Europe T: +353 1 685 4800 F: +353 1 443 0784 W: www.ionoptix.com

Table of Contents

System Overview 2

IonWizard Software Suite 3-4

IonWizard Core 3

VesAcq Vessel Dimensioning Acquisition 3

FloAcq Vessel Flow Characteristics Acquisition 4

Vessel Microscope Package 4

VesCam: Digital Video Dimension 5

Data System Interface: System Integration 6

IonOptix Systems 6

Contact ..... Back Cover

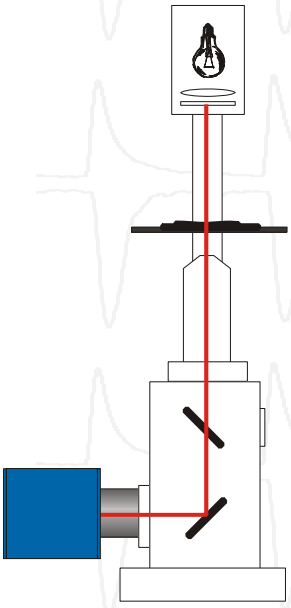
March 2010

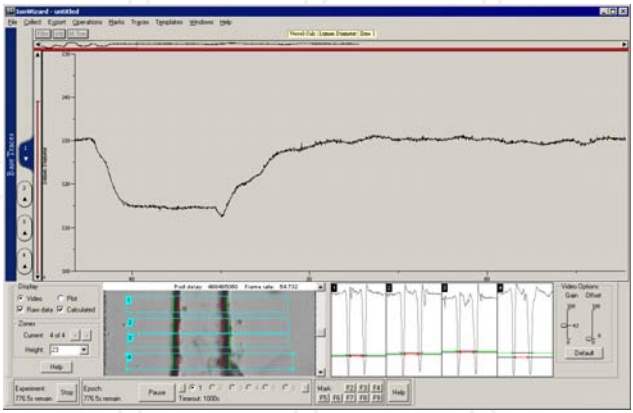
Vessel Dimensioning System Overview

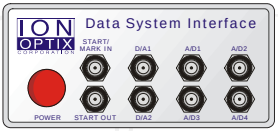
Interest in the physiology and pathology of the circulatory system has led to a substantial increase in the number of laboratories studying isolated and pressurized blood vessels. Although vascular constriction and dilation has been an area of intense investigation for decades, elucidation of the fundamental molecular and biophysical mechanisms remains at the forefront of vascular physiology research. Impairment to the regulatory machinery governing vasodilation and vasoconstriction correlates strongly with the onset and progression of many pathologies, including cardiomyopathies. Dimensioning of arterial segments offers an important physiologic measurement while providing key insights into the processes that affect vascular health.

IonOptix developed its **Vessel Diameter & Flow Recording System (VDSYS: Vessel Dimensioning System)** over many years of collaboration with top vascular researchers. We take pride in a line of precision products that are application driven and built to meet the needs of a demanding research environment. Since its inception in 1990 IonOptix has built and installed hundreds of high performance, turnkey systems in research laboratories worldwide.

When coupled to your pressure myography system, VDSYS provides everything necessary for acquiring vessel geometry and flow data with our new IonWizard 6 software. VDSYS also includes an inverted microscope with brilliant optics, a digital dimensioning camera and a suite of analog and digital connections for synchronous data collection.







IonWizard Software Suite

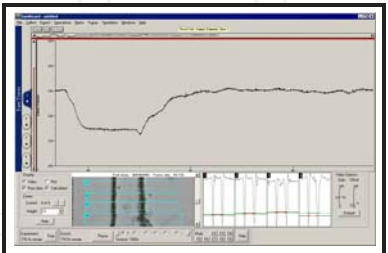
Acquisition of Vessel Diameter & Flow Data

Our IonWizard core software coordinates the control and recording of hardware components through a suite of acquisition modules, providing completely synchronous and accurate data acquisition. IonWizard's core functions are expanded through the **VesAcq** and **FloAcq** acquisition modules to record vessel diameter and flow characteristics. Through these acquisition modules, IonWizard communicates directly with root devices, the VesCam digital video acquisition camera, our data system interface and available pressure myography interfaces.

IonWizard 6 (IW6) supports a suite of A/D inputs and outputs, including digitization of up to 4 channels of 1000 Hz analog data and 2 channels of data output as well as digital inputs. IW6 now features a signal generator function for programming voltages to drive and control external hardware such as myograph pressure regulators.

Our new VesAcq dimensioning software offers a simpler user-interface, more precise control and enhanced functionality. VesAcq promises to make your data more reproducible, reliable and accurate.

