FISO

FISO-LS SERIES

Exclusively from

HARVARD APPARATUS

Fiber Optic Micro-catheter Pressure Transducers

300 micron & 640 micron

SMALL VESSEL • INTRACRANIAL • INTRAOCULAR • URO-GENITAL • AND MORE!

The FISO Advantage

Micro – No need for high-priced solid-state pressure catheters when a mass manufactured glass fiber is inexpensive and small.

Low Noise – Because a beam of light is inherently quiet, there is no EMI/RF from the catheter itself interfering with the pressure signal. It is also uninfluenced by high EMI/RF environment. The sensors can be made long enough to be used for MRI image gating.

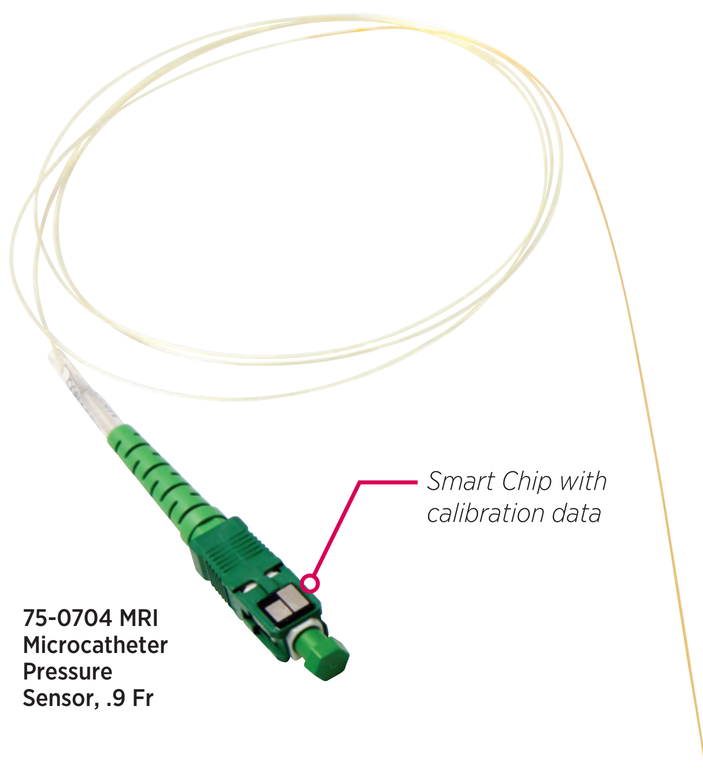
Accurate – Due to the speed of light, the frequency response is completely dependent on the signal conditioner. The fast 15 kHz FISO-LS Conditioner ensures you will obtain high fidelity pressure traces.

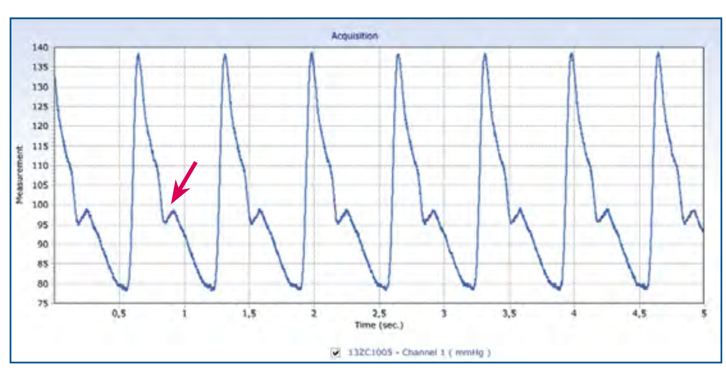
Tip Sensor – The sensor is located at the tip of the fiber, allowing the measurement of the target signal with no signal artifacts due to vessel wall or cardiac wall contact with the sensor.

Ease-of Use – Pre-calibrated pressure sensor with data stored in the smart chip allows for plug-and-play ability.

Proven – over 200,000 sensors in the field since 2006!

