

T400-Series Technical Note

Tethers and Swivels for Conscious Measurements

Transonic® Flowprobes allow continuous volume flow measurements in conscious rats and mice. Following surgical Probe placement, the mini-connector of the Flowprobe is tunneled subcutaneously and exteriorized to the mid-scapular region. To monitor blood flow, the Probe connector must be attached to an extension cable connected to the Transonic® Flowmeter. The “extension cable tether” used for rats has a 9 inch metal spring covering the wire so that the animal does not damage the lead during periodic measurements. Mouse extension cables are not covered since the spring would be too heavy.

For long term continuous measurement, the use of an electrical swivel to transfer the Probe signals will allow free movement of the animal without twisting or damaging the cables. A Transonic® Flowprobe requires 4 electrical channels on the swivel plus ground to transmit and receive signals from the Probe.

To use a swivel device, the swivel must be spliced into the extension cable that attaches to the Flowmeter. If using a swivel from Dragonfly Inc. for mice, compatible cables with connectors that match the Dragonfly swivel may be purchased from Transonic Systems. For rats, the extension cable is cut and the wire ends are soldered to the swivel input and output contacts. The following procedure ensures that proper signal transmission to and from the Probe is maintained.

General Steps to Attach a Swivel

- 1) Cut the spring and wire end of the 4-pin extension cable to the appropriate length for the cage.
- 2) Strip 1-2 inches of the wire to attach to the input end of the swivel.
- 3) Use rosin core electrical grade solder to attach the wires to the swivel contacts. *Note:* solder connections must be done carefully. A sloppy connection can add offset or noise to the measurement.
- 4) The Transonic® cable contains Kevlar threads which may be tied to the swivel end to provide mechanical strain relief.
- 5) Match the colored wire leads of the 10-pin Flowmeter portion of the extension cable to the corresponding contacts of the end of the swivel and solder the connections.
- 6) Insert the Probe calibration key in the Flowmeter when taking measurements.

Configurations for Rats

Three cable configurations are offered to attach a swivel for monitoring in rats. They differ by:

- 1) Where the attachment of the Probe is made;
- 2) The type of spring and button that are used;
- 3) The cable length requirements of the implanted Probe.

Research Equipment Sources:

Electrical Swivels:

Rats:

[AEROFLEX](#) (acquired Airflyte Electronics)
Miniature Slip Ring Assembly Reference # 1001671-6
www.aeroflex.com/ams/motion/motion-airflyte.cfm

Mice:

[DRAGONFLY INC.](#)

Ridgeley, WV
www.dragonflyinc.com

General:

[LOMIR BIOMEDICAL, INC.](#)

Malone, New York
Perrot, Quebec, Canada www.lomir.com

[HARVARD APPARATUS, INC.](#)

Holliston, MA www.harvardapparatus.com

Tethers & Swivels for Conscious Measurements Cont.

A. Instech P0135 Spring Tether & Instech Polysulfone Skin Button

The animal subject is permanently connected to swivel.

The Probe is supplied with a long cable. The connector is cut off with a small wire lead and the cable is threaded through the skin button and spring tether and soldered directly to the swivel input contacts. If cannulation tubing is required for drug infusion or pressure measurement, it is installed in the spring tether during this procedure. The removed Probe connector is soldered to the output contacts of the swivel to connect to the Flowmeter extension cable.

B. Transonic MCS11 Spring Tether & Silicone CA4 Cuff Skin Button (AAPC103)

Flowprobe with tether attachment connect at the swivel input.

The Probe is supplied with a long cable and 4-pin micro connector that is passed through the silicone cuff and spring tether. The Flowmeter extension cable is cut and its 4-pin connector section is soldered to the swivel input contacts. The 10-pin section is soldered to the swivel output contacts to bring signals to the Flowmeter. The size and number of cannulation tubes may be limited by the diameter of the Transonic spring. *Note:* the Probe cable is left intact so that it may be easily tested on the Flowmeter before and after use. Probe cables should be ordered with long enough cable to exit the mid-scapular area, pass through the 18" spring tether and connect to the swivel attachment with enough ease in the cable so that it is not pulling on the exit wound. The silicone Cuffs are not intended for very long term studies and may need replacement after 3-4 weeks.

C. Attachment to Swivel at Mid-scapular Skin Button-Transonic Rigid Cuff (AAPC104).

Animal can be disconnected from swivel & tether.

The Flowprobe is ordered with a short cable that will terminate at the midscapular wound exit. A Transonic® rigid cuff is applied over the connector to secure the connector in place and convert it to a skin button. A standard 4-pin extension cable with spring cover is cut as above, and soldered to the swivel input and output contacts. The spring covered portion of the extension cable forms the tether and plugs directly into the skin button on the rat when measurements are required. This method allows the animal to be removed from the swivel and tether and returned to its home cage after periodic monitoring. Since the tether construction is pre-sealed on the extension cable, alternate methods for installing cannulas for pressure measurement or drug delivery must be made.

Swivels for Mice

The swivel movement requirements for mice are much greater than the apparatus for rats. A 20 gram mouse requires a swivel that will spin with no rotational torque and a cable that is nearly weightless. Transonic® has collaborated with Dragonfly Inc. to provide compatible input and output cables to their swivels (models SL-8X-6 and SL-8X-10) which provide noiseless signals and do not hamper the activity of the mouse.

Mouse Nanoprobes use very fine stranded wire in the cable and should be handled with more care than the Flowprobes for rats. Nanoprobe wires should not be cut or covered with a spring shield or significant offset or damage can result. By providing the cables that are compatible with the Dragonfly swivel, we ensure that signal integrity is maintained. Check model numbers with Transonic® before ordering to ensure compatibility.

