

**MEDIUM-FLOW PNEUMOTACH TRANSDUCER**

- SS11LA for MP3x and MP45 System
- TSD117 & TSD117-MRI for MP150/MP100 System
- RX117 Replacement Airflow Head
- See also: **AFT series** of accessories for airflow and gas analysis

These medium-flow airflow transducers are designed to measure human subject respiratory, bi-directional airflow (liters/sec) and can be used to measure respiratory flow in a wide range of tests and conditions relating to airflow and lung volume. Volume measurements are obtained by integrating the airflow signal. The airflow transducer is lightweight, easily held in one hand, and has a removable head for sterilization and replacement. *For reasons of hygiene, it is important that only one person use each disposable mouthpiece and disposable filter.*



SS11LA needs 5-10 minutes to warm up; during this time, the baseline offset changes slightly.

The SS11LA/TSD117 airflow transducers include an optically clear detachable flow head (RX117) for easy cleaning and inspection. As the detachable flow head is snapped into the transducer handle, the flow head plugs directly into an integral, precision low-differential pressure transducer. Accordingly, the transducers will output an electrical signal proportional to respiratory flow. Use with the AFT22 Non-Rebreathing “T” valve for low dead space requirements.

The transducers connect to industry standard bacteriological filter AFT1 with disposable mouthpiece AFT2 or AFT13 filter and mouthpiece with AFT11H coupler. The RX117 detachable flow head can be cold sterilized, autoclaved (220° F max), or placed in a dishwasher.

- For airflow and lung volume measurements, use the airflow transducer with the AFT2 mouthpiece and the AFT1 bacterial filter.
- For measurements of expired gases, use the airflow transducer with the AFT22 non-rebreathing T valve with AFT10 facemask and the AFT15A or AFT15B mixing chambers.

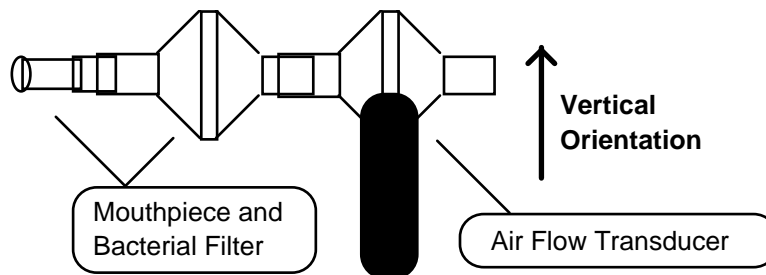
All connections can be performed with AFT12 (22mm ID) tubing and AFT11 series couplers.

Please note the following:

- The bacterial filter and mouthpiece are disposable and are “one per person” items. Please use a new disposable filter and mouthpiece each time a different person is to be breathing through the airflow transducer.
- For more effective calibration, use a bacterial filter between the calibration syringe and the airflow transducer.

**NORMAL MEASUREMENT CONNECTIONS**

- SS11LA plugs directly into the MP3x or MP45 unit
- TSD117 plugs directly into the DA100c amplifier module
- TSD117-MRI plugs into MECMRI-DA cable to DA100C amplifier module



For the most accurate lung volume recording, be sure to use a noseclip to prevent airflow through the nose. Also, be sure not to remove the airflow transducer assembly from the mouth during the recording. All air leaving or entering the lungs must pass through the airflow transducer during the lung volume measurement.

Use the following measurement procedure for determining lung volume:

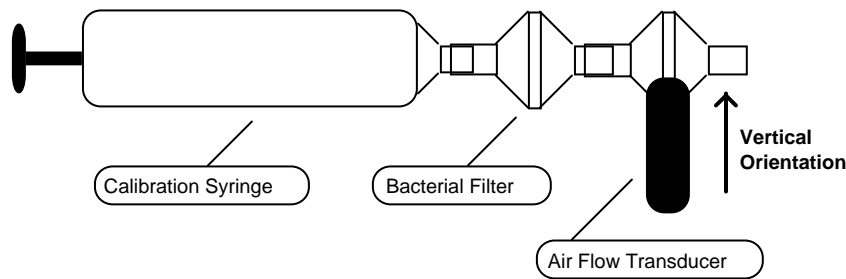
1. Breathe normally for 3 cycles (start on inspire)
2. Inspire as deeply as possible
3. Return to normal breathing for 3 cycles
4. Expire as deeply as possible
5. Return to normal breathing (end on expire)

**DATA PROCESSING**

When integrating the collected data to determine lung volume, it’s important to integrate from the starting point of the first inspire, to the end point of the last expire. Before integration, the mean of the selected (airflow) data must be determined and then subtracted from the record. This process insures that the integral will have the same starting and ending point.