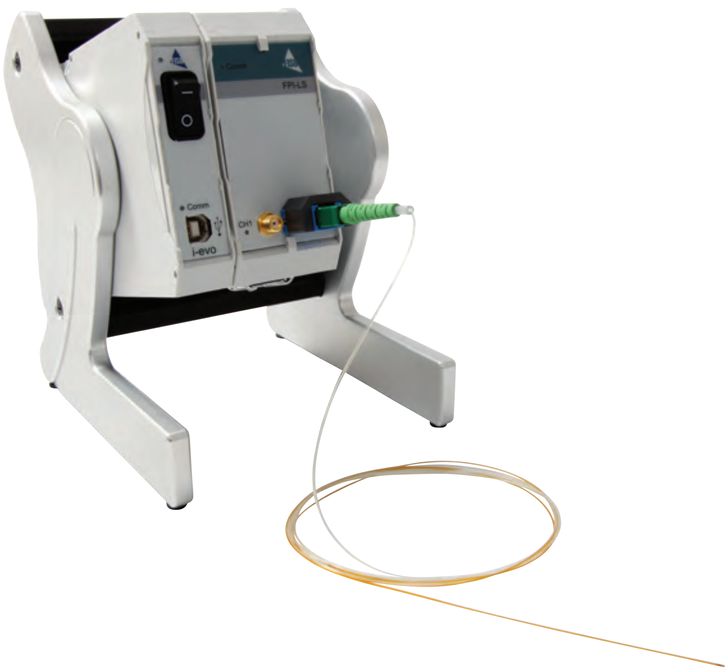
The FISO-LS-PT9 has a 300 micron tip!





The Dicrotic Notch, difficult to see clearly with traditional fluid-filled sensors, is easy to identify with the FISO-LS fiber optic pressure sensor.

Microcatheter Pressure Transducers



Applications include:

Neuroscience – Intracranial pressure; blast wave and impact trauma

Cardiovascular – Left ventricular pressure, arterial or venous blood pressure

Ocular Tonometry – Non-invasive intraocular pressure tonometry

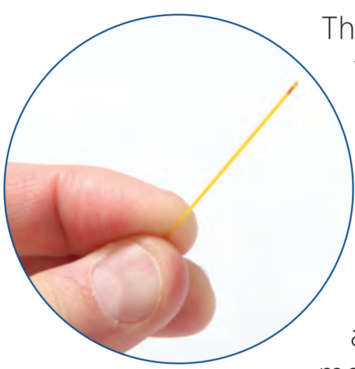
Intraocular Pressure – Invasive intraocular pressure

Urology - Bladder/Ureter pressure

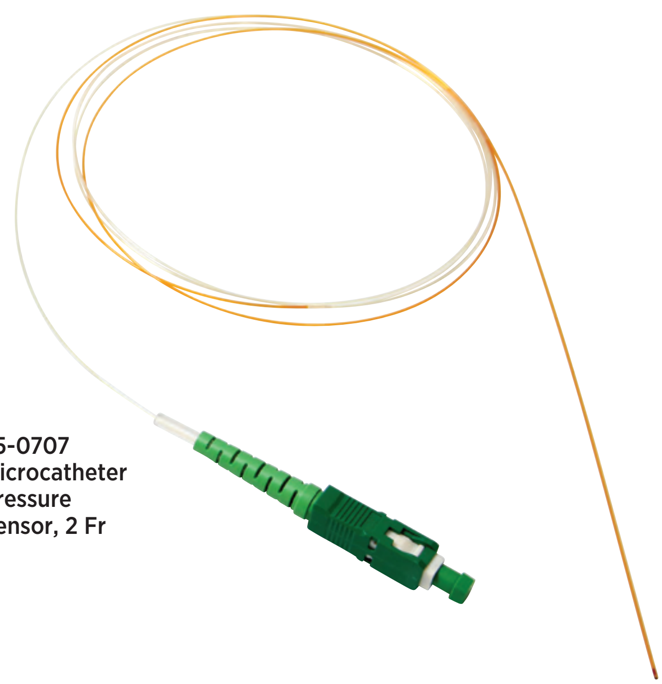
Spine - Intradiscal pressure

Bone - Intramedullary pressure

MRI Gating - Arterial blood pressure or left ventricular pressure for image gating



The FISO-LS series catheters were designed as semi-disposable for multi-use applications in the life-sciences and small animal research. Unlike its disposable counterpart in clinical applications, this sensor is more robust with a protected tip. The standard transducers have 1 meter of nylon sheathing to protect the fiber, where the 10 m transducers have 9.3 to 9.8 m of nylon sheath, further protecting the glass fiber. With proper use and care the sensor can be used many times.