(See swivel diagram on last page.)

Tethers & Swivels for Conscious Measurements Cont.

RAT SWIVELS				
CONFIGURATION	CUSTOMER MODIFICATION	RAT ATTACHMENT TO SWIVEL	PROBE CABLE LENGTH	PROBE CONNECTOR
A	Cut probe cable	Permanent for long-term monitoring	60 - 100 cm maximum length	CM4B removed - soldered to swivel
B	Cut extension cable	Spring tether attached to rat	60 cm or length up spring + animal	CA4 with spring silicone cuff
C	Cut extension cable	Rat can be separated from swivel for periodic measurements	9 - 20 cm from vessel site to scapula	CM4S with rigid cuff

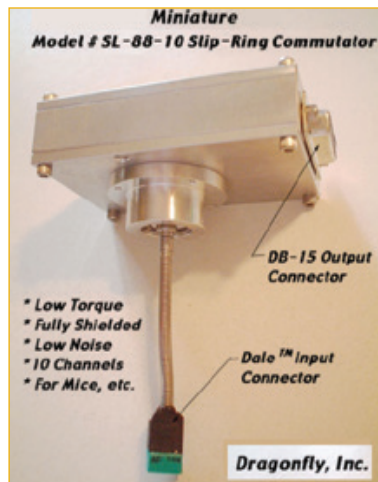


Fig. 1: Miniature Slip-Ring Swivel from Dragonfly Inc.

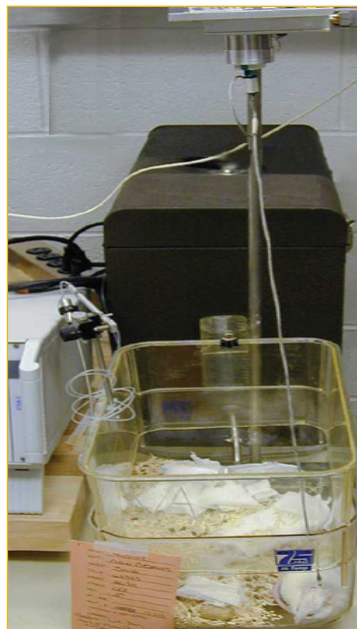


Fig. 2: Swivel setup

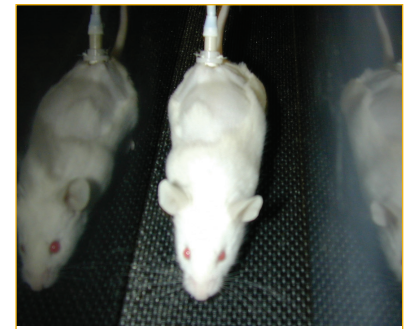
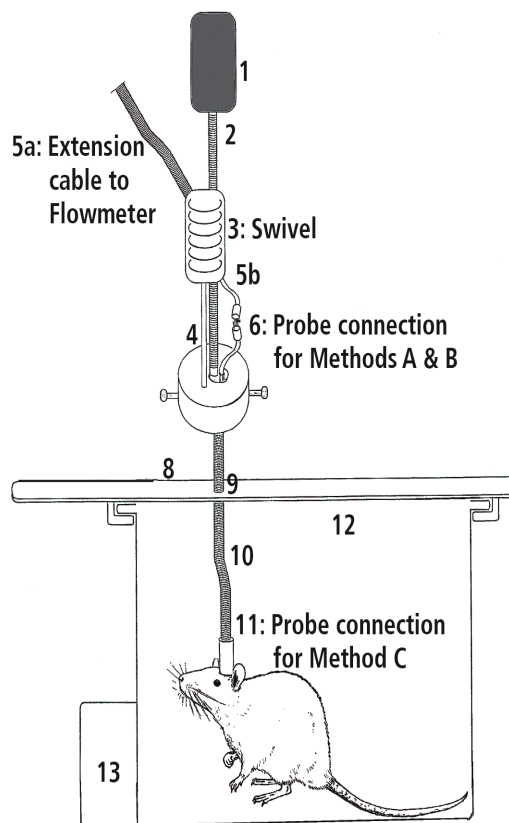


Fig. 3: Mouse running on treadmill; free movement enabled by electrical swivel interface to Flowmeter cables.

Tethers and Swivels for Conscious Measurements Cont.



SWIVEL DIAGRAM KEY

1. Instech hydraulic swivel
2. Spring segment for fluid cannula through center of Airflyte swivel
3. Airflyte electronic swivel for Flowprobe
4. Post to swivel
5. Transonic® CA4 extension cable
 - a. Flowmeter end is cut and soldered to swivel output
 - b. Flowprobe connector end soldered to swivel input
6. Transonic® CA4 mini Flowprobe connector
7. Machined brass stabilization disk: 1" diameter with set screw for post/spring
8. Shelf
9. Hole in shelf
10. Transonic® #MCS111 (fits CA4 connector) -or- Instech PS135 spring tether (May require splicing of Flowprobe cable for threading with 2 cannula through tether)
11. Transonic® CA4 cuff (#AAPC103) inserted into spring receptacle -or- Polysulfone button (Instech)
12. Metabolic cage
13. Food compartment



Transonic Systems Inc. is a global manufacturer of innovative biomedical measurement equipment. Founded in 1983, Transonic sells "gold standard" transit-time ultrasound Flowmeters and monitors for surgical, hemodialysis, pediatric critical care, perfusion, interventional radiology and research applications. In addition, Transonic provides pressure and pressure volume systems, laser Doppler Flowmeters and telemetry systems.

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