42 Aero Camino, Goleta, CA 93117
Tel (805) 685-0066 | Fax (805) 685-0067
info@biopac.com | **www.biopac.com**

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Application Note 114b TSD107B Pneumotach Transducer

Overview

The TSD107B is a highly linear, wide range, airflow transducer. Using the TSD107B and a DA100C amplifier with the MP System, a variety of tests relating to airflow and lung volume can be performed. With the equipment listed below and the proper software parameters, precise lung volume measurements can be obtained.

Equipment

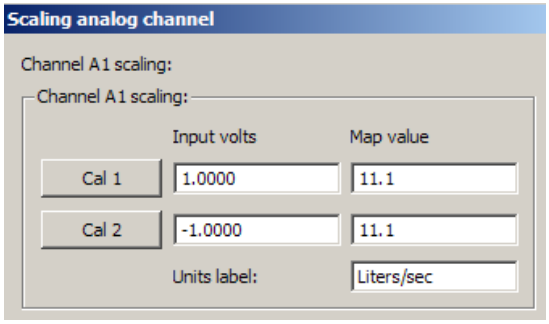
- MP System for data acquisition
- DA100C general purpose amplifier
- TSD107B pneumotach transducer

Hardware Setup

1. Select DA100C module for Channel 1.
2. Set Gain at 1000.
3. Set the high frequency response to 10 Hz (300 Hz in some cases).
4. Set the low frequency response to DC.
5. Set VREF1 to +1.0 Volts (default) with a Volt/ohm meter or with BIOPAC REFCAL (VREF2 will track VREF1 with opposite polarity).
6. Plug the TCI connector into DA100C.
7. Insert the airflow tube between the bacterial filter and the airflow transducer.
8. Place the mouthpiece on the free end of the bacterial filter.

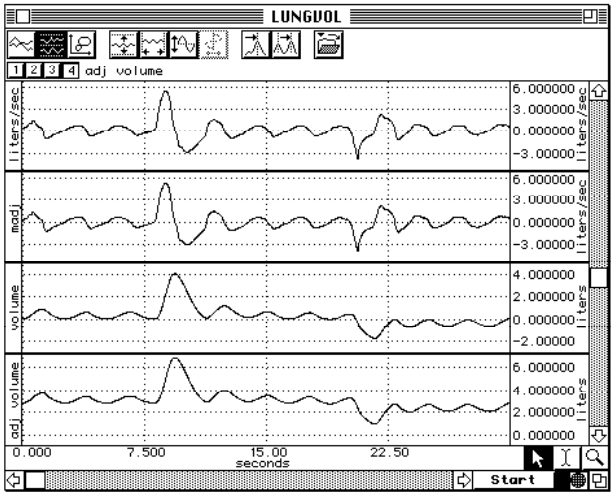
Software Setup

1. Under **Set Up Channels** select channel 1 and click on the scaling button.
2. Complete the scaling dialog box as shown here:



3. Under **Set Up Acquisition** set
   a) Storage: Disk
   b) Sample rate: 50 samples per second
   c) Acquisition length: 30 seconds.

Recording Procedure



1. Start breathing normally through the mouthpiece.
2. After several normal breaths, inspire as deeply as possible (just once) and then return to normal breathing for several seconds
3. Expire as completely as possible.
4. Return to normal breathing for the remainder of the recording.

The recorded wave should look something like the top wave in the following graph. Normal Tidal Volume can vary quite a bit, even over a 30-second period. Note that in Wave 4 – adj volume, the starting tidal volume is almost a liter, then, as the test progresses, the tidal volume drops to about 0.5 liters. This level of variation is somewhat expected, since respiratory effort has a strong voluntary component.

Analysis — Acq*Knowledge*

1. Duplicate the recorded data.
2. Subtract the mean value of the entire record from the duplicated data to create the Mean Adjusted Flow (madj). This procedure will simply remove any DC bias from the airflow signal.
3. Duplicate madj.
4. Integrate the duplicated madj channel. This process results in the third wave, which is the volume (in liters), which correlates to the airflow.
5. To correct for the proper residual volume in the lungs (estimated at about 1 liter), add a constant to the third wave to create a new adjusted volume (adj volume). The minimum point on this curve should be the estimated residual lung volume (1 liter).

TSD107B Calibration

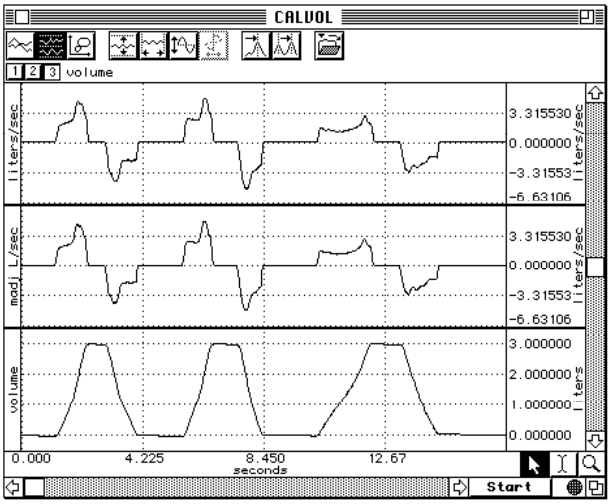
The TSD107B is factory calibrated to nominally satisfy the scaling factor:

1 mVolt output = 11.1 liters/sec flow rate

When connected to the DA100C with Gain =1,000, the calibration factor is:

1 Volt = 11.1 liters/sec

This graph illustrates how a calibration check is performed.



1. Insert a three-liter calibration syringe into the free end of the airflow tube.
2. Push three liters of air through the airflow transducer, first one direction, then the other.
3. Subtract the mean value of the first wave from the second wave, to correct for DC bias.
4. Integrate the second wave; the result will be placed in the third channel (volume).

As air is forced back and forth through the transducer, the expected volume would be from 0 to 3 liters. As air goes one way the volume climbs to 3 liters, and as that same air is then pulled the other direction through the transducer, the volume signal should head back to 0. As shown in the sample graph, the volume measurement is independent of the rate of flow, as would be expected for a linear airflow measurement transducer.

See also: DA100C Calibration options.

TSD107B Specifications

Pneumotach type:	Hans Rudolf® #4813 with integral differential pressure transducer
Voltage excitation:	+/- 5 volts (10 volts pk-pk) maximum
Nominal Output:	45 µV/[liters/sec] (normalized to 1V excitation)
Calibration factor:	90 micro-volts/(liters/second) – normalized to 2 VDC excitation
Calibrated flow range:	±800 Liters/min
Dead space volume:	87.8 ml
Back pressure:	2.8 cm H_2O/400 liters/min
Flow bore (Ports):	35mm OD
Weight:	690 grams
Dimensions:	4 cm (deep) x 11 cm (high) x 19 cm (wide)
Cable:	3 meters
Interface:	DA100C

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