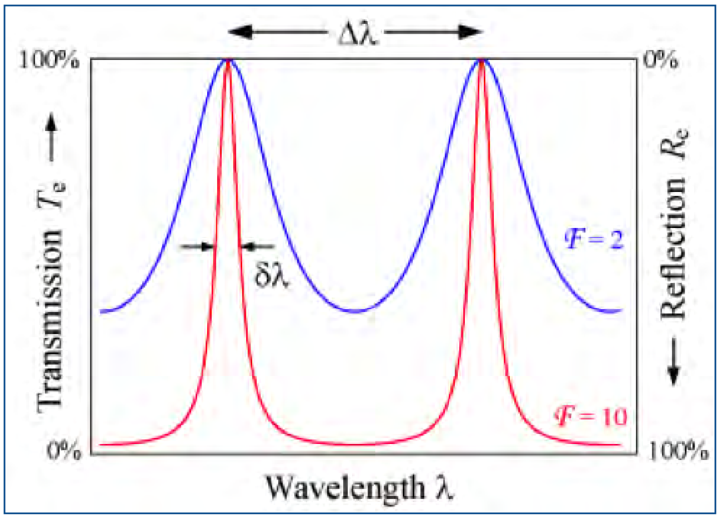
75-0707 Microcatheter Pressure Sensor, 2 Fr

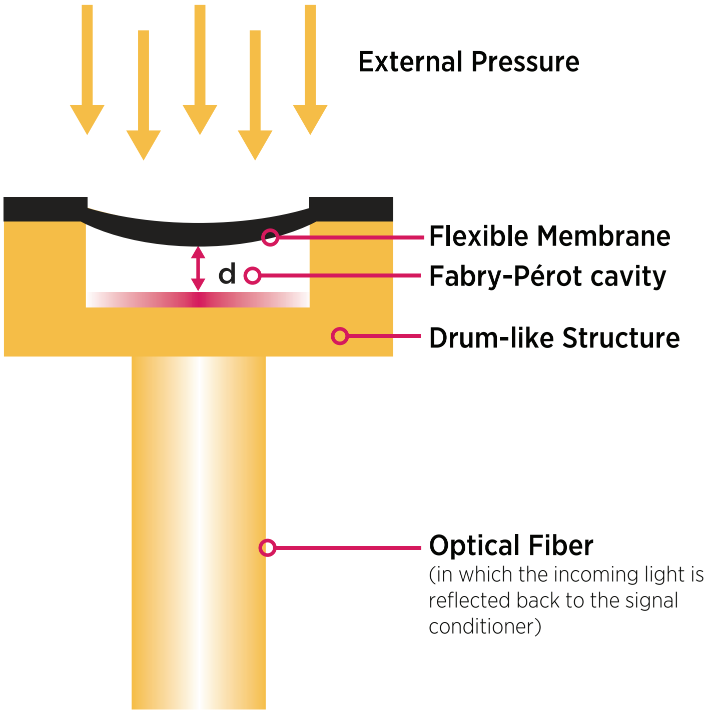
Ordering - Transducers

Order #	Model	Description	Bare Fiber Length	Total Length	Pressure Range	Tip Diameter
75-0706	FISO-LS-PT9-10	Physiological Microcatheter Pressure Sensor, .9 Fr	20 cm	1.2 m	± 300 mmHg	300 µm
75-0715	FISO-LS-PT9-20	MRI Microcatheter Pressure Sensor, .9 Fr	20 cm	10 m	± 300 mmHg	300 µm
75-0707	FISO-LS-2FR-10	Physiological Microcatheter Pressure Sensor, 2 Fr	70 cm	1.7 m	± 300 mmHg	640 µm
75-0716	FISO-LS-2FR-20	MRI Microcatheter Pressure Sensor, 2 Fr	70 cm	10 m	± 300 mmHg	640 µm
75-0714	FISO-LS-2FR-30	High Pressure Microcatheter Pressure Sensor, 2 Fr	70 cm	1.7 m	0 to 10 bar	640 µm

How it Works

The **Fabry-Pérot etalon** was modeled over 100 years ago by two French Physicists, after whom it was named. The device is characterized by two parallel reflecting mirrors on either side of a transparent medium, where the distance between the mirrors is known as the etalon cavity length. The transmission characteristic for the F-P etalon has distinct transmission peaks in wavelength as a function of the cavity length, physically corresponding to resonances of the etalon. FISO's pressure sensors are a flexible embodiment of the F-P etalon. As illustrated to the right, a deformable membrane is assembled over a vacuumed cavity, thus forming a small drum-like structure. The sensing F-P cavity is located between the base of the drum and the flexible membrane. When pressure is applied, the membrane is deflected toward the bottom of the drum, thus reducing cavity length. After appropriate sensor calibration, completed at the factory, each etalon cavity length corresponds to a specific pressure value. The signal conditioner is designed to determine the cavity length to the nanometer level, providing the researcher with an extremely accurate and repeatable pressure measurement system.