**CALIBRATION FOR MEDIUM-FLOW PNEUMOTACHS**

**1. Syringe Calibration**



After the calibration process, please remove the calibration syringe and attach a new bacterial filter and mouthpiece to the airflow transducer.

It’s very important that each individual use his/her own mouthpiece and bacterial filter.

Place the narrow end of the bacterial filter and mouthpiece assembly into either side of the airflow transducer. Airflow data can now be recorded. For best results, hold the airflow transducer vertically.

**2. Mathematical Calibration**

The transducer can be roughly calibrated without using the calibration syringe. Using the transducer’s nominal output of 60µV per liter/sec (normalized to 1 volt excitation), the following calibration factors can be entered in the software Scaling window.

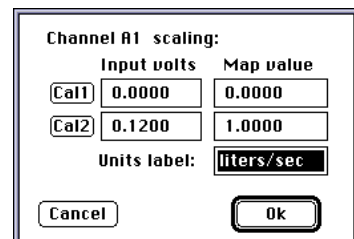
**Scaling Factors for Rough Calibration of the airflow transducer**

The following equation illustrates why 0.12 volts maps to 1.00 liter/sec:

$$\text{Calibration Constant} \cdot \text{Amp Gain} \cdot \text{Amp Excitation} = \text{Scale Factor}$$

Thus

$$60 \mu\text{V}/[\text{liter}/\text{sec}] \cdot 1000 \cdot 2 \text{ Volts} = 0.12 \text{ V} / [\text{liter}/\text{sec}]$$



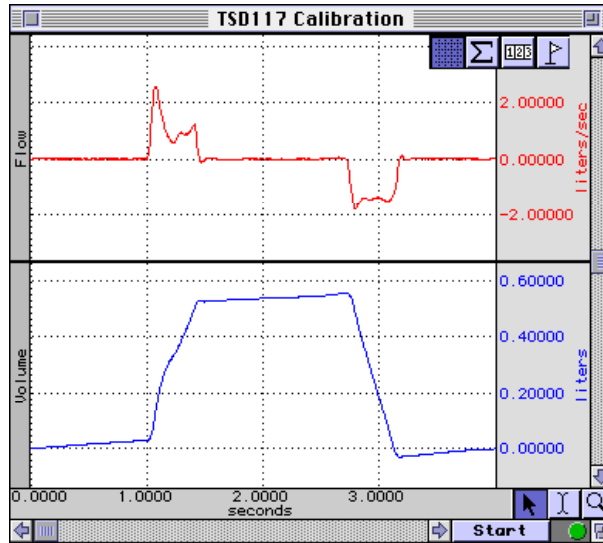
Data can now be collected directly. Prior to analyzing the data, remember that there will always be some offset recorded in the case of zero flow.

**Note:** With the TSD117 and MP150/100 system, it’s possible to largely trim this offset out, using the ZERO potentiometer on the DA100 amplifier, but some residual will always remain.

To remove residual offset after the flow data has been collected, select a portion of the baseline (zero flow reading) and calculate the mean value using the popup measurements. Subtract this mean value from the raw data to obtain a mean corrected flow signal.

Now, the integral of the mean can be calculated as shown in this graph →

In this case, a 600ml-calibration syringe was used to check the rough calibration of the airflow transducer. The rough calibration indicates a syringe volume of about 550ml, so this method may only be expected to be accurate within ±10% of the real reading.



*Flow Measurement and Volume Calculation*

To achieve a more exact calibration, start with the above scaling factors and then boost or drop them slightly as indicated by the rough calibration. In this case, if the map value correlating to 0.12 volts were boosted about 10% to 1.10 (from 1.0 liters/sec), the resulting calibration would be fairly accurate.

See also: DA100C Calibration options.

>>> All Instructions also apply to the older airflow transducer — model SS11L with non-removable head <<<

### SS11LA TO MP3X CONNECTION

1. Make sure the BIOPAC MP3X unit is turned OFF.  
**Note: Turn the MP3X power off even if the software is running.**
2. The airflow transducer (SS11LA) can be plugged into any input channel on the MP3X.
3. After the transducer is plugged in securely, turn the MP3X power ON.

