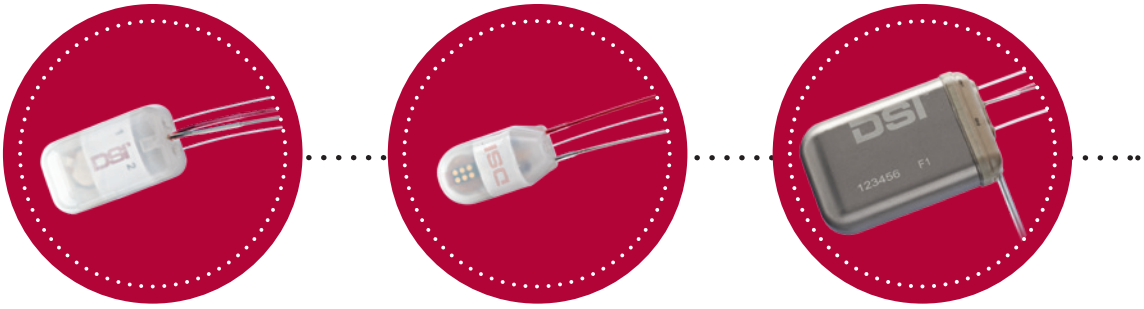
Guide to DSI's

Telemetry Devices



Continuous, real-time *In Vivo* Physiologic Monitoring Solutions for Animal Models

DSI™

a division of
Harvard Bioscience, Inc.

Telemetry Devices from DSI

Implantable Telemetry

DSI's PhysioTel™ implants are designed for acquiring data from conscious, freely moving laboratory animals, providing stress-free data collection while enhancing animal welfare. PhysioTel implants are offered in various sizes to support a range of research models, including mice, rats, dogs and non-human primates.

Physiologic signals measured include:

- **Pressures: arterial, left ventricular, ocular, bladder, intra-cranial**
- **Biopotentials: ECG, EMG, EEG, EOG**
- **Blood glucose**
- **Respiration**
- **Temperature: core and localized with thermistor**
- **Activity**
- **Sympathetic nerve activity**

External Telemetry

DSI's external telemetry includes JET™ for large animals and the CA-EXT external telemetry device for rats and similarly sized animals. By jacketing subjects, multiple physiologic endpoints may be collected continuously without requiring surgery. Animals remain freely roaming and unstressed, providing high quality data for your studies.

Advantages of Telemetry

- Animals can be chronically instrumented and used sequentially as their own control or in multiple studies to reduce the number of animals.
- Stress artifact induced by handling is avoided.
- Physiologic measurements can be obtained around the clock with no lab personnel present.
- Decreases the costs of many protocols by reducing the number of animals and maintenance required.

Implants for Rodents

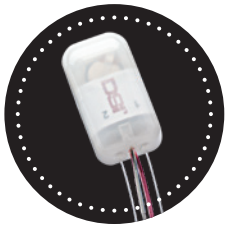
- DSI offers the broadest choice of implants for use in mice and rats
- Proven physiologic research partner for more than 30 years
- The most physiologic endpoint options, serving a global research community

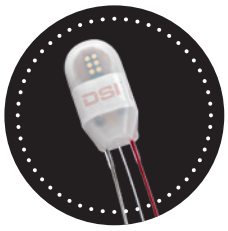
Extra-Small Implants

For use with mice and other similarly sized animals.

Model	Pressure	Biopotential	Respiratory Rate^	Temperature	Activity	Continuous Glucose	Warranted Battery Life	Implant Weight (g)	Implant Volume (cc)	Minimum Animal Weight (g)*
HD-X11	1	1	1	1	1		1	2.2	1.4	19
HD-X10	1		1	1	1		1.5	2.2	1.4	19
HD-X02		2		1	1		1.5	2.2	1.7	19
HD-XG°				1	1	1	1.5	2.2	1.4	19
PA-C10	1		1		1		1.5	1.4	1.1	17
ETA-F10		1		1	1		2	1.6	1.1	17
TA-F10				1	1		6	1.6	1.1	17

* All minimum animal weights assume subcutaneous implantation. Intraperitoneal implantation would require a larger animal.
° Sensor often functions for 6-8 weeks; warranty is 4 weeks.
^ Implants can derive respiratory rate from pleural pressure or blood pressure.





DSI's PhysioTel™ HD implants allow researchers to focus on what matters — research.

Enhance data security with *Animal ID*

- Have confidence that the data collected is from the intended animal.

Reduce study setup time with *Auto-Calibration*

- Save time and eliminate human error during manual entry of offsets.