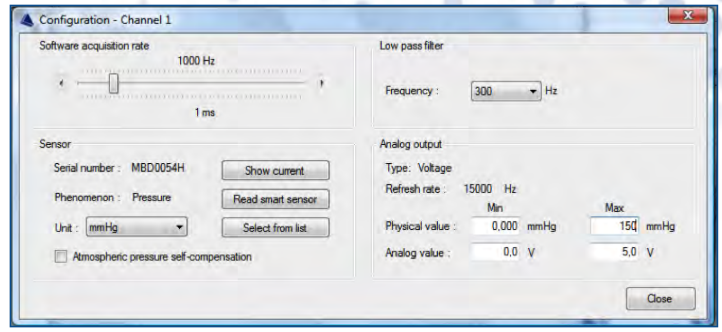
All-In-One Preclinical Pressure Test Solution

The entire solution comprises: an animal-use catheter, the signal conditioner in power supply housing (FPI-LS with EVO chassis) control & acquisition software, and optional extension cables and data acquisition system. Computer interface is supplied by the researcher.

Evolution Software

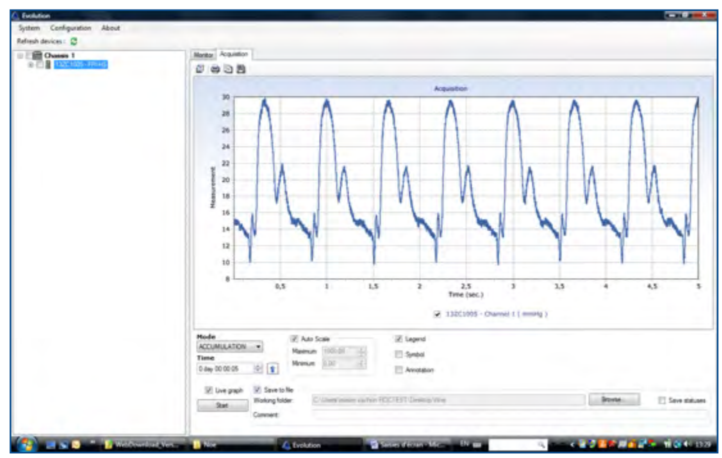
Configure and Control the Reading Instrument

The most common set-up for users will be to configure the 0-5V analog output level to the pressure range of interest, but the end-user will also enjoy the ability to visually confirm proper communication between catheters and the instrument.



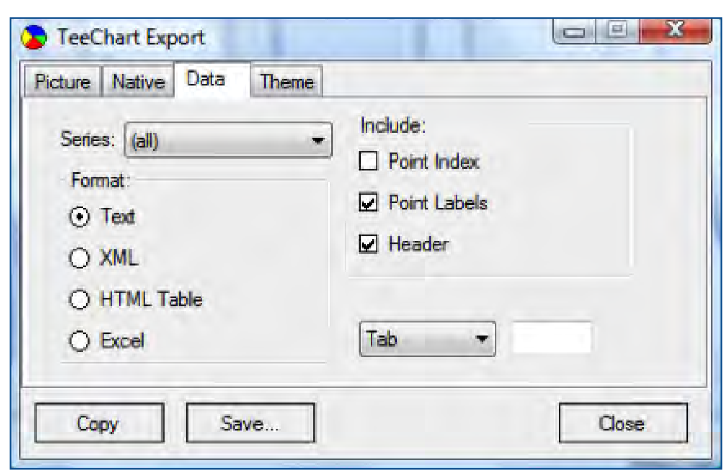
Simple Monitoring & Real-Time Graphing

Users may easily choose between reading the actual measurement, or plot (both in real-time) with user specified screen refresh rates and graphing options.



Export Data

While users may generally prefer to use the 15kHz analog output on the FPI-LS, data may also be recorded and saved in multiple file formats.



Computer System Compatibility

On Windows XP SP3:
2 GHz CPU (like Pentium 4); 1 GB of RAM (DDR2)