IONWIZARD



VESACQ

VesAcq Features

- Vessel diameter data sampled at rates as high as 60 Hz with our VesCam.
- Multiple 'epochs' define separate acquisition regimes. Within each epoch, independent sampling rates for cell length, photometry, and analog data are specified.
- Switches between different epochs occur automatically or via user intervention.
- Line averaging - unlike convention "edge detection", where contrast information is evaluated on a single line, VesAcq averages contrast over all of the lines within a user-defined region to minimize artifactual contrast from remnants of blood, fat, folding, etc., making your measurements simpler and more reliable.
- Multiple ROIs allow measurement of up to four regions along the vessel at the same time.
- Auto-gained contrast - simplifying the user interface, contrast information is automatically maximized within the contrast window to enable precise control of thresholds.
- Real-time calculations of:
  - Inner/outer diameter
  - Left/right/average wall thickness
  - Inner/outer/cross-sectional area
  - Media/lumen ratio

IonWizard Software Suite (cont.)

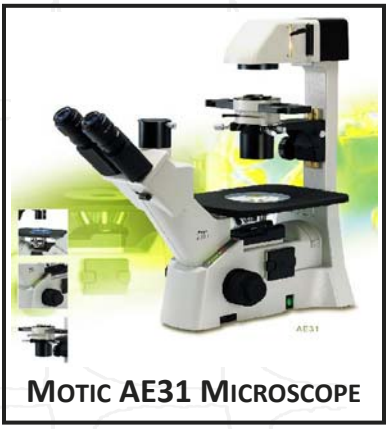
Acquisition of Vascular Flow Dynamics

IonOptix' FloAcq acquisition and recording module provides real-time indicators of arterial flow dynamics. By acquiring the raw flow rate and inlet and outlet pressures from your myograph system, along with dimensioning outputs from our VesAcq software, FloAcq calculates and reports the following values:

- **Mean pressure**
- **Flow velocity**
- **Vessel wall *shear stress*** - Shear stress is a characterization of the frictional drag exerted on arterial walls during flow. Shear stress is of particular importance to vascular function. It has been linked to the release of vasoactive substances as well as the regulation of gene expression, cellular metabolism, and morphology. In contrast to stretching, which acts as a circumferential force in response to pressure, shear stress is a tangential force applied along the endothelium. Normal levels of shear stress serve to maintain wall physiology and vascular homeostasis. High shear stress triggers vasodilation in order to regulate the mechanical forces exerted on arterial walls, often referred to as "endothelium-dependent flow-mediated dilatation".
- **Vascular resistance** - The vascular resistance is a definition of the force opposing the movement of solution through a vessel. It is inversely related to vessel diameter. A greater vascular resistance will require a greater degree of vasodilation in order to maintain constant pressure within the vessel.
- **Reynolds number (Re)** - The Reynolds number, Re, describes whether the flow is either turbulent or laminar. A very large Re (≥2000) suggests turbulent flow, where nonaxial flow instabilities increase stress on blood vessels. Turbulence-induced shear stress triggers nitric oxide synthesis in the endothelium which leads to relaxation of smooth muscle cells and restoration of laminar flow in normal healthy tissue. High Re values occur from high flow volume in narrow vessels, high flow velocity, branching (bifurcations), etc. Laminar flow exists at lower Re, although laminar vortices may be driven by inertial forces. At much lower Re, where flow is dominated by very viscous forces, inertial force becomes negligible and flow stops.

Vessel Diameter Microscope: Motic AE31

The IonOptix-configured Motic AE31 inverted microscope provides an ideal platform for dimensioning measurements. It features upscale research functions, such as halogen Koehler illumination and epifluorescence capacity. The AE31 also incorporates Motic's Color Corrected Infinity Optical System [CCIS®] to produce crisp, flat, high contrast images. We equip our microscope packages according to the specific demands of the proposed IonOptix system. Properly equipped, the Motic serves as an exceptional choice for researchers in search of reliable, high fidelity data acquisition at an affordable price.



MOTIC AE31 MICROSCOPE

Features

- **CCIS Optics.** Color corrected infinity optical system.
- **Brightfield Illumination.** Koehler illumination system w/ true DC 6V-30W output delivers bright, consistent illumination at all optical magnifications.
- **Mechanical Stage.** Precise control of sample position. Comfortable long wand allows user to rest forearm while manipulating stage.
- **Trinocular Head.** Easy access to auxiliary components. Efficient transmission of light for photometry and cellular dimensioning.
- **Microscope Base.** Wide base for strength and rigidity. Inverted "Y" support provides additional lateral support. Ergonomic design provides easy adjustment of focus and stage controls.

VesCam

Digital Video Dimensioning

The IonOptix VesCam is a high performance yet economical solution for visualizing vessels. It's an all-digital camera that utilizes the USB 2.0 standard to remove the restrictions of analog video formats and frame grabbers. The camera utilizes a monochromatic Sony CCD progressive scanning sensor. We offer three VesCams with varying sensor sizes and resolutions to suit the needs of the investigation. Exposure times and contrast levels are adjustable to maximize the contrast of vessel features. All analog processing and digitization is done inside the camera to minimize noise. The digital data is then transferred to the computer using a standard high-speed USB 2.0 port eliminating the cost of a frame grabber.

