



Small Animal Cardiovascular Telemetry Solutions

Cardiovascular physiology can be affected by many conditions including, but not limited to, arrhythmias and high blood pressure. By monitoring cardiovascular endpoints, such as hemodynamics and electrocardiograms, researchers can obtain valuable information to develop animal models of cardiovascular disease or evaluate potential therapeutic compounds.

DSI has proven technologies, products and services for researchers performing acute or chronic studies.

PhysioTel™ HD Cardiovascular Implants

HD Benefits

DSI's PhysioTel™ HD implants enable researchers to collect various combinations of physiologic endpoints from small animals to explore and better understand the cardiovascular system. The HD platform offers ease of use, enhanced performance and confidence in results.

Specifications

Species commonly monitored with DSI small animal implants include rats, guinea pigs, rabbits, ferrets and marmosets.

Model	Pressure(s)	Biopotential	Temp.	Activity	Battery Life (months)	Implant Weight (g)	Implant Volume (cc)
HD-S10	1		1	1	5	4.4	3.1
HD-S11-F0	1	1	1	1	2	8	5.9
HD-S11-F2	1	1	1	1	3	8	5.9
HD-S21	2	1	1	1	2	8	5.9

HD-S10: Single Pressure Implant

Accurate blood pressure measurements in cardiovascular studies are critical. Research has shown that direct monitoring (implantable telemetry) generates more accurate data than indirect monitoring (cuff monitoring).¹ In addition, the ability to continuously measure blood pressure directly is ideal because it allows the researcher to monitor second-to-second changes in the data.

The HD-S10 enables researchers to continuously measure pressure, temperature and activity from small animal models. By simultaneously recording pressure and temperature in an animal, the HD-S10 is ideal for hypertension and immunology studies.



HD-S11: Single Pressure, Single Biopotential Implant for Pair House Studies

This implant was designed to support pair housing in small animal models where cardiovascular endpoints are needed. The HD-S11 is available in two frequencies. Researchers can simultaneously collect pressure, biopotential, temperature and activity data continuously and in real-time from two small animals in a single cage.

The HD-S11 allows for cardiovascular research paradigms including:

- Behavioral studies
- Chronic stress exposure
- Comparison of drug effects in single vs. pair housed animals
- Acute stress response



Alternatively, the second frequency HD-S11-F2 may be implanted with another implant to collect more parameters from a single subject. An example of this would be implanting the HD-S11-F2 with continuous glucose telemetry (HD-XG) to explore cardiovascular interaction with blood glucose. The HD-S11-F2 can be paired with any DSI implant operating on a different frequency.

HD-S21: Dual Pressure, Single Biopotential Implant

The pressure generated in the heart can be measured and analyzed in a variety of ways to understand changes in cardiac function. DSI's HD-S21 implant offers two pressure catheters capable of detecting very subtle pressure changes in small animals. Scientists seeking greater measurement accuracy will find the HD-S21 to be ideal for high-fidelity applications.

This dual pressure implant provides precise measurement of various physiologic cardiovascular signal combinations such as:

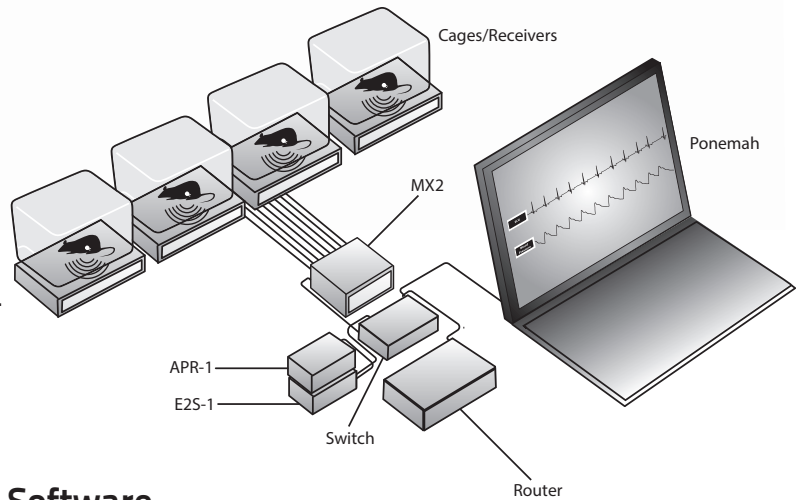
- Left ventricular pressure + blood pressure (BP)
- Pulmonary artery pressure + BP
- Right ventricular pressure + BP
- Pulse wave velocity



The HD-S21 is often used in rodents early in the drug discovery process or for safety screening studies, prior to evaluating drug candidates in larger species.

Small Animal Implantable Telemetry System

DSI offers a complete solution for cardiovascular research. Each system includes the necessary implants, hardware and software to facilitate successful studies. Shown (to the right) is an overview of a DSI small animal telemetry system. Additional system configurations exist that can be adapted to specific research needs.



Ponemah Acquisition and Analysis Software

Ponemah is a complete physiologic data acquisition and analysis software platform used by researchers to confidently collect, accurately analyze and quickly summarize data. Available analysis modules incorporate validated algorithms developed from scientific peer-reviewed journals for reliable, consistent results. Specific analysis modules allow for detailed analysis of cardiovascular endpoints including, but not limited to, blood pressure, left ventricular pressure and ECG. In addition, the latest Ponemah analysis module, Data Insights™, automatically detects, classifies and reports arrhythmias.

Ponemah™ is compatible with all DSI monitoring solutions offering flexible, customizable acquisition interfaces. Ponemah's modular design gives researchers the power to select analysis modules that best suit their research needs.

Scientific Services

DSI Scientific Services help researchers streamline studies by providing trustworthy expertise through Surgical Training, Technical Training, Validation and Data Services. DSI Scientific Services allow researchers to achieve greater implanted telemetry success, meet software validation GLP requirements, and summarize data for confidence in results.

Featured Small Animal Cardiovascular Telemetry Publications

Johnson P.L., Federici L.M., Fitz S.D., Renger J.J., Shireman B., Winrow C.J., Bonaventure P., Shekhar A. "Orexin 1 and 2 Receptor Involvement in Co2 Induced Panic-Associated Behavior and Autonomic Responses." *Depression and Anxiety, Mechanisms of Disease in Depression and Anxiety*, Volume 32, Issue 9, pages 671–683, September 2015

Annoni E.M., Xie X., Lee S.W., Libbus I., KenKnight B.H., Osborn J.W., Tolkacheva E.G., "Intermittent electrical stimulation of the right cervical vagus nerve in salt sensitive hypertensive rats: effects on blood pressure, arrhythmias, and ventricular electrophysiology." *Physiological Reports* Published 11 August 2015 Vol. 3 no. e12476 DOI: 10.14814/phy2.12476

Rey, M., Weber, E.W., Hess, P.D., "Simultaneous Pulmonary and Systemic Blood Pressure and ECG Interval Measurement in Conscious, Freely Moving Rats." *Journal of the American Association for Laboratory Animal Science*. 2012 March; 51 (2): 231-8.

Sayin H., Scridon A., Oréa V., Chapuis B., Chevalier P., Barrès C. and Julien C. "Pyridostigmine enhances atrial tachyarrhythmias in aging spontaneously hypertensive rats."

1. [Selecting the Most Appropriate Blood Pressure Measurement Method for Preclinical Research: AHA Recommendations Then and Now](#)