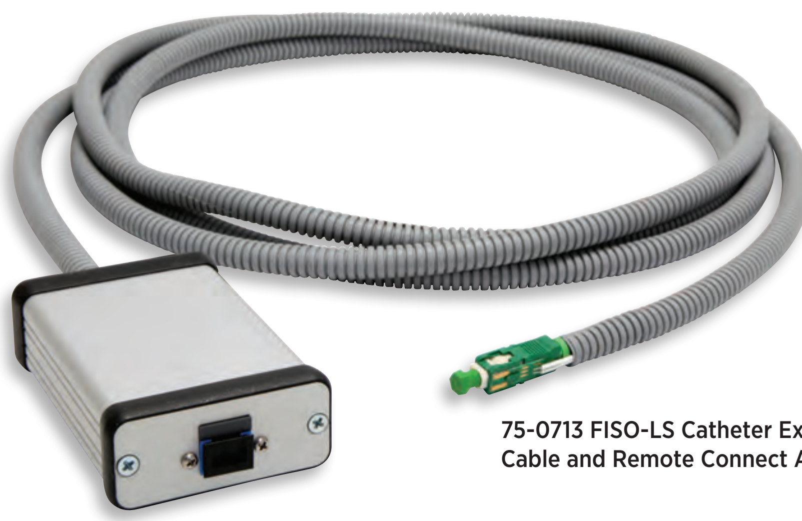
On Windows 7 64 bits:
2 GHz CPU (dual core); 2 GB of RAM

FISO-LS LIFE SCIENCE SERIES

Exclusively from HARVARD APPARATUS

Module and Chassis Specifications

75-0704 FISO-LS Signal Conditioner
1 Channel, 15 kHz Analog Output



75-0713 FISO-LS Catheter Extension Cable and Remote Connect Adapter

FPI-LS Module

This "signal conditioning" module is both the light source and receiver of the fiber optic measurement system. The FPI-LS converts the optical signal to a pressure reading and requires no external amplification box. The catheter's optical cable plugs directly into the FPI-LS. Alternatively, the catheter can be plugged into a remote connection box with extension cable should the researcher not have the space proximal to the point of measurement for the signal conditioner and chassis. Each FPI-LS module is supplied with an analog output cable for interfacing with standard Data Acquisition Hardware with BNC inputs.

Specifications

Parameter	FPI-LS and the FISO Catheter
Pressure Range	± 300 mmHg
Accuracy	± 3 mmHg
Resolution	± 0.3 mmHg, filter setting dependent
Temperature Range	10° to 50°C
Sampling Rate:	
Analog Output	15,000 Hz
Digital Output	Up to 5,000 Hz settable via Evolution Software
Data Output	Digital USB 2.0 / Analog 0-5V 16 bit

Ordering - Signal Conditioner

Order #	Model	Description
75-0704	FPI-LS-10	FISO-LS Signal Conditioner 1 Channel, 15 kHz Analog Output
75-0713	CFO-LS-M3	FISO-LS Catheter Extension Cable and Remote Connect Adapter

EVO Chassis

The bench-top chassis is provided with the Power/ Interface module, Evolution data acquisition and instrument control software, a USB cable, power supply, and module removal tool.

Modular in design, researchers can add FPI-LS modules, and thus more channels, as time and budgets permit.

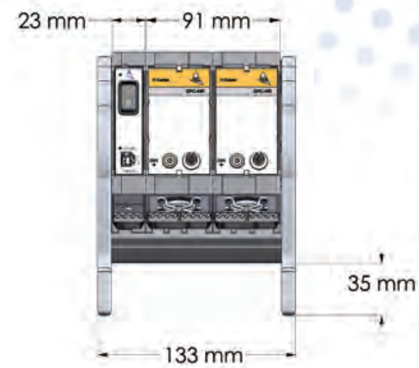
Specifications

Parameter	EVO-SD-2	EVO-SD-5
Communication	USB 2.0	USB 2.0
Data Logging Memory	Via USB connected computer running Evolution Software, up to 5 kHz	Via USB connected computer running Evolution Software, up to 5 kHz
Number of FPI Modules	Up to 2	Up to 5
Expansion Chassis	24VDC 70W	24VDC 70W
Size (Bench space)	19.5 x 15.8 x 18.2 cm	19.5 x 15.8 x 18.2 cm