Maximize battery life with *Battery On-Time Counter*

- Dynamic battery life updates to assist with efficient study planning and re-use of implants.

Small Implants

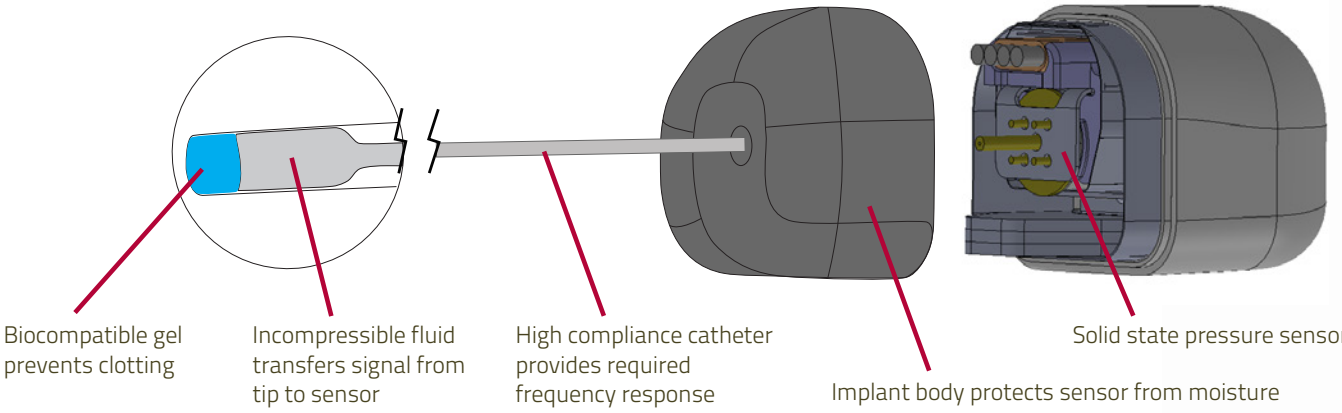
Species commonly monitored with small implants include rats, guinea pigs, ferrets, marmosets and others.

Model	Pressure	Biopotential	Respiratory Rate^	Temperature	Activity	Continuous Glucose	Warranted Battery Life	Implant Weight (g)	Implant Volume (cc)
HD-S21	2	1	1	1	1		2	8	5.9
HD-S20	2		1	1	1		2	8	5.9
HD-S11-F0/F2**	1	1	1	1	1		2(F0)/3(F2)	8	5.9
HD-S1-F0/F2**	1		1	1	1		2(F0)/3(F2)	8	5.9
HD-S10	1		1	1	1		5	4.4	3.1
HD-S02		2	1	1	1		5	4.7	3.3
HD-XG°				1	1	1	1.5	2.2	1.4
4ET+		4	1	1	1		3	12.8	8.8
F50-EEE		3	1		1		2	11.5	5.5
CTA-F40		1	1	1	1		6	8	4.2
F40-TT				2	1		4	7.5	3.5
TA-F40*				1	1		12	7.25	3.5
F50-W-F2 (records sympathetic nerve activity)					1		2	12	5.5

**Available in two frequencies: 455 kHz (F0) and 18 MHz (F2). Pair housing capable.
° Sensor often functions for 6-8 weeks; warranty is 4 weeks.
+ Available in two frequencies: 8 MHz (F1) and 18 MHz (F2). Pair housing capable.
*Available with an external thermistor probe if desired.
^ Implants can derive respiratory rate from pleural pressure, blood pressure or diaphragmatic EMG.

PhysioCath Telemetry Catheters

DSI pressure sensing implants use a solid state sensor coupled with a proprietary and biocompatible catheter to acquire high fidelity signals.



Implants for Large Animals

The trusted partner for drug discovery, safety pharmacology, toxicology and biodefense research. Scientists using DSI's reliable, high performance research tools have published data across numerous high impact journals.

Medium & Large Implants

Designed with social housing in mind, PhysioTel™ Digital implants have a 3-5 m transmission distance. Species commonly monitored include, but are not limited to, non-human primates, dogs, rabbits, and swine.

Model	Pressure	Biopotential	Respiratory Rate**	Temperature	Activity	Continuous Glucose	Warranted Battery Life	Implant Weight (g)	Implant Volume (cc)
M00				1	1		100 days	13.7	11
M0G* NEW				1	1	1	95 days	13.7	11
M1G* NEW	1		1	1	1	1	48 days	13.7	11
M01		1	1	1	1		40 days	13.7	11
M10	1		1	1	1		55 days	13.7	11
M11	1	1	1	1	1		35 days	13.7	11
L03 NEW		3	1	1	1		90 days	56	29
L04 NEW		4	1	1	1		95 days	56	29
L11	1	1	1	1	1		105 days	56	29
L21	2	1	1	1	1		84 days	56	29
D70-PCTR^	1	1	1	1	1		75 days	49	33

* Sensor often functions for 6-8 weeks; warranty is 4 weeks.
** Implants can derive respiratory rate from pleural pressure, blood pressure or diaphragmatic EMG.
^ D70-PCTR provides respiratory volume and respiratory rate via respiratory impedance.