**Note: SS11LA to MP connection instructions also apply to 2-channel MP45 hardware.**



*SS11LA to MP3X connection*

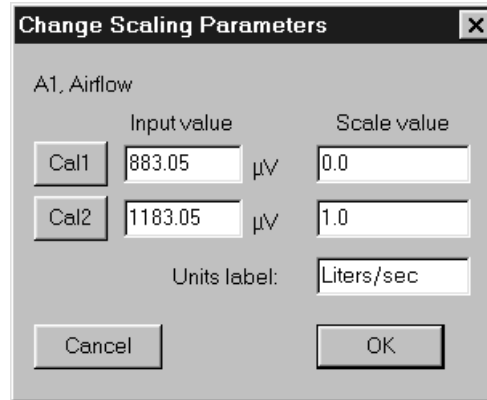
### ROUGH CALIBRATION (MP3X)

1. Pull down the **MP3X** menu.
2. Click **Setup channels**.
3. Select the **Analog** channel that the SS11LA transducer is plugged into and activate it by clicking in the **Acquire**, **Plot** and **Values** boxes.

The SS11LA can be roughly calibrated without using the AFT6 calibration syringe. The SS11LA has a nominal output of 60 μV per liter/sec, which is then scaled to account for the amplifier excitation. For the MP3X, this is factory set to 5 Volts. Therefore:

$$60 \mu\text{V}/[\text{liter}/\text{sec}] \cdot 5 = 300\mu\text{V} / [\text{liter}/\text{sec}].$$

4. Pull down the **Presets** pop-up menu and select **Airflow**.
5. Click on the **View/Change Parameters** button.
6. Click on the **Scaling** button.
7. Click on **Cal1**: Leave the **Input value** reading and enter **0** for the **Scale value**.
8. For **Cal2 Input Value**, add **300µV** (or .3 mV) to the **Cal1 Input Value**. For **Cal2 Scale value**, enter **1**.
9. Click **OK** for each window to exit Channel Setup.



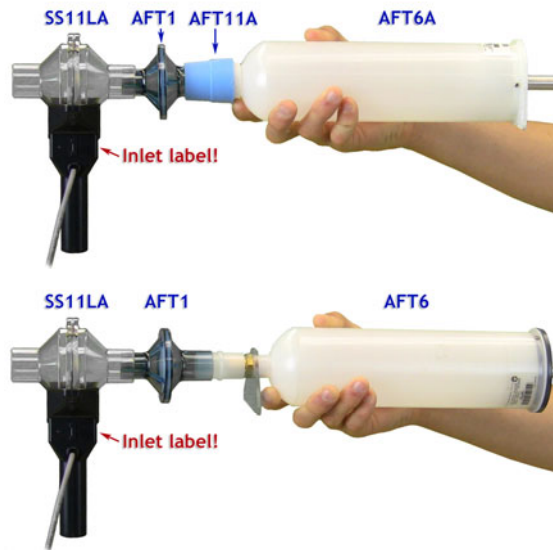
Note: Add 300µV to the Cal1 Input Value for Cal2.

### USING THE CALIBRATION SYRINGE

1. Place a filter onto the end of the calibration syringe.
2. **Insert** the Calibration Syringe/Filter Assembly into the airflow transducer.

**IMPORTANT!**  
 Always insert on the side labeled **“Inlet.”**

The filter is necessary for calibration because it forces the air to move smoothly through the transducer. This assembly can be left connected for future use. The filter only needs to be replaced if the paper inside the filter tears.



*Calibration Syringe into airflow transducer*

Insert syringe assembly so that the transducer cable exits on the left, as shown above.

- If using an older **SS11L** transducer with non-removable head, insert syringe assembly into the larger diameter port.

**IMPORTANT:** If the lab sterilizes the airflow heads after each use, make sure a clean head is installed now.

The Airflow Transducer is sensitive to gravity so it needs to be held upright throughout the calibration and recording.

**Never** hold onto the airflow transducer handle when using the Calibration Syringe or the syringe tip may break.

3. **Pump** the plunger several times before the recording. **Always** pull and push the plunger all the way until it stops when using the syringe. This assures that the full volume of air (0.6 liter) flows in and out of the airflow transducer.



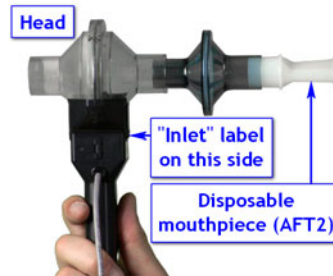
*Proper handling of the Calibration Syringe Assembly*

**RECORDING WITH THE AIRFLOW TRANSDUCER**

- 1) **Attach** the appropriate filter and mouthpiece on the side labeled **Inlet**.