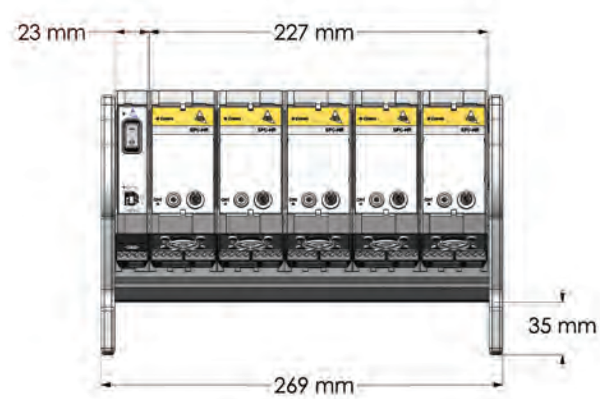
Ordering - Chassis

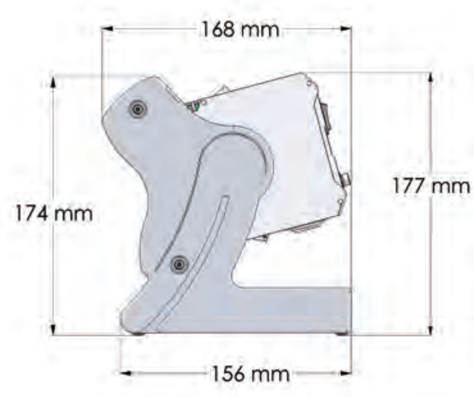
Order #	Model	Description
75-0700	EVO-SD-2	FISO Evolution Chassis 2 Channel
75-0701	EVO-SD-5	FISO Evolution Chassis 5 Channel

EVO-SD-2



EVO-SD-5





75-0700

Publication List

Cardiovascular Applications:

1. Konieczny, G., Opilski, Z., Pustelny, T., Gacek, A., Gibinski, P., & Kustosz, R. (2010). Results of experiments with fiber pressure sensor applied in the polish artificial heart prosthesis. Acta Physica Polonica-Series A General Physics, 118(6), 1183.

2. Konieczny, G., Opilski, Z., Pustelny, T., & Maciak, E. (2009). State of the work diagram of the artificial heart. Acta Physica Polonica-Series A General Physics, 116(3), 344.

3. Laksari, K., Agah, M. R., Rachev, A., & Darvish, K. (2012, March). Investigating the effects of dynamic and static loading on the stability of porcine aorta. InBioengineering Conference (NEBEC), 2012 38th Annual Northeast (pp. 205-206). IEEE.

4. Pinet, É., Pham, A., & Rioux, S. (2005, M ay). Miniature fiber optic pressure sensor for medical applications: an opportunity for intra-aortic balloon pumping (IABP) therapy. In Bruges, Belgium-Deadline Past (pp. 234-237).

5. International Society for Optics and Photonics. Romanov, V. V., Darvish, K., & Assari, S. (2010, January). Characterization of Material Properties of Aorta from Oscillatory Pressure Tests. In 26th Southern Biomedical Engineering Conference SBEC 2010, April 30-May 2, 2010, College Park, Maryland, USA (pp. 380-384). Springer Berlin Heidelberg.

Intraocular Pressure:

1. Ahmed, E., Ma, J., Rigas, I., Hafezi-Moghadam, N., Iliaki, E., Gragoudas, E. S., ... & Adamis, A. P. (2003). Non-invasive tonometry in the mouse.Investigative Ophtalmology and Visual Science, 44(5), 3336.

2. Chi, Z. L., Akahori, M., Obazawa, M., Minami, M., Noda, T., Nakaya, N., ... & Iwata, T. (2010). Overexpression of optineurin E50K disrupts Rab8 interaction and leads to a progressive retinal degeneration in mice. Human molecular genetics, 19(13), 2606-2615.

3. Filippopoulos, T., Matsubara, A., Danias, J., Huang, W., Dobberfuhl, A., Ren, L., ... & Grosskreutz, C. L. (2006). Predictability and limitations of non-invasive murine tonometry: comparison of two devices. Experimental eye research, 83(1), 194-201.

4. Ma, J. J., Bellevile, C., Nouri, M., Ahmed, E., & Dohlman, C. H. (2003). Interferometry for a Non-contact, in vivo Method to Measure Intraocular Pressure using Silicone MEMS (Micro-electro-mechanical Systems) Photolithography Based Chips on a Keratoprosthesis (Kpro). Investigative Ophtalmology and Visual Science, 44(5), 4703.

5. Ohnuma, O., et al. "Intraocular pressure change during phacoemulsification and aspiration." Journal of the Eye 23.9 (2006): 1225.

6. Senatorov, V., Malyukova, I., Fariss, R., Wawrousek, E. F., Swaminathan, S., Sharan, S. K., & Tomarev, S. (2006). Expression of mutated mouse myocilin induces open-angle glaucoma in transgenic mice. The Journal of neuroscience, 26(46), 11903-11914.

7. Zhong, L., Bradley, J., Schubert, W., Ahmed, E., Adamis, A. P., Shima, D. T., ... & Ng, Y. S. (2007). Erythropoietin promotes survival of retinal ganglion cells in DBA/2J glaucoma mice. Investigative ophthalmology & visual science, 48(3), 1212-1218.