PhysioTel Digital Solid Tip Lead... clean, artifact-free ECG data

PhysioTel Digital

L series: These implants are designed for chronic physiologic monitoring research in colony animals. Implants are used in safety pharmacology studies to address core battery requirements in cardiovascular (CV), neuroscience, and respiratory applications. Core CV measurements include systemic pressure and ECG and include LV pressure as a secondary measurement.

M series: The smaller size of M series allows PhysioTel Digital technology to be expanded into a broader range and size of species including rabbits and cats. Primary applications for M series are toxicology and biological defense, discovery, and glucose metabolism studies. Single use implants are ideal for shorter duration studies.

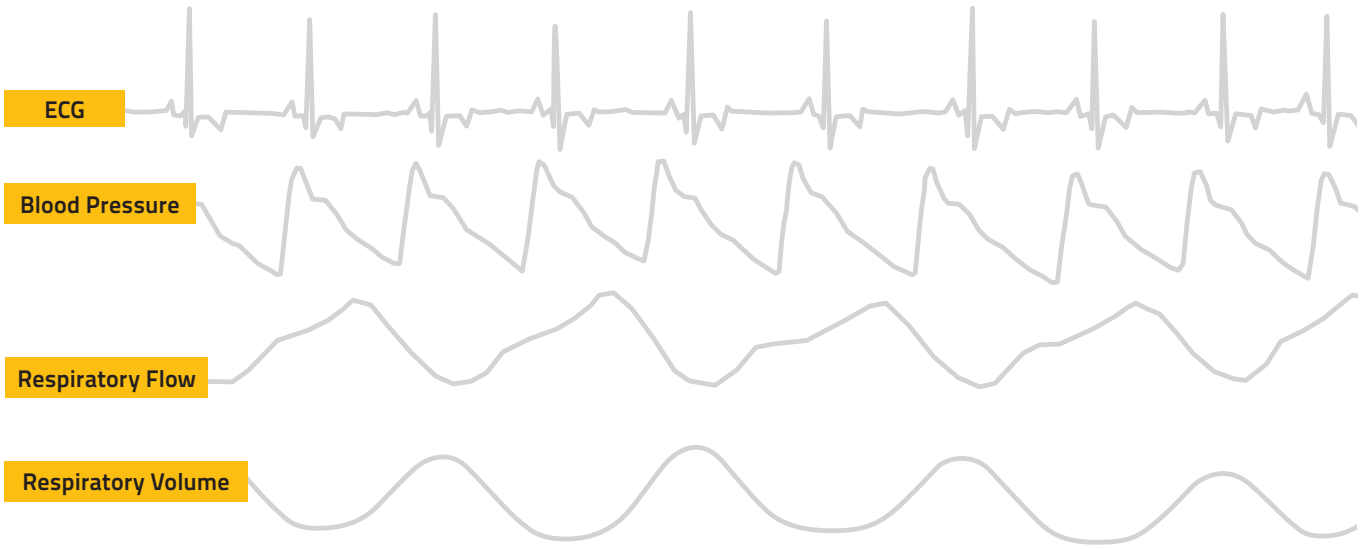
External Telemetry

For toxicology, repeat dose, and other high-throughput studies, less invasive physiologic monitoring may be desired. Collect accurate, continuous physiologic data from jacketed animals.

Species	Device	ECG Vectors	ECG Vectors with Respiratory Impedance Plethysmography (RIP)	Blood Pressure Add-on^	Temperature	Activity	Battery
Large Animals	JET-EA-BP	1	NA	Yes	No	Yes	Rechargeable 27-hr life
	JET-3ETA-BP	7	1	Yes	Yes	Yes	
	JET-5ETA-BP	9	7	Yes	Yes	Yes	
Rats and Guinea Pigs	CA-EXT	1	NA	No	No	Yes	6 months

^PA-C10-TOX is available for less invasive blood pressure measurement.

Collect multiple endpoints with JET™



About Data Sciences International

DSI provides a complete preclinical platform to assess physiological data for research ranging from basic, to drug discovery, and drug development. DSI is the leading provider of telemetry systems, pulmonary solutions, associated software platforms, and services.

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