

MiniLab – Commercial Spirometer

GOAL

Measure expiratory flow using a commercial spirometer.

GENERAL GUIDELINES

- 1) Teams are allowed (even encouraged) to help each other. Of course, Buma will be around to provide assistance as well.
- 2) Do not worry if you need lots of help during the lab. Just make sure you know your stuff for the exams. In addition to the written exams, there will be a lab practical where each student is tested on basic Arduino and MATLAB skills and putting together a complete measurement system.
- 3) Ask questions! The more questions you ask, the more you learn (assuming Buma can provide adequate answers ... ☺).

REQUIRED PARTS AND MATERIALS

- Vernier spirometer kit
- Adapter module for breadboard
- +5V benchtop power supply
- Scope and scope probe
- Wires and banana cables

We will use the scope to acquire a SINGLE trace (just like we did for the blood pressure lab).

- Step 1: Install the adapter plug into the breadboard.
 - The plug attaches to the breadboard in a similar manner as an op amp (e.g. across a gap).
 - Configure the benchtop supply to provide +5V and GND to the adapter plug.
 - Attach the scope probe to “SIG1” pin of the adapter.
 - Connect the Vernier spirometer to the adapter.
- Step 2: Configure the scope for single trace acquisition.
 - Turn on the scope.
 - Press “Force Trig” to enable front-panel control.

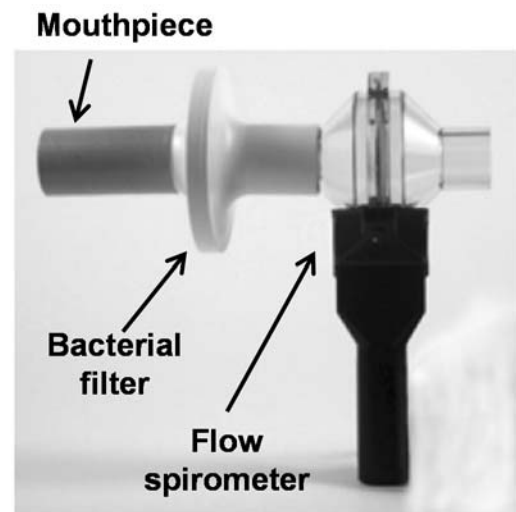


Fig. 1: Commercial spirometer based on a Lilly pneumotachometer. Attach the white plastic bacterial filter to the "INLET" side of the flow tube. Then attach the cardboard mouthpiece to the filter.

- Press “Default Setup”.
- Make sure both Ch1 and scope probe are set to “1X”.
- Vertical settings:
 - Scale = 500 mV/div
 - Offset = scroll down until the baseline is near the bottom of the screen (see Fig. 2).
- Horizontal settings:
 - Scale = 500 ms/div
 - Offset = -2 sec (trace should shift to the left side of the screen as you do this)
- Push the “TRIG MENU” button, go to “SOURCE” and select “AC Line”.
- Press the “Run/Stop” button so that it appears RED.

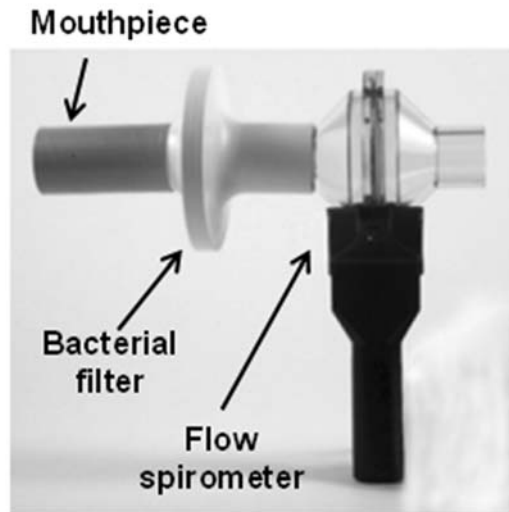
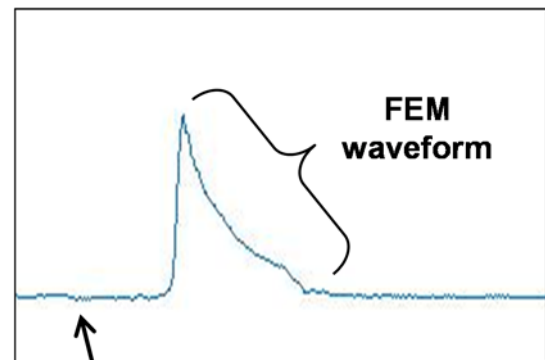


Fig. 2: Each person should use a different mouthpiece! It is OK to share the same bacterial filter.

- Step 3: Perform a forced expiratory maneuver (FEM) with the spirometer. Assemble the spirometer as shown in Fig. 1. For multiple people, please use a separate mouthpiece for each person (same filter is OK). You will need to attach a nose clip for the FEM. Try to keep the spirometer head stationary during the FEM (e.g. don't tilt it up and down).

- Press the “Single” button on the scope and quickly take a deeeeeeeeeeeeeeep breath.
- Bring the mouthpiece to your lips and exhale as FORCEFULLY as possible!
- Try not to inhale again until the scope trace is done (takes 5 seconds).



Baseline is near bottom of the screen

Fig. 3: Example scope trace from forced expiratory maneuver (FEM) with spirometer.

- Step 4: Compute peak expiratory flow (PEF).
 - Measure the peak-to-peak voltage.
 - Convert volts to flow by using a conversion factor of 7.1869 L/s/V (from manufacturer's data sheet).
- Step 5: Who is the class winner?
 - Buma will tabulate the PEF from each student and crown the winner!

(End of Spirometer MiniLab)