8. Zhou, Y., Grinchuk, O., & Tomarev, S. I. (2008). Transgenic mice expressing the Tyr437His mutant of human myocilin protein develop glaucoma. Investigative ophthalmology & visual science, 49(5), 1932-1939.

Intracranial Pressure, Blast Wave & Impact Trauma:

1. Bauman, R. A., Ling, G., Tong, L., Januszkiewicz, A., Agoston, D., Delanerolle, N., ... & Parks, S. (2009). An introductory characterization of a combat-casualty-care relevant swine model of closed head injury resulting from exposure to explosive blast. Journal of neurotrauma, 26(6), 841-860.

2. Dal Cengio Leonardi, A., Keane, N. J., Bir, C. A., Ryan, A. G., Xu, L., & VandeVord, P. J. (2012). Head orientation affects the intracranial pressure response resulting from shock wave loading in the rat. Journal of biomechanics.

3. Chavko, M., Koller, W. A., Prusaczyk, W. K., & McCarron, R. M. (2007). Measurement of blast wave by a miniature fiber optic pressure transducer in the rat brain. Journal of neuroscience methods, 159(2), 277-281.

4. Leonardi, A. D. C., Bir, C. A., Ritzel, D. V., & VandeVord, P. J. (2011). Intracranial pressure increases during exposure to a shock wave. Journal of neurotrauma, 28(1), 85-94.

Other Applications:

1. Cibula, E., Pevec, S., Lenardic, B., Pinet, E., & Donlagic, D. (2009). Miniature all-glass robust pressure sensor. Optics Express, 17(7), 5098-5106.

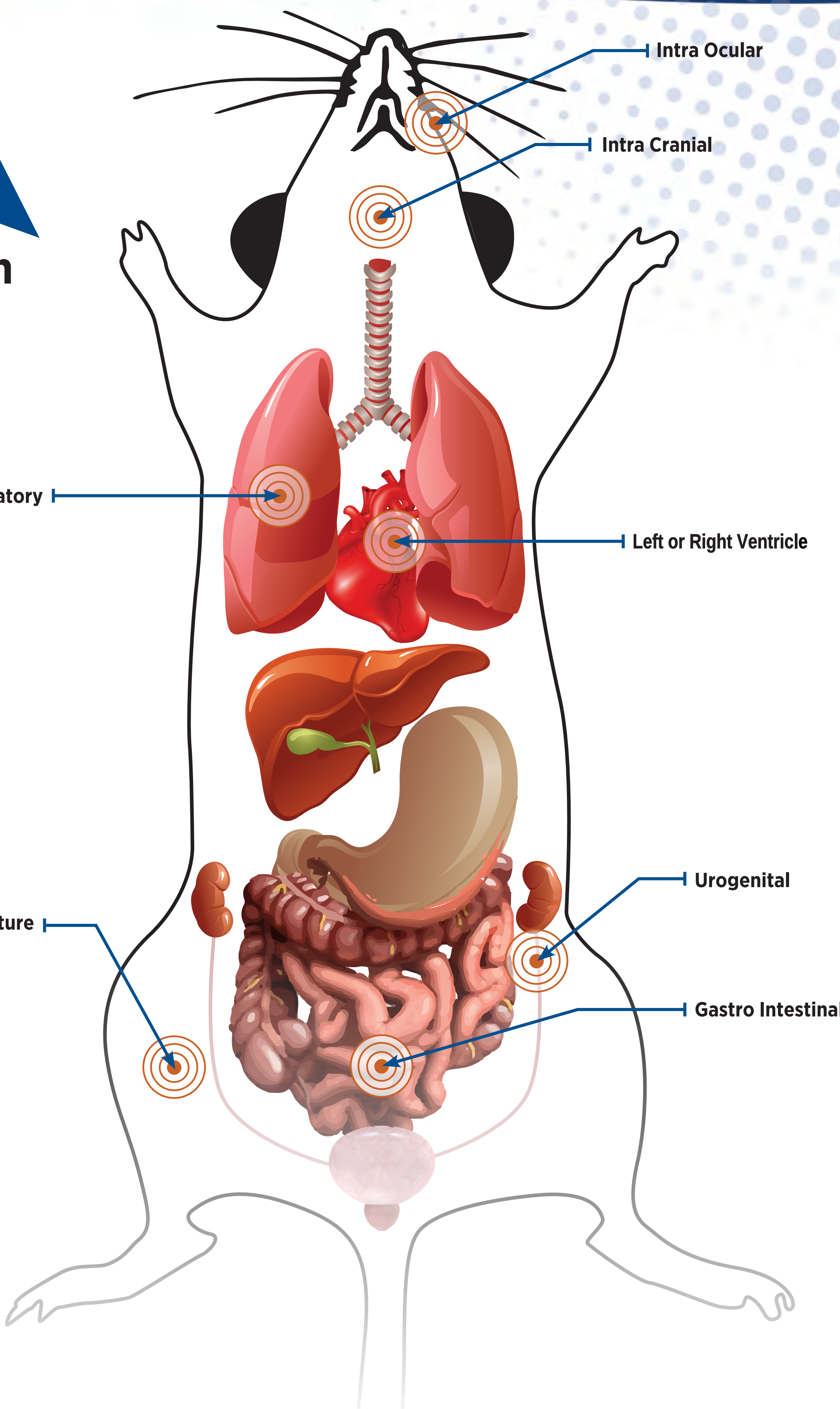
2. Kong, D. R., He, B. B., Wu, A. J., Wang, J. G., Yu, F. F., & Xu, J. M. (2013). Fiberoptic sensor for noninvasive measurement of variceal pressure.Endoscopy, 45(S 02), E55-E56. Hamel, C., & Pinet, É. (2006, February).