**WARNING**  
 The bacterial filter and mouthpiece are disposable and are “one per person” items. Please use a new disposable filter and mouthpiece each time a different person is to be breathing through the airflow transducer.

If using **SS11LA** transducer and not sterilizing the head after each use, insert a filter and mouthpiece into the airflow transducer on the side labeled “Inlet.”



*SS11LA with unsterilized head*

If using **SS11LA** transducer and sterilizing the head after each use, insert a disposable mouthpiece (BIOPAC AFT2) or a sterilizable mouthpiece (BIOPAC AFT8) into the airflow transducer on the side labeled “Inlet.”

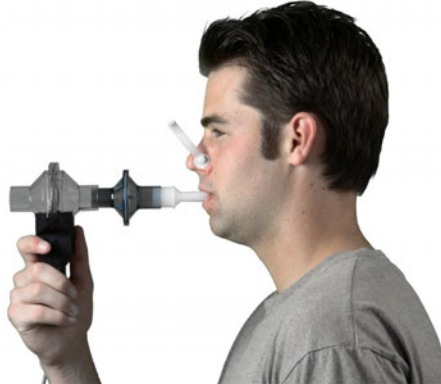


*SS11LA with sterilized head*

- 2) Breathe through the airflow transducer, following the proper procedure defined to the right.

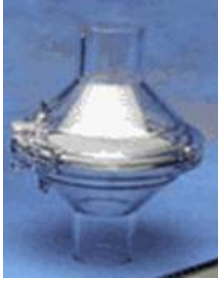
*Hints for obtaining optimal data:*

- a) Keep the Airflow Transducer upright at all times.



- b) Always insert on and breathe through the side of the SS11LA airflow transducer labeled “Inlet.”
- c) Always use a nose clip when breathing through the airflow transducer and secure a tight seal with the mouth so that air can only escape through the airflow transducer.
- d) Always begin breathing normally through the airflow transducer prior to the beginning of the recording and continue past the end of the recording.
- e) If starting the recording on an inhale, try to end on an exhale, and vice-versa. This is not absolutely critical, but will increase the accuracy of Airflow to Volume calculations.
- f) The Subject must try to expand the thoracic cavity to its largest volume during maximal inspiratory efforts. (The Subject should wear loose clothing so clothing does not inhibit chest expansion.)
- g) During recording of FEV, the Subject should attempt to exhale as quickly as possible into the mouthpiece.
- h) During recording of MVV, the Subject should attempt to exhale and inhale as quickly and deeply as possible. Breathing rates should be faster than 60 breaths/minute or greater than 1 breath/second for the best results. The breathing needs to be maintained for 12-15 seconds.

**RX117 REPLACEMENT AIRFLOW HEAD**



The RX117 is a sterilizable airflow head for the TSD117 and SS11LA pneumotach transducers. The material used in the flow head is polycarbonate and the screen is Stainless Steel. To reduce the cost of disposable items, use the RX117 with the AFT8 sterilizable mouthpiece. (22mm ID/30mm OD). Multiple RX117 heads help eliminate equipment downtime during cleaning procedures.

*Recommended sterilization:* cold sterilization (i.e., Cidex®) or autoclave. If autoclaved, RX117 Airflow Heads should be cleaned at the lowest autoclave temperature setting. The life cycle will be about 10-20 cycles, depending upon temperature used.

**SS11LA & TSD117 TECHNICAL SPECIFICATIONS**

<b>TRANSDUCER:</b>	<b>TSD117</b>	<b>TSD117-MRI</b>	<b>SS11LA</b>
Interface:	DA100C	MECMRI-DA to DA100C	MP36/35/30/45
Flow Rate:	±300 Liters/min (±5 liters/sec)		10 liters/sec (highest linearity (±5 liters/sec))
Nominal Output:	60 µV/[liters/sec] (normalized to 1 V excitation)		60 µV/[liters/sec]
¼" 25 TPI mounting nut:	Standard camera mount		-----
Cable Length:	10 m, shielded		2 m, shielded
<b>RX117 SPECS:</b>			
Flow Head Construction:	Clear Acrylic		
Flow Bore (Ports):	22 mm (ID), 29 mm (OD)		
Flow Head Dimensions:	82.5 mm (diameter) x 101.5 mm (length)		
Flow Head Weight:	80 g		
Handle Weight:	85 g		
Handle Dimensions:	127 mm (length) x 23 mm (thick) x 35 mm (wide)		
Handle Construction:	Black ABS		
Dead Space:	93 ml		