VESCAM (LENS NOT INCLUDED)

Features

VesCam1.25

- **CCD sensor.** 1/4" sensor chip; 640 pixels wide by 480 lines (progressive); 5.6 µm X 5.6 µm pixel size.
- **Frame rates.** 60, 30, 15, 7.5, 3.75 fps.
- **Sensitivity.** 0.5 lx at 1/30s.

VesCam1.33

- **CCD sensor.** 1/3" sensor chip; 1024 pixels wide by 768 lines (progressive); 4.65 µm X 4.65 µm pixel size.
- **Frame rates.** 30, 15, 7.5, 3.75 fps.
- **Sensitivity.** 0.5 lx at 1/15s.

VesCam1.5

- **CCD sensor.** 1/2" sensor chip; 1280 pixels wide by 960 lines (progressive); 4.65 µm X 4.65 µm pixel size.
- **Frame rates.** 15, 7.5, 3.75 fps.
- **Sensitivity.** 0.5 lx at 1/7.5s.

All models

- Programmable CCD gain.
- Programmable integration time to stop fast movement or increase camera sensitivity.
- Single USB 2.0 cable to camera for power and data transmission.
- **Independent software.** Complete video controls for imaging acquisition included. Can be used to snap single images or generate movies.

Data System Interface: System Integration

The IonOptix Data System Interface, model DSI300, provides all the standard non-video analog and digital inputs/ outputs needed for your vessel dimensioning system. The interface box is typically used to collect output data from vessel myographs in real time. It also serves as the master timing device for the system.

The DSI300 may be connected to external devices using the four analog inputs, the two analog outputs or the digital start/ mark trigger input. IonWizard's flexible device configuration allows the experimenter to specify the name and unit scaling of each auxiliary signal for easy-to-read data files.

DSI300

Features

Inputs

- **Start/ mark in.** This TTL signal allows external initiation of data sampling and/ or can be recorded during data acquisition to provide event synchronization information.
- **Analog to Digital.** Four channels of 16-bit A/D with input voltage range of ±5V. Sampling rates can be adjusted within IonWizard up to 1000 Hz.

Outputs

- **Digital to Analog.** Two channels of ±5V. 12-bit D/A outputs can be configured as a variety of monitor or control signals.

Includes

- Includes half-length, full-height PCI computer interface card and six foot cable.
- IonWizard driver software for Windows 2000, XP.

IonOptix Systems

Our goal is to support the scientific research community with an array of systems that meet experimental demands while adhering to our philosophy of designing and developing innovative high-performance products at fair prices. The following are some of the application-driven systems currently available.

Calcium and Contractility/ Diameter

- Myocyte Calcium and Contractility Recording Systems
  - Calcium (HyperSwitch & MuStep)
  - Contractility (Cell & Sarcomere Length)
- Vessel Calcium and Diameter Recording System

General Photometry

- Fluorescence Photometry System

Tissue Bath Fluorometry

- FluoroPlex
- FluoroHeart

Cell Pacing

- Cell Culture Pacing

Myocyte Harvesting

- Myocyte Harvesting System

ION OPTIX

"The Barn" — IonOptix Headquarters in Milton, Massachusetts

Company History

IonOptix makes quality ratiometric fluorescence and cell dimensioning data acquisition systems. We have been making reasonably priced, high performance systems since 1990.

IonOptix prides itself on post-sale customer support. Telephone and email support is available on an unlimited basis. More importantly, every system sale includes a one to two day installation visit to set up the system and train the customer. We consider this training to be critical as it gets the customer up and running as quickly as possible. We run experiments with your preparations during the visit to be assured that all technical issues particular to the experimenter's preparations have been covered.

Resellers

Our good friends at Cairn Research are currently our only resellers. They sell our components in conjunction with their fluorescence and electrophysiology systems.

Cairn Research
www.cairn-research.co.uk

Authorized Representatives

In efforts to afford this high level of service to all our customers, IonOptix has entered into agreements with local representatives in several countries. The representatives have been chosen based on their technical and biological expertise, familiarity with our products, and on their customer service skills.

Bioprobes Ltd.
China, Hong Kong
www.bioprobeshk.com
www.bioprobeschina.com

Scitech Korea Inc.
Korea
www.scitechkorea.co.kr

Kuo Yang Scientific Corp.
Taiwan, Republic of China
www.kuoyang.com.tw

SDR Clinical Technology
Australia, New Zealand
www.sdr.com.au

Primetech
Japan
www.primetech.co.jp

Commat Ltd.
Turkey
www.commat.com.tr

IonOptix
USA T: 1-617 696-7335 F: 1-617 698-3553 E: info@ionoptix.com
Europe T: +353 1 685 4800 F: +353 1 443 0784 W: www.ionoptix.com