3. Temperature and pressure fiber-optic sensors applied to minimally invasive diagnostics and therapies. In Biomedical Optics 2006 (pp. 608306-608306). International Society for Optics and Photonics.

4. Pinet, E., Cibula, E., & Donlagic, D. (2007, September). Ultra-miniature all-glass Fabry-Pérot pressure sensor manufactured at the tip of a multimode optical fiber. In Proc. of SPIE Vol (Vol. 6770, pp. 67700U-1).

5. Zhang, P., Su, M., Liu, Y., Hsu, A., & Yokota, H. (2007). Knee loading dynamically alters intramedullary pressure in mouse femora. Bone, 40(2), 538-543.

Insertion Points



Exclusively from HARVARD APPARATUS

Harvard Apparatus Worldwide

United States
Harvard Apparatus
84 October Hill Road
Holliston, MA, 01746, USA
Tel: +1 508 893 8999
Toll Free: +1 800 272 2775 (USA Only)
Fax: +1 508 429 5732
techsupport@harvardapparatus.com
www.harvardapparatus.com

Warner Instruments
1125 Dixwell Avenue
Hamden, CT, 06514, USA
Tel: +1 203 776 0664
Toll Free: +1 800 599 4203 (USA Only)
Fax: +1 203 776 1278
support@warneronline.com
www.warneronline.com

Canada
Harvard Apparatus Canada
Attn: Sales Department
6010 Vanden Abeele
Saint-Laurent, Quebec, H4S 1R9, Canada
Tel: +1 514 335 0792
+1 800 361 1905 (Canada only)
Fax: +1 514 335 3482
sales@harvardapparatus.ca
www.harvardapparatus.ca

France
Harvard Apparatus, S.A.R.L.
Attn: Sales Department
6 Avenue des Andes Miniparc – Bat. 8
91952 Les Ulis Cedex, France
Tel: +33 1 64 46 00 85
Fax: +33 1 64 46 94 38
info@harvardapparatus.fr
www.harvardapparatus.fr

Germany
Hugo Sachs Elektronik /
Harvard Apparatus, GmbH
Gruenstrasse 1
D-79232 March-Hugstetten, Germany
Tel: +49 0 76 65 92 00-0
Fax: +49 0 76 65 92 00-90
info@hugo-sachs.de
www.hugo-sachs.de

Spain
Panlab, S.L. / Harvard Apparatus Spain
C/Energia, 112
08940 Cornellà, Barcelona, Spain
Tel: +34 934 750 697 (International Sales)
+34 934 190 709 (Sales in Spain)
Fax: +34 934 750 699
info@panlab.com
www.panlab.com

Sweden
CMA Microdialysis, AB
Box 7048
SE-164 07 Kista, Sweden
Tel: +46 8 470 10 00
cma@microdialysis.se
www.microdialysis.se

United Kingdom
Harvard Apparatus, Ltd.
Attn: Sales Department
Fircroft Way, Edenbridge
Kent TN8 6HE, United Kingdom
Tel: +44 1732 864001
Fax +44 1732 863356
sales@harvardapparatus.co.uk
www.harvardapparatus.co.uk

Worldwide
Harvard Apparatus solutions are available from a wide network of distribution partners. Please contact us or visit www.harvardapparatus.com to find a distributor near you.

Note: *Products in this catalog are for Research Use Only. They are not for use on humans unless proper investigational device regulations have